HYGIENE

VOLUME I

HYGIENE AND ECOLOGY

ENVIRONMENTAL HEALTH, HOSPITAL HYGIENE, RADIATION PROTECTION, NUTRITION, CHILD HEALTH, PERSONAL HEALTH, AGEING, MENTAL HEALTH

EDITED BY

Prof. Dr. Dimitar Tsvetkov, DSci

2019

I dedicate this book to the memory of my father -
Prof. Dr. Lyubomir T. Tsvetkov (1899-1984),
my mother - Dr. Tsvetana Hr.Tsvetkova (1905-1985) and my family -
Kristina (1939-2009) , Mira and Dorothea

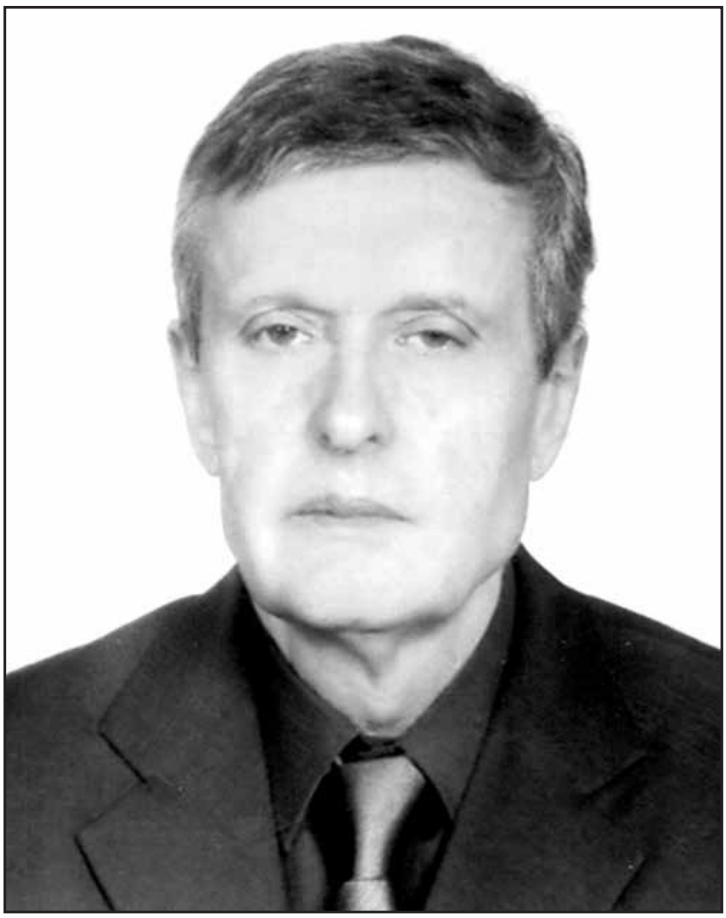
With gratitude and thanks to
Prof. Dr. Andreeva-Galanina Evgeniy Cesarevna (1888–1976),
Russia, Prof. Dr. Vladimir Boyadzhiev (1923–2011), long-time
Head of the Department of Hygiene and Occupational Diseases

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PROF. DR. DIMITAR TSVETKOV, MD
EDITOR

Prof. Dr. Dimitar Tsvetkov, MD graduated in medicine in 1961 from 1990 to 1999 was head of the Department of hygiene, ecology and professional diseases - MF - Sofia. PhD happened in 1972 and Doctor of Medical Sciences in 1991. He was a vice dean and vice rector of the Medical University Sofia, member of the Academic Board and a member of the senior educational council - Ministry of Education, Director National Center of Hygiene.

His research interests are in the field of occupational medicine, in particular physical factors in work environment. Developing methodology for research risk role of physical stressors on cardiovascular diseases and dyslipidemia. Prof. Tsvetkov has numerous studies on working conditions and health of workers in mining, ferrous and nonferrous metallurgy, production of building materials, etc.; in the field of communal hygiene, nutrition, occupational toxicology, hygiene of children and adolescents ergonomics.

Prof. Tsvetkov is a member of the leadership of the Scientific Society of Hygiene Bulgaria, Bulgarian National Academy of Medicine, a member of New York Academy of Sciences, Polish Society of Hygiene, the leadership of Atlanto - Euro - Mediterranean Academy of Medical Sciences and Bulgarian Lipid league. Editor and member of boards of numerous scientific journals at home and abroad.

Author of over 190 scientific publications. He has participated in writing and edited of 5 textbooks, 3 manuals on hygiene and occupational diseases, one monograph.



Assoc. Prof. Atanaska Alexandrova PhD ends Medicine in 1973st Petersburg sanitary Medical Institute. By 1973 assistant in the department Hygiene and Professional Diseases at the Medical University - Plovdiv. 1985 Doctor of Medicine and from 1989 Ass. Prof.

Her scientific developments are in all areas of hygiene, mainly in the field of Child Health.

Co-author of textbooks and manuals of hygiene.



Assoc. Prof. Tsanka Vodichenska, DSci. graduated in medicine in 1963 Kharkov Medical Institute - Ukraine. 1973 was assistant in Department of hygiene - Sofia. 1988 is a Ass. Prof. Doctor in Medicine in 1970, and DSci. - 1997 Its scientific developments in the field of communal hygiene and specially on the problems of hygiene standards, and atherogenic effect of chemical components in drinking water; contamination of the environment with heavy metals and status of health among population of industrial areas; hygienic evaluation and regulation of microclimate in hospital rooms and in house; epidemiological studies and concept importance of the chemical composition of drinking water for distribution of cardiovascular diseases in Bulgaria. Author of over 200 scientific publications, co-author monograph, three textbooks and 6 manuals of hygiene.



Prof. Liudmila Ivanova, PhD, graduated in medicine in 1979 at the Medical faculty - Sofia.

Since 1982 he has worked as a research fellow III-I, and since 1998 as a senior research associate in nutrition and dietetics at the laboratory "Nutrition" to the National Center for Hygiene, Medical Ecology and Nutrition. Doctor of Medicine since 1991. Member of the European Academy of Nutrition Sciences (EANS). There are over 100 publications in our and foreign nutrition magazines: assessment of dietary intake, mineral exchange and mineral status, identification of nutritional deficiencies, interaction of heavy metals, minerals and trace elements, assessment of nutrition risk.



Ass. Prof. Nina Verjikovskaya DSci. work in the Institute of Gerontology - Ukranian Academy of Medical Sciences. Involved issues for organization of medical and social assistance services to population in elderly, preparation on medical and social workers in gerontology and geriatrics. She has authored more than 200 publications, including three monographs.



Prof. Dr. Yuri Grigorov, DSci. is Head of Department "Social gerontology and gerohygiene" and laboratory in gerodietetics to Institute of gerontology of Ucrainian Academy of Medical Sciences, Emeritus activist of science and technique of Ukraine, a laureate of state prizes. His research links between regional differences in nutrition and phenomenon longevity, justification on basic principles of gerodietetics and norms of feeding elderly people in Ucraine, development of new functional products for feeding senior persons and elderly. He has authored more than 300 publications including 10 monographs.

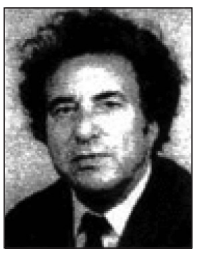


Assoc. Prof. Raina Kaynakchieva, PhD ends Medicine at the Medical University - Sofia in 1962. By 1976 assistant at the Department of Hygiene, medical ecology and professional diseases - Medical University - Pleven.

In 1989, she was named associate professor, PhD in 1975.

Her scientific works in the field of communal hygiene, nutrition and child health. Her main scientific contributions are in the field of hygiene of water.

She has over 70 publications and co-authored four textbooks and manuals of hygiene.



Prof. Dr. Stoyan Vizev, DSci. graduated in medicine in 1958 at the Medical University - Sofia. 1966 is assistant at the National Center for Gerontology and Geriatrics. He is a member of the European Association of gerontoantropoloogy and the Association in gerontology and geriatrics - Yugoslavia. Author and co-author of monographs and over 120 scientific publications in Bulgarian and international journals. A special importance are his works devoted to the aging process and age as an integral risk factor for the development of atherosclerosis.



Prof. Rositsa Enikova, PhD graduated in medicine in Kiev Medical Institute in 1970. From this year - assistant in laboratory "Microbiology of nutrition" in Scientific hygiene Institute - Sofia. Since 1987 Ass. Prof. Head of Laboratory "Microbiology of nutrition." PhD is 1979. National Expert for hygiene and microbiology of food and diagnostics of food infectious diseases.

Her scientific activity is in the field of hygiene and microbiology of food products.

There are over 100 scientific publications in national domestic and foreign journals, monographs, textbooks.



Prof. Dr. Margarita Koleva, DSci., graduated in medicine in 1970 at the Higher Medical Institute - Kharkiv. Since 1976 is assistant in the Department of Hygiene - Sofia. Since 1990 - Associate Professor, 2006 - Professor. PhD from 1976; DSci - 2004 Member of Medichem (Occupational and Environmental Health in the Chemical Industry), EAA (European Anthropological Association), EASO (European Association for the Study of Obesity), BASORD (Bulgarian Association for the Study of Obesity and Related Diseases), member of the leadership of the Bulgarian lipid league, Bulgarian Society for Hygiene, Vice Ch. editor of the magazine. "Hygiene and Public Health".

Her scientific works are mainly in field of toxicology, occupational medicine and professional diseases, the assessment of working conditions and health risk, anthropological characteristic and obesity in workers, toxicological assessment of heavy metals, pharmaceuticals, pesticides and organic solvents.

She has authored more than 130 scientific publications in Bulgaria and abroad, co-author of monographs, textbooks and manuals.



Assoc. Prof. Dr. Anastasia Krasteva, PhD, graduated from Medical University - Sofia in 1961. PhD from 1970. From 1985 - Ass. Prof in National Institute of Gastr. and Nutrition. In 1972, she specializes Gastroenterology and Dietetics in Paris.

Her main research interests and works in the field of allergy and nutrition, congenital and acquired intestinal enzimopathy, immunology of the small intestine, new dietary foods, metabolic diseases, parenteral and tube feeding.



Assoc. Prof. Dr. Biserka Miteva PhD graduated from Medical University - Sofia in 1954. Ass. Professor in 1974. Chief Republican specialist in school medicine in 1985-1989. Her scientific interests are in the areas of reactivity, health and performance of pupils from general education schools; hygiene problems of vocational training and professional orientation; medico-biological problems of primary school age. She has authored more than 90 scientific papers, co-author of a textbook on hygiene, many monographs and collections.



Assoc. Prof. Vasil Pisev, PhD graduated in medicine in 1970 at the Kiev Medical Institute. 1972 is Assistant in National Center of Hygiene, Department "Hygiene of children and adolescents" Ass. Prof. since 1990. PhD in 1981. Head of Department Child Health at the National Center of Hygiene, Medical Ecology and Nutrition. There are over 120 scientific publications, co-author of collections, monographs and textbooks in the field of Child Health.



Assoc. Prof. Antoaneta Manolova, PhD graduated in medicine in 1977 in Sofia Medical University. In 1978-82, she was a post-graduate student in Moscow. 1982 is Assistant in Department "Hygiene of children and adolescents" in NCHMEN. PhD in 1982. Research activity in the field of prognostication the health of children and adolescents; problems of children in the "disadvantaged"; problems of children and adolescents with deviant behaviour; with chronic diseases and varying degrees of disability.



Assoc. Prof. Dr. Prolet Nikolova, PhD graduated in medicine at the Medical University - Sofia in 1961. Since 1964 is assistant in the Department of Hygiene at the Medical University - Varna. In 1966-67, he specialized in Paris. Associate Professor from 1978. Head of the Department of Hygiene and Ecology - Varna from 1981 to 1995. Member of the Board Scientific of Society of Hygiene in Bulgaria. There are over 100 scientific publications n Bulgaria and abroad mainly on the field of intoxication with metals and protective role of nutrition and various food ingredients and complexes of nutrients with high biological activity. Co-author of three textbooks, two guides on hygiene and of two monographs.



Prof. Bozhidar Popov, DSci. graduated in medicine at the Medical University - Sofia in 1968. From 1971 he was a Research Fellow at the Institute of Nutrition BAS. 1978 is a medical doctor, and since 1992 - MD Science.

In 1980 he was elected associate professor and head of the Department of Hygiene at MF - Pazardzhik, and since 1991 he is Associate Professor at the Department of hygiene, ecology and occupational diseases - Sofia, 2000 - Professor and Head of Department. Chairman of the Scientific Society of Nutrition and Dietetics and section Hygiene of nutrition to the Scientific Society of Hygiene.

More than 120 publications at home and abroad in various aspects of nutrition science, participated in manuals, textbooks and monographs.



Professor Dr. Kyril Milenkov, DSci. graduated in medicine in 1952. From 1955 to 1991 worked in the institute of neurology and psychiatry. From 1991 to 1994 he was vice Director of the Center for Health Promotion. PhD from 1972, DSci 1982, Ass. Prof. in 1974, Professor in 1986. Member of the World Psychiatric Association , the World Association of Group Psychotherapy and others. Works on problems of neuropsychic diseases. There are more than 250 scientific publications in Bulgarian and foreign journals and congresses. He participated in 12 monographs and several textbooks.



Assoc. Prof. Dr. Liliana Tsoneva-Pentcheva, PhD graduated "statistics" in 1965 from the Higher Institute of Economics - Sofia. 1968 was Assistant at the Research Institute of Neurology and Psychiatry. 1983 is a PhD and from 1994 - Ass. Professor in National Center for Health Prevention. Works mainly in the field of prevention of maladaptive behaviour. Specialize in England and Germany. There are about 140 scientific papers published in nationals and foreign magazines.



Prof. Vladimir Radulov, DSci. graduated in 1969 pedagogy at Sofia University. In 1976, he defended the scientific degree Doctor of Pedagogy, and the next year he started working as Assistant at NIB. In 1991 he was elected assistant professor

at the Department "Special Education" at Sofia University "St. Kliment Ohridski ". In 1993-1995 is the Head of the department. Doctor of pedagogical sciences from 1999. Member of the European Regional Committee of the International Council for Education of the visually impaired. There are over 130 scientific publications and 3 monographs.



Prof. Dr. Arnold Reshetyuk (1930-1997), DSci was Head of Laboratory Professional - occupational rehabilitation at the Institute of Gerontology of the Ukrainian Academy of Medical Sciences. He has works of medical expertise of professional performance and professional rehabilitation of older workers. Author of more than 150 publications, including 5 monographs.



Prof. Dr. Bozhidar Stefanov DSci. graduated in medicine at the Medical University Donetsk - Ukraine in 1970. Two years later he completed dissertation - PhD. He has worked in HEI Varna and at the Medical University of Varna as an assistant. Since 1977 he is Associate Professor and Head of Department "Hygiene, Medical Ecology and Occupational diseases" at the Medical University - Pleven. Since 1984, Doctor of Medical Sciences and Professor. During the period 1980-1987, and the 1989-1991, he was vice Rector of the Medical University - Pleven. Since 2001 he is Chairman of the General meeting of the Medical University - Pleven. There are specialties of general hygiene, occupational, hygiene and communal hygiene. Since 1988 a member of the Global Environmental Epidemiology Network (GEENET). He published over 200 scientific papers in the field of hygiene, ergonomics, medical ecology and medical informatics, 10 brochures and monographs, including. "Glossary of Hygiene", "Radio waves and magnetic fields (hygienic aspects)."



Professor Mira Tsvetkova-Arsova, DSci. habilitation graduated from Sofia University "St. Kliment Ohridski" "Special pedagogy" in 1989 Since 1990 doctorant and 1991 - assistant on pedagogy of vision troubled, Department of special education of the Faculty of primary and preschool pedagogy. Associate professor - 2006. PhD from 1998, Doctor of pedagogical sciences - 2014. She has specialized in Boston College and School for blind "Perkens", Boston - United States and institutes for the visually impaired with additional disabilities - Finland. Author of more than 100 publications in Bulgarian and foreign specialized magazines, six separate text books for orientation and mobility of blind and training persons with visually difficulty and multiple disabilities, one monograph.

Participated in several international projects with partners from USA, Germany, Britain and others.



Assoc. Prof. Dencho Tsonevski, DSci. He graduated in medicine in 1961 at the Medical University - Plovdiv. MD happened in 1974. From 1979 he was Ass. professor and Head of the Department of Hygiene and Occupational Diseases at the Medical University - Varna (branch - Dobrich). From 1985 to 1990 he was Director of the "Prevention and State Sanitary Control" at the Ministry of Health, and from 1990 he is Associate Professor at the Department of Hygiene, Ecology and Prof. Diseases - Sofia. Doctor of medical sciences - 1996. In 1997 he was elected an extraordinary professor at the University of Ruse. His research is related to the combined effects of pesticides and the toxicology of heavy metals and nitrites. He authored over 170 scientific publications in the fields of hygiene, ecology and toxicology. Co-wrote 10 monographs and textbooks on hygiene and occupational diseases.



Assist. Dr. Sabina S. Sabeva, PhD, graduated from Medical University - Sofia in 1982. Her professional career began as a MD pediatrician, in Sliven. From 1989 to 2002 she was assistant at the Department of Hygiene, Ecology and Prof. Diseases at the MU - Sofia. PhD in 1999 Master's degree in Public Health from the University of Geneva in 2002. He has over 40 scientific publications and reports in bularian and foreign scientific journals and congresses.



Assoc. Prof. Nedyalka Stamova, PhD graduated from the Medical University - Sofia in 1963. Doctor of Medicine (PhD) from 1969. In 1986 became an Associate professor in the Department of Hygiene - Medical University - Sofia. Its main research interests are in the field of occupational medicine. He has authored more than 90 scientific papers, co-author and editor of three textbooks, four manuals, one monograph.



Prof. Dr. Vladimir Frolkis, DSci. was academician of the National Academy of Sciences - Ukraine, vice-president of the Ukrainian Academy of Medical Sciences (UAMS) Head of Department "Biology of Aging" and Laboratory of Physiology at Institute of Gerontology of UAMS. His research related to studying the mechanisms of aging, new ways to increase the duration of life. Creator an adaptation regulatory theory of aging development. Proves the existence of the process of anti- aging (vitaukt), offers genoregulation hypothesis of the mechanism of aging. Uncover new regulatory proteins. He has authored more than 700 publications, including 16 textbooks and 24 monographs issued in many countries worldwide.



Prof. Fanny Ribarova, PhD She graduated from the Sofia University "St. Kliment Ohridski in 1967 with a degree in biochemistry and chemistry. Since 1972 is the head of laboratory for analysis of food and biological fluids at the Institute of Hygiene and Nutrition of MA. Assistant - 1979, Assoc. Prof. - 1991, Professor of Hygiene in 2008. PhD in Biology - 1977. Scientific develop-

ments in her field are study of the amino acid as an ingredient in food and markers of nutritional status; determination of vitamins in foods and biological liquids; energy content of foods and new correction factors; food safety - vitamins, mycotoxins, polychlorinated biphenyls and others. There are over 190 scientific publications in national and international journals and is the author of five monographs in the field of nutrition science. He specialized in Germany, Holland, USA. He is a member of the European Academy of Nutrition, Bulgarian National Medical Academy, Bulgarian Hypertension League. Member of the editorial boards of Bulgarian and foreign scientific journals.



Assoc. Prof. Jenny Staykova, DSci graduated in medicine in 1984 St. Petersburg Medical Academy" I. I. Mechnikov", specialized in" communal hygiene in MNIIG "F. F. Erisman" - Moscow. Acquire a second specialty "Social Medicine" at the Medical University in Plovdiv. She has a Masters in Public Health and Management - Sofia. In 2008, the HAC (BAK) awarded its educational and scientific degree "Doctor of Medicine", and in 2010 - the academic title "Ass. Professor". Director of HEI - 1995 RIPCPH of 2001, RHC in 2009 and 2011 - Regional Health Inspectorate, Kardzhali. DSci in 2018. There are more than 70 scientific publications in bularian and foreign journals, author and co-author of monographs in the field of preventive medicine. As an expert in health management participated in the working groups of the Ministry of Health on the development of regulations, structural changes in inspection programs and projects. Head of the regional projects implemented health promotion and prevention of chronic non-infections diseases, financed by SIF, MH, PHARE program "Regional Development". Coordinator of the WHO CINDI program in Kardzhali and the national programs of the Ministry of Health in implementing the national health policy in the Kardzhali region. Expert EIA. In connection with the increase of professional qualification has conducted several courses and specializations in the field of public health at home and abroad. Participated in prestigious forums with scientific developments in England, Greece, France, USA, Mexico, Russia, Spain and others. Member of the Bulgarian and international scientific organizations: the World Organization for Environmental Epidemiology; National Association of Health Policy and Management; Board SMS - branch Kardzhali. Vice-President of the Association "Coalition for Public Health - Kardzhali." Co-founder of the Bulgarian Society for Preventive Medicine.



Prof. Vladimir Boyadzhiev, PhD. Prof. Dr. Vladimir Boyadzhiev was born in 1923. PhD defended in 1958. Habilitation in 1962 as an associate professor and in 1968. - Professor. He founded and led until 1974. Department of hygiene and occupational diseases at the Medical University - Varna. Since 1974 he joined the Department of Hygiene and Occupational Diseases at the Scientific Institute of Hygiene and Occupational Diseases, which operates in the period 1974-1979, and from 1984 until his retirement in 1989. He is the author of over 150 scientific publications in domestic and foreign magazines, reports on national and international congresses. The main direction of scientific activity are nutritional problems of the impact of xenobiotics - mainly heavy metals. He laid the foundations of scientific developments in the country of the preventive professional nutrition and moved first protective diets for people in contact with lead and manganese. New direction in his scientific activity are studies on environmental pollution and its impact on the health of the population in ecologically threatened industrial regions in developing approaches and methods for carrying research on cumulative import of heavy metals in the body. Editor and co-author of 13 text books and manuals on hygiene, and General and Tropical Medicine.



Ass. Prof. Constantsa Angelova graduated PhD in biology and biochemistry at Sofia University "St. Kliment Ohridski "in 1968. Until 1971 she was a specialist in biochemistry at the Central Laboratory of Histochemistry of the Medical Academy. From 1973 to 1997 she was assistant in nutrition at the National Center of Hygiene, and from 1997 to 2006, Associate Professor at the Department of nutrition.

PhD - in 1985. Her scientific work in the field of nutrition includes: nutrition and prevention of chronic diseases, nutrition of the population in Bulgaria - general and individual population groups (pregnant, elderly), lipid metabolism and nutrition, circadian rhythm and absorption of proteins, change of mode of work and nutrition, etc. There are over 80 scientific publications on nutrition in our and foreign scientific journals. She is a member of Ass. of scientist in Bulgaria, and EANS.



Prof. Emil Vodenicharov, PhD, graduated in medicine at the Medical Institute - Sofia in 1980. He is a graduate of the Department of Hygiene, Ecology and Occupational Diseases, Medical University, Sofia since 1981, since 1984 is an assistant, since 1989 - Chief Assistant in the Department, since 2004 - Associate Professor, and since 2008 - Head of the Department. Professor - 2013.

Since 1984, he has been PhD. In 1996-1997 he specialized in France. There are two recognized rations in the field of experimental medicine.

His scientific interests and publications are in various areas of hygiene, but mostly in occupational medicine, experimental medicine, and the impact of the dust factor in the work environment. More than 100 scientific papers and contributions to monographs and textbooks have been published and reported.



Ass. Prof. Rumen Tzanev, PhD graduated from the Higher Institute of Chemical Technology - Sofia in 1969. In 1981 acquired specialty "Sanitary Chemistry" and in 1994 "Biochemistry." Defended his dissertation" in 1987. From 1975 he worked as a chemist at the Institute of Nutrition at Medical Academy - Sofia. Since 1995 Ass. Professor in the chemical composition of food, heading a laboratory "Chemical composition of foods." It works mainly in the chemical composition of food, analysis and evaluation of fatty acid composition of dietary fat content of trans fatty acids in food products, salt and others. Author or co-author of over 100 publications in Bulgarian and foreign magazines. Biographical notes and information about its activities included in the international yearbooks Who's Who in Food Chemistry, 2000-2001, Who's Who in Finance and Industry, 2002-2003, Who's Who in Science and Engineering, 2005-2006.



Prof. M. Mutafova, PhD graduated in medicine in 1972 at the Medical Academy - Sofia. In 1973 he became assistant in the Department Social Medicine at the Faculty of Medicine, Medical University - Sofia. In 2001 she was elected associate professor and in 2009 - Professor. Besides the discipline Social medicine, in different periods also teach the history of medicine, medical sociology and medical statistics. Author of numerous publications on the issues of medical demography, epidemiology and health of the population. Presentation is their research papers in international forums in France, UK, Netherlands, USA, Australia and others. She specialized in Moscow, Nottingham (United Kingdom) and Maastricht (Netherlands). Member of the expert committee on the problems of the aging population of the United Nations. He is a member of the International Network for the study of the expected health (REVES) and the New York Academy of Sciences.



Professor Petko Salchev, PhD graduated in medicine at the Medical University of Sofia in 1987. Since 1989 Assistant at the Department of Social Medicine at MU - Sofia. Since 2003PhD. In 2005 he was elected assistant professor at the Department of "Social Medicine and Health Management" and in 2008 was head of the department. Deputy Minister of Health 2003-2005. Professor - 2012. Vice President of the Bulgarian Association of Medical Law, member of the Scientific Committee of the World Association of Medical Law. There are many publications in scientific books and textbooks in the field of health policy, health management, primary care, medical ethics and law, preventive medicine, health promotion and prevention, history of medicine, public health, drug policy. He specialized in the UK, Austria, Spain, the Netherlands, Romania, USA.



Prof. Donka Baykova, PhD, graduated in medicine at the Medical University - Sofia. At 1975 - Assistant in section "Food and Nutrition" at the National Center of Hygiene and Occupational Diseases, PhD - 1981, Ass. Professor - 1991 ., Head of Lab. "Physiology of Nutrition" - 1992, Professor - 2009. Scientific developments in the field of nutrition include: epidemiological studies of dietary and nutritional status of the population in Bulgaria and different population groups, the dietary management of obesity, physiological norms of nutrition, methods for assessing nutritional status and more. There are over 130 publications in national and foreign scientific journals, monographs and textbooks. Vice Chairman of the Bulgarian Society of Nutrition and Dietetics, a member of FENS, of IASO and the Bulgarian Association of obesity and related diseases.



Prof. Dr. Theodor Popov, PhD, graduated Germanic studies and history in the Algerian State University - 1977, German philology, Psychology and Education at Sofia University "St. Kliment Ohridski" - in 1981, pedagogy with music profile in West University "Neophyte Rilski" - Blagoevgrad - 1986 Health Management - Medical University - Sofia - 2007. In 1996 PhD. Since 2003 he is Associate Professor and in 2007 Professor of Pedagogics at the Faculty of Public Health of the Medical University of Sofia. Head of Department "Medical Education". Lectures as a part-time lecturer at the National Music Academy "Pancho Vladigerov" - Sofia, Veliko Tarnovo University "St. St. Cyril and Methodius ", the Academy of Music, Dance and Fine Arts - Plovdiv University" Zlatarov "- Bourgas and others. Author of 29 books and textbooks, more than 200 scientific publications, printed at national and foreign journals. Awards "Golden Lyre"(2005), "Crystal Lyre"(2007), Indonesian diploma for cultural cooperation and others. Member of the editorial board of the journal. "Musical Horizons".



Ass. Prof. Daniela Popova, PhD. Head Clinic of metabolic diseases and dietetics at the University Hospital "Queen Giovanna - ISUL." Specialized in Poland and Russia. There are over 100 scientific publications in the field of prevention and treatment of diseases of nutrition and metabolism, clinical testing of new dietetic foods and dietary regimes, clinicoepidemiological studies and others. Teaching students and postgraduate training in Clinical Dietetics, metabolic diseases, internal medicine, clinical pharmacology and therapy. Author of curriculum for dietetics for medical college. He is a member of many international and national scientific organizations - European Academy of nutrition, the European Association for the study of diabetes and obesity, Atlanta-Euro-Mediterranean Academy of Medical Sciences, Bulgarian Association of Nutrition and Dietetics, Bulgarian Society of Endocrinology, Bulgarian Diabetes Association and other.



Ass. Professor Dr. Ruza Nikolova, PhD, graduated medicine at the Higher Medical Institute - Sofia in 1985. In 1986 - 1987, she worked as a resident in internal medicine department. In 1987 - 1990 she was a regular graduate student in Department "Physiology of labour" of the Scientific Institute of Hygiene and occupational diseases; in 1990 - 2009 she was assistant. Since 2009, she worked as ass. Professor at the Department "Health at work" of the National Centre for Public Health, and from 2012 she is Ass. Professor in the Department "Occupational Medicine" of the Faculty of Public Health at MU - Sofia. In 1993 she acquired PhD degree. In 2008 she acquired the specialty of Physiology. Specialization at the Institute of Occupational and Social Medicine, Dresden, Germany, and the Institute of Physiology of the University of Oxford, UK. There are over 150 scientific publications in Bulgarian and foreign scientific periodicals about the physiology of labour and occupational medicine. He is a member of the International Brain Research, the International group "Psychophysiology in ergonomics," International Group "Occupational medicine and physiology of labour," International Society neurootology.



Assistant Nikolay Hristov, graduated from Medical University - Sofia in 1999. Since 2005 works as assistant at the Department of Social Medicine and Health Management of MU - Sofia. He has a specialty in social medicine and organization of health and pharmacy. He has specialized in USA and Japan. He has over 30 publications in Bulgaria and abroad and is co-author of monographs and textbooks. Member of the Scientific Society for Social Medicine,

Scientific Medical Society of Epidemiology, Bulgarian Association of Public Health and Epidemiology, Bulgarian Association for Prevention and Control of nosocomial infections.



Assistant Dr. Lalka Stefanova, PhD, graduated from the Medical University - Plovdiv in 1996. At 2004 she graduate as PhD, assistant and senior assistant at the Department "Food and Nutrition" of the National Centre for Public Health and Analysis. In 2009 he defended dissertation on "Nutrition and nutritional status in infants and young children up to age 5 in Sofia." Its scientific interests are in the fields of epidemiology, food and nutrition policy. He has over 30 scientific publications, participation in national and international scientific forums and congresses. Member of the Bulgarian Society of Nutrition and Dietetics and WPHNA (World Public Health Nutrition Association).



Prof. Dr. Carolina Ljubomirova, PhD graduated in medicine - Sofia in 1988. Since 2007 he is Associate Professor and since 2013 - Professor at the Department "Occupational Medicine" at the Faculty of Public Health - Sofia. He is a specialist in toxicology and occupational medicine. Member of the Bulgarian toxicological society and Bulgarian Academic Society of Occupational Medicine. National Secretary for Bulgaria of the International Commission on Occupational Health (ICOH). Author of more than 80 scientific publications in the field of industrial toxicology, occupational medicine, evaluation and management of health risks among workers.



Assoc. Prof. Zachary K. Ivanov, PhD, graduated in medicine in MU - Sofia and then a doctorate in NIHPZ in 1967 PhD from 1968. Worked as a Assistant and Ass. Prof. in Scientific Institute of labour and Institute of economy and organization of engineering (where is chief of the "Ergonomics and physiology of labour") until 1990. Since 1990 Ass. Prof. in the department" Hygiene, ecology and Prof. Diseases" of MF - Sofia. There are over 135 scientific publications and reports in the field of ergonomics, hygiene and safety. He has authored over 15 scientific and popular brochures, 2 educational film on ergonomics and hygiene, co-author in the manual of Hygiene and Professional Diseases.



Assistant Adriana Iv. Agovska, PhD graduated medicine in 1989 at the Medical Faculty - Sofia. From 1989 to 1991 doctor intern in HEI - Vratsa. Since 1991 Assistant at the Department of Hygiene, ecology and occupational diseases at MU - Sofia. Its scientific interests are in the fields of psychophysiology and school medicine - nutrition of children and social related diseases, problems of education of chronically ill students, evaluation of performance and stress at different age and professional groups, etc. Since 2000 PhD. She has published over 40 scientific and research work at home and abroad.



Assistant Dr. Maria Nikolova, PhD graduated in medicine in 2004 at the Medical University - Sofia. Since 2005 is an assistant in the Department "Hygiene, Medical Ecology and Nutrition" - Sofia. PhD in 2018. Its scientific interests are in the field of Nutrigenomics, child nutrition, dietary management and treatment of obesity and related metabolic diseases, food allergies and intolerances, clinical nutrition. He has published scientific papers in nutrition and dietetics in domestic and foreign scientific journals, participation in national and international scientific congresses and symposiums. Conducted a specialization in Clinical Nutrition in the Netherlands, Italy, Poland. Member of the Bulgarian and international scientific organizations: Bulgarian Association of Nutrition and Dietetics, Bulgarian Society of Endocrinology, Bulgarian Society of Osteoporosis and Osteoarthritis, Bulgarian Society of enteral and parenteral nutrition, the European Society of enteral and parenteral nutrition - ESPEN, Bulgarian Diabetes Association.



Ass. Prof. Maya Lyapin, PhD was born in 1965. He graduated medicine at the Medical University - Sofia in 1989. Since 1996 is an assistant in the Department of Hygiene, Ecology and Occupational Diseases, Medical University, Sofia. She specialized in Sweden - the Karolinska Institute and Belgium. PhD in 2015. Ass. Prof. at 2017. Its scientific interests and publications are in the study of the impact of physical and chemical factors the working environment on neutrophil function and activation, immunology and imunotoksikology. There are specialties of Occupational Medicine and Clinical Immunology.



Assistant Momchil Sidjimov, PhD, graduated in medicine - MU - Sofia in 2001. 2002-2005 he graduate PhD at the National Centre for Public Health and Analysis (NCPHA). Since 2005 assistant at the Department "Environment and health risk" - NCPHA. His research interests are mainly in the field of hygiene of soil and waste, health risks associated with solid domestic, hospital and industrial waste; health problems with the treatment of sewage sludge; health assessments of contaminated soils. Participated in several international programs on environment and health.



Professor Dr. Tontcheva, DSci. graduated in medicine at the Medical University - Sofia 1974. PhD (1978), DSci. in Molecular Biology (2006), a specialist in medical Genetics (1979), assistant (1978), associate professor (1997) and professor (2008). Visiting Professor at the University of Nis (2008), Honorary Professor at the Faculty of Biology, Sofia University "St. Kliment Ohridski" (1999). Head of the Department of Medical Genetics - Sofia 2000, head of the National Genome Centre for socially significant diseases since 2006. She has published in national and international journals more than 200 scientific publications, supervisor of 28 doctoral students;

coordinator or consultant on over 50 national and international scientific projects. Editor of the international journal "Balkan Journal of Medical Genetics", member of the editorial board of "Facta Universitatis", "Biotechnology and Biotechnological Equipment" and "Medicine and Pharmacy".



Prof. Tzvetana Todorova Popivanova, DSci. graduated in medicine at the Medical University - Sofia in 1967. From 1975 is Assistant in "HDYUV" at the National Center of Hygiene. Since 1986 Assoc. Prof. 1992 - Professor. PhD took place in 1974, DSci - in 1984. Its scientific developments are in the field of vocational guidance and recruitment of adolescents; chronic non-infectious disease in children and adolescents; health - hygienic and psychosociological problems for adaptation in childhood and adolescence; age peculiarities of the functioning of supreme specialized nerve activity and more. There are more than 200 scientific publications and participation in monographs.

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FOREWORD

Medicine includes three key areas - prevention, treatment and rehabilitation. This division is provisionally, since they are interconnected, and the main purpose of medicine is health (not disease), which determines its preventive orientation. Among numerous of medical disciplines - fundamental, clinical, rehabilitation, hygiene is the primary preventive science. It is a new science in the modern sense and at the same time one of the oldest units of human knowledge and practice related to medicine.

Like any modern science hygiene constantly enrich their knowledge and dynamic besides interacting with medical and other sciences.

The relationship of hygienic science with other preventive medical sciences (social medicine, epidemiology, microbiology and parasitology) show that unity of integration and differentiation. From one historical aspect of science, now they have their specificity in mutual relations and penetration into each other in some areas. Hygiene is directed to the health of the individual, but above all to the health of the larger population groups. Achievement of its objective - studying, preserving, strengthening and improving the health and human performance, is done by optimizing the interaction of "man - environment", to determine the most favourable parameters of the environment and increased adaptation capabilities of the organism.

The proposed volume of Hygiene guide includes two volumes: Hygiene and ecology Volume I; Hygiene and occupational diseases (Occupational Health) Volume II. In writing they involved a large number of Bulgarian authors mainly from higher medical institutes and also authors from abroad. In his writing we have tried not only to present hygiene in its modern light, as a wide and comprehensive preventive science, but to direct its contents to more training and knowledge needs students of medical specialties and doctors.

Compared with previous textbooks of hygiene, content now is not only voluminous, but many altered. Processed entirely all sections, it is mainly emphasized changes in health (biological action, diseases, changes in the adaptation) under the action of environmental factors.

In focus - for doctors and students, and voluminous, this guide in Hygiene is the modern successor of issued more than 40 years two volumes Textbook hygiene - first and second parts, ed. Prof. Dr. L. Tsvetkov (1958) and Occupational medicine. ed. Prof. Dr. M. Lukanov (1984). Now in the second volume is on and discipline professional diseases.

We are grateful for the quality requirements of higher education concerning environment, and support the project JEP 2154 - 91/94 program "Tempus" with the Head Professor Andre Pavia, University of Montpellier II, France.

The guide can be used by other non-medical professionals. Gratefully we will accept all criticism and views on quality.

Prof. Dr. D. Tsvetkov, DSci.

PREFACE

La médecine comprend trois directions fondamentales-prophylaxie, traitement médical et réhabilitation. C 'est une division relative puisque ce sont des partie mutuellement liées, et le but principal de la médecine est la santé (non pas la maladie), qui détermine son orientation prophylactique. Parmi les nombreuses disciplines de médecine: fondamentales, cliniques et de réhabilitation, l'hygiène est une des moderne, mais en même temps une des branches les plus anciennes de la connaissance et de la pratique humaines, liées a la médecine.

Comme chaque science contemporaine, l'hygiène enrichit constamment ses connaissances et sa coopération avec les autre sciences de médecine ainsi que avec des sciences dans les domaines homologues.

Les relation réciproques entre l'hygiène et les autres sciences medico-prophylactiques-mèdecine sociale, èpidèmiologie, microbiologie et parasitologie, progressent surtout durant les dernières décades. Elles témoignent d'une unité d'intégration et de différenciation. Etant parties, historiquement d'une seule science, actuellement elles présent une specifite sur le fond des liens réciproques et d'une interpénétration. L'hygiène est orientée vers le santé de l'individu, mais avant tout vers celle de large groupes de la population. L'hygiène envisage la réalisation de son but – l'étude, la protection, la promotion, l'amélioration de la santé et de la capacité de travail par l'optimisation de l'interaction entre l'homme et l'environnement, c'est a dire, par l'identification les plus favourables paramètres de l'environnement et la promotion de la capacités d'adaptation de l'organisme.

Le présent manuel d'Hygiène est constitue de deux volumes: „Hygiène et écologie" – v.l et„Hygiène du travail et maladies professionnelles» (Médecine de travaille)-v.11 a ètè rédigé par des nombreux auteurs bulares – surtout des Instituts supérieurs de médecine, et d'étranger. Comparant ce cours avec les manuels précédents d'Hygiène on constate un changement ainsi bien au point de vue volume et composition que d'amélioration d'approche et de quantité. Toutes les parties sont remaniées et revissées. L'accent est mis principalement sur les changements de l'ètat de santé (influence biologique, maladies, modification d'adaptation) sous l'influence des facteurs de l'environnement.

Dans son esprit, contenu de base, but et destination le cours est un continuateur contemporain de Manuel en deux volumes du prof. L. Tzvetkov (1958-1958) et de Medicine de Travail, sous la dir. de prof. M. Loukanov (1984). Le nouveau v. Il comprend aussi la discipline maladies professionnelles.

Nous sommes reconnaissants pour les exigences a l'égard de la qualité de l'éducation supérieurs dans le domaine de l'environnement et l'assistance du Projet JEP 2154 – 91/94 du programme TEMPUS sous la direction du prof. André Pavia, l'Université de Montpellier II (France).

L'ouvrage peut être utile a nombre de spécialistes qui travaillent dans des secteurs qui ne sont pas en liens étroits avec la médecine. Les auteurs seraient contents de recevoir des critiques et de commentaires concernant les qualités de cette publications.

Prof. D. Tzvetkov, D.Sc

INTRODUCTION

B. Stefanov, D. Tsvetkov

Medical science and practice comprises three ***main areas***:

1. Prevention.
2. Treatment.
3. Rehabilitation.

It is also divided on preventive and clinical. This division is conditional, because medicine now is a starting point and ultimate goal not the disease, but the human health. So in essence the medicine is preventive directed.

- **Health prevention**

The term preventive (prophylactic) is from the latin word **prophilatto**, which means protect, store. Broadly this concept includes a system of complex measures (individual, group, government, social, medical, etc.)., aiming to prevent disease, and to protect strengthen, human health and to ensure a high labour efficiency and active longevity.

In its target prevention can be constructive (health promotion), primary (preservation of health), secondary (early identifying and addressing the disease) and tertiary (recovery of health – **Fig.1**).

Overall prevention. It's a set of measures aiming to stimulate positive effect of factors of living environment on human health, to develop and improve adaptation and body's defense mechanisms.

Primary prevention. It is system of complex measures that are targeted to prevent the disease. This is achieved through:

- Detection, study and removal reasons and conditions for the emergence and development of diseases.
- Development and implementation of effective measures to enhance the sustainability of organism to the harmful effects of factors of the living environment.

Secondary prevention. It is complex of measures and activities which have purpose of weakening or termination of already arose in the body pathological process (early diagnosis, etiological directed treatment, etc.).

Tertiary prevention. Aimed at faster recovery of the sick person immediately after the disease. The aim is to preserve transition from sickness to health, to prevent functional and social inferiority (disability). It includes rehabilitation, vocational rehabilitation, dispensary (which is included in primary and secondary prophylactictics) and other events.

- **Hygiene**

Hygiene is a ***major share of primary preventive health*** care (called so by the name of one of the daughters of Aesculapius - **Hygieia**, goddess of purity and health (**higienos** g. - bearing health cooperating for health). Contemporary hygiene is a medical science which stargating interaction in the system "man - living environment" for the efficient development, maintaining, strengthening and improving health and performance and insurance of active longevity.

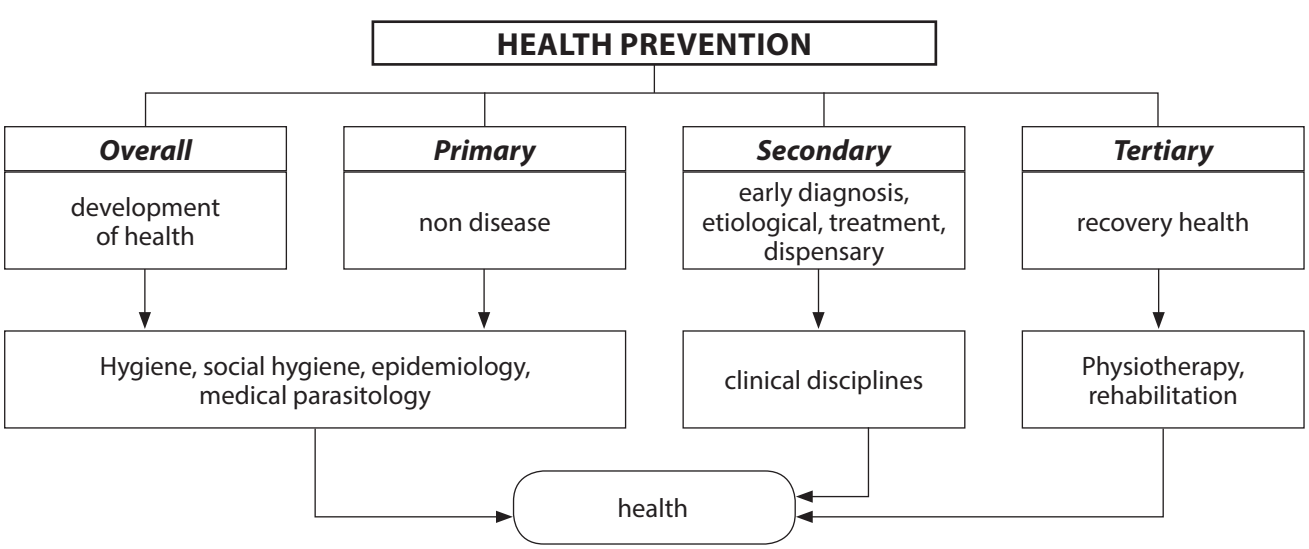


Fig. 1. Types of preventive health care

Hygiene is a new science in modern meaning and is also one of the most ancient shares of human knowledge and practice related to medicine, the preservation and improving health.

Millennia BC (IV-I cent. to J.C.) in written laws and rules in ancient India, China, Egypt, Assyria-Babylon (Laws of Manu, Veda, Hammurabi) in religious canons of Moses, Mohammed has many hygienic rules for food, personal hygiene, prevention of infectious diseases (variolizatsiya) disposal of carcasses, liquid waste, structure and maintenance of the settlements.

In ancient Greece, the founder of scientific Medicine Hippocrates (**Hippokrates**, 460-337, to J.C.) except genius healer is founder of preventive medicine. In one its 59 labour - the treatise (the labour of scientists from the Library of Alexandria), "For the air, water and soil "(" De aere, aquis, locis ") he locating the importance of water, climate, air for health. He started that it should be treated not disease, but the patient and that "the physician must care for healthy persons, not sick. "

In ancient Rome (up to the IV cent. after J.C.) is reached great for time development of sanitation. There were (preserved just now) huge equipment for the removal of liquid waste (famous cloaca maxima, built in time of Tarquinius Old) and Roman aqueducts were supplied by 500-1000 l drinking water a day for person. Is there are officials - Edils, for sanitary control of water and foods.

Later, only during the Renaissance (XV-XVI), with the development of the natural science was revived and growing interest of problems of hygiene and professional pathology. In the writings of Thomas More (T. More) "Utopia", Francis Bacon (Fr. Bacon) "New Atlantis", Tommaso Campanella (T. Campanella) "City of the Sun", indicated the role of doctor, personal and public hygiene for prophylactic of health. Frakastor (G. Fracastoro) in his work "Contagium vivum" rethrows theory for so called "Miasma" as factors of infections. Ulrich Elenbok (U. Elenbock) in 1473 described poisoning with mercury vapors, lead and coal smoke. Paracelsus (Paracelsus - Philipus Theophrastus Bombast, 1493-1541) stargating diseases in miners. Agricola (G. Agricola, 1494-1555) describes in his work "De re metalica " disease in miners from inhalation to dust.

At the beginning of the XVIII century (1700) appears remarkable treatise Ramatsini (Bernardino Ramazini) "De morbis artificum diatriba" ("For diseases of artisans"), which presubmit working conditions and diseases for 70 professions ("Diseases of writers and scientists", "diseases of pharmaceutists ", etc.).

At the end of the XVIII century are the first attempts for formation the hygiene as an independent scientific discipline, but based on empirical observations. In 1778-1819, the six volume work of J. Frank (Jochen Peter Frank) "System of medical police" in which are exposed known then sanitary knowledge. The famous book "Macrobiotics or Art for the continuation of human life"(1796) of Hufeland (Chr. Wilhelm Hufeland 1762-1836) is dedicated to opportunities strengthening health to old age.

In the middle of the XIX century the development of scientific knowledge of science - physics, chemistry, and experimental approach in development of biological and medical sciences, gives opportunities for the development of hygiene as science in the modern sense.

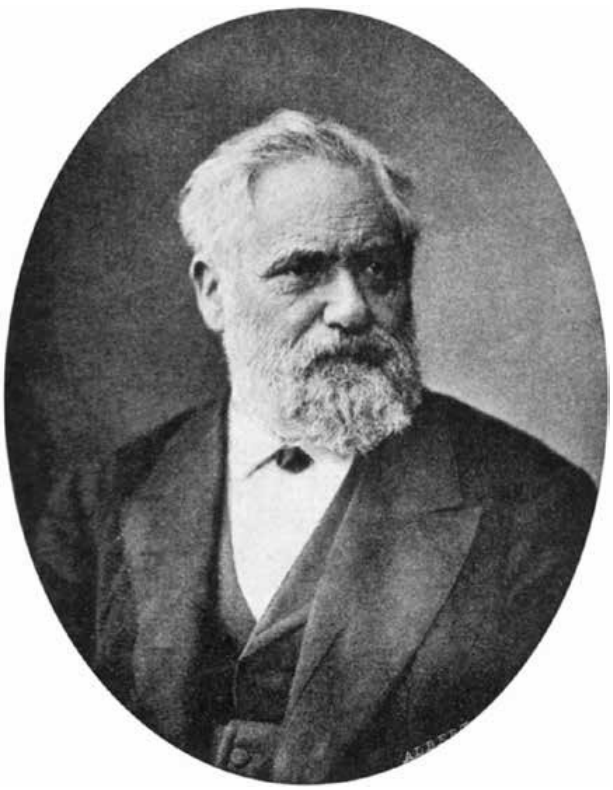
Discoveries of L. Pasteur and P. Koch (Lui Pasteur, Robert Koch) in experimental and applied microbiology, widely disseminated infectious diseases (tuberculosis, rabies, smallpox, cholera, etc.) provided by this highlighted bacteriological and epidelogical focus of hygiene.

Experimental direction in hygiene is associated with the name of Pettenkofer (Max von Pettenkofer, 1818-1901), created the first Hygiene Institute (Germany) and hygienic school in which were other cofounders of temporary hygiene - Rubner, Prausnits, Flyuge (M. Rubner, W. Prausnitz, K. Flugge), A. P. Dobroslavin, F. F. Erisman.

At that time (1857) released the big "Manual in practical hygiene" Parks (E. Parkes), which is also reflected experimental direction in hygiene science. Another famous English hygienist is Simon (J. Simon).



Lui Pasteur (1822–1895)



Max fon Pettenkofer (1818-1901)



Prof. Dr. Toshko Petrov (1872-1942)

Appeared, respectively in 1884 and 1851 hygienic guides - M. Levy (M. Levy) and F. Osterlen (F. Oesterlen), are aimed at public health and the role of environment.

In the area of nutrition and bromatologie worked Liebig (J. Liebig), Voith (K. Voit), Rubner (M. Rubner), A. P. Dobroslavin, in occupational hygiene and professional diseases - F. F. Erisman, Teleki (L. Teleky), Hill (L. Hill), Devoto (L. Devoto), Alice Hamilton (A. Hamilton).



Prof. Dr. Lyubomir T. Tsvetkov (1899-1984)

In Bulgaria the development of hygiene as science is associated with the creation in 1919 Medical Faculty in Sofia and the Department of Hygiene and Social Medicine, headed by Prof. Toshko Petrov - founder of Bulgarian hygiene school with contributions in all fields of hygiene and a bacteriolology (introduce BCG vaccine in our country).

During the period of 40^{s} and 70^{s} years of XX century, a leading bularian scientist in the field of hygiene is prof. L. Tsvetkov. Prominent bularian scientists are: M. Lukanov, Hr. Hadzhiolov, Ts. Aleksieva F. Kaloyanova, Vl. Boyadzhiev - occupational hygiene; G. Stefanov, L. Grigorov Em. Efremov - communal hygiene; B. Yanev B. Miteva, Ivan Naydenov, T. Yordanov - school hygiene; T. Tashev, M. Markova, L. Balabanski M. Sheytanov - nutrition; Kr. Kirjakov - medicine of transport; Dr. Mateev, G. Stoynev - gerohygiene; P. Stavrev - military hygiene and others.

As in medicine and in the hygiene in particular, axiomatically accepted indivisible unity of the human body and its vital environment. Hygiene studied all (positive and negative) effects of the factors of living environment on people from positions of his health **(Fig. 2)**.

Purpose of hygiene. The purpose of hygiene is study, protects, strengthens and improves health and man performance, to provide his active longevity. Hygienic science scientifically justified, devel-

ops and implements recommendations, standards and requirements by which to optimize interaction "man-living environment, "and so like that provide health **(Fig. 3)**.

In other words, the hygiene have aim to make human development most perfect, decline life - slow, life - the most health and death - the most remote **(E. Parkes)**.

Main tasks of hygiene. They are **(Fig. 4)**:

1. To make hygienic assessment of factors and the conditions of the living environment from the point of view of human health.

Hygiene study the physical, chemical, physicochemical, ergonomic, biological and psychosocial factors. Subject to hygienic knowledge are as harmful effects of various natural and anthropogenic factors, and also their favourable (sanogennic) impact action.

2. To study the processes (nutrition, training, work, recreation, etc.) that integrate different complexes of external factors and have substantial relation to human health.

3. To study changes in human body arising from interaction with living environment (factors and processes).

The human body reacts in all a time with a huge number of factors. Hygiene study changes that factors of the living environment and the processes cause in the human body, their impact on physical and mental state and development on performance and health.

4. To develop norms and activities for the factors and processes in living environment, with view to optimizing the interaction "man-living environment."

In some conditions, the factors may be harmful, but essentially they are necessary as ***"The body without outside environment, supporting its existence is impossible"*** (I. M. Sechenov, 1829-1905).

Harm (stressor) is any factor that can cause or provoke adverse health consequences. Of importance to human health is not so much the type of factors, but before all their dose, concentration and continued duration of the impact.

Ideal option in the living environment no harmful. It even theoretically impossible, because a number of natural factors are practically out-of-control.

Hygiene scientifically justified norms the factors of the living environment, determine to what concentrations, doses and intensities these factors are still not damage for health and performance. In develoption of these regulations are leading health criteria rather than technical accessibility, economic accessibility and "public acceptable live risk ", but of course they take into attention.

5. To develop approaches, methods and meroenterprises to increase the possibility of organized organism to adapt to new conditions living environment, to increase its reserve and adaptive stimulation and development human health.

Availability of health is determined by harmony of optimal external and optimal internal environment. If the external environment improves and the body has a reduced adaptive capacity, for untraining a result of the operation in terms of irrational mode of work, recreation, nutrition or education, can hardly expected health. Therefore hygiene has a task not only to determine the most favourable health parameters of the environment, but also to different work approaches and methods for its improving.

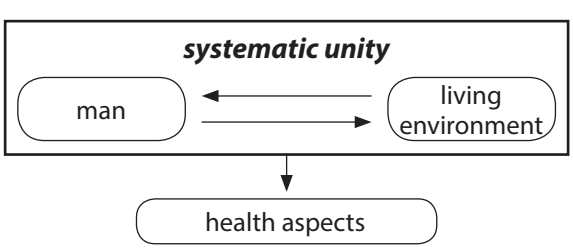


Fig. 2. Subject of hygiene

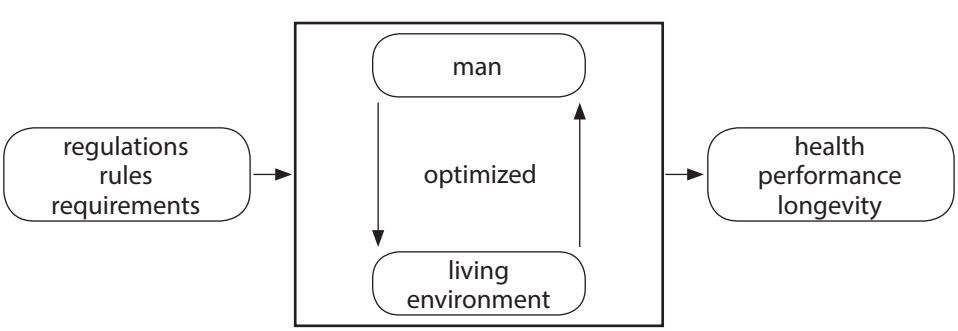


Fig. 3. Purpose of hygiene

Methods of hygiene. To implement its tasks hygienic science uses joint a census of:

1. The general scientific.
2. Particular scientific.
3. Specific methods.

General scientific methods. They are descriptions, surveillance, natural and laboratory experiment, analysis and synthesis, modeling, systematic approach and others.

Particular scientific methods. They can be classified as:

1. Methods for studying mainly subsystem living environment:
- physical;
- chemical;
- physicochemical;
- biological (microbiological).

2. Methods for studying mainly subsystem man:
- biophysical;
- biochemical;
- biological (physiological, medical);
- psychological;
- sociological.

Hygienic science uses methods of other sciences, according to the specifics of its subject. **Specific methods.** These include:
- sanitary description;
- sanitary inspection;
- hygienic expertise;
- complex hygienic method.

Sanitary description is essentially monitoring, detecting and fixing state of the living environment. Through it makes qualitative characteristics of the factors and environmental conditions.

Sanitary inspection includes in order with the description also raising instrumental data. Determine the amount characteristics of the factors to assess more fully and more accurately state of environment.

The objective effect of the living environment on human health is determined by method of ***hygienic expertise***. It includes above two methods, but includes also analysis, comparison and hygienic evaluation. By knowing some already established laws for influence on the environment, through expertise on its status can predict its impact on human health.

A full evaluation of the interaction "man-environment", by which is defined human health, requires the use of system integration used methods. Expression of such integration is ***complex hygienic method***.

The complex method, as a structural and organized multiple of particular scientific methods is specific method of hygiene, which enable most adequate knowledge of its sophisticated object - the system "man - living environment."

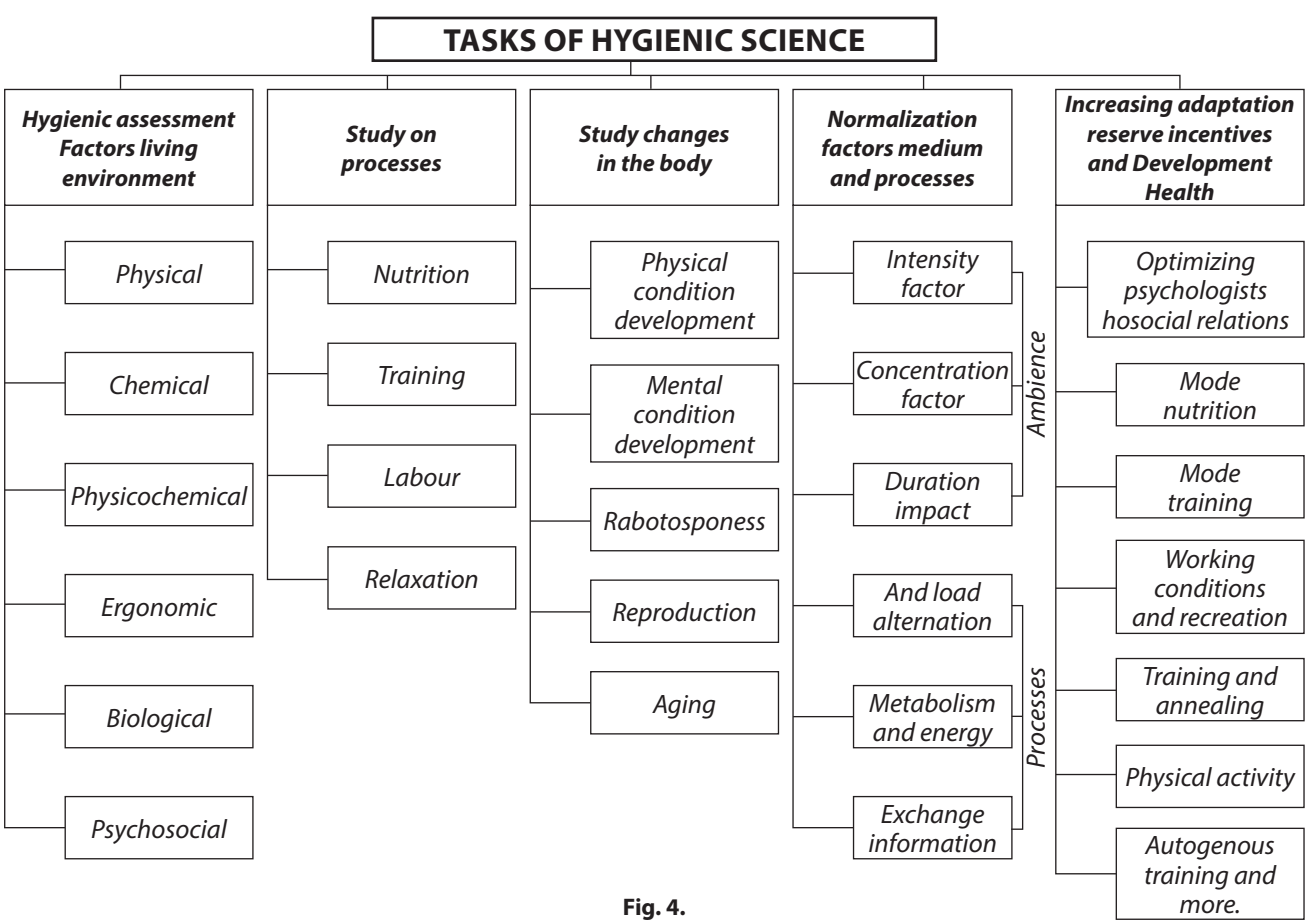


Fig. 4.

Link hygiene with other medical and non medical sciences. The study of complexing and multifaceted problem - the health and the diseases of human is possible only in the most narrow relationships and deepening integration of various medical sciences.

Like any modern complex science hygiene borrows knowledge and methods on the other sciences. Thus it enriches content and its fund of knowledge. While hygiene similarly enriched other sciences.

By providing their knowledge of interaction "man - living environment", hygiene contributes to the enrichment of contents of medicine, for the study solving complex problems of human health. In the study of reactive changes in people under the influence of life environment, hygiene science draws methods and approaches from the rich fund of medicine.

Closest relationships are with hygiene and other ***preventive sciences***.

The relationship between hygiene sciences on the one hand and social hygiene, epidemiology, medical parasitology and microbiology on the other are suitable illustration of the unity of differentiation and integration. From single in the past science, consecutively differentiate separate sciences with its specific subject.

Hygiene studies mainly physical, physicochemical and chemical factors: epidemiology, medical parasitology and microbiology mostly biological, and social medicine - social factors, of course and their impact on the body. But these groups of factors are not in isolation, but in real conditions always act in the complex. Therefore scientific interest and research of hygiene and indicated sciences interwave and complement.

Hygiene carried out intensive information, factual and methodical exchange with ***clinical*** disciplines. The most significant integrating point in this case is the principle of preventive orientation of modern medicine. Clinical courses of study have the objective of removing the disease, restoration of health. Compared with them hygiene most complete study determination of health and disease, causes and conditions for their emergence and development. Therefore with its specificity hygiene has contact points with virtually all medical science importance of hygiene of nutrition in healing process - for ex. development the specific issues of nutrition of sick (dietary), study of etiology of food illnesses and justification their prevention and others.

Especially strong is the integration between hygiene of labour and professional pathology. Their relationship gives rise to unite in the term "occupational medicine".

The sophistication of the system "man - living environment" have a more complete integration between hygiene and ***Biological Sciences*** Microbiology, parasitology, genetics, biochemistry, biophysics, ecology and others. A full and thorough study of factors and conditions of life environment and their impact on human health is impossible without the active cooperation between hygiene and ***physics, chemistry, mathematics, statistics, urban studies, technical sciences, psychology, sociology, ergonomics and many others*.**

The integration of these sciences is expressed in different personal guidance:

- ***In some cases it is methodological***, for example of physics and chemistry, from which hygiene use research methods.
- ***In other cases, it is an object***, for example of urban studies, architecture, acoustics with which has a common object (the urban environment, dwelling).
- ***In the third Integration is objective***, for example, psychology and physiology, ergonomics, medical climatology, medical geography and others.

Functions of hygienic science. They are:

- cognitive;
- prognostic;
- applied.

In studying the interaction "man - habitat" hygiene established facts and laws that together with ***cognitive significance have important prognostic role***. Fundamentally hygiene inspection and hygienic expertise (as a method and result) aimed not so much the establishment of concrete realities, but assessing they relevance to human health.

Studying the subsystem "life-environment", its factors, conditions, and their special features in each concrete case left hygienic science to ***predict*** (with great probability) what would be the health of the population. Thus hygiene contributes to social management, to organized of "in time" reactions of society for the protection and improvement of human health.

Cognitive and prognostic function of hygiene science are subjected to its ***Applied*** function. Complex applications activities for implementation of hygiene requirements and norms and practical implementation the purpose of the hygiene is called ***sanitary*** (sanitas - lat., health).

The applicability of hygiene knowledge is comprehensive.

Organization and optimization in all area of public life concerning human health, requires the application of knowledge, received or refracted through the prism of hygiene science.

Currently hygiene is a complex of scientific disciplines, each of which study separate aspects of subject and object.

Hygiene disciplines. General hygiene disciplines are: communal hygiene, hygiene of nutrition, occupational hygiene, hygiene of children and adolescents, personal hygiene, radiation hygiene, military hygiene, transport hygiene. Along with them as individual sections of hygiene have evolved more: hospital hygiene, marine hygiene, aviation hygiene, space hygiene, recreation hygiene, sexual hygiene, sports hygiene, psychohygiene, gerohygiene and others.

Communal hygiene (Environmental health) studied the health effects of conditions of life in the settlement: impact on human health of components of atmosphere, water and soil, climate and weather; hygiene problems in the housing and community development, of water supply and assenisation; the influence of the processes of urbanization on health and morbility of population.

Specialized section of the community hygiene is the ***Hospital hygiene***. Its subject are: the conditions for conducting health process, specifics of construction of medical-prophylactic institutions, nutrition of sick and healing regime, the fight against nosocomial infections, occupational hygiene of healthcare workers and others.

Food hygiene (Nutrition) as part of the science of nutrition, studying all problems of the impact of food and nutrition, securing normal growth, development, health, performance and longevity of people. This hygiene discipline establishes physiological norms of different age, sex and professional groups; studying healthful professional and therapeutic feeding; the hygiene of the food, ways of culinary processing and preserving; prevention of food borne illness and poisoning, hygiene aspects of catering.

Hygiene of labour (Industrial hygiene) has the subject of the entire health problems of interaction "working man - labour process - working environment." This hygienic disciplines study: the impact of the forms of work, of the various factors of the working environment and technology on the worker; performance, fatigue, strain and their prevention; prevention of occupational diseases; hygiene of labour in separate sectors of production; hygiene requirements for industrial objects. Hygiene of labour most closely interacts with the physiology and psychohology of labour with ergonomics and profpatology.

Hygiene of children and adolescents (Child health) aims to ensure the normally development of children and adolescents, to preserving and strengthening their health. She studied anatomy-physiological features in the period of growth and development of man on a background to the acceleration; develop rational regimes of life, education and physical training; justifies the specific requirements of the device of child and educational institutions; hygienic problems of professional guidance and others.

Personal hygiene (Personal health) is the subject of personal health problems: rational daily regimen, body care matters and forming health habits of healthy life style; sex hygiene, hygiene of clothing, shoes, households and cosmetics and others.

Radiation hygiene (Radiation protection) deals with hygienic problems that arise from the use of ionizing radiation in energy, science, medicine, industry and agriculture. This section of the hygiene develop requirements and standards for the protection of environment and for radiation safety of workers and the population.

The specifics of the object of **military, transportation, space hygiene (Military hygiene, Aviation medicine, Aerospace medicine)** and other hygienic disciplines defines their concrete content and tasks.

The current state of hygiene and prospects for its development are part of the scientific and technical progress of humanity - the close connection of hygienic science with the development of other medical, biological and so on. sciences with their practical applications and cultural, economical and social capabilities of society to realize prevention. In all hygienic disciplines can indicate very specific contemporary issues and guidelines for their development, as well as some common problems and prospects concerning for eg. with application of chemicals in industry, food and environment; various physical factors as hazards in labour and community; combined (sequential, complex, continuous or intermittent) action on human organism of factors with less intensity; assessment of new technologies and productions; evaluation of the new forms of training and increasing the intellectual possibilities of person, etc.

Primary and broad direction in the development of hygiene science is in connection with the state and forecast for the current acute and above all chronic diseases as the cause of death. In developed countries 70% and more of the deaths were due to the large group of cardiovascular diseases and cancer diseases. They are connected both with genetic factors and the negative impact of the factors of the environment and unhealthy lifestyle (but genetic factors are also associated with it!).

Main focus in the development of hygiene is the study and evaluation of risk factors (in their diver-

sity) for accelerated aging - in a broad sense, as reduced adaptive reserve, structural and functional changes of the human organism and the offspring, how "specific" adverse effects of risk factors on the body potentiate process of aging (in all life) and the development of socially significant illnesses. This is closely related to duration, quality of life, creative longevity - also in the broad sense, as state of health and performance maintained throughout life.

Of course, strict adherence to hygienic standards at individual factors (hazards) guarantee safety and the lowest possible risk, but in the reality is not always, so it is necessary as studies on the role of risk factors in this regard and also permanent control of health status of the individual.

"Not every doctor should be specialists in hygiene, but everyone is obliged to form in themselves hygienic and preventive approach of thinking "(F. F. Erisman). Conversely, any modern doctor - generalist or a specialist, it is necessary to apply in their work hygienic knowledge.

REFERENCES

1. **Beck E.G., P. Schmidt.** Hygiene. Enke, 1991, 355 p.
2. BME. Ed. "Rus. Encycl ", Moscow, 1977, vol. 5, 349 -361. (in russ.)
3. BM E. Ed. Med. lit., Moscow, 1958, t. 6.1026 -1059. (in russ.)
4. Comparative quantification of health risks. ed. **Ezzati M.** et al., V. 1-2, WHO, 2004, p. 2235.
5. Handbuch der Hygiene und der Gewerbekrankheieten. hzsg, Von, **M. Pettenkofer** u. **H. Ziemssen**, bd 1-9, Leipzig, 1882 -1887.
6. Hygiene. WHO (http://www.who.int/topics/hygiene/en) 2011.
7. Mental Hygiene. Encyclopedy Britanica Ultimate Ref. Suite, 2011.
8. **Minh, AA** General hygiene. Medicine, Moscow, 1984, 5 -17. (in russ.)
9. Occupational Hygiene. ed. **Gardmerk K., J.Malcolm, C.Harringtin**, 2005, p. 510.
10. **Parkes, E. H.** A manual of practical hygiene, prepared especially for use in medical service of the army. Lon., 1866.
11. **Prausnitz, W.** Grundzuge der Hygiene. J. F. Lehmanns Ver., Munchen, 1923.
12. **Roday S.** Food Hygiene and Sanitation. 1998, p. 315.
13. **Rumyantsev GI, EP Vishnevskaya, T. Kozlova.** General hygiene. Med., Moscow, 1985, 4-21. (in russ.)
14. **Stefanov, B.** Terminological dictionary on hygiene and medical ecology. Ed. "VMI - Pleven", 2003, 190 p. (in bul.)
15. **Stefanov, B.** Theoretical and metodological basis at hygienic science. Doctoral dissertation, S. 1984, 360 p. (in bul.)
16. **Tsvetkov, L.** Manual of hygiene. Part 1, Med. and phys.., Sofia, 1957, 3-22. (in bul.)

1 ENVIRONMENT AND HEALTH

B. Stefanov, P. Salchev, M. Mutafova,
D. Tontcheva, D. Tsonevski, D. Tsvetkov

1. ECOLOGY AND HYGIENE
B. Stefanov

1.1. NATURE OF ECOLOGY

Ecology (gr. Oicos - house, logos - science) is a relatively new biological science, created by Ernst Haeckel - 1866. In general it learning Interrelationships of living matter with the environment. Initially ecological subject is relationships and interactions between organisms and between organisms and their environment.

In modern conditions it is perceived as a complex interdisciplinary science of causal relationship and interrelation of organisms, society and the environment. Depending on the different classification discriminatory signs, the following major sections of ecology are: ecology of individuals and species (autecology) ecology of populations (demecology), ecology of communities (sinecology), ecology of ecosystems (biogeocenology), ecology of human (social, medical ecology), radiation ecology, marine ecology, zooekology, fitoekology and others.

By its content, purpose and tasks closest to hygiene is the **ecology of the human** (social, medical ecology). Uniform definition of her essence lacks. Some authors accept as a private-scientific discipline, others - to approach or direction, way of thinking, metateoretical concept. There is a growing view that the ecology of human is interdisciplinary science and integrative functions, with subject the general regularities and interaction "man - living environment" and developing events and recommendations for optimization.

In comparison between the ecology of man with hygiene (see previous chapter) is evident their community:

- ***The object of the study is the same - the man and his environment in their unity.***
- ***The subject of both sciences are the health aspects of the interaction between man and environment.***
- ***The purpose of these studies is limited to usage category health.***
- ***Many nearby of their specific methods:*** complex dynamic method and hygienic expertise - on the hygiene; the method for integrated reporting and forecasting of health status of the population and the method of environmental expertise - on the ecology of man.

The proximity of these sciences bordering identity, outlines the relationship between hygiene and medical ecology (ecology of man), relations as part of the whole, with all inherent in these categories distinctive and common traits. Assuming that the medical ecology becomes wider general theoretical and methodological importance for medicine, while it should be noted that in general don't "dissolve" in itself a private, did not take his relatively independent and specificity.

The main difference between these two sciences is the following: studying the interaction in the system "man - environment" hygiene has to focus primarily on the impact of the environment on human and human ecology - mainly on anthropogenic (human provoked) influences on the environment.

Basic concepts in ecology, resp. in the medical ecology are:

- biosphere;
- ecological system (biogeocenosis);
- biotope (ecotope);
- biocenosis (ecocenosis).

1.2. THE CONCEPT OF BIOSPHERE AND ECOLOGICAL SYSTEM

1.2.1 BIOSPHERE

Biosphere, in the broadest sense, is that part of the Earth's surface, water and air environment in which it exists forms of life. The founder of the doctrine of the biosphere V. I. Vernadsky and his followers accept that it is a space in which life is concentrated and is realized constant interaction between living beings and inorganic conditions of environment. According to today's concepts biosphere is

complex, multicomponent, thermodynamically open, self-regulating system of living matter and natural factors in which arise and exist earthly life. Components of the biosphere are lower atmosphere (troposphere), hydrosphere and the superficial layer of the lithosphere.

1.2.2. ECOLOGICAL SYSTEM

Natural ecological system is complex of animals, plants and factors haunted their environment interconnected by metabolism and energy. Synonymous with ecological system is biogeocenosis which is composed by corresponding biocenosis and its biotope (ecosystem = biogeocenosis = biotope + biocenosis).

1.2.3. BIOCENOSIS

Biocenosis is a combination of live organisms (plants, animals, microorganisms) inhabiting a biotope. Biotope (ecotope) is haunted the organisms part of the environment in which there are uniform conditions for existence **(Fig. 1.1)**.

1.3. ECOLOGY OF KNOWLEDGE AND PRODUCTION

1.3.1. ECOLOGYSATION

Ecologysation is using environmental knowledge in various fields of scientific knowledge and public areas of human activity, organization of social practice so as to maintain ecological balance in Human Environment. In other words - the current strategy "conquering nature" to replace with a new one - "harmonious cooperation human-nature. "

Our time is characterized by a significant increase in productive activity of society, due to the hurried introduction of the achievements of scientific and technological revolution (STR). STR is stage of scientific and technical progress and is defined as a set of qualitative changes in the structure of production, public relations, science and technology, more intensive development in the name of progress of civilization.

Serious human intervention in the course of natural phenomena, threaten to cause irreversible changes in life environment, with inevitable negative health consequences. Anthropogenic environmental changes, especially intensified by STR, gradually make nature unconform to the biological and social nature of man. There is a growing, along with the production aspect of STR, also take account of this changing relationship between nature and society. This determine great social role of ecology as a process that corrects direction, methods and forms of scientific and technical progress in order to avoid substantial degradation changes in the biosphere and adversely affecting human health.

Of particular importance is the ecological production. It is a system of technical and technological measures to align production with the principle of recirculation of matter, to preserve the ecological balance and the creation of non-waste and resources restoration economy.

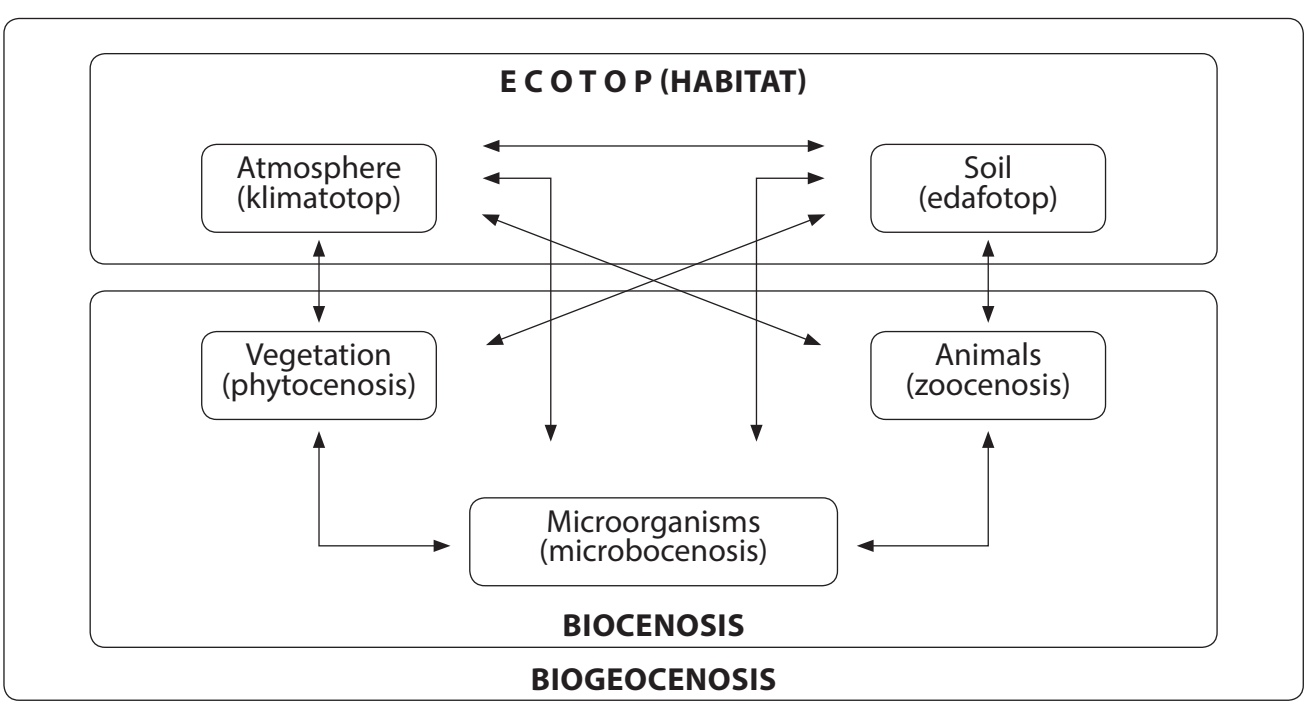


Fig. 1.1. Structure of the biogeocenosis

1.3.2. ECOLOGY AND OTHER SCIENCES AND SCIENTIFIC FIELDS. GLOBALIZATION, P. Salchev, N. Hristov

Interaction of organisms and the environment is study of many other sciences, but unlike them in ecology prejudice those sides of relations that help development, reproduction and survival of individuals, structure and dynamics of populations and communities. At a certain stage of development of human knowledge of nature has been a **convergence of ecology with other biological and non-biological sciences**. Particularly close are relationships with physiology - develops direction functional ecology. Between ecology and morphology - direction embryology. Ecology is closely linked with systematics, which includes environmental criteria for the classification of organisms. Uniting evolutionist geneticists and ecologists identifies changing of ecological mechanisms of evolution in nature. Based on ecology develop biogeography, molecular biology and others. Ecology is closely linked to many non-biological sciences - geography, hydrology, geomorphology, landscape studies, climatology, meteorology, mathematics and others.

The achievements of ecology successfully applied in human medicine, veterinary medicine, implementation of measures for the protection of nature and rational use of natural resources. Develops ecological economics (of bioresources), environmental engineering and biotechnology to solve problems for the elimination of the negative consequences on the environment. Develops and social ecology - the science of environmental protection.

Penetration of ecological ideas in all sections of biology. In all existing classifications is clearly visible place of ecology among other disciplines - organization of bioobject- molecular - molecular biology, genetic engineering; cellular and organism tissue - histology, anatomy, physiology; of organism level - botany, zoology. Insofar as any kind of nature defines itself not as a sum, but as single functional unit - population (for living organisms are biocenoses, ecosystems and the biosphere), ecology with other sciences studying as complex biological macrosystems.

In recent decades, **globalization** has become a major challenge for the specialists dealing with public health and health policy. Globalization stand and on the focus of attention of activists working in international health and with health realated organizations (WHO, IARC, UNEP, ILO, FAO and many others. etc.).

One of the differences of previous processes of urbanization typical of the second half of XX century, is constantly increasing cross-border movement of people.

Many authors developed conceptual models of interdependence of globalization and health (Mc Michael, Biygalhoul, Taylor, Betchar, Woodward, etc.). However, there is no single opinion and unified conceptual structure for evaluation of these links. Much of the models are based primarily on the influence of economic processes on health, the opening of economies and the increasing volume cross-border connections, which is close to the **mechanical** approach. It does not allow fully disclose the actual relationships and their importance to individual, in a group and public health in each country. It is necessary to apply synthesis between this approach and **behaviouric,** directed inside the man.

Public health depends both on the impact at the population level, and the risks health at the individual level. They can be referred to these few basic setting relations between globalization and health:

- Indirect - impact on the health system and the policy of health by: the impact of multinational pharmaceutical companies with their policy on sales and prices; the impact of international health organizations and the European Union - global rules and institutions; transboundary carry of goods and services - expanding market of multinational pharmaceutical companies, expanding influence of multinational monopolies (with a negative impact on health - sale of tobacco, alcohol and other goods); expanding integration of private health insurance companies;

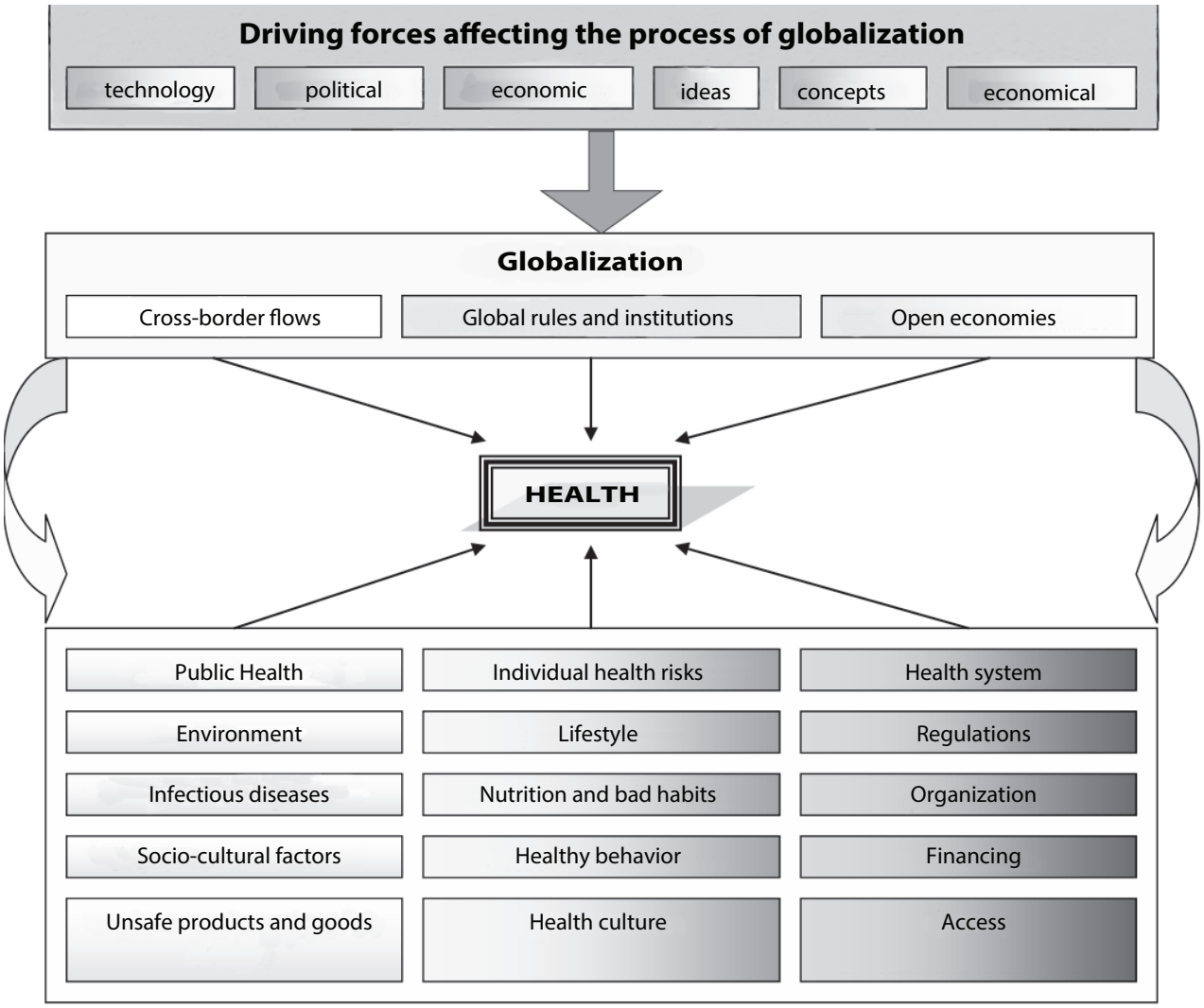
- Direct - cross-border transmission of infectious diseases (especially indicative are AIDS, SARS and bird's flu); gradual integration of medical knowledge and services of worldwide importance;

- Direct - impact of the national economy on the national health - related to nutrition, conditions and way of life, a direct impact on household income, redistribution of financial flows their impact on public health and on the health care system in the country.

- Indirect - impact on the surrounding environment (ecosystem) on the health of individuals and society as a whole.

Global trends related to health, can be analysed by grouping countries in geographical regions, level of economic development and political, cultural or ethnic characteristics.

Global health status includes a variety of social and economic standards and indicators of morbidity, disability, life expectancy and mortality. They are influenced by socio-economic factors, environmental and health interventions. Despite the many differences between developed and developing coun-



tries have a common concern and shared interests of promoting health **(Fig. 1.2)**.

In a study of global health status countries can be grouped in different ways - **geographically** (WHO regions); **economic status** (as is done by Organisation of economical collaboration and development - OECD).

Huge differences in NBP capita and demographic indicators (fertility, mortality, natural growth) affect almost all indicators of health status.

It should be noted that substantially higher than the average annual growth observed in many African and Asian countries, while many European countries have strong trend of ever-increasing negative natural growth.

At the UN forecasts expect serious reduction in most developed countries of the population in some it will be above 20%. Especially troubling these forecasts for Bulgaria, Ukraine, Georgia, is expected to decrease the population by more than 40% **(Fig. 1.3)**.

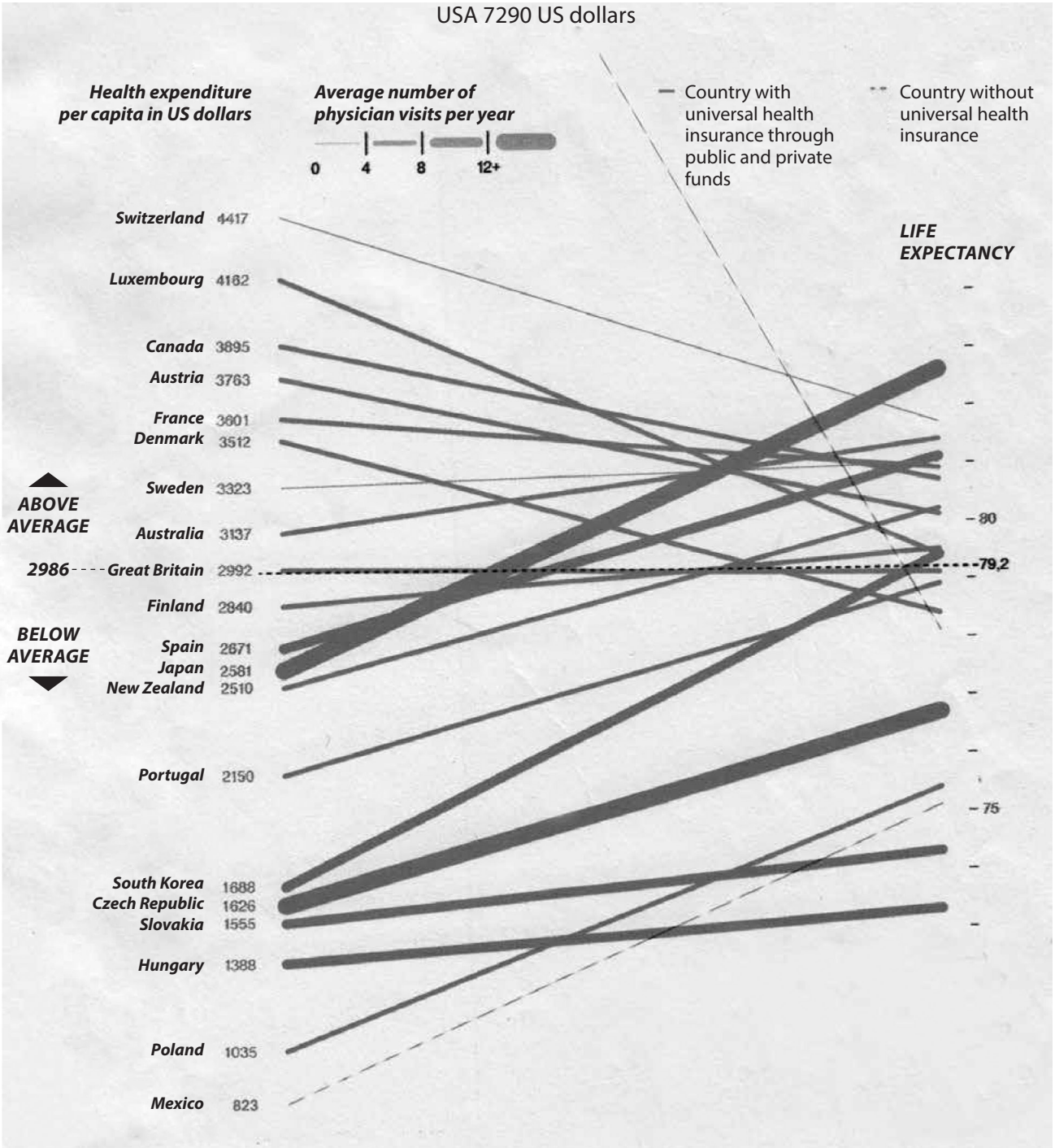
In the worldwide trend towards aging population, which is uneven in different regions and countries. The highest rate of increase is expected to people aged over 60 and 80 years, while those under 15 will increase only 0.15% in the next 50 years **(Tabl. 1.2)**.

Aging speak increase in average age, particular-

Tabl. 1.1. Population in the World

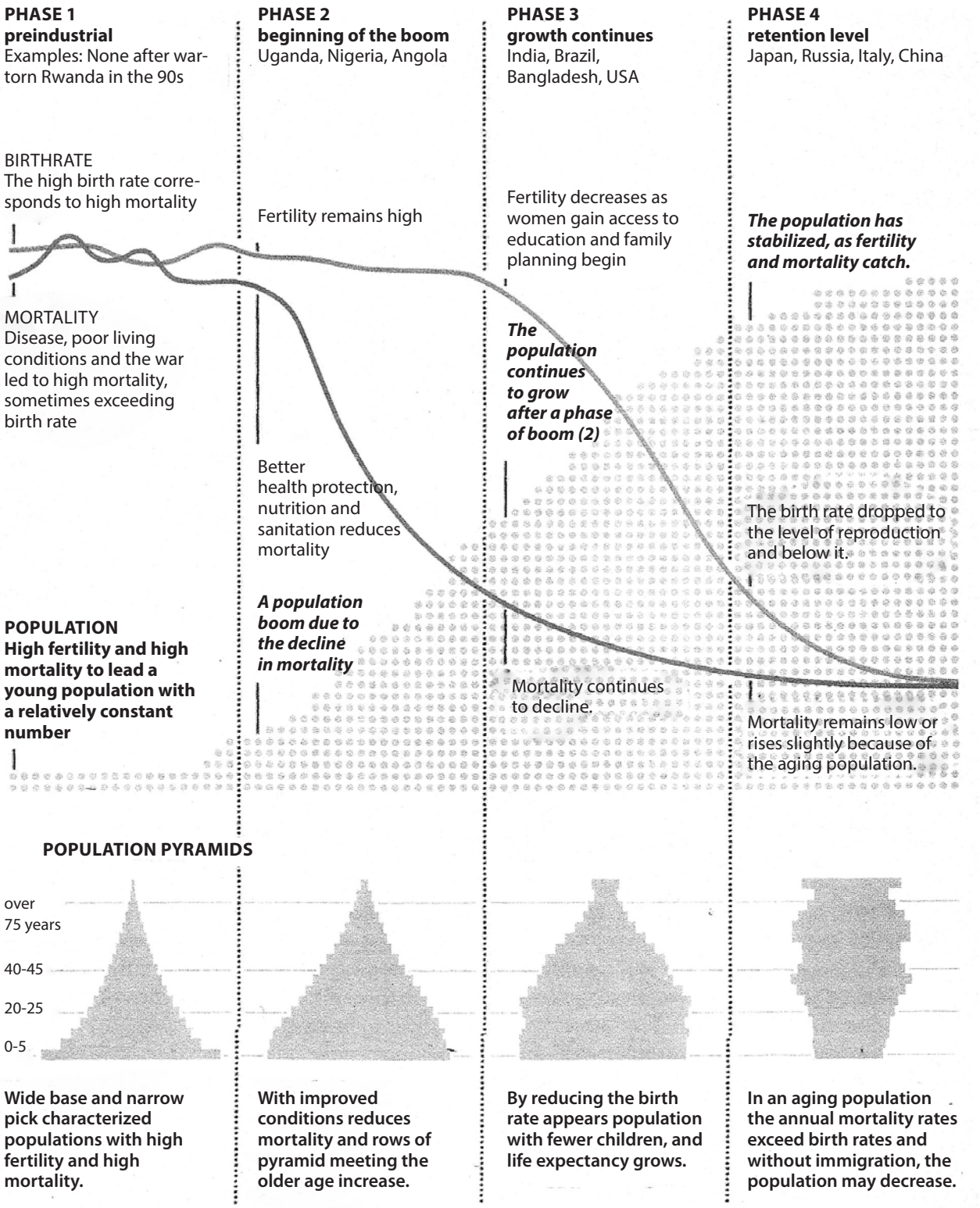
YEAR	POPULATION	AVERAGE GROWTH (%)
1650	500 million	-
1820	1 milliard	0,4
1939	2 milliard	1,1
1960	3 milliard	1,8
1974	4 milliard	1,9
1987	5 milliard	1,6
1999	6 milliard	1,4
2013	7 milliard	1,2
2028	8 milliard*	0,8
2050	9 milliard	0,5

Source: UN Department of Economic and Social Affairs. World Population Prospects. The 2000 Revision. New York, 2000.
* Data for 2028 and 2050 are at medium variant forecast.



(source: OECD HEALTH DATA 2009, Organization for Economic Cooperation and Development (OECD) - a NG, January.2010.

Fig. 1.2. Health - insurance costs and life expectancy



* United States have characteristics of phases 3 and 4: relatively high birth rate, but aging
(source: Carl Haub, Dep. the problems of the population - NG, January 2011)

Fig. 1.3. How growing population

Table 1.2. Average annual population growth (2000-2050) per cent

Countries	0-14	15-59	60+	80+	Total
Developed	-0,34	-0,42	1,07	2,23	-0,02
Developing	0,21	1,01	2,87	4,22	1,03
Underdevelopment	1,26	2,38	3,37	4,07	20,4
Total	**0,15**	**0,79**	**2,35**	**3,40**	**0,86**

Source: UN Department of Economic and Social Affairs. World Population Prospects. The 2000 Revision. New York, 2000.

ly pronounced in Europe and North America. While in the last 50 years the average age the population increased only by three years it is expected for the next 50 years it will grow by more than 10 years **(Tabl. 1.3)**.

The increase in the number of older people in the world will be one of the most important factors affecting the systems of health and social security. UN prognoses shows that in addition to increasing the share of persons of 65 years and will increase the number of people over 80 years, which means that in the coming decades there will be more adults and older people dependent on a small number of persons in working age who are the main source of funding for health and social systems.

Table 1.3. Average age of the population in the world

Countries	1950	2000	2050
Highly developed	28,6	37,4	46,4
Developing	21,4	24,3	35,0
Underdevelopment	19,5	18,2	26,5
Total	**23,6**	**26,5**	**36,2**

Source: UN Department of Economic and Social Affairs. World Population Prospects. The 2000 Revision. New York, 2000.

The main priorities come under specialists dealing with public and global health through coming decades are related to: **overcoming poverty**, which leads to many **diseases**, **population growth (Tabl. 1.1)**, **malnutrition**, progressive **damage environment** and management of **disaster situations (Fig. 1.4)**.

Globalization, accepted or not, is a process that is objective and influenced entirely on development of mankind. This process must be analysed and managed to can any health institution, other, be prepared for the challenges that it stay.

For example, the interaction between countries in the field of health begins as activities to prevent the spread epidemics and infectious diseases. It is expressed in the timely collection and distribution of information, preventive measures such as immunization campaigns to control the spread of disease

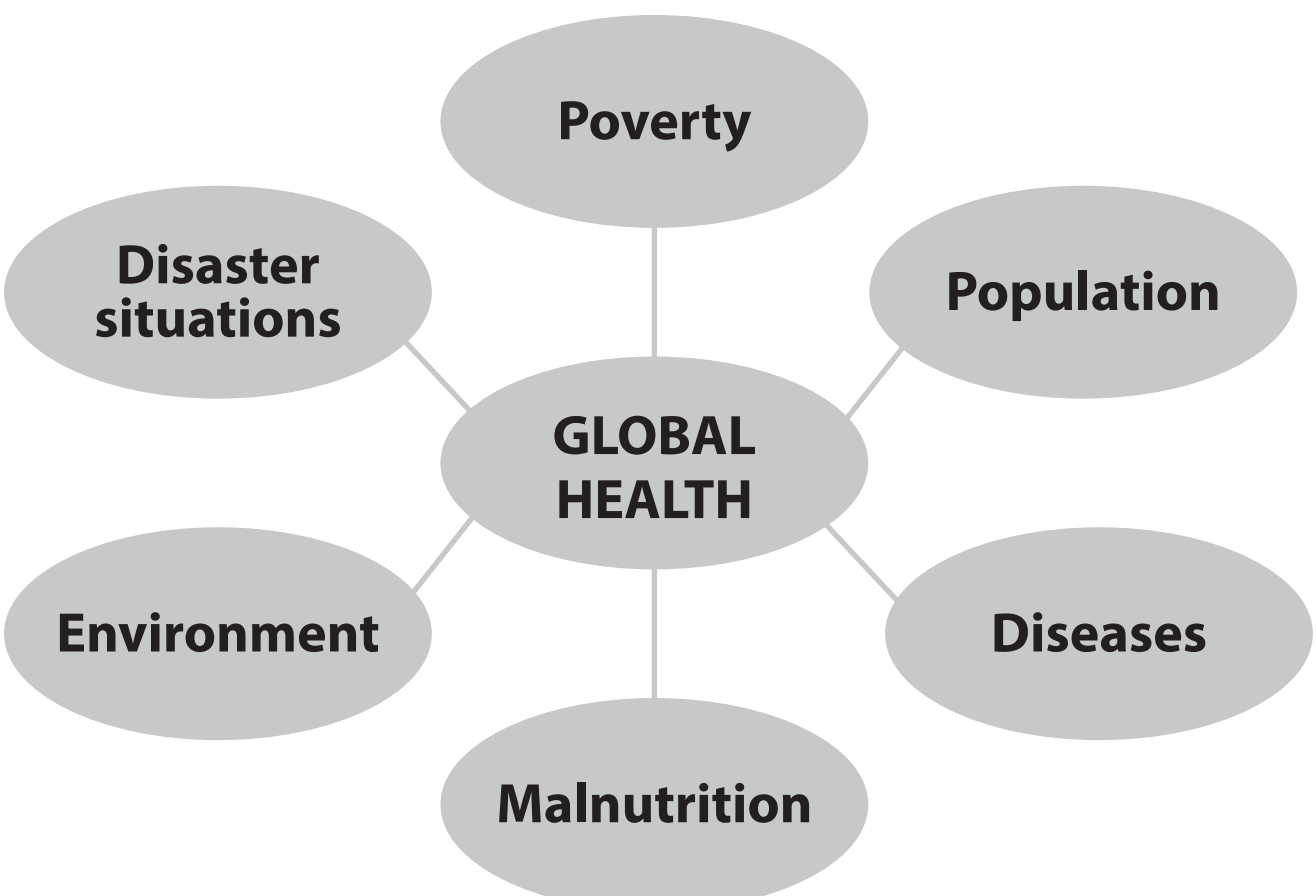


Fig. 1.4. Challenges to global health

and follow-up activities. Success in eradicating smallpox and increasing on control disease, preventable with vaccines led to enthusiastic assessments that epidemic diseases are controlled. This optimism in recent years is quite emerged from breakthroughs in control of malaria and tuberculosis, as well as many emerging diseases. The increase in population, increasing urbanization and overcrowding in urban ghettos, mass migration and more trips, greater international distribution of diseases that were previously regarded mainly as local. Resistance to existing antibiotics also creates new challenges for medicine. International cooperation for detection of new infections or other threats to health and prevent pandemics, is an important priority for both all mankind, and for national health systems around the world **(Table. 1.4)**.

Table 1.4. Strategies for dealing with emerging infectious diseases

Goals	Activities	Examples
1. Observation	Opening, studying and monitoring of emerging pathogens, diseases that cause and the factors for their emergence and development	Monitoring through safety observation networks -blood banks, emergency rooms, laboratories. Field investigations on place of onset. Local and international distribution of epidemiological data through electronic media, Internet Monitoring of vector diseases.
2. Applied research	Integrating laboratory science and epidemiology to optimize public health practice	Improving laboratory diagnostic techniques, genotyping, DNA mapping (fingerprinting)
3. Prevention and control	Improving communication and health information for appeared diseases and ensure rapid implementation of prevention strategies	Immediate and widespread among health professionals, the public and groups at risk of sufficient and clear health information for emerging infectious diseases. Development of health education to prevent the spread of communicable diseases
4. Infrastructure	Enhancement of the infrastructure of public health at local, national and regional level to ensure the monitoring and implementation of programs for prevention and control	Construction and modernization of laboratories, IT systems and staff training

REFERENCES

1. Association of local self-governments: "Choose your partner - Report from the meeting of the selfgovernment city commission about partnership cooperation ". London: LGA Publications, 1999.
2. **Bardach E. A.** Practical Guide For Policy Analysis: The Eightfold Path To More Effective
Problem Solving, ISBN 1568029233, CQ Press
3. **Falťan L.:** Partnerstvo - výzva a šanca. In: Spoločná vec. Rozvoj - partnerstvo -medziobetsná spolupráca. Bratislava: PHARE, 2001.
4. **Forrester, Christine; Bailey, Roshan; Westland, Peter,** 1998: "Building Cross-Sectoral Partnerships ". A Study for the Charles Stewart Mott Foundation. Report. London: Charities Aid Foundation Consultants
5. **Georgieva L, Salchev P, Dimitrova S, Dimova A, Avdeeva O.** Bulgaria: Health system review.
Health Systems in Transition, 2007; 9 (1): 1-156. ISSN 1817-6127 Vol. No. 9 1
6. **Nilda Bulletin:** European Centre for Non-Profit Law, Budapest, 2004.
7. **Salchev P.** Electronic textbook "Social Medicine and Health Management" ed. "Dilidzhentis" EOOD, Sofia 2006, 1126 pp. ISBN 10: 954-91955-1-1; 13: 978-954-91955-1-4 (in bul.)
8. **Salchev P., L. Ivanov, H. Griva,** "Report on the Health of the Nation at the beginning of XXI. Analysis the Health Reform ", 2005, Ministry of Health, Sofia (in bul.)
9. WHO, World Health Report, 1997-1998
10. World Bank, World Development Report, 2000

1.4. MAIN MODERN HYGIENIC ENVIRONMENTAL PROBLEMS

Such as helps for filling satisfy the needs of society, while NTS cause a number of negative consequences for the environment and for human health. It must immediately clarify that cause isn't the essence of the Scientific Revolution, but insufficient studies and hasty implementation of some of its achievements.

More substantial negative effect of NTS are *degradation* changes in the living environment, some of which are global. They are manifested in several ways:

1. Air pollution **(Fig.1.5)**. Atmospheric pollutant is a substance that is not a permanent component of the air and in sufficient quantity causes measurable adverse (harmful) effect on humans, animals, plants, food and materials. Usually in pollutant understand dust and chemical compounds: in the wider sense of the term pollutant can be any physical agent (noise, radiation), chemical compound or species, exceeded natural level.

The main pollutants are wastes from industry, thermal power plants and transport (mainly road transport), in less important are agricultural and municipal waste. Typical atmospheric pollutants are dust, carbon dioxide, nitrogen oxides, sulfur dioxide, lead aerosols, various radionuclides and many others.

Entering in the atmosphere various gaseous and solid impurities lead to changes in the normal gas composition of air. Increasing the amount of carbon dioxide which released as waste gases from fuel combustion and in some technologies. It is estimated that its quantity annually enters in the atmosphere is more than 250 million tonnes. Simultaneously has notably reduces ambient of oxygen.

2. Water pollution. Water basins are polluted mainly by industrial and municipal wastewater. Particularly unfavourable pollution of readily degradable surfactants (detergents, synthetic detergents, etc.), pesticides, oil and etc.

3. Soil contamination. Intensive application of fertilizers and pesticides violates normal soil processes. Entering the soil radioactive waste, plastics and others. may remain undestructed for many years.

4. Increase of atmospheric heat. The sharp increase in energy powers and use of new forms of energy and radiation significantly increased the accumulation of heat in the surface air layer. This is a prerequisite for a number of climatic disturbances and abnormalities.

5. Violation of ecological balance. One of the most serious consequences of NTS is adversely affected the ecological systems. Human intervention in natural processes, development of quarries, irrigation, unregulated hunting, irrational clear the forests and more lead to disturbance in the biogeocenosis.

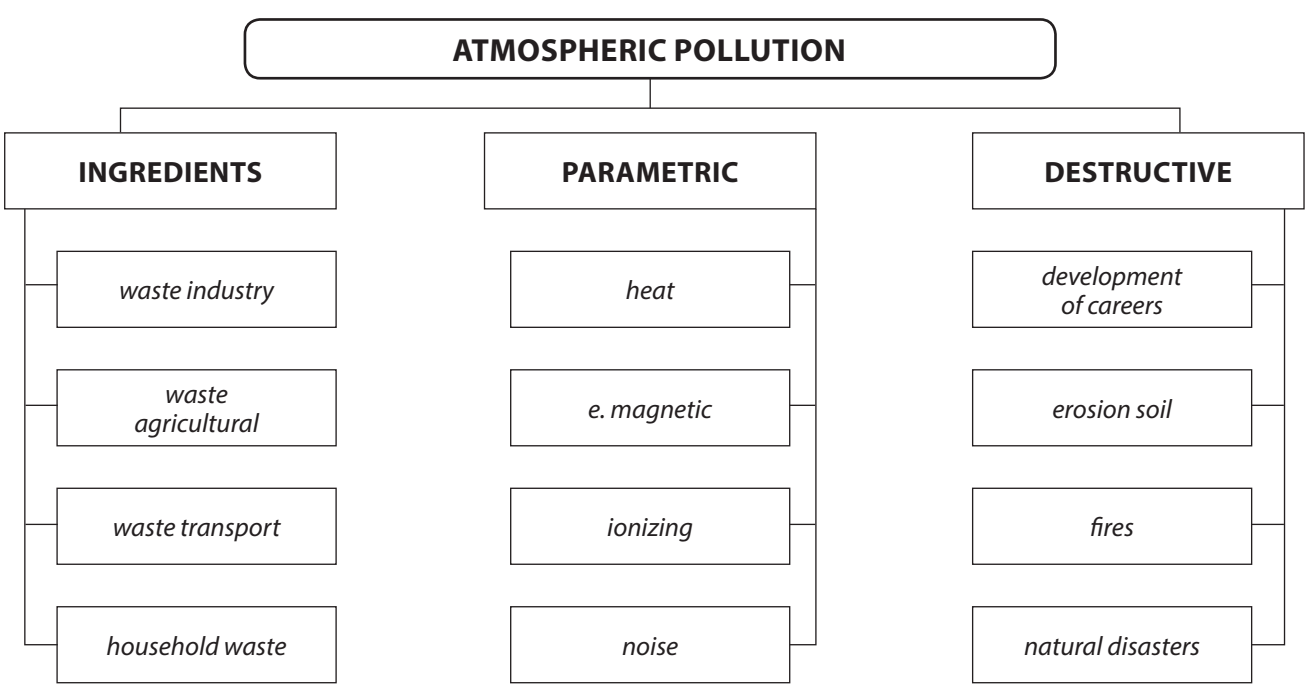


Fig. 1.5. Main types of atmospheric pollution

Fig. 4.

A typical example of the destruction of the so call ecological pyramids is presented in **Fig. 1.6.** For example if in a habitat man swat away or destroy the tip of the pyramid (in case the eagle), it all collapses: there is no one to threaten the snakes and they begin to massively multiply, thus reducing the number of frogs; Ants freely increase their numbers as a result of which the vegetation in this region fell sharply.

Ultimately any substantial interference with the ecological systems inevitably leads to adverse effects on human and directly or indirectly to health.

Pollutants are not only disposed and accumulate the various components of the living environment, but also migrate from one to another and they fall into the so-called food (trophic) chains. Food chain is sequence of organisms in which each organism is food for next member of food chain. Thus transferred energy and substances (in this of increasing amounts/concentrations), pollutants and others. When the final link in the food chain is the man in his organism may fall pollutants of air, water and soil, previously absorbed by plants and animals **(Fig. 1.7)**.

When systemic impact on man harmful substances may have an irritating, toxic, fibrogenic, allergic, mutagenic, carcinogenic and teratogenic effect **(Fig. 1.8)**.

With listed degradation changes in living environment, irrational implementation of the achievements of STR can also cause other negative consequences. Increased productive activity of mankind as a result of STR, changing living conditions, work and recreation of man.

Due mechanization, automation and intensification arise **new forms of work**, which brought increased requirements for qualification of employees and the reliability of the human link in the system "human-machine". Despite the mechanization of labour and reduction of heavy physical work, fatigue problems do not disappear, and acquire new content. Reduces muscle activity and increases the workload of nervous psychic sphere arises disproportion between the activity of the higher centres of the brain and the passivity of the centres that regulate muscle activity. The labour process increasingly takes place in conditions of hypokinesia and significant sensory, mental emotional and nervous tension. Qualitative changes in the structure of production, public relations, science and technique significantly increased the information load of people. Life, especially in larger cities, more inconsistent with the natural biorhythms. Recreation becomes irrational and inadequate. Application of potent drugs can cause drug allergy and so called drug disease. Increased significantly the number of factors and situations that cause stress.

New problems arise in **hygiene of nutrition**. Introduced more progressive methods and technologies for the processing of foodstuffs, it is possible to create artificial products, adequate biologically. However, this requires their comprehensive hygienic assessment. Network catering expand. The role of the preventive professional and dietetic nutrition arise. Apply of new materials, products, additives, plastics, chemicals, determine new technological requirements, norms and standards. Serious problems arise in protecting food from contamination. More important question becomes for physiological justified norms and diets in different age and professional groups and their constant updating.

Acceleration (accelerated physical and sexual development) of adolescents also causes new problems. As a universal expressive of human biomor-

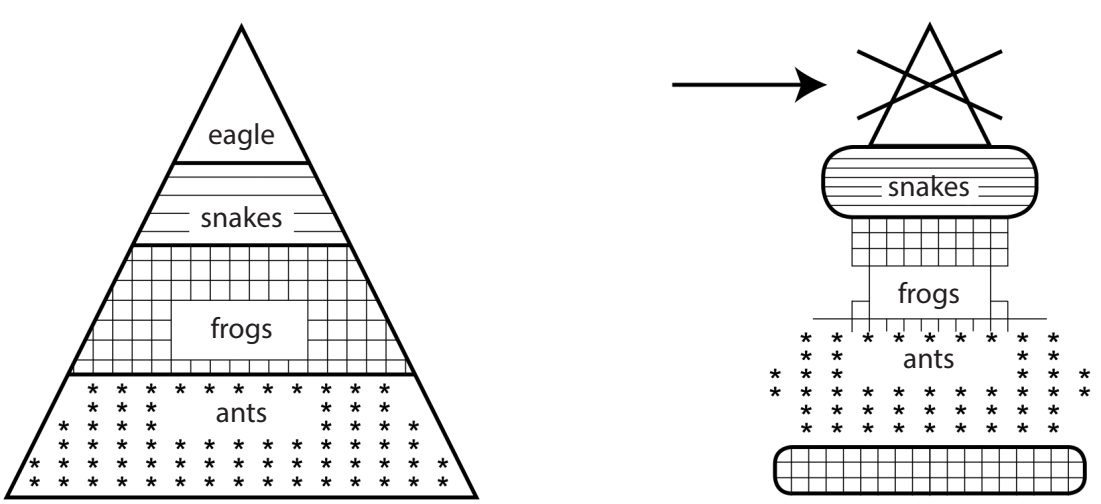


Fig. 1.6. Ecological pyramid

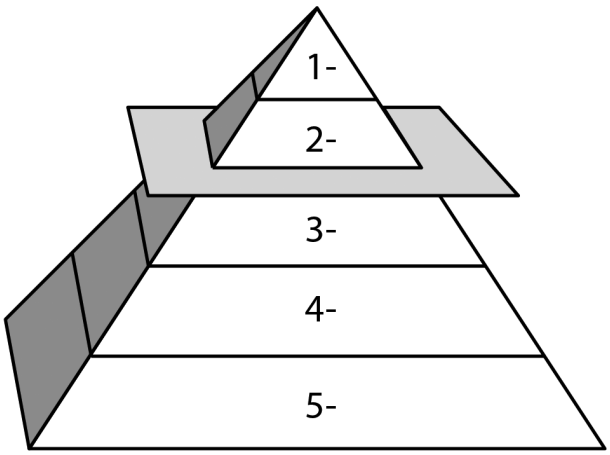


Fig. 1.8. Spectrum biological response of exposure to pollution
1 - mortality; 2 - morbidity; 3 - preclinical changes; 4 - functional and other changes unidentified matter; 5 - accumulation of pollutants in the body.

foses, it includes all the contemporary problems of the complicated relationship between humans and their environments, as children are the most sensitive "biological model" to that of exogenous harmful factors. Even more relevant is the development of new requirements and regulations to ensure normally development of children of school workload and modes of study in accordance with the age of students.

One of the effects of STR is the acceleration of **urbanization**. This is a process of socio-demographic growth of cities, concentration and intensification of non-agricultural functions in them. Characterized by increasing the number of urban population and the number and size of cities.

The city as the highest form of organization of space has clear social benefits. While urbanization raises a number of new hygienic - environmental issues: overcrowding, overloaded public transportation and increased transport accidents, increased communal noise, increased nervous emotional tension, "pendulum" migration, degraded recreation, polluted living environment and others.

Listed factors, and typical modern citizen hypokinesia and irrational nutrition, become a threat to his health.

1.5. SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND CONTEMPORARY PATHOLOGY

In recent decades, the structure of morbidity occurred amendments. Improving living conditions and the latest advances in medicine have allowed dramatically reduce infectious morbidity. However, an increase occurs in the frequency of other diseases: myocardial infarction, cancer, neurosis, diabetes, dental caries and others. Hastily they were called "diseases of civilization" and the reason for their upsurge was adopted STR.

The name "diseases of civilization" in this case is incorrect, because civilization is the degree of social development. Some authors support the controversial concept that improved nutrition, better mode of life and sedentary life in the era of STR are the reasons for the high incidence of these diseases and even call them "diseases of prosperity".

Should not be ignored and some other factors - improved diagnostics, powerful modern drugs, active tracing of diseased, mass screening, dispensary and others. Moreover definitely adversely influenced and changed conditions of living environment - air pollution, water, food, irrational mode of work, recreation, dining and more.

In each case, however, the cause is not the essence of STR. Be "blamed" technical progress and STR means to be denied their appropriateness. And they emerge and evolve due to the needs of society.

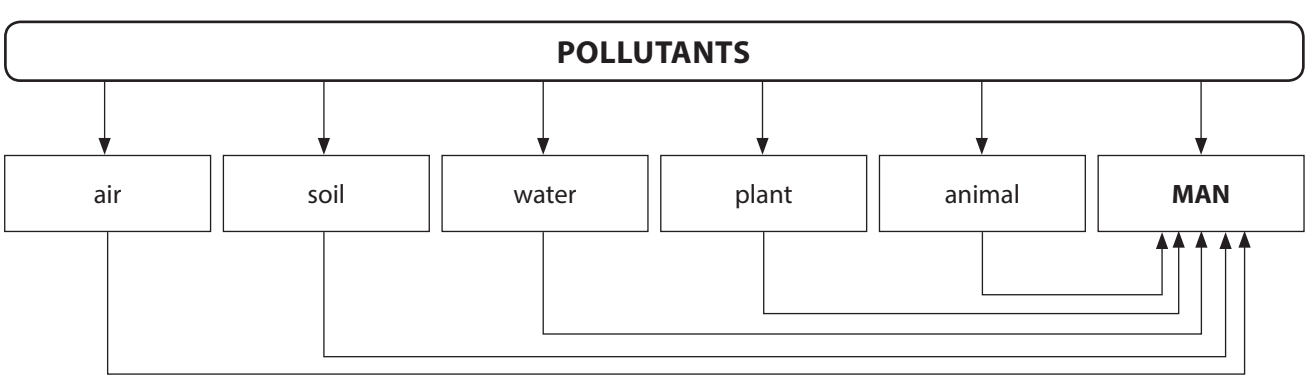


Fig. 1.7. A food chain

1.5.1. OVERCOME NEGATIVE CONSEQUENCES OF STR

The main reason for the pollution of the living environment are generally old industrial technologies. Their production cycle is open: the entrance to enter inputs and outputs out of the finished product and discard a variety of waste. Approaches to overcome this global negative consequence of STR:

1. Restriction - exchange of raw materials and limiting the capacity, for disposal of smaller quantities and less harmful waste.

2. Compensating - the introduction of new, more advanced technologies, but generally in older establishments, ie in such an open production cycle.

3. Preventive - Implementation of new technologies in radically new enterprises, ie organize waste-free production with closed loop.

The first two approaches, though palliative, limit pollution of the environment; third approach is radical and resolve the issue of protection of environment.

1.5.2. SOCIALLY SIGNIFICANT (CHRONICAL NONINFECTIOUS) DISEASES P. Salchev

The diseases of "modern life" or noninfectious diseases have become a major cause of morbidity and mortality in developed countries. Modern picture of the pathology in recent years is formed by a small group classes diseases.

Antibiotics and vaccines, along with improved living conditions, hygiene, nutrition, access to clean water, reduce to diminish the mortality from infectious diseases and increase in life expectancy. All these factors lead to higher survival rate and increasing the number of people who live to age when the incidence of malignancies and cardiovascular diseases are higher.

Chronification of diseases, however, is social, economic and psychological burden for individuals and their families, and often leads to disability.

This change in the structure of morbidity, the impact of chronic non infectious diseases on the overall psychosocial and socioeconomic status of the individual and the population as a whole, has introduced the use of term "socially significant diseases", i.e. these diseases, which define the profile and structure of mortality and morbidity in a country or region.

In different countries the type of socially significant diseases in the general structure of morbidity varies, both in their levels and in trends and structure. For Bulgaria, as well as other developed countries, here we can treat the following diseases:

1. Diseases of the circulatory organs
2. Malignant neoplasm
3. Injuries and poisonings
4. Respiratory diseases
5. Tuberculosis
6. Diseases of the nervous system
7. Diabetes
8. Sexually transmitted diseases.

These eight groups of diseases account for over 90% of the total structure of the diseases in the country, become chronic and often lead to disability. Have seen a continuous trend for "rejuvenation", i.e. their penetration and increasing among people in active age.

Cardiovascular diseases include a large group of diseases of the heart and blood vessels, such as coronary/or ishemic heart disease, hypertension and cerebrovascular disease (insult). The main factors for these diseases are atherosclerosis, excess dietary fat intake and increased lipids in the body, as well as disturbances in endocrine function associated with glucose metabolism and diabetes. The standardized death rate per 100 000 population in Bulgaria for the period 1970-2004 was in the range 200-800 (for different groups of diseases and total) and tends to sustainable growth.

Studies of cardiovascular mortality show racial, gender and regional differences, but perhaps there are other factors that contribute to these differences, such as education, nutrition, access to health care, knowledge, attitude, behaviour and activities.

Primary and secondary prevention here include a set of activities for health promotion related to the reduction of specific risk factors - smoking and reduce obesity, better eating habits, increased physical activity. They require institutional support, education of the population, adequate information systems monitoring the incidence and prevalence of risk factors, well-informed medical community. These activities should be population-based and individually focused. Population-based programs designed to change the lifestyle and habits as a method of reducing the risk factors are for example in Bulgaria, under the auspices of WHO, CINDI - (Country wide Integrated Noncommunicable Disease Intervention Programme), program MONICA (Multinational Monitoring of trends and determinants of cardiovascular disease).

Countries with high levels of cardiovascular diseases should develop cross-cutting and aggressive intervention programs at national and regional level.

Malignant diseases are the second leading cause of death in developed countries. Malignant diseases cause a lot of suffering and a heavy economic burden to society, the individual and the family, resulting in increased demand for medical services, disability and premature death.

Incidence of malignant diseases in Bulgaria is constantly increasing. Standardized mortality from malignant diseases in Bulgaria for 100 000 of total population for the period 1980 to 2004, the was 137-164.

Prevention of malignancies aims at better awareness among the population about risk factors and their reduction or elimination.

Primary prevention of malignant diseases require a reduction in the incidence of risk factors: smoking (lung cancer and bladder), a diet high in fat (breast cancer, colon and rectum), exposure to infectious carcinogens and alcohol (liver), multiple sexual partners (a cancer of the cervix), excessive exposure to sunlight (melanoma), and others. Secondary prevention or screening programs aimed at early diagnosis of new cases of diseases.

The injuries and poisoning are one of the leading causes of death, as in the world and also in Bulgaria (third place), due to its high incidence among young and middle-age groups. They are a broad category of health risks, including traffic accidents, poisonings, suicides, murders and violence - at home and away. For Bulgaria standardized mortality rate per 100 000 population for the period 1980-2004, the was 35-52.

As of **chronic lung diseases** include four major groups that are most important to the individual, family and society and deal with social major diseases are:

- asthma;
- chronic obstructive pulmonary disease;
- lung diseases related to work environment;
- tuberculosis.

Asthma not established specific etiology; the disease is associated with family history, infections, allergies, psychosocial and environmental factors. As risk factors are considered allergens of animal origin, household dust, direct or passive smoking, outdoor allergens - environmental pollutants.

Chronic obstructive pulmonary disease (COPD) is advanced stepwise chronic lung disease with impaired air flow as a result of chronic bronchitis. To this disease further include **chronic bronchitis** and **emphysema**.

Prevention - off smoking, which is considered the main cause, annual influenza and antipneumococcus immunizations, monitoring and early treatment.

To **lung diseases related to work environment** include: pneumoconiosis, silicosis, asbestosis, byssinosis, professional asthma and others.

Tuberculosis (Myc. tuberculosis and Myc.bovis) spread aerial through secretions, and affects humans and animals.

WHO recommends vaccination with BCG as soon after birth as part of a general obligatory immunization.

Primary and secondary prevention of tuberculosis include:

- detection of persons with clinically active tuberculosis;
- using diagnostic methods: microbiological examination of sputum, skin tuberculodiagnostiks, radiographs of the thoracic cage;
- search and detection of persons in high-risk groups (poor, prisoners, minorities);
- search contacts;
- isolation for initial therapy;
- treatment (mainly ambulatory) of patients with active tuberculosis;
- treatment of the contact;
- environmental monitoring;
- training of health professionals for the early detection of TB and activity in doubt.

Table 1.5. Major risk factors leading to:

Cardiovascular diseases	Cerebrovascular disease (insult)
Hypertension, unstable or permanent, systolic or diastolic, moderate or severe is an independent factor for cardiovascular disease for each age and gender. Impaired glucose tolerance or diabetes are additional atherogenic factors, especially in women. Family history also recorded as an additional risk; Smoking; Physical inactivity; Foods rich in fats.	heart disease; atrial fibrillation systolic hypertension; diastolic hypertension; left ventricular hypertrophy; diabetes; excessive use of fats and carbohydrates in the diet; smoking; family history; low socio-economic status; old episodes of insult or transitional ischemic cerebral attack.

The neurological diseases are socially significant because they often lead to disability, loss of labour efficiency, premature death, and because of the high cost of treatment and rehabilitation.

This group of diseases include:

- **Alzheimer's disease**;
- **Parkinson disease**;
- **multiple sclerosis**;
- **epilepsy**;
- **head and spinal cord trauma**.

Diabetes is a common chronic disease and also is the major risk factor for many other diseases - cardiovascular, peripheral vascular, nerve, kidney, eye.

Prevention of diabetes include:

1. Health promotion - increased information of the population in terms of disease, risk factors and complications;

2. Primary prevention against obesity (a risk factor), introduction and accustom to appropriate food habits.

AN EXEMPLARY CIRCUIT FOR THE PREVENTION OF MALIGNANCIES

I. Primary prevention

- Smoking cessation;
- A diet rich in fruits, vegetables, grains and low-fat foods;
- Limiting exposure to sunlight;
- Reduction of chemical exposure - eg. pesticides;
- Immunization against hepatitis B;
- Reduce the risk of sex with different partners;
- Eliminate exposure to the known other risk factors.

II. Secondary prevention (early diagnosis)

- Lung cancer - screening by X-ray and cytological examination - nonefficient and does not give results;
- Breast cancer - a monthly self-examination and mammography every 2-3 years for women from 20 to 50 years old - High efficiency;
- Colorectal cancer - rectal examination once a year, testing for occult blood - high efficiency;
- Cancer of the cervix - screening.

Source: Adapted from Canadian Task Force on Screening (1994)

Table 1.6. Classification of injuries and prevention measures

Cause of trauma	Regulatory measures	Prevention
Traffic accident	Use of safety belts and seats for young children; control speed and alcohol when driving; mandatory surveys for the good technical condition of vehicles; airbags in cars; areas for pedestrians, etc.	Training of drivers for safe driving; Training pedestrian safety rules; Training children to acquire habits safe on road.
Falls	Fittings, railings and security environment	Training awareness
Burns	Safe heating systems, electrical appliances, toys refractory, standards for electricity, smoke detectors, door opening outwards, etc.	Awareness measures for fire safety and compliance. Evacuation plans
Poisonings	Tags manufacturer, safe packaging (for children)	Education about the dangers of self-medication, safe storage, labeling and sealing of chemical products
Domestic violence	Especially regarding children and women; directed attention to the police and social services; shelter for persons subjected to domestic violence; isolation of persons exercising violence	Awareness of forms of violence and ways of notification (hotlines)
Occupational accident	Safety measures; responsibility of employers; monitoring sites	Training of workers and employers - briefings for safety
Sports injuries	Use protective equipment for different sports; control of objects and products related to sports	Good control of coaches and referees
Suicides	Observation and careful attitude towards risk groups; Mental Health	Helplines/hotlines
Drowning	Safety requirements for watersheds; construction of reservoirs, training of lifeguards, etc.	Training in swimming, all awareness of the dangers

Source: Adapted Tulchinski. "New public health", Varna, 2004

3. Secondary prevention aimed prevention of complications:

- Early detection of the disease - screening
- Treatment and control the course of the disease.

Each country should have made health standards for behaviour in people with diabetes.

The spread of **sexually transmitted diseases** is with greater frequency in all over the world. This distribution is associated with low health and reproductive culture, lack of hygienic habits, socio-economic factors - prostitution.

This group of diseases include: syphilis, gonorrhea, chlamydiosis, trichomoniasis, condiloma, HIV/AIDS.

These diseases (except AIDS) are treatable, but of later opening or improper treatment can lead to various complications, impair reproductive function of individuals or be passed on to offspring. This requires the development of specific measures for primary prevention, control, early detection and treatment.

Table 1.7. Incidence of sexually transmitted diseases for 100 000 of the population in Bulgaria

Year	Incidence of		
	Syphilis	Gonorrhea	Clinically diagnosed AIDS
1988	5,32	43,09	0,0111
1989	5,33	45,76	0,0445
1990	4,20	61,12	0,0445
1991	5,03	64,24	0,0223
1992	7,44	58,27	0,0703
1993	11,12	54,71	0,0708
1994	14,48	44,51	0,1184
1995	20,08	23,26	0,0119
1996	27,17	20,24	0,1196
1997	15,09	19,15	0,0962
1998	32,87	16,58	0,0363
1999	30,56	10,90	0,134
2000	19,77	6,74	0,1958
2001	18,39	4,60	0,1769
2002			0,1652
2003			0,0639

2. ASSESSMENT AND MANAGEMENT RISK OF HEALTH, D. Tsonevski

Human environment includes biological, chemical, physical, socio-economic factors that may affect the health status of the population and affect the likelihood of developing a disease. Fixing these hazards, hazard assessment, created to human populations and comparative assessment of these hazards have the task of assessing the health risk. This assessment requires a multidisciplinary approach.

Environmental pollutants, known for its negative effects on health can be explored in different ways. For example, carcinogenesis can be learned through clinical observation, epidemiological studies on humans or experimental animals. The main tool for studying the health effects of pollutants are human epidemiological methods to study the occurrence and distribution of diseases and other health-related conditions and their determinants in populations. Environmental research aims to clarify and assess the possibility of contaminants to cause harmful effects on health, measure and analyse exposure in which they appear. Another objective is to assess the likelihood of a disease in specific conditions.

One of the main practical tasks of environmental epidemiology is to create hygienic safety standards in terms of harmful environmental factors and to ensure health protection for the entire population.

Usually study the causes of diseases conditioned by the environment in epidemiological studies, is a gradual process that can distinguish the following basic steps:

1. Description of the frequency and distribution of disease in different populations and in different parts of the same population (descriptive epidemiology). These observations provide the basis for the formulation of causal hypotheses, provide the necessary information to assess the health of the community and facilitate management decisions for which it is necessary to know the nature and severity of health problems in the community.

2. Formulation of hypotheses using the descriptive epidemiological data, clinical and laboratory observations on the incidence of diseases depending on the specific characteristics of the population or its exposure.

3. Verification of the hypothesis by observational or experimental studies based on observation of specific groups of individuals (analytical and experimental epidemiology).

The assessment of human health risks associated with exposure to chemicals is one of the main tasks of the International Program on Chemical Safety (IPOS), conducted by the World Health Organization (WHO) in cooperation with other specialized institutions of United Nations (UNSP-ILC).

From the National Research Council of the USA (NRC, 1983, NRC, 1989) for risk assessment and risk management offers the following definitions:

Risk assessment is the qualitative or quantitative characterization of adverse effects on the health of individuals or populations as a result of exposure people of environmental risks. The risk is a statistical value, which shows the expected incidence of adverse effects from exposure to harmful factors. Expressed in absolute (increased frequency of a given phenomenon) and relative (the ratio of the frequency in exposed and unexposed people) values.

Risk management is the process of evaluating alternative regulatory options and choosing between them. It is made by risk managers in departments such as the Ministry of Health and Ministry of Environment. Their decisions comply with the political, social, economic data and ongoing control of environmental pollution. Risk managers develop, analyse and compare various regulatory options before you choose the one they think is most appropriate.

The process of risk assessment involves the consistent implementation of these paradigms (stages):

1. Identification of the risk.
2. Assessment of the relationship dose - response.
3. Exposure assessment.
4. Risk characterization.

Methodological approaches for the realization of these stages are general or specific to each of them. They apply to all activities associated with the use and production of chemicals: development, deployment, production, packaging, storage, transport, sale, application, disposal of waste.

2.1. RISK IDENTIFICATION

Tasks in this stage is detection of phenomena and substances which can have harmful effects on health, and assess the nature and likelihood of these effects. Identification of risk most often use the following data types:

- *epidemiological data;*
- *clinical data in humans (for non-carcinogenic substances);*
- *data analysis for short time mutagenesis (Ames test);*
- *analysis of biological data in animals;*
- *comparisons of molecular structure.*

Methods for the identification of risk. To obtain the necessary data for identification of risk, the following methods applied:

1. Toxicological forecast - worked out based on the toxicological properties of chemical substances or toxicological passport.

2. Official permission for deployment.

3. Permanent poison control preventive and ongoing nature.

Continuous poison control is one of the most important and reliable sources of information. He periodically doing and includes the following forms:

- *Permanent control the parameters of external exposure.*
- *Continuous biological control of exposure* - levels of toxic substances or their metabolites in biological materials and on biochemical and biological effects.
- *Continuous control over health effects.* Permanent poison control method is suitable for the identification of risk, and for the evaluation of the dose-response.

2.2. EVALUATION OF THE DOSE-RESPONSE

Tasks of this stage are collecting specific information necessary to assess the probability of occurrence and the nature of a harmful effect and its relation with generative cause. For this purpose, the following data types:

1. Epidemiological data.

2. Clinical data in humans (for non-carcinogenic substances).

3. Data of biological analysis in humans (and models for extrapolation).

In many cases edidemiological data from large population groups allow easy development of a dose-response. Data on the dose-response received from people exposed to high concentrations of industrial or formed as a result of incidents pollutants, often extrapolated to the general population. The clinical data in humans are used for obtaining information on the evaluation of the dose-response of non-carcinogenic substances, but these data are often quite limited. It is also difficult to extrapolate from animal bioassay exposure expected in the general population. In establishing the relationship between dose and intensity of the effects ideal case is the possibility it be quantified, with some degree of confidence. For this purpose, often applied calculation method by dividing the successive intervals measure exposure and calculating the percentage of persons with deviations in each interval, combined with regression statistical analysis. In the case of properly planned exploration for risk assessment is possible on the basis of negative health indicators to calculate odds:

- *morbidity coefficient (K_m)* - an indicator of the incidence of a disease in a determinate group.
- *Relative risk /OR/* - comparative expression of the incidence of a disease in a population

exposed to a determinate hazard to the frequency in a group of unexposed persons.

These dependencies can be calculated for following, simultaneously received data;

- *Parameter of external exposure* - effect (health, biological, biochemical).
- *Parameter of internal (biological) exposure* - effect. The data for such dependencies occur relatively more frequently in practice because of toxicological that both parameters are measured simultaneously in a biological material taken from the same person, and analysed with a relatively good accuracy. The determination of the substance or its metabolites in biological materials reflect the real integral exposure and influence of individual characteristics of the respondents.
- *Parameter of external exposure - parameter of internal (biological) exposure.*

2.3. ASSESSMENT OF HUMAN EXPOSURE

In exposure assessment include the sum of the results of the concentrations of a pollutant to which the person is exposed to different microenvironments, multiplied by the time the stay of people in relevant microenvironments. For units for example accept, concentrations in mg/m^3 of pollutants in air, multiplied by the time in hours. Often used the term "total exposure" when studying the health risks. The total exposure reflects the experience to take into account all human exposure to a pollutant, regardless of the environment and the way of entry into the body.

Of course, the main parameter in terms of health is the dose, as it directly determines the amount of pollutant having the potential to attack the target organ. He has made a number of distinctions in discussing the dose. The inner dose refers for example, to the quantity of contaminant absorbed in the tissues of the body by inhalation, ingestion, dermal absorption or interaction with cell membranes. The biologically effective dose is the quantity of absorbed contaminants or introduced, which gives the dose in the cells or target areas where the side effect occurs. The total dose is the sum of the doses received by humans at a pollutant in a given interval of time, in interaction with all surroundings (air, water, soil and food) that contain contaminants. Individual doses that make up the total dose are particularly useful parameters in assessing the relative risk because they can be divided into portions the risk of a pollutant in a specified period of time in different environments. It is important to note that the assessment and management of risk, risk managers typically establish rules and regulations that are directly related to reducing exposure, than dose. Therefore as regulatory perspective, the exposure is more practical parameter than the dose. From the standpoint of health effects, the primary measurement is the exposure rather than the concentration.

Exposure measuring has two basic approaches:

1. Direct.

2. Indirect **(Fig. 1.9)**.

◆ Direct Approach

It includes personal and direct measurement of concentrations of air pollutants in the breathing

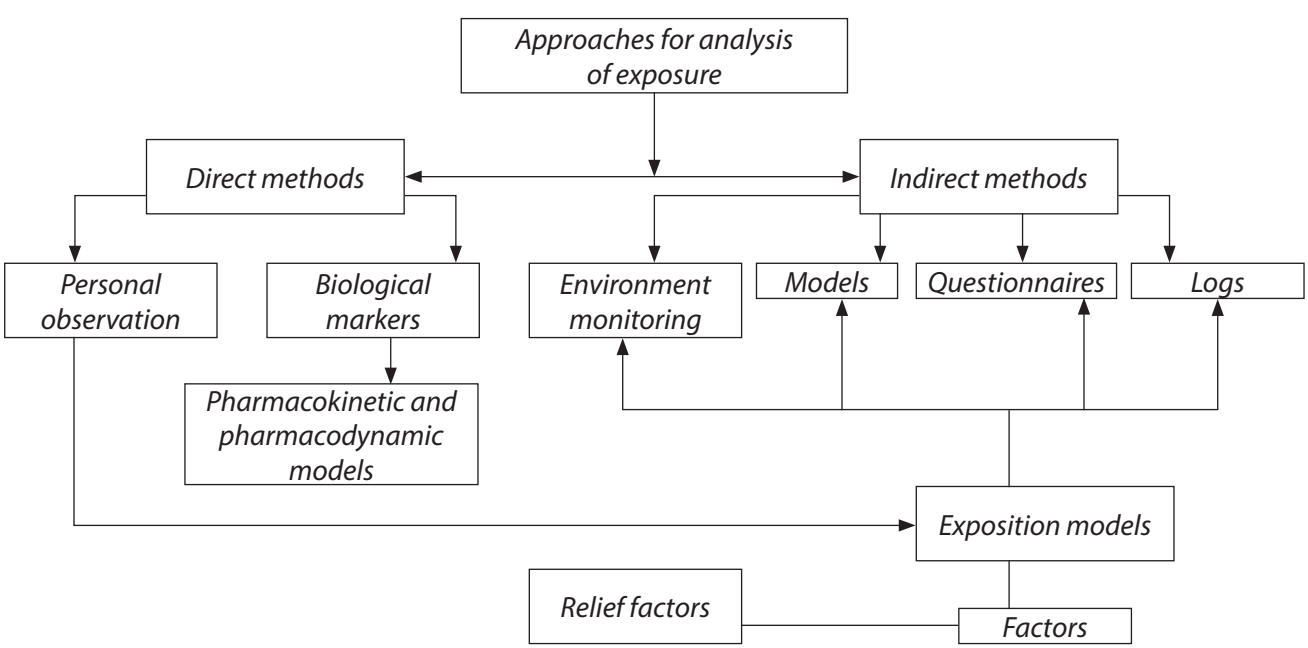


Fig. 1.9. Possible approaches to the analysis of exposure to air pollutants (NRC, 1991)

zone, to which the individual is in contact during routine activities. In the case of water, direct examination could be that samples were taken from the main water valve; in food - twice analyse food samples; in the case of skin exposure, measurements are made directly on the skin. In biological monitoring as a direct approach to exposure assessment are used mainly three types of biological markers: markers of exposure, effect markers and markers for sensibility **(Fig. 1.10)**.

1. Markers of exposure. Markers of exposure are exogenous substances, their metabolites, interaction between xenobiotic agents and target molecules or cells, studied in any part of the body (NRC, 1989). Markers of exposure tend to integrate all routes of exposure to certain chemical. One of the best known markers, for example are lead in blood and carboxyhemoglobin. The concentration of lead in blood reflects the exposure as a result of inhalation of lead in the air, and as a result of ingestion of lead, which can be found in food, water, dust, or soil. In the literature it is assumed that usually the marker of exposure is more useful to the appraiser, if in biologic materials is measured the substance and not its metabolites. The reason for this is the possible loss of specificity, trying to connect metabolite exposure.

2. Markers of efficiency. Efficiency markers are measurable biochemical, physiological or other change in the body, which, depending on its quantity is adopted as established or as potential health deterioration (NRC, 1989). Markers for effect can be useful for assessing exposure, if they signal for presymptomatic preclinical stages in the development of disease, specific to the substance. Other markers of effect can report only for adaptive changes that by themselves are not pathological.

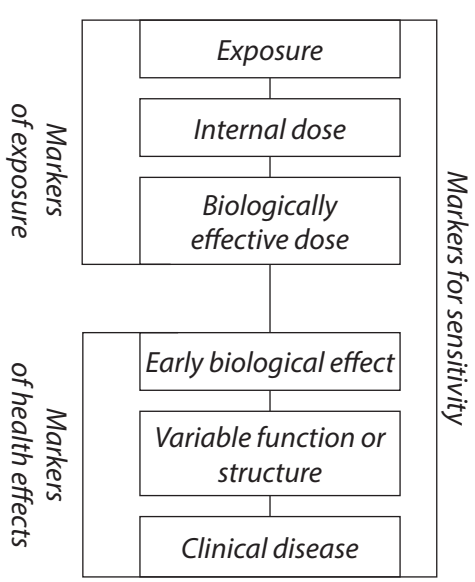


Fig. 1.10. Types of biological markers (NRC, 1991. Adapted by Commission Biological markers, 1987)

3. Markers for sensibility. Markers of sensibility (hypersensitibility) are indicators of inherent or acquired limiting the body's ability to meet the challenge of exposure to a specific xenobiotic substance (NRC, 1989). Some people are sensitive due to congenital differences in metabolism, physiological characteristics, nutritional status or absorption characteristics. For example, the measurement of the reactivity of the airways to inhaled bronchoconstrictor can be used as a biological marker of sensibility. The increased non-specific reactivity of the airways typical of most asthmatics, may play a role in the development of the disease. Markers for sensibility can be attributed also to induced variations in absorption, metabolism and response to environmental factors.

In recent years there has great progress in developing a new class of biomarkers, namely measuring the labeled DNA molecules and proteins. These new techniques are available only to those chemical substances or metabolites, which can bind covalently with biological molecules (such as DNA or proteins), in the target peripheral tissues. Chemical methods for the detection and quantification of labeled molecules often rely on methods such as gaschromatografy/mass spectrometry (GC/MS), primarily because of the requirements of high specificity and sensitivity. Today is an increased interest in the use of immunoassays for determination of labeled molecules.

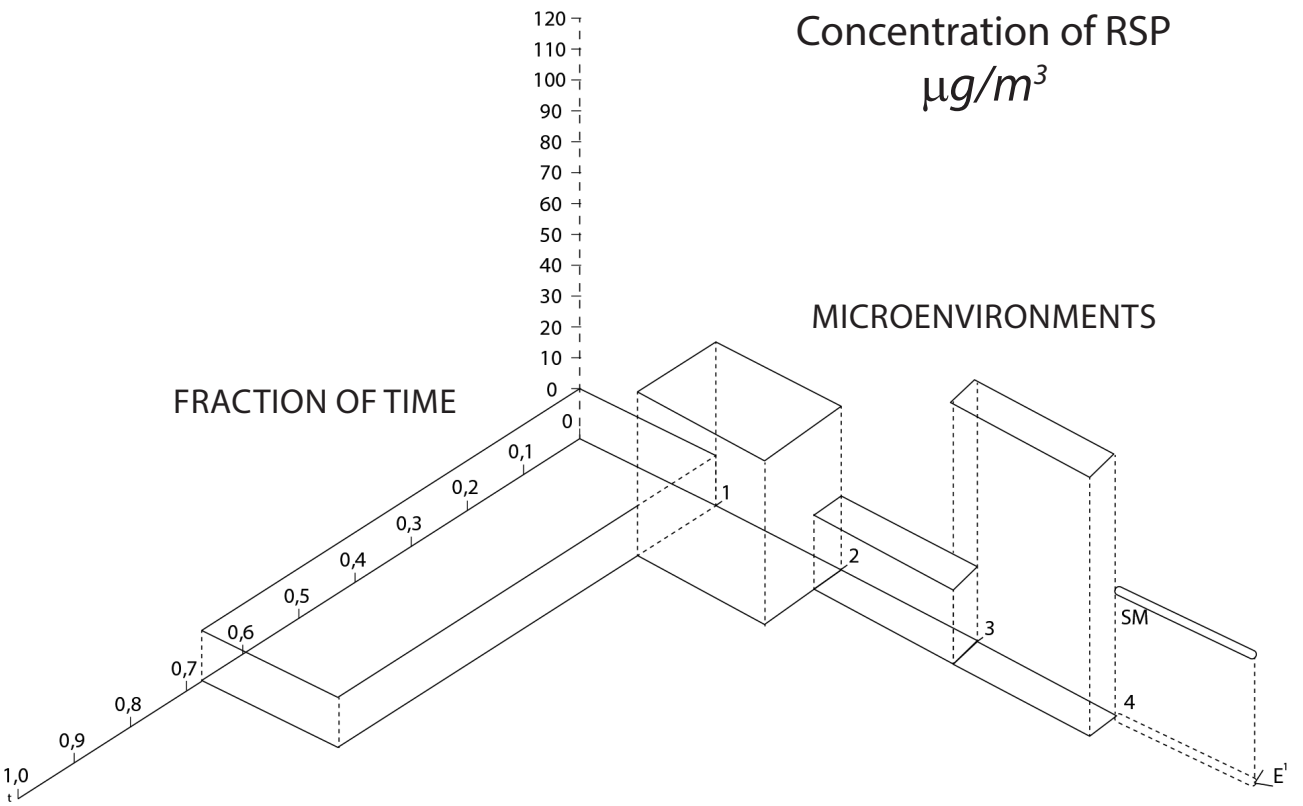
◆ **Indirect approach**

It is used to determine the individual or population exposure to a pollutant by combining measurements of concentration in the micro environment, with human activity information obtained through the use of questionnaires or job logs. For the purposes of the indirect approach to the assessment of exposure, most often used two types of models: for concentration and for exposure. Concentration models are mathematical constructions that predict concentrations. Such predictive models use as input information source emissions, atmospheric dispersion of pollutants, of transport, deposition and atmospheric chemistry. They are useful when there is no or there is limited direct measurements of the concentrations of pollutants in the environment.

The exposition models predict the exposure of individuals or populations **(Fig. 1.11)**.

They used as input the concentration of a pollutant to which the individual or the population are exposed, and the length of this exposure. The importance of the exhibition models to pass over the need for intensive and extensive data collection, by making estimates of population exposure, based on a relatively small number of representative surveys.

Studies evaluating exposure, whether used directly or indirectly approach to measurement or use questionnaires or interviews, usually try to collect four broad class data: demographic data, data on the health status of the population, data on environment and data for time-activity. From these data is crucial is accurate evaluations of time studied population spent in various micro environments. Known are three main approaches to obtain information on time-activity: assessment, observer approach and using logs to time-activity. Participants in the study in the evaluation approach themselves evaluate the amount of time spent in various activities for a certain period (for example, such as the previous week). The approach using diaries, study participants consistently describe all activities that are engaged for a period of time. In observer approach the activities of



Microenvironment Kind	***Concentration of RSP (C_j μg/m³)***	***Fraction of time[a] (t_{ij})***	***$C_j xti_j$ (μg/m³)***	***Contribution to microenvironment of E_1 (%)[b]***
1. Room of home	15	0,75	11,25	47
2. Room of work	50	0,15	7,50	31
3. Room other	25	0,04	1,00	4
4. When switching	90	0,04	3,60	15
5. Outside	40	0,02	0,80	3
$E_1=\Sigma C_j xt_{ij}=24,15 μg/m^3$				

a - Fraction of the 24 hours in each microenvironment.

b - Percentage contribution of each microenvironment to 24-hour time- integrated exposure (E_1)

Fig. 1.11. Examples of the relative contributions of specific microenvironments to time- integrated exposure of individual (t) for respirable particles (RSP) (Sexton and Ryan, 1988)

the participants are monitored and recorded by outside observers. This naturally adds a higher degree of competency and accuracy in the study in which someone will continuously monitor their activities. Potential solution to these difficulties is the implementation of electronic sensors that distinguish three environments: room, in vehicles and external.

2.4. RISK CHARACTERIZATION

For the fourth stage of the risk assessment does not require new information, but rather is used resulting in the first three stages are summarized in order to assess the risk for certain population groups. The information from the risk characterization used by the risk manager with political, social, industrial and economic considerations for the development of regulatory options. Nevertheless, the risk characterization is not done off-hand, because it requires to decide which assessments of the dose-response and exposure to use, what are the statistical and biological unknowns in the measured health effects and which population groups should be the main objects of protection. Managers are usually not in a good position to make such decisions, because of their limited scientific and technical knowledge. Therefore, the risk characterization is a joint responsibility of managers and scientists. But the fact that scientists are involved in the selection, for example, which model for extrapolation to be used, does not make this choice devoid of political participation.

Political decisions should be taken in compliance with the scientific assumptions and proposals, must reflect not only informed scientific opinions, but also economic, health and political attitudes and social goals. Therefore, these decisions should be taken with the participation of the whole society, including government assessors and managers, representatives of industry, interested groups and the entire community.

REFERENCES

1. **Badura, B. I. Kickbusch.** ed. Health Promotion Research. Towards a new Social Epidemiology, WHO, Regional Publications. European Series, 1991, No, 37,

2. **Bojinov, T.** Ecology and Management. Sofia, 1989. (in bul.)

3. **Cothern, C.R., M.A. Mehiman, W.L. Marcus,** ed. Rise Assessment of Industrial and Environmental Chemicals. Princeton Scientific Publiching Co., Inc., Princeton, New Jersey, 1988.

4. Physical environmental factors. Ed. **E. Efremov,** Sof. Med. and phys.., 1988, 278 p. (in bul.)

5. **Kaloyanova, F., K. Basmadjieva, M. Popov** et al. Ecology and Health, Sofia, Med. and phys., 1985, 67-78. (in bul.)

6. **Laboy-Nieves E.N., Goosen M.F., Emmanuel E.** Environmental and Human Health. Risk Management in Dev. Countres, CRS Press, 2010.

7. **La Dou, J,** ed. (1990). Occupational Medicine, Appleton and Lange.

8. Law on Environmental Protection - SG. 91, 2002. (in bul.)

9. National Research Council (NRC) (1989). Biologic Markers in Pulmonary Toxicology, National Academy Press, Washington, DC

10. National Research Council (1991). Human Exposure Assessment for Airborne Pollutants, National Academy Press, Washington, DC

11. **Paustenbach, D.J.** et al. (1990). J, Air Waste Manage. Assoc. 40: 12.1620-1630.

12. **Rohman, K. J.** (1986). Modern Epidemiology, Brown and Co, Boston/Toronto.

13. **Shipkovenska E.** Cardiovascular risk, Sofia heart study, "Filvest", Sofia, 2004, 168 p. (in bul.)

14. **Theodor L., Dupont R.** Environmental Health and Hazard Risk assessment. Principles and Calculations, CRC Press, 2012.

15. **Tsonevski D.** Hygiene and Public health. N 6, 1994, 23-25. (in bul.)

16. **Tsonevski, D., K. Tsachev, Ts. Vodichenska, E. Dincheva, H. Christov** Hyg. and Public health. N 4-5,1993, 32-34. (in bul.)

17. **Vincoli J.W.** Lewis' Dictionary of Occupational and environmental Safety and Health, CRC Press, 2010.

18. **Wesolowski, J., Jedrychowski, E. Flak** (1992), J. of Exp. Anal and Environ. Epidem., 2,323-339.

3. ASSESSMENT OF HEALTH AS QUALITY OF LIFE, M. Mutafova

Words "life and health", people often say to themselves and to each other, express wise folk understanding of the uniform nature of highest human good - long life in good health. This simple philosophy of ordinary people for the most important value in life until recently no specific scientific dimension, that connects these two components and to allow to define briefly the health status of the population through the quality of coming life.

At the end of the twentieth century, the need for such a measure becomes greater and therefore substantial changes in both time of life and in morbidity.

For many years in all countries in the world **reduces mortality and life expectancy** slowly but gradually increasing. Half a century ago the majority of the human population is dying before reaching 50 years of age. Today in developing countries newborns can expect to live on average 64 years, and in Japan - even over 80 years. This is a leap in human evolution, which is undoubtedly a result of the achievements of medical science and protection of health in modern society.

Along with the increase in life expectancy observed change in **the pattern of morbidity**. Continuously growing chronic diseases (cardiovascular, diabetes, malignant neoplasms), leading to severe physical and mental disorders, especially among adults. The World Health Organization states that "Inevitably, every human life reaches its end. The most important priority over any other concern is this end came in the most dignified and painless way. This is a **priority not only of the medical profession, the health sector and social services, it is the priority of every society, family and individual. "** (WHO)

What is the real cost of longer full life, whether the additional years added to the life of people at the end of this century are in good health or are years of illness and dependence? Using independently traditional indicators of public health as mortality, morbidity and life expectancy does not answer the question.

In the late 60s of the XX century researchers in the field of public health put a very serious problem for the creation of **integrated health indicators to assess the likelihood of a healthy life in the human life cycle**, i.e. new indicator, which can be combined at the same time as mortality and also morbidity.

Overall concept of integral health indicator was first presented by the B.S. Sanders in 1964. In 1971 David Sullivan, provides a method for assessing the life expectancy as a function of the different states of capacity. Created a new indicator is generally called "Expected health" or "Life expectancy in good health" (*"Health expectancy index"*), showing specifically how many years of his life, people can expect to survive in good health. For each age is determined on how much of an impending average life expectancy, individuals of the age group and the population as a whole can expect to live without physical or mental disorders, violating health. For the first time in the history of **statistic health - as a social phenomenon and as an important parameter of the quality of life becomes a measurable quantity.**

The determination of the "Estimated health" includes two types of information:

- **mortality data** (official statistics)
- **data for a specific health characteristics** (eg. - Incapacity or mental health - through health interview or objective medical research)

Self-assessment of individually **physical health** WHO recommends the use of groups of issues, characterizing the different functional states included in the International classification of "Disability, incapacity and social failure (1981).

Assess:

- **general assessment of health**.
- **social failure.**
- **the state of physical incapacity**.

Health interview is also available as the primary method of gathering information about the **mental state** of individuals. In recent years this is approbate created by D.Goldberg "General Health Questionnaire".

In determining the quality of forthcoming life can be used and data from the statistics on the incidence of certain chronic diseases.

Using data obtained based on a uniform questionnaire WHO identified the following indicators:

- **"perceived health based on total self"** *(perceived health expectancy)*
- **"life expectancy in physical capacity"** *(disability-free life expectancy)*
- **"life expectancy free from social failure"** *(handicap-free life expectancy)*.

Based on data obtained by Goldberg questionnaire is calculated indicator **"Expected mental health"** (Mental health expectancy).

The first studies of "Anticipated health" are made in the US in the early 70s. Later includes Canada, France, Holland, Japan, and in the past decade such calculations are performed already in 50 countries of the world. In some developed countries the data collection for the calculation of "Expected health" is already routine in their health statistics.

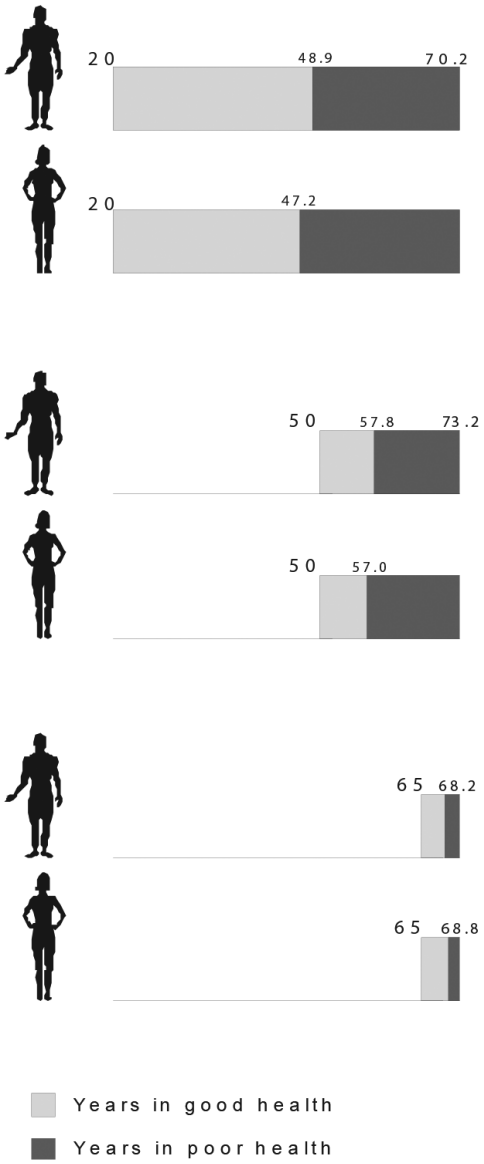


Fig. 1.12. Expectancy of life in good and in bad health in general assessment itself for men and women of a certain age in Bulgaria, 2001

Studies in different countries show that:

- **Women** have a longer life expectancy than men, but in comparison **expect to spend in good health smaller part of his life**.
- **In economically developed** countries the proportion of **expected healthy life is higher** than in less developed countries.
- **The poorest and least educated people not only have a shorter overall lifespan than the rich, but much less of it can expect to be in good health.** Studies by social groups in Canada have shown that differences in "Life expectancy without incapacity" between rich and poor segments of the society are 14 years for men and 8 for women in favour of the rich.
- Life expectancy in good health **in urban areas is higher than rural**.

Studies conducted in Bulgaria in 1996 and 2001 show that the trends found life expectancy in good health (a common self-assessment) in 1996 are identical to those in 2001, but with different degrees of degradation of performance in 2001. At an early age groups has a significant deterioration in 2001 of life expectancy in good health, self-estimate in both sexes., while in high-age this difference becomes negligible.

The average life expectancy for women in all ages is significantly higher than men. In all ages, however, the proportion of expected life in good health and in physical capacity of women is lower than that of men, i.e. **women live longer than men, but much longer than they are in poor health (Fig. 1.12)**.

Assessing the health status of the population quality of life is perceived as basic position in modern philosophy and strategy of the World Health Organization. The annual report of the organization on the state of health in the world in 1997 stated that "the expected health is much more important than life expectancy because enjoying the added extra years, we must admit that **the prolonged period without quality life is a meaningless prize. "**

There are also different for the future development of these processes. Some authors (Kramer N. and Gruenberg E.M.) provide that mankind can expect extension of life, however, at the expense of longer period in poor health. Other (Fries J.F.) are optimistic and hope that scientific and social achievements will lead to a reduction of the years of suffering in human life cycle.

The inclusion of **"Anticipated health"** in the WHO recommendations **as the primary indicator for assessing the public health** and shows its importance as a major incentive to improve population health.

REFERENCES

1. **Boshuizen H.C., Water H.P.A.** van de. An international comparison of health expectancies. Leiden, TNO Prevention ND Health, 1994

2. Comparative quantification of health risk, ed. **Ezzati M., Lopez AD, Rodgers A., Murray C.J.L,** V. 1 and 2, WHO, 2004, 2235

3. **Goldberg D.** Mannual of the General Health Questionnaire. Windsor, England: NFER Publishing, 1978

4. Health status studies. National Statistical Institute of Bulgaria. Vol.6, book4, Sofia, 2002

5. **Mutafova M.** Integrated indicators for assessing the health of the population. "Propeller", S., 1007, 291 (in bul.)

6. **Mutafova M., Hr. Maleshkov.** Method of statistical evaluation of life expectancy in good health., Social Medicine, 2,1996,25-28 (in bul.)

7. **Robine J.M.** et al. Contribution of the Network on Health Expectancy and Disability Process to the World Health Report 1995. Montpellier, INSERM, 1995

8. **Robine J.M.,** Healthy life expectancy & evaluation of global indicator of change in population health., BMJ, Vol.302

9. **Salchev P.,** Health and risk - risk factors, Social Medicine, Salchev P. 20 399-434 (in bul.)

10. **Sanders B.S.** Measuring community health levels. Am J Public Health, 1964; 54: 1063-70

11. Sante Publique, sous dir. **Brucker G, Fassin D,** Paris, Ellipses, 1990, 848

12. **Sullivan D.F.** A single index of mortality and morbidity. In: Health Services and Mental Health Administration (HSMHA) Health Reports 1971; 86: 347-54

13. The World Health Report, 1997, Geneva

14. Urban Sprawl and Public Health, **Frumkin H., Lawrence F., Jackson R.,** Island Press, Wash., Covelo, London, 2004, 338

15. **Water H.P.A. van de, Boshuizen H.C., Perenboom R.J.M.** Health expectancy in the Netherlands. European journal of public health, 1996, 6: 21-28

16. WHO, International Classification of impairment, disability and handicaps, 1981

4. GENOMIC MEDICINE - HEALTH RISK AND PREVENTION, D. Tontcheva

Reading the human genome is a feat of genetics in the late 20th century. After completion of the mega project "Human Genome" arose new directions in science ending in "omiks" as genomics, proteomics, metabolomics, pharmacogenomics and many others. The results of the extensive research found the greatest impact in medicine.

In the post-genome era science faces a major challenge - identifying and mapping the genes that determine susceptibility to socially significant diseases; revealing the molecular mechanisms of carcinogenesis, searching for genetic prognostic and predictive markers, development of target therapy and **personalized medicine**.

Genetic factors play a role in the emergence and development of almost all human diseases by creating a predisposition to risk components of the environment, determine the susceptibility or resistance to infectious agents, contribute to the severity and progression of the disease, as well as drug metabolism, the effect of therapy and adverse reactions to drugs.

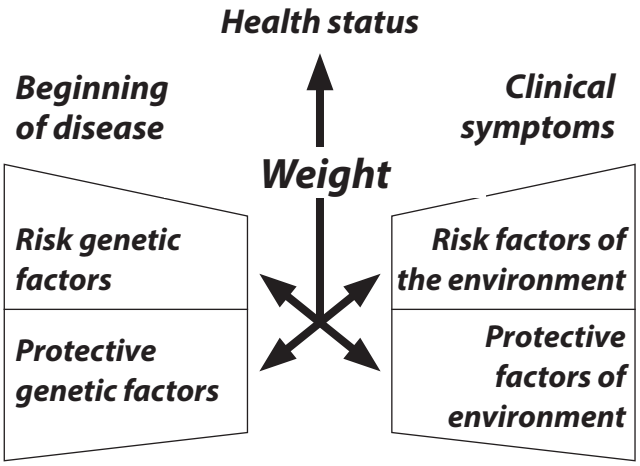
Most important problems of multifactorial disease associated with interactions between gene-gene, gene-external factors and correlations between genotype and phenotype. The study of genetic factors for susceptibility to human diseases (infectious and widespread diseases), became possible after the discovery of a large number of DNA variants - SNPs - single nucleotide substitutions, VNTR - variable number of tandem repeats, short sequence repeat polymorphisms - repeated short polymorphisms and simple sequence polymorphisms - polymorphic simple sequence. They are widely used as a powerful tool in molecular genetic research. Unlike monogenic diseases, detection of the genetic basis of complex diseases is more complicated. Identifying genetic risk factors is difficult because they are very, interact in complex ways and on many levels. With the help of molecular genetic studies by analysing linkage (linkage analysis) and positional cloning are identified hundreds of genes which alone determine the occurrence of monogenic disease. These two approaches have limited use in genetic research on multifactorial disease. With them it is necessary to analyse a large number of genetic markers, and to explore many patients with a known history of the disease (i.e., knowledge of the effect of therapy, the progress and outcome of the disease, etc.). This complex process of discovery of genes for predisposition to multifactorial diseases, need to develop new molecular cytogenetic methods to use quick, easy and inexpensive methods for automatic genotyping of single nucleotide polymorphisms (SNPs), to develop different techniques of microchips (cDNA, tissue and protein microchips) and improve bioinformatics to analyse large data set and create new patterns. Avalanche accumulation of results led to a clarification of the pathogenetic mechanisms of many diseases, the creation of a new classification of genetic diseases by introducing an individual approach to treating patients based on their genetic constitution. New developments in genomics turned medical genetics in genomic medicine.

Genetic factors in etiopathogenesis of common diseases.

Socially significant diseases have a complex aetiology, involving a variety of genetic and external factors with risk or protective effect. Some scientists have raised the hypothesis of a frequently disease/frequently polymorphic variant. In support of this hypothesis are the results of genetic studies revealing ApoE4 allele frequent variant of Alzheimer's disease, VNTR minisatellite alleles from class I insulin gene with diabetes type I and HLA alleles with several immunodeficiency diseases. Modern genomic studies have shown that not all genes for predisposition occur frequently. It is possible alleles with low population frequency associate with frequent diseases.

The number of genes involved in the etiology of socially significant diseases is not known, but is probably different for different diseases. The inclination can be monogenic, polygenic or oligogenic. In the inheritance of a mutation in a gene may result from a predisposition to a disease of monogenic type. E.g. mutations in genes MSH2 or MLH1 are associated with hereditary non-polyposis colorectal cancer. Some mutations create monogenic type of predisposition to adverse effects of various environmental factors - drugs, food, infections. A classic example is glucose-6-phosphate dehydrogenase deficiency (G6PD), which manifests itself by different individuals in the clinic: favizam, neonatal hyperbilirubinemia, acute drug-induced hemolytic anemia and chronic non-spherocytic hemolytic anemia, spontaneous abortion, etc. Oligogenenic type of predisposition occurs in humans, e.g. LDLR mutations in genes predispose to coronary heart disease, but the risk increases significantly when combined with a polymorphic variant of 5,10-methylene tetrahydrofolate reductase (MTHFR), which increases the level of homocysteine. Studies of dia-

betes mellitus type 1 on NOD mouses reveals at least 11 genes, but only two of them are of greater importance for the disease, while others have little effect on the phenotype. Polygenic diseases develop when inherited in a "predisposing" gene in the presence of adverse external influences. The same variant genes may participate in the initiation of various diseases. E.g. HLA B27 predispose to the occurrence of ankylosing spondylitis (relative risk RR = 87.4), to the syndrome of Reiter (RR = 37) and acute anterior uveitis (RR = 10.4). Genetic factors may be at risk or protective. An interesting example of a gene with a protective effect against the development of AIDS is the gene CCR5. It encodes the receptor for the HIV virus on the surface of human immune cells. When a mutation in the CCR5 gene, which leads to decreased expression of the gene product or him structural changes, to give a genetic resistance to the HIV virus, which does not bind to the cellular receptor, and does not pass into the cell.



Exogenous factors and etiopathogenesis of common diseases.

Classic examples of involvement of environmental factors in the occurrence of common diseases are linked to population studies for migration processes. In Japan, the incidence of stomach cancer is high,

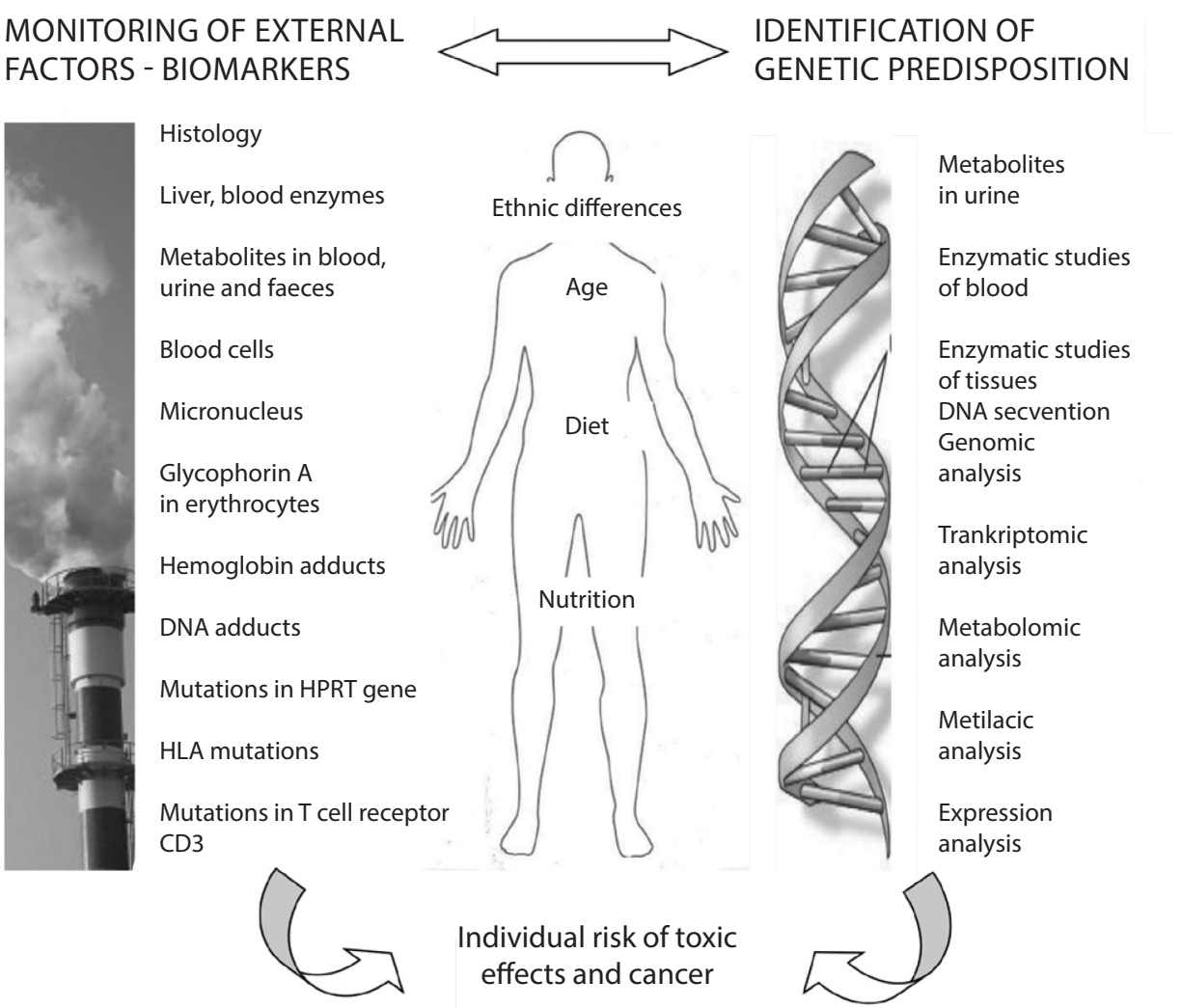


Fig. 1.13. Genetic determinants of toxic response and carcinogenesis

and the incidence of colon cancer is low, but in Japanese immigrants in the United States the incidence of stomach cancer decreases and the incidence of colon cancer increases. The incidence is affected by the changing external environment, because the genes are unchanged. Exogenous factors can be risky or protective. The overall effect of the etiological components are determined by the cumulative effect of external and genetic factors.

The term external environment can be formulated in various ways depending on the initial position. With respect to the individual, are external environmental factors (mutagens, carcinogens, teratogens, infectious, etc.), and with respect to the genetic material, they are intracellular components. The majority of monogenic diseases develop without regard to environmental factors, while others require specific exogenous factor (e.g. phenylalanine in the diet provokes development of phenylketonuria - PKU in carriers of the phenylalanine hydroxylase deficiency), or many external agents - drugs , food, infections in glucose-6-phosphate dehydrogenase deficiency. The role of environmental factors increases by monogenic to polygenic diseases. The most poorly involvement they have in the etiology of mucoviscidosis and hemophilia, their effect is increased in Alzheimer's disease, diabetes, asthma, more significant role they have in the etiology of cardiovascular diseases, lung and skin cancer and their effect is greatest with injuries.

Genotoxicity. Some polymorphic enzymes involved in the metabolism of a number of exogenous and endogenous substances with toxic and carcinogenic effects. Entered in the body xenobiotics can stimulate specific or nonspecific cellular, physiological or pharmacological response, cause changes in homeostasis, cell proliferation and differentiation, or to provoke apoptosis and necrosis. A number of studies have found a link between individuals ability to effectively detoxify the body and the occurrence of chronic multifactorial diseases (cardiovascular and neurodegenerative), hypersensitivity to chemicals and carcinogens. Most of exogenous compounds of mutagenic activity, represent precarcinogens, which are converted to carcinogens after metabolic activation **(Fig. 1.13.)**.

Detoxification enzyme systems are classified into three distinct phases. In phase I, the enzymatic reactions of oxidation, reduction or hydrolysis is referred to as functional. Xenobiotics are transformed into active metabolites intermediates by incorporating functional groups, become more hydrophilic and reactive to subsequent reactions and sometimes more toxic for the cells. Phase II intermediate metabolites, and radicals undergo biotransformation

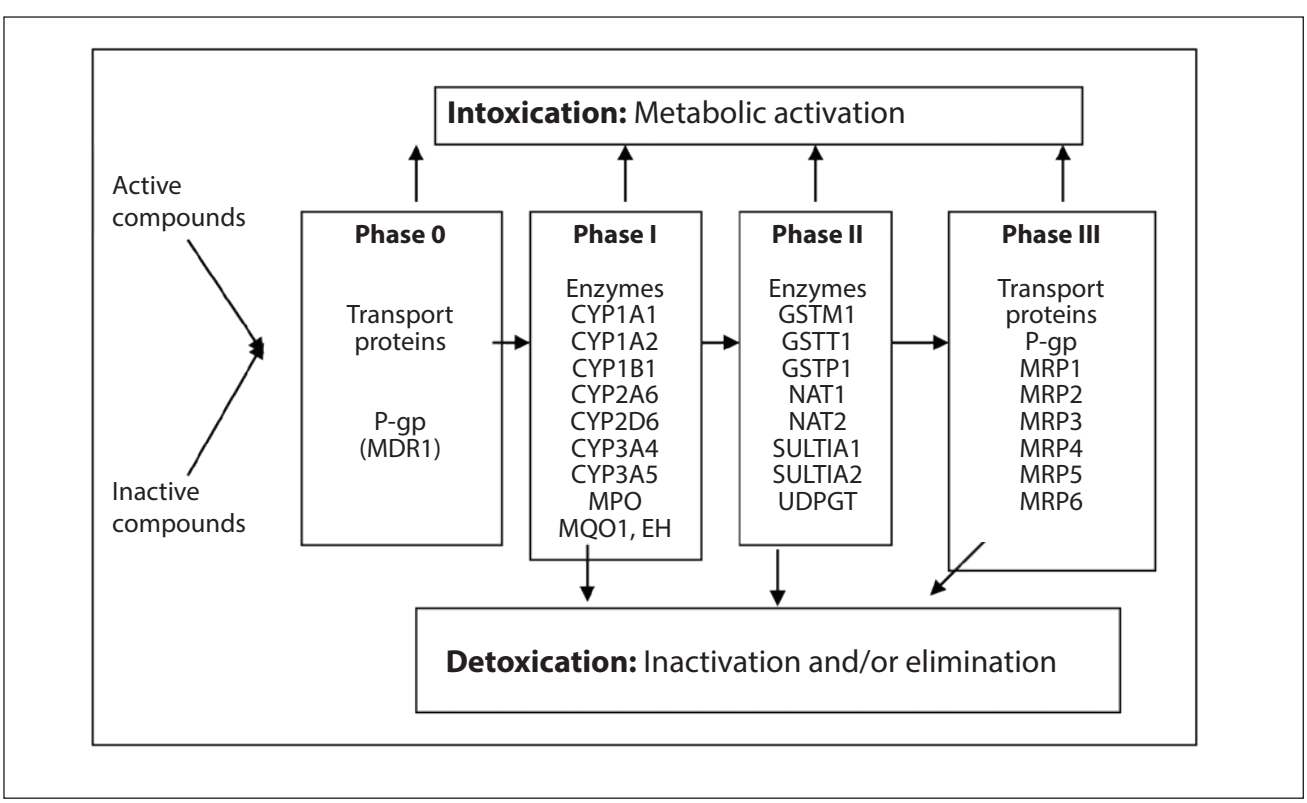


Fig. 1.14. Participation of the polymorphic enzymes and transport proteins in the processes of absorption, biotransformation and excretion of xenobiotics, according Brockmöller et al., 2000

to end products by coupling amino acid, sulfate, acetate, glutathione and glucuronic residuals. Phase III xenobiotics excreted outside the cell area of the so-called antiporter system which is energy-dependent pump. In phase I and II are involved certain enzyme systems, in phase III a number of transport proteins **(Fig. 1.14.)**.

It is known that there are a variety of allelic variants of all the enzymes involved in detoxification processes. The polymorphic alleles encoding enzymes with normal or changed in some degree enzymatic activity, compared to the wild type allele. Polymorphic enzymes that metabolize xenobiotics are subject to molecular epidemiological and clinical pharmacological studies. They have been extensively studied in relation to the occurrence of cancer induced by carcinogenic environmental factors. Cytochrome P450 (P450) constitute a super family of heme-containing enzymes and occupies the largest share of the enzymes involved in Phase I detoxification. P450 isoenzymes have a certain substrate specificity, as they are generally divided into two classes: the first class isoenzymes (CYP4, CYP7, CYP11, CYP17, CYP21, CYP27), which are involved in the oxidative metabolism of a large number of endogenous substances (steroids, prostaglandins, leukotrienes, fatty acids, biogenic amines and bile acids) and a second class isoenzymes (CYP1, CYP2, CYP3), whose metabolic range includes a wide range of xenobiotics, such as alcohols, compounds of plant origin, chemical compounds and medicines. Genes encoding enzymes of the first class, are highly conservative. This is related to the critical role they play in the metabolism of endogenous substances. In contrast, the genes encoding the enzymes of the second class is characterized by a high polymorphism. NAD [P] H: quinone oxidoreductase 1 (NQO1), known as 4 diaphorase is an enzyme involved in the detoxication of a range of natural and synthetic components, and activates agents with anti-cancer effect. It catalyses the direct conversion of the quinone to hydroquinone and participates in the detoxification of benzene and its derivatives. Microsomal epoxide hydroxylase catalyzes the attachment of a molecule of water to epoxide and the formation of di-hidrodiol. The enzyme is considered as part of the detoxification of PAHs.

N-acetyltransferases (NAT) involved in the biotransformation of many drugs precarcinogenics and xenobiotics in phase II. Many allelic forms of *NAT1 NAT2* and set different enzyme activity. Glutathione S-transferases (GST) catalyze reactions of transferring a glutathione reminders on various substrates such as heterocyclic compounds and aromatic epoxides. GST involved in bioactivation of xenobiotics with proven nephrotoxic effect, as trichlorethylene, di-chloroacetylene, tetra-chloroacetylene and the like. GST polymorphisms play a role in secondary carcinogenesis after himiotherapeutical treatment. Uridine diphosphate-glucuronosyl transferases involved in another mechanism to eliminate hydrophobic xeno- and endobiotics. UGT are enzyme super family, divided into two major classes UGT1 and UGT2. They catalyze the transfer of glucuronic acid residue to a small hydrophobic molecules. UGT1 catalyze glucuronisation of bilirubin and phenol, and UGT2 - of steroids and bile acids. Excretion of a number of drugs, xenobiotics, neurotransmitters and steroid hormones is carried out by sulfotransferases. Superfamily of sulfotransferases include many enzymes which catalyze the attachment of the sulphate reminders to specific substrates.

Transport proteins found in connection with the study of drug resistance (MDR - multidrug - resistance protein). Currently identified are six protein MRP1 to MRP6, forming the family of ABC - transport proteins. The most well characterized is the transport protein Pgp, encoded by the MDR1. He has a broad substrate specificity and is believed to play a leading role in the detoxication of xenobiotics from the body. Pgp is included before the cascading effects of Phase I, but its main function is excreted metabolites of phase II. *MDR1* likely recognizes hydrophobic toxins even more entering the cell membrane and prevents the toxic action, before they are moved into the interior of the cell. Several mutations define functionally different allelic variants of *MDR1*. The wild type allele (*MDR1*1*) is connected with normal enzymatic activity, efficient detoxification and resistance to xenobiotics. Mutant alleles show low Pgp expression, and possibly lead to a higher susceptibility to xenobiotics, and a lower capacity for detoxification.

Genetic predisposition. The genetic component of multifactorial disease revealed different methodological approaches: studies of populations, families, twins and adopted children (adoptive studies) and genetic/genomic analyses. Population studies have identified differences in the frequency of some socially significant diseases among isolates and other populations. In isolates accumulate risky or protective genetic variations with very high frequency and researchers reach easier to detect susceptibility genes. Lack of type I diabetes in Australian aborigines and inuites of Greenland, and the high incidence of the disease in the isolate groups of pima Indians (35%) is explained in both the absence and in the other the accumulation of genetic risk factors. Family studies demonstrate the presence of a genet-

ic predisposition, when the family rate is higher than the population (e.g., schizophrenia population at a frequency of 1%, and the family is 10%; in insulin-dependent diabetes, they are 1:500 and 5-10:100) and when the incidence of disease decreases with the distance of the relationship (with multiple sclerosis: population rate is 0.1%, rate in first-degree relatives of patients is 3% -5% in second-degree relatives - 2% -3 %, while those of third degree - 1%). These empirical risks are used in genetic consultations. Studies of twins enable you to determine the relative proportion of genetic and exogenous factors. Monozygotic twins are genetically identical, unlike dizygotic. In this type of study compares the degree of concordance (i.e. illness of both twins) between monozygotic (MZ) and dizygotic (DZ) twins and determine the proportion of genetic factors (heredity) in the pathogenesis of the disease. When the disease is entirely genetic concordance in MZ is 100%, while DZ was 50% (for dominant diseases) and 25% (for recessive). When the disease is primarily due to external factors, the degree of concordance in MZ and DZ will be the same. Studies of twins have revealed that the proportion of genetic factors in the occurrence of hypertension, bronchial asthma, type I diabetes and overweight is around 65-80%, and schizophrenia is 41-87%, according to various authors. Adoptive studies are used to distinguish genetic from exogenous factors involved in the etiology of multifactorial disease by determining the incidence of the disease in three groups of adopted children (sick biological parents, with healthy biological parents and with sick adoptive parents) or by determining the incidence of the disease in two groups of individuals (biological parents and adoptive parents of children ill after adoption). Population, family, twin and adoptive studies reveal the role of genetic factors in etiopathogenesis of complex diseases, but do not determine the genes of polygenic complex.

Where it is established that the genetic components involved in the pathogenesis of widespread diseases, it is necessary to identify the specific gene (s) and predisposition to determine "abnormal" molecular variants (alleles) of the gene. The classic approach is to start from the pathophysiology of the disease and the known biochemical disorder, to determine the sequence of the responsible protein and in reverse to arrive at the mutant gene responsible for the variant protein. This approach has limited application because it does not know well disturbed physiological processes of disease, biochemical abnormalities and abnormal protein. Modern research of socially significant diseases are conducted on genetic and genomic level.

Susceptibility genes can be analysed by linkage or association studies of case/control and triaxial (patient and both parents). The aim of linkage analysis is to determine whether the disease in large families (with many patients relatives) is transmitted to a particular chromosome associated segment. Used a large number of markers to detect those which are closely spaced to the disease gene and are inherited in the family together with the disease. Follows the co-segregation of genetic markers with the disease and calculate LOD score. Linkage analysis has been used successfully for mapping genes for monogenic diseases, for which is known the type of inheritance, mutation in the gene is a full penetrance and frequency of variant alleles is determined. The method proved to be unsuitable for the study of complex diseases as it is not applicable to the detection of polymorphic genes with weak phenotypic effect and without a definite pattern of inheritance.

In positional cloning makes systematic study of the genome to search for genes associated with diseases, without any prior information about gene product and pathogenetic violations. By positional cloning are identified hundreds of gene mutations, which are rare and are associated with a monogenic disease.

In the associative studies case/controls seek specific allele/s and genetic marker that is distributed with a statistically significant higher frequency in diseased individuals as compared to healthy individuals. The association can be direct or indirect. The association is a direct, if a research variant encodes a defective gene product with altered structure and function, with reduced or missing quantity. Genetically-functional strategy seems promising and at the same time difficult to implement as yet little is known about the functional significance of genes and pathogenetic mechanisms underlying polygenic diseases. Failure to use such an approach for analysis are related to several reasons - the small number of respondents, poorly defined phenotype errors of genotyping, multifactorial disease and others. The association is indirect when the tag does not cause disease, but is located close to the disease gene on the same chromosome and passed through generations coupled with it, i.e. they are in linkage disequilibrium (Linkage Disequilibrium - LD). When searching for an indirect association explore multiple random polymorphisms (SNPs - single nucleotide polymorphisms) for linkage disequilibrium with the disease phenotype. Linkage disequilibrium (LD) is a population phenomenon in which alleles from two nearby loci on chromosome remain together during their transmission in generations. LD repre-

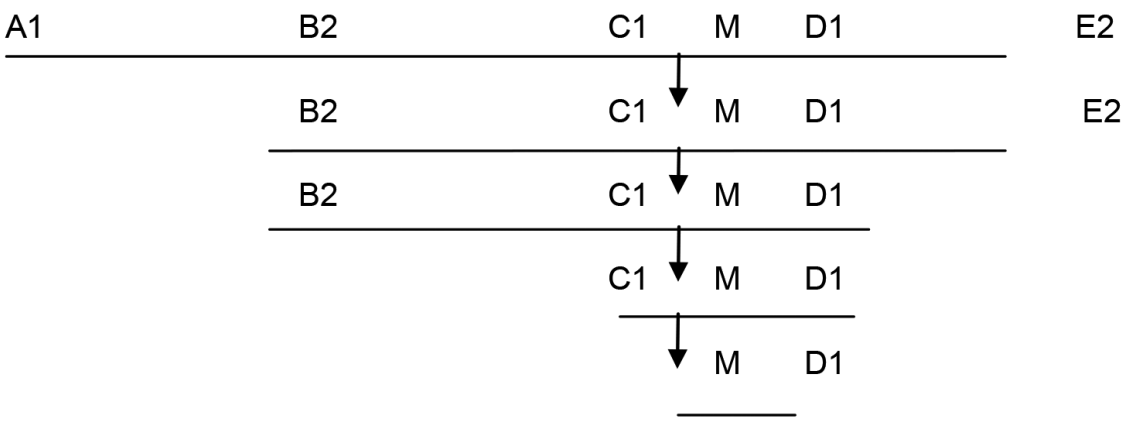


Fig. 1.15. linkage disequilibrium

sents the degree of association (co-segregation) of two closely spaced polymorphic alleles (SNPs). The principle of the method is that the mutation associated with the disease, patients often inherited allele of the marker locus coupled with the mutation as compared to the expected values of the accident event. At the time when the mutation (M) in the individual, it is included in a particular haplotype (A1-B2-C1-D1-E2) of chromosome **(Fig. 1.15.)**. Later as a result of recombination, the association of M with markers gradually lost in subsequent generations. After many generations LD is retained only for markers that are located closest to the mutation.

The probability meiotic recombination occur, which divide the polymorphic marker and the disease gene, is less at the distance between them is short. LD can be established between closely spaced alleles of the marker gene and susceptibility spaced 50 kb. The degree of association was measured by the ratio between the input of the predisposing genes and the contribution of the genes that are not associated with the disease (Odds ratio). Genotyped cases which are "sick" (D) and controls "healthy" (not D) and calculated Od. In Od = 4 cases (patients) bear 4 times more often defined genetic modification (genotype or risk allele) compared to controls; at Od = 1 - no association between genetic factors and disease and, at Od <1 genetic factor has a protective effect.

Genomic technologies. Microarray technology allows simultaneous holding hundreds/thousands of studies. They are based on two long known principle: a Watson-Crick, according to which "any nucleic circuit detects a complementary sequence by connecting the bases - hybridization" and the parallel hybridization, where "each of the many sequences in the sample can hybridize with the complementary sequence chip". The essence of the technique consisting in a fine alignment (in columns and rows) and immobilizing hundreds to thousands of biomolecules (DNA sequentials) on the microscope slide, which is used for parallel hybridization. Microarrays can be used for integrated monitoring of gene expression, to determine the number of gene copies, analysis metilation status in the promoter regions of genes. This is a technology that can be defined as "a new kind of molecular microscope" to monitor the expression program of the genome. Microchips are a powerful tool for the collection and analysis of a large amount of genetic information, and for identifying the genetic markers which can be used for diagnosis, prognosis, and genetic-based therapy.

Genomic studies in humans have led to the emergence of genomic medicine and pharmacogenomics.

Pharmacogenetics and pharmacogenomics. Pharmacogenetics studied variants in genes associated with drug metabolism, which define the secondary or toxic effects of the drugs. Genetic studies conducted prior to treatment may reduce secondary effects of drugs by individual dose adjustment or determining treatment strategy. E.g. CYP2D6 is a member of the superfamily of cytochrome P450 monooxygenases. He was involved in the metabolism of over 65 different commonly used drugs - antipsychotics, tricyclic antidepressants, beta-blockers, anti-arrhythmic and others. There are 78 variants of the enzyme that define three different phenotypes: PM - slow metabolisers, EM - fast metabolisers and UM - ultrafast metabolizers and have different pharmacological effects. In PM phenotype daily dose of drugs should be reduced in order to avoid adverse

reactions; at EM phenotype - the daily dose should be increased to achieve better therapeutic effect. Another member of the family associated with pharmacogenetic consequences is CYP2C9. His alleles CYP2C9 * 2 and CYP2C9 * 3 worsen the anticoagulant effect of warfarin and associated with increased risk of bleeding and the possibility of death. Prior to treatment the gene to be genotyped to determine therapeutic dose. There are other genes with pharmacogenetic effect as: CYP2C19, G6PD, TPMT, NAT2, MDR1 and others.

Pharmacogenomics is a continuation of pharmacogenetics in a new direction - genomic studies on the relationship of genetic variants (mostly SNPs) with the effect of drug therapy. The main priorities of this new branch of science are optimizing drug therapy according to the individual genetic profile of patients and create a new generation of drugs. To this end, examine polymorphisms that can be used to predict the maximum effect and minimal toxicity of the drugs. Unlike the classic stage of pharmacogenetics, currently the interest of researchers is aimed at: a) detection of SNPs, associated side effects; b) determination of genotype-phenotype correlations; c) use of SNPs based diagnostic tests in order to determine individual treatment, consistent with a genetic profile of the patient.

In the post-genome era, to create a new generation of drugs (known as targeting drugs - monoclonal antibodies or small molecules), based on ***a)*** pharmacogenomics and pharmacoproteomics studies; ***b)*** identifying, functional analysis and validation of molecular targets of clinical relevance ***c)*** in silico drug design, a virtual screening and development new target drugs that block the target molecules. Eg. Iressa target drug that blocks the action of the mutant *EGFR* and stops conducting signals from cell surface to the nucleus and stops the process of neoangiogenesis, metastasis and antiapoptotic. Iressa is conducted only after genetic testing and diagnosis of mutations in the gene, creating a sensitivity to a drug target. The target drug Vectibix is a monoclonal antibody which is administered for the treatment of colorectal cancer in patients with wild-type *KRAS*. With Herceptin treating patients suffering from breast cancer with amplified *HER2* tumor marker.

Genetic preventive medicine are successful due to the introduction of new genetic tests to identify healthy individuals with an increased risk for multifactorial disease. They are used primarily in familial forms of cancer syndromes as healthy cancer risk families may inherit a mutation that creates a high risk for cancer. Currently explore these genes for predisposition to cancer: *mutations in the tumor-suppress gene P53* (in hereditary cancer syndromes - syndrome Li-Fraumeni.); *mutations in the RB1* (Retinoblastoma) and *WT1* (Wilms tumor); *mutations in the gene APC* (in familial adenomatous polyposis - FAP); *mutations in the genes MLH1* and *MSH2* (HNPCC - hereditary nonpolyposis colon cancer, or Lynch syndrome); *mutations in the BRCA1* and *BRCA2* genes, which creates a predisposition to hereditary breast cancer and ovarian cancer in members of high risk families.

An important objective of oncogenetic research is the discovery and introduction of new prognostic markers for early diagnosis, staging and prognosis of solid tumors. In uroepithelial tumors early genetic diagnosis may be set by UroVysion test for most frequently chromosomal changes in uroepithelial tumors cells isolated from urine. In sporadic breast cancer and/or ovarian carcinoma to analyse mutations in oncogenes *CHK2*, *p16*, and *HER2*.

Genetic screening programs (mass and selective) are one of the main approaches to prophylaxis. They aim to identify individuals in the population and members of at-risk families, carriers of "unhealthy" mutations. For this purpose they have been developed biochemical or genetic tests and software to identify high-risk individuals. According to covered patients or groups, the screening is defined as mass (the study of all newborns, all pregnant or certain population groups) and selective (in search of heterozygote mutation carriers among healthy siblings of sick proband; patient groups selected a specific phenotype, e.g. the infants with "strange disease" suspected of a metabolic disorder; children with mental retardation, deafness, blindness, etc.). According to the time of the research, screening is: prenatal (e.g. a biochemical screening of pregnant women for determining risk for having children with most frequently chromosomal disorders or neural tube defects; determination of fetal morphology and diagnostics of development defects by ultrasound in pregnant women); neonatal (the study of newborns for diagnosis of phenylketonuria, galactosemia, hypothyroidism and other metabolic diseases) and postnatal (for the diagnosis of genetic diseases or detect heterozygous carriers).

Bulgaria is among the first states member of the EU, which has developed a national policy for "Rare" diseases in the field of public health. Rare diseases (RD) constitute pathological conditions which occur with low frequency (1 of 2000 persons). Although rare, they generally have serious public health problem of any health system, due to the large number of nosological units (over 6000 with a total frequen-

cy up to 6%). For Bulgaria with a population of about 7.4 million, the likely number of patients with rare diseases is about 400 000 - 450 000.

Priority of National Programme Rare diseases are:

- Provision of epidemiological data on rare diseases in Bulgaria by creating a National registry;
- Improving the prevention of genetic rare diseases by enlarging the current screening programs;
- Improving the prevention and diagnostics of genetic rare diseases certainty by introducing new genetic tests (microarray technology), decentralizing laboratory activities and easier access to genetic counseling;
- Integrated approach to the prevention, diagnosis, treatment and social integration of patients and their families;
- Further training of doctors in the field of early diagnostics and prevention of rare diseases;
- Establishment of a reference center for rare diseases in Bulgaria;
- Organization of a national campaign to raise awareness of rare diseases and their prevention;
- Support and cooperation with NGOs and associations of patients with rare diseases;
- Close collabouration with other members of the European Union relevant to the purpose of the program and the Expert group on rare diseases to the Department of Public Health and Consumer Protection - European Commission.

Other approaches to the prevention of hereditary diseases and predispositions are genetic counseling and prenatal diagnosis. They are relevant to the specific counseling patients and families; insertion of early preclinical diagnosis and taking individual treatment; for determining the risk of giving birth to a sick child with a particular genetic disease and to conduct diagnosis before birth. They have a particular meaning and to clarify the genetic status of the population.

REFERENCES

1. Genomic and Personalized Medicine, **Huntington W., Ginsburg G.** Editors, Volumes 1-2, Duke University, Durham, NC, USA, Published 2010

2. **Kevin U.V.** Advances in Genetics Research: v. 5, Publisher: Nova Science Publishers Inc, ISBN: 9781611220728, Publication date: 1 April 2011

3. Medical Genetics in the post-genome era. Genomic medicine. **Toncheva D.** (Editor) Ed. Smart art, Sofia, 2010. (in bul.)

4. **Perry G., Randy Sh., John S.** Genome exploitation. Publisher: Springer-Verlag New York Inc., ISBN: 9781441936912, Pages: 268, Publication date: 4 April 2011.

5. HYGIENE NORMS AND STANDARDS - HEALTH POLICY, ORGANIZATIONS AND ACTIVITIES.

D. Tsvetkov, M. Lyapin, L. Ivanova, M. Nikolova

5.1. PRINCIPLES, MULTIDISCIPLINARY APPROACHES AND STANDARDIZATION IN THE FIELD OF HEALTHY AND SAFETY CONDITIONS AT WORK

Labour legislation guarantees the protection of the worker's right to a healthy and safe work environment and the employer has a moral obligation to provide it.

Valery Giscard d'Estaing

Major, general principle and perspective on health and safety conditions of labour and occupational medicine is a multidisciplinary cooperation and intersectoral collabouration.

Protection of the rights and freedoms of workers is ensured by international labour standards. The fundamental principles of human rights in the workplace are reflected in the ILO standing orders (International Labour Organisation), Philadelphia Declaration, in a number of international instruments governing labour standards and decent work agenda.

International Labour Organisation and the World Health Organization (WHO) formulate a common **definition of health in** the workplace (occupational health), which was adopted at the first session (1950) of the United Committee of the ILO/WHO health and safety (Joint ILO/WHO Committee on Occupational Health) and has been revised on the twelfth session (1995).

The definition reads: Activities for providing workplace health (health and safety) must aim to achieve and maintain the highest level of physical, mental and social well-being of workers in all occupations; protection of workers from the occurrence of health problems caused by working conditions; protection of workers from the risks related to exposure to harmful health factors in the work environment; placing a worker and maintaining a working environment adapted to his physiological and psychological capabilities and, in conclusion: adaptation of work to man, and every man to his work.

The main **objectives** can be focused in the following areas:

Maintenance and promotion of health and the ability of workers. To ensure healthy and safe working conditions.

Development of organization and work culture conducive to health and safety at work, as well as creating a positive social climate and organization of work, raising labour productivity.

The terms health in the workplace, health and safety at work **(occupational health)**, safety at work **(occupational safety)**, occupational medicine **(occupational medicine)** and hygiene **(occupational hygiene)** are used to recognize the contribution of various specialists (engineers, doctors, health inspectors, etc.) and the fact that the organization of health and safety at the enterprise level is complex, often composed of separate units and specialists responsible for health and safety in the workplace, as well as Committees for working conditions.

To achieve these objectives promote the approach of the World Health Organization (WHO) (primary health care) and the ILO approach (improvement of working conditions). The main focus in the work of the ILO is to provide international guidance and legal framework for development of policies and infrastructure in the provision of health in the workplace on a tripartite basis (with the participation of governments, employers and workers), as well as practical support of these activities. WHO activities focus on providing the scientific foundations, methodologies, technical support and training for occupational health (Joint Committee of the ILO/WHO for health and safety of labour, 1992).

Currently one of the main activities of WHO/Europe is the implementation of the Global Plan of Action for the protection of workers health for the period 2008-2017 with instructions for actions both at global and regional levels.

The work of the WHO European Region includes:

- establishing a European network for health workers;
- development of a regional work plan in agreement between key stakeholders.

The final version of the European work plan for the implementation of the Global Plan was developed in 2008-2009. Representatives of WHO, ILO and the European Union discussed with delegates from Member States' approaches to the development of international and national strategies in the field of health.

The main **partners** with which WHO collabourating in activities to ensure healthy and safe working conditions are:

- the cooperation of health and safety at work
- cooperation with the European Agency for Safety and Health at Work **(EU-OSHA)**.

- International Labour Organisation **(ILO)**.
- Network for health and safety at work of the Baltic Sea (Baltic Sea Network on Occupational Health and Safety) - a regional network, unifying the activities of institutions for health and safety at work in 10 countries.
- Network for the protection of workers 'health for Southeast Europe (The South East European (SEE) Network on Workers' Health) - an international network to WHO providing cooperation of centres for health and safety at work, health institutions and WHO national coordination centres on territories of the nine countries.

5.1.1. INTERNATIONAL POLICY AND LEGISLATION IN THE FIELD OF HEALTHY AND SAFETY CONDITIONS AT WORK

International regulations on healthy and safety conditions at work is contained in documents ILO, WHO, the United Nations, the International Organization for Standardization (ISO) and others. Bulgaria, as a member of these organizations is obliged to comply with international regulations.

The more important treaties containing provisions on ensuring healthy and safe working conditions are: *Universal Declaration of Human Rights of the United Nations, 1948*, proclaimed the right of every person to work under fair and safe working conditions; *decisions, health standards and* ***norms,*** recommended by *WHO* and *ILO, conventions* and *recommendations* of the ILO; *International standards* developed by the *International Organization for Standardization (ISO)*.

International standards generally, are recommendatory in character, and the fulfillment of their requirements is proven by certification. More important international standards which relate to the provision of healthy and safe working conditions are: Series standards for quality management ISO 9000; 9001; 9004 and 19011; International standard on social responsibility ISO 26000; OHSAS 18001 standard for creating and maintaining safe working conditions; BS OHSAS 18001: 2007, as well management ILO-OSH-2001 Guidelines on occupational Safety and Health Management Systems.

Standard OHSAS 18001 was developed in 1999 in response to widespread demand from the business standard for certification, which specifies the requirements for the management of health and safety at work.

The standard BS OHSAS 18001: 2007 contains requirements for the management system of health and safety at work.

Based on the cycle of Deming PDCA - (Plan-Do-Check-Act), OHSAS 18001: 2007 enables any organization to:

- define its policy on health and safety at work;
- establish objectives and processes to achieve the objectives of the policy;
- take all necessary measures to improve the company's performance on health and safety at work;
- provide evidence of compliance of system for management of health and safety with requirements of BS OHSAS 1 8001.

International Labour Organization has developed ILO-OSH-2001 Guidelines on occupational Safety and Health Management Systems (voluntary acceptance guide for the management of health and safety at work).

Unlike specification OHSAS 18001: 1999, developed by leading certification organizations, the leadership of the ILO OSH-2001 developed jointly by representatives of the three parties in labour relations - experts in coordination with governments, employers and workers organizations. According to them, the main task of the application management ILO-OSH 2001 is the creation and effective functioning of the management of health and safety at work.

Each country in accordance with national law and practice, can based on ILO-OSH 2001 to create a normative document and its certification system. For example, France, Israel, Argentina, Ireland, already adopted ILO-OSH 2001 as the basis of its legislation on the management of health and safety at work and certification of management systems. But Russia and CIS countries adopted their interstate standard GOST 12.0.230-2007 based on ILO-OSH 2001.

In the so-called common European law, the basis on which the Treaty of Rome (Treaty establishing the European Economic Community/1957), supplemented by the Unified European Act of 1986 for the creation of internal market) contains two basic provisions relating to the insurance of healthy and safety conditions at work:

Article 100 A, which regulate the maximum requirements regarding the level of safety and health in the design, manufacture and marketing of machinery, equipment and materials;

Article 118 A, which regulates the establishment of minimum requirements concerning the working environment and working conditions.

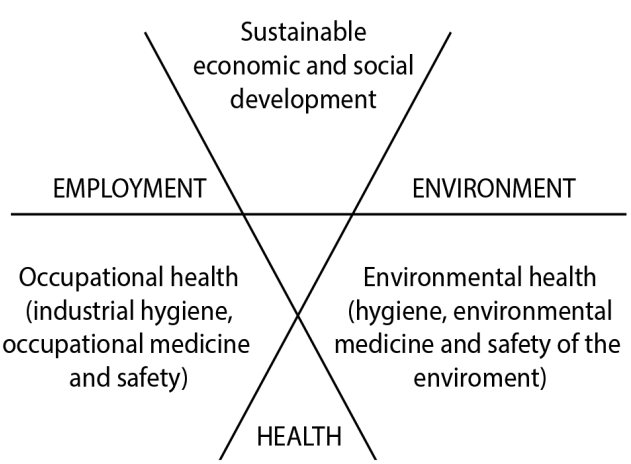
The main European regulations are directives - framework and individual. **Framework Directives** set out the general principles and basic positions, forming strategy and policy in a given area and are exposed mainly in national laws. Such is Directive 89/391/EEC of 1989 for the implementation of measures to encourage improvements in the safety and

health of workers at work. It contains general principles on prevention of occupational risks, protection of safety and health, the elimination of the risks and causes of accidents, information and consultation, the obligations of the employer and employees and others.

Individual directives complement and implement the Framework Directive in certain areas (the minimum safety and health requirements of work place using personal safety means in individual specific sectors and activities, to ensure symbols for safety and health at work, specific risks, exposure of specific chemical agents, sectors with high risk jobs, work equipment, handling heavy loads, work with video display, mobile and temporary jobs, etc.). They are exposed mainly in national regulations.

According to Recommendation (№ 171) of ILO occupational health services, in consultation with representatives of employers and workers should contribute to **scientific research** by participating in surveys in the enterprise or in the branch of economic activity (e.g. collection of data for epidemiological researches or through participation in national research programs). Doctors specialists in occupational medicine involved in research projects must adhere to ethical standards proposed by the World Medical Association (WMA) and the Council for International Organizations of Medical Sciences (CIOMS). Research can include healthy "volunteers", but the occupational health service shall inform them of the purpose and nature of the study. Each participant must give informed consent to participate in the project. Collective agreement, by syndical union of workers in the enterprise is not enough.

Conventions and recommendations of ILO to ensure healthy and safe conditions, approaches and standards embodied in them, strategies and resolutions of the WHO, and international programs of both organizations represent a solid base and broad international cooperation in the further development and improvement services and practices in occupational medicine - especially necessary against the background of a rapidly changing working environment in the application of new technologies.



5.1.2. ORGANIZATION AND LEGAL BASIS OF OCCUPATIONAL MEDICINE IN USA

Beginning of the legislative framework on the provision of a health and safety conditions of work in the United States dates back to 1800 in connection with elevated levels of industrial production and significant increase in the frequency of accidents in enterprises. In 1869, Pennsylvania adopted the first law for checks of coal mining, and Massachusetts was the first state to adopt in 1877 a law on checking in industrial enterprises. In 1913 was established Ministry of Labour, and in 1934 founded the Bureau of labour standards and the Interagency Council on safety.

The constant increase in the frequency of accidents in the 1960s led to the adoption in 1970 a low of the Health and Safety at Work. Requirements of the law comprise the majority of jobs in the United States. On the basis of the law to the Ministry of Labour was founded and the Agency for Safety and Health at Work **(Occupational Safety and Health Administration - OSHA)** in order to enact and control in respect with the standards for health and safety, as well as providing information, training and assistance for employers and employees. On the basis of law is founded and the National Institute for Safety and Health at Work **(National Institute for Occupational Safety and Health - NIOSH)** - the federal agency responsible for conducting research, training of specialists in the field of health and safety at work and the development of recommended standards for safety and health at work and prevention of occupational accidents and diseases. NIOSH is part of the Centres for Disease Control and Prevention (Centres for Disease Control and Prevention - CDC) of the Department of Health and Human Resources. Also, NIOSH helps to ensure **safe and healthy working conditions for workers by providing research**, information, education and training in the field of safety and health.

The approach to the hygiene regulation of chemical agents at work - i.e. *occupational exposure standards for airborne contaminants*, developed in the United States, is accepted in European and other countries. Developed in the United States so called **TVLs** (Threshold Limit Values) by **ACGIH** (American Conference of Governmental Industrial Hygienists); **RELs** (Recommended Exposure Levels) from **NIOSH** and **PELs** (Permissible Exposure Levels) from **OSHA**,

which are officially authorized, recommended limits for various chemicals in the air of the working environment and in biologicals media and are accepted in many other countries, including in Bulgaria, with/or without some adjustments for specific chemicals.

Moreover, the US operates Administration for Safety and Health in Mines (Mine Safety and Health Administration - MSHA), which defines and sets standards for reducing accidents, illnesses and deaths in mining. MSHA inspect all underground mines at least four times a year and each new mine at least twice a year.

In practical operation for application of the legal requirements to ensure healthy and safe working conditions in the US participate occupational medicine services.

In the US, worked university and academic clinics for occupational medicine, consulting and providing the medical expertise on occupational pathology. These clinics can maintain an independent point of view, since few of them depend on contracts with employers or similar financial incentives that could pose a conflict of interest in the evaluation of diseases of workers. Many clinics maintain computer databases containing patient data, occupation, professional route (or at least the current and/or most important jobs), name of employer, types of exposures, related to occupation diagnoses, evaluate the relationship with exposures. The clinics may also offer specialized diagnostic services depending on their expertise experience and research interests.

5.1.3. LEGISLATION AND PRACTICE FOR REQUIREMENTS TO ENSURE HEALTHY AND SAFETY WORKING CONDITIONS IN RUSSIA

In accordance to Art. 216 of the Labour Code of the Russian Federation (2009), the government on labour protection is carried out by the government directly or by his mission, by federal executive bodies.

Federal executive authority responsible for the protection and labour protection, is the Ministry of Health and Social Development of the Russian Federation. It carries out functions on elabourating state policy and normative-legal regulation in the field of health, social development, labour and users rights.

Federal Labour Inspectorate carries out state supervision and monitoring of compliance with legislation of the Russian Federation through checks, investigations, issuing obligatory for implementation instructions to remove violations, constituting protocols for administrative offenses, investigate accidents, conducting training on legal standards, carry out inspections on complaints from citizens about violations of their labour rights and others. State supervision and monitoring of compliance with the law is carried out by labour inspectors, in cooperation with law enforcement authorities.

In accordance with the Labour Code of the Russian Federation, the obligation of the employer's leadership in securing the safety and security of work and organization of the control of the state of working conditions in workplaces. Any employer realised production activity, with a number of workers over 50 people is required to establish an office for labour protection or reveal office specialist in labour safety, having adequate training or experience in this area. In the absence of service of labour safety or payroll specialist, these functions are carried out by the employer, employee or authorized organizations providing services in the field of labour protection (similar to occupational health services).

On April 26, 2011 was promulgated Decree of the Ministry of Health and Social Development of the Russian Federation №342 on the detailed performance evaluation of jobs for working conditions, which start from 01.09.2011 and is similar on this assessment risk jobs. Scorecard must be submitted by the employer to the Federal Labour Inspectorate.

In the Russian Federation, to September 1, 2011 legal framework requires mandatory compliance standards in the parts intended to protect the life or health of citizens, environment, life or health of animals and plants and others.

As regulatory authorities in the Russian Federation functioned Federal budget office on health "Federal Centre of Hygiene and Epidemiology" and "Federal Service for Supervision in the sphere of protection of consumer rights and welfare of man."

5.1.4. ORGANIZATION TO PROVISION OF HEALTHY AND SAFETY WORKING CONDITIONS IN CHINA

Over the past 20 years, China has seen tremendous growth in the economic development that country is facing the problem of eliminating both the traditional occupational risk factors, and new problems for a short period time. By the end of 2001, the economically active population in China reached 730.25 million, much of which is potentially exposed to occupational risks. At greatest risk are workers in small and medium enterprises. According to the ILO in 2001, the incidence of fatal accidents in China is 11.1 per 100 000 workers. By the end of 2008, recorded 704 602 cases of occupational diseases.

In 2002, the Code was adopted for the prevention of occupational diseases. This law identified 115 illnesses in ten categories. Other laws and **regula-**

tions for the prevention of occupational diseases and protect the health of workers are Law on safety of production, Rules for safe at exposure to toxic substances in the workplace, Regulations to protect against radioisotopes, Ordinance for emergency aid protection of public health. So far, China has established a system of health standards covering physical, chemical, biological agents at work. Furthermore, ergonomic factors such as the severity of the labour, involved in this system - **Fig. 1.16.**

In China, the institutions providing health and safety at work include health oversight agencies and institutions for technical services. In 1980 is created Institute for Health Inspection (IHI). At the end of 2006, health inspections have more than 90% of cities. In 2006 the Ministry of Health examines focused working conditions in the mining, metallurgical, pharmaceutical, building materials, electronics and light industry (furniture, footwear, leather processing), particularly in small and medium enterprises.

Responsible for providing services for the health and safety at work, technical assistance, medical surveillance and training in the workplace are Institute for health and safety in the workplace and poisoning control (IOHPC) at the Chinese Centre for Disease Control and Prevention (CCDCP). Some large state enterprises reveal their own departments for health and safety at work, and even hospitals. For medium and small industrial enterprises that can not keep its own consultancy units, CCDCP providing service of occupational medicine services.

From 80^{s} years of XX century created hospitals for treatment and prevention of occupational diseases in most provinces and in certain industrial sectors established institutions for health and safety at work (occupational health institutions - OHIs). To strengthen the capacity for research, training and coordination of occupational health services, created a National Centre for prevention and treatment of occupational diseases (National Centre for Occupational Disease, Prevention and Treatment - NCODPT). Due to the rapid transfer of labour force from agricultural to non-agricultural activities in rural areas, as well as the relocation of hazardous

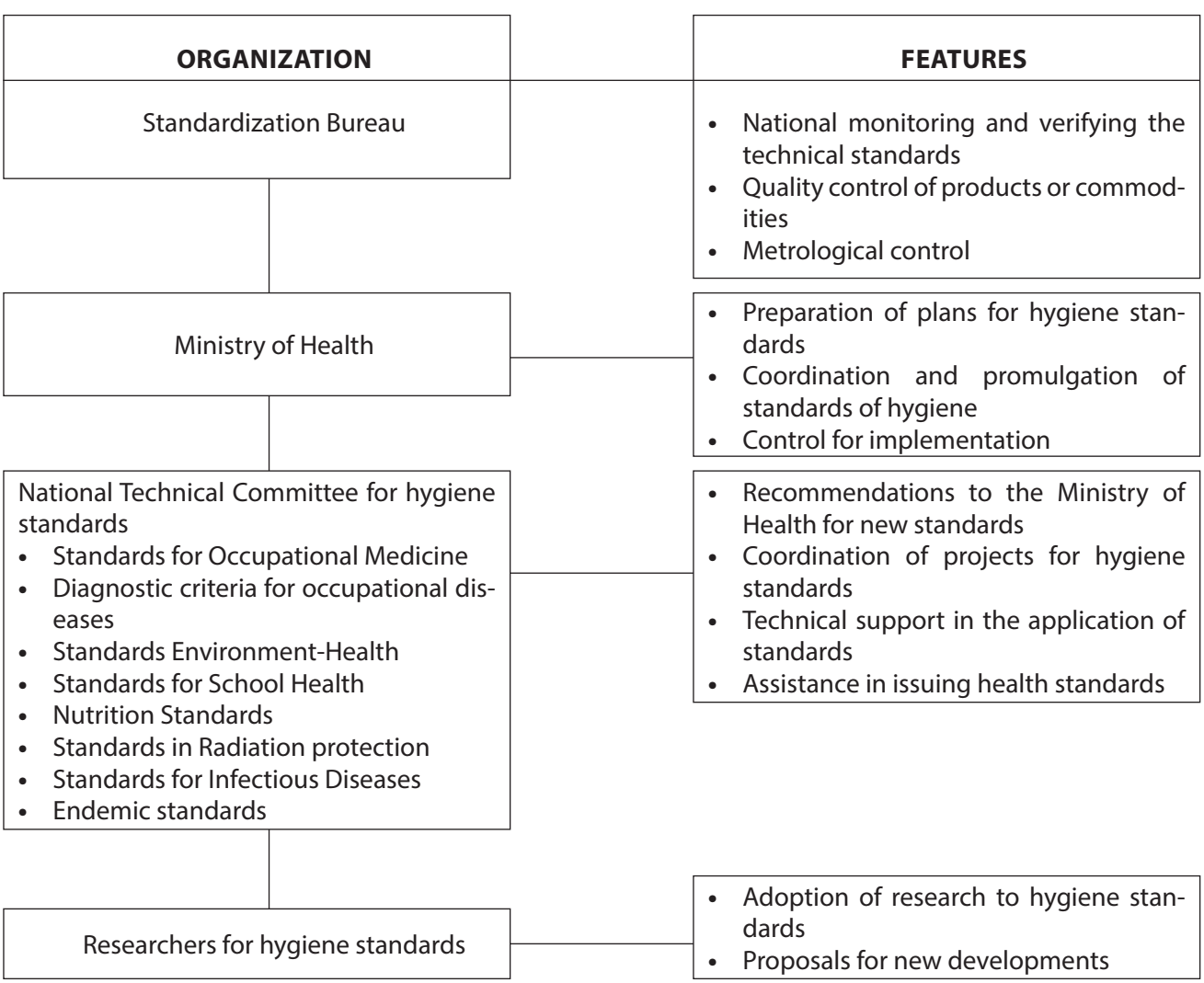


Fig. 1.16. Management of the network of health standards

industries from urban to rural areas, however, there is a low degree of coverage of occupational health services for migrant workers.

5.2. LAW AND AUTHORITIES IN FOOD SAFETY

Food safety is one of the most important themes for consumer protection. Crises safety over the last decade intensified the need for coordinated action to ensure consumer safety. In this process is essential not only cooperation between institutions working in the field of safety of food and consumer organizations at national level, but also the interaction and exchange of information and experience between different countries.

Beginning of the food policy is placed in the First World War in connection with the need to maintain an army in Europe and helping feed the people of the devastated areas. Between the First and Second World War halted food policy itself, but marked a significant achievement in the science of nutrition with the opening of a number of vitamins, essential minerals and amino acids.

With World War II again revives the idea of nutrition policy, based and developed a number of important agencies. These agencies, together with the academic and industrial communities achieve much for a very short period, for example launching the concept of physical performance, energy and nutritional needs, are elaborated methods to analyse the composition of food products and others.

In the XXI century health is a shared responsibility, involving equitable access to essential care and collective defense against transnational threats. Currently, in Europe and worldwide, a number of authorities and organizations concerned with food safety based on international regulations.

5.2.1. INTERNATIONAL ORGANIZATIONS

World Health Organization (WHO) is a specialized agency of the United Nations (UN), which functions as a coordinating authority on international health. WHO is coordinating body that provides assistance on global health issues such as the formation of the agenda of the research, justification of norms and standards of software research, technical support to Member States and the monitoring and evaluation of health trends.

On Oct. 16, 1945 in Quebec, Canada with the signing of the Statute of the 20 countries was founded **Food and Agriculture Organization, (FAO)**. Its main objectives are to reduce global poverty, fight hunger and achieve food security by promoting the development of agriculture. In 1946 FAO is recognized as a specialized agency of the United Nations on food resources and development of agriculture. FAO is also a source of knowledge assistance to countries seeking to modernize and improve their agriculture, forestry and fisheries to ensure food security and nutrition for all. Since 2011, FAO has 191 member states.

- Main FAO/WHO Expert Committees

Joint FAO/WHO Expert Committee on Food Additives (JECFA) was established in 1955 for dealing with chemical, toxicological and other aspects of contaminants and residues of veterinary medicines in foods intended for human consumption. Joint FAO/WHO Meetings on pesticide residues (JMPR) began work in 1963 as a result of the decision that the Codex Alimentarius Commission should recommend maximum residue levels (MRLs) for pesticides and contaminants in certain foodstuffs to ensure food safety. JMPR provide independent scientific advice to the Codex Alimentarius Commission (CAC) and its special committee on pesticide residues (CCPR). Following the assessment of JMPR, CCPR held discussions on the recommended MRLs and in the event that they are acceptable, send them to the CAC for adoption as Codex MRLs. Joint FAO/WHO Expert Meeting on **Microbiological Risk Assessment** (JEMRA) **began work in 2000 with the aim** of providing advice to the CAC on microbiological aspects of food safety. JEMRA works most closely with the Codex Committee on food hygiene.

- Codex Alimentarius ("Codex Alimentarius" - "Law/food code"). Codex Alimentarius is a collection of internationally recognized standards for food and related texts (codes of good practice, guidelines and other recommendations). Codex Alimentarius includes standards for all foods, processed, semi-processed or raw materials intended for the user.

Codex Alimentarius includes provisions in respect of food hygiene, food additives, pesticide residues and veterinary medicinal products, contaminants, labeling and methods of analysis and sampling, inspection of imports and exports, and certification.

Codex standards and related texts are not a substitute or alternative to national legislation. Although they are recommendations for voluntary application by members, in many cases Codex standards serve as a basis for national legislation.

Codex Alimentarius activities at national level are carried out in cooperation with the National Contact Point. In Bulgaria functions NPCs implemented by the department "Animal Health and Food Safety" at the Ministry of Agriculture and Food.

The texts of Codex Alimentarius shall be prepared and updated by the **Codex Alimentarius Commission - CAC**, created in 1963 by FAO and WHO.

CAC currently consists of 186 members (185 member states of the Code and one organization - the European Union) and 215 Code observers. Bulgaria is a member of the Codex Alimentarius from 1969.

The development of standards, Committees of the Code apply risk analysis and rely on independent scientific advice provided by expert bodies/ committees organized by FAO/WHO. The Secretariat of the CAC is located at the headquarters of FAO in Rome. Codex Alimentarius Commission in principle hold one regular session each year at the headquarters of FAO or WHO.

5.2.2. EUROPEAN AUTHORITIES RELATED TO FOOD SAFETY

The problem of consumer safety, public health and the environment are examined by three scientific committee led by the Department of Health and Consumers (**Directorate-General Health and Consumers**) to the European Commission:

- THE SCIENTIFIC COMMITTEE ON CONSUMER SAFETY;
- THE SCIENTIFIC COMMITTEE ON HEALTH AND ENVIRONMENTAL RISKS;
- THE SCIENTIFIC COMMITTEE ON EMERGING AND NEWLY-IDENTIFIED HEALTH RISKS

The work of the three committees are complemented by the activities of other Community bodies like.

- EUROPEAN FOOD SAFETY AUTHORITY (EFSA);
- EUROPEAN MEDICINES EVALUATION AGENCY (EMEA)
- EUROPEAN CHEMICALS AGENCY (ECHA).

The European Safety Authority Food (EFSA) was created as part of a comprehensive program to improve food safety in the EU, ensuring a high level of consumer protection and restore and maintain confidence in the food supply in the EU.

EFSA provides independent scientific advice and technical Support for EU policies in all areas which have a direct or indirect impact on the safety of food and feed.

The areas of competence EFSA are safety of food and feed, nutrition, animal health and welfare, protection and plant health , phytosanitary issues and questions concerning genetically modified organisms (GMO).

Preparation of EFSA's risk assessments provide a solid basis for developing European policies and legislation and serve the European Commission, European Parliament and EU Member States to take effective and timely solutions for risk management.

EFSA's Advisory Forum provides the link with national authorities on food safety from all 27 countries - EU members, Iceland and Norway, Switzerland and the candidate countries participate as observers. Advisory Forum consisting of representatives of the national authorities carrying out tasks similar to those of the Authority.

Since 2007 Bulgaria is a full member of the **Rapid Alert Sistem for Food and Feed - RASFF**. The purpose of sistemara to protect the health of humans and animals of any kind of harmful effects or potential risks arising from food, feed and materials intended for contact with food by providing rapid information exchange between Bulgaria Member Network members and the European Commission . Each Member State in establishing the hazardous products distributed in its territory or stopped at a border post is required within 48 hours notify the European Commission, which in turn distributes the information within 24 hours of receipt to all members of the system.

System for rapid communication is ensured by National contact points (NPCs) located in the department "Animal Health and Food Safety" of Ministry of Agriculture and Food (MAF), which communicates with the European Commission. It coordinates the activities of competent contact points located in the Bulgarian Agency for Food Safety (BAFS), Ministry of Health (MH), the Executive Agency on Vine and Wine (EAVW) and the Commission on Consumer Protection and contact points located in the Ministry of Interior, Ministry of Defense and Ministry of Justice.

Other European authorities:

- Directorate General for Health and Consumers (DG SANCO)
- the Food and Veterinary Office (FVO)
- Sanitary and phytosanitary agreements with third countries
- Bulgarian Focal Point of EFSA

5.2.3. NATIONAL SERVICES OF FOOD SAFETY

Bulgarian Agency for Food Safety is a unique authority to control the safety and quality of food in the Republic of Bulgaria. Established in early 2011, BAFS follows the best practices in the application of high standards in monitoring the safety and quality of foods, food supplements and beverages, veterinary medicine and animal welfare, plant protection

and fertilizers, phytosanitary control, feeds, border control, etc. BAFS experts daily conduct strict control whole food chain.

BAFS realize a consistent policy of cooperation with professional organizations in the country. Together with them develops standards aimed at improving the quality of products such as bread, milk, dairy and meat products, and other traditional bularian foods. BAFS is in constant cooperation with the Authority for Food Safety, with all structures of the European Union relevant to the activities of the Agency and with the authorities on food safety in the Member States of the EU and third countries.

Regional units notify headquarters of **BAFS** in case of emergencies or crises, take action for restriction or elimination of their consequences. Inspect the quality characteristics of the food requirements of national standards, technical documentation, standards developed by professional organizations and approved by the competent authority.

HACCP (Hazard Analysis and Critical Control Point). Critical points are the stages of the production cycle of food, which can eliminate potential biological, chemical and physical hazards to humans.

HACCP focuses on preventing the occurrence of hazards, rather than testing the final product. HACCP system includes identification of possible mistakes and prepare a plan on how to prevent these errors.

Since 1993 EU directive 93/43 EEC for food hygiene, regulates HACCP as a legal requirement for food safety at export. In 2002, Regulation 178 of the EU implementation of the HACCP system is mandatory for small businesses for food production. USA, Canada, Australia, the countries - members of the European Union and many other countries worldwide use HACCP as a basis for development of normative edicts for regulations activities in the food sector.

In Bulgaria the Law on Food required the companies to implemented the HACCP system or procedures in accordance with its principles.

FAO and WHO developed and introduced seven principles used in HACCP, set in 1993 in *Codex Alimentarius* - Alinorm 97/13A, AppENDIX P.

These are:

- **Hazard analysis** - at this stage determine the potential hazards associated with all stages of food production.
- **Determination of** Critical Control Points - these are the points of the production process, in which risks can be managed/controlled efficiently.
- **Determination of critical limits for certain items**, which must be observed to ensure that CCPs are kept under control. For example, - minimum and maximum temperature during the sterilization or roasting, to ensure the elimination or reduction of harmful microorganisms.
- **Establish a system for monitoring the CCP through observation** - These procedures determine how, how often and by whom monitor these indicators
- **Establish corrective actions** when monitoring indicates that a CCP is out of control.
- **Establish procedures to verify** the ability of measures to control the CCP to produce the intended results
- **Introduction of documentation**, which covers procedures and records for the CCP and hazard analysis.

HACCP system is part of the management systems of food safety - ISO **22000**.

REFERENCES

1. Safe food in an enlarged Europe - Proceedings of the International Conference "Food safety in an enlarged Europe - enhancing consumer confidence" Plovdiv, 11 -12.04.2005 , the Bulgarian National Consumer Association.

2. BSOHSAS 18001: 2007

3. European Commission (EC). 1994 Europe for Safety and Health At Work. Luxembourg: EC.

4. FAO/WHO. "FAO/WHO guidance to governments on the application of HACCP in small and/or lessdeveloped food businesses". Retrieved 14 October 2007.

5. **Fedotov LA., A.M. Sayu, J. Rantanen.** Occupational Health Services, in Encyclopaedia of occupational health and safety, ed. J.M. Stellman, 4th edition, ILO, 1998, Chapter 16.

6. **Fotbes A.L** Nutrition Policy, Food Labeling and Health claims. In Modem Nutrition in Health and Disease, ed Shils ME. JA Olson, **M. Shike**, 8th ed, vol. 2, chapt 94, 1994, 1626-1655

7. http://www.babh.zovemment.be/be/rasff.html

8. http://www.efsa.eurova.eu/en/aboutefsa.htm http://www.babh.zovemment.be/be/rasff.html

9. http://www.euro.who.int/en/what-we-do/health-topics/environment-andhealth/occupational-health

10.http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/occupational-health / activities

11.http://www.euro.who.int/en/what-we-do/health-topics/environment-andhealth/occupational-health/partners.

12. http://www.euro.who.int/en/what-we-do/health-topics/environment-andheal th/occupational-heal th/policy.

13. http: //www.eurocare.ore/resources/policy issues/eu health strategy/directorate gem ral health and consumers affairs dg sanco european commission

14. http: // www. fao. ogts/aboutcn/

15. http://www.fda.gOv/Food/GuidanceRegulation/HACCP/ucm2006801.htm#princ

16. http://www.ilo.org/safework bookshelf/english? content & nd = 857 170 174

17. http : // www. who, int/about/en/

18. ILO. Geneva 1981b. Occupational Safety and Health Recommendation, 1981 (No. 164). Geneva: ILO.

19. ILO. Geneva 1984. Resolution Concerning Improvement of Working Conditions and Environment. Geneva: ILO.

20. ILO. Geneva 1985 a. Occupational Health Services Convention, 1985 (No. 161). Geneva: ILO

21. ILO. Geneva 1985b. Occupational Health Services Recommendation, 1985 (No. 171). Geneva: ILO. Report VI. Geneva: ILO.

22. ILO. Geneva: 1981a Occupational Safety and Health Convention, 1981 (No. 155).

23. ILO-OSH-2001 Guidelines on occupational Safety and Health Management Systems.

24. International Commission on Occupational Health (ICOH). 1992. International Code of Ethics for Occupational Health Professionals. Geneva: ICOH.

25. International Labour Organization (ILO). 1959. Occupational Health Services Recommendation, 1959 (No. 112). Geneva: ILO.

26. Joint ILO/WHO Committee on Occupational Health 1992. Eleventh Session, Document No. GB. 254/11/11. Geneva: ILO.

27 Joint ILO/WHO Committee on Occupational Health 1995b. Twelfth Session, Document No. GB.264/STM/Il. Geneva: ILO

28. Joint ILO/WHO Committee on Occupational Health. 1950. Report of the First Meeting, 28 August-2 September 1950. Geneva: ILO.

29 Joint ILO/WHO Committee on Occupational Health. 1995a. Definition of Occupational Health. Geneva: ILO.

30. **Trusvell A. S.**, Dietary Goals and Guidelines: National and International Perspectives. In Modern Nutrition in Health and Disease, ed. Shils M E., J.A. Olson, M. Shike, 8th ed, vol 2, chapt 93 1994.16121625.

31. World Health Organization (WHO). -1995c. Reviewing the Health-For-All Strategy. Geneva: WHO

32. **Zhang X, Zhongxu Wang, Tao Li.** The current status of occupational health in China, Environ Health Prev Med. 2010 September; 15 (5): 263-270.

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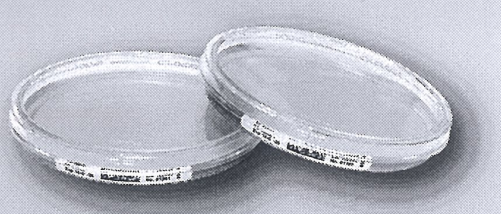
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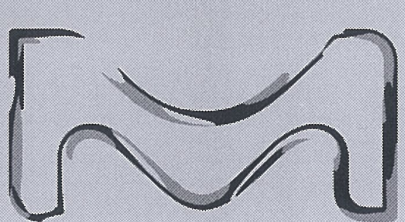
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- Easy calibration with anemometer DA-100™ NT



Settle plates

- Ready to use culture media in 90 mm Standard Petri dishes
- Room temperature stability 15-25C: Storable at site of use
- Long shelf life: Fewer incoming goods controls and less QC testing
- High filling volume: Allows prolonged exposure and incubation periods
- They are supplemented with neutralizers such as lecithin (L), tween 80 (T), histidine (H) and soidum thiosulfate (Th) to inactivate a wide range of disinfectants.





B. Stefanov, D. Tsvetkov, D. Tsonevski

2 AIR

1. CHEMICAL FACTORS. ATMOSPHERIC POLLUTION

Communal hygiene is a main section of sanitary science and practice whose object is to study the impact of natural and social factors on human health in terms of the settlements. On this basis, developed hygiene norms and sanitation activities to ensure the best living conditions, disease prevention and improve public health.

Elements of the natural environment, which constitute a necessary condition for the existence of man, the most important is the atmosphere. The terms atmosphere and atmospheric air are not completely identical. Under atmospheric air understand constant a gas mixture of oxygen, nitrogen, carbon dioxide and inert gas and the term atmosphere shall also include except permanent gas mixture more water vapor, various volatile gaseous admixtures from natural or anthropogenic origin as various chemicals, dust and microorganisms. Virtually human no contact with the air but the atmosphere as a whole, which is characterized also by its physical properties.

Even in ancient times, scientists point to the importance of air. Anaximenes of Miletus (VI c. BC.) called the air "primary matter" Empedocles (V c. BC.) and Aristotle (IV c. BC.) - one of the four elements (along with fire, water and earth), which form matter.

The atmosphere is a gaseous envelope of the Earth, which reaches a height of up to 3,000 km. Conditional atmosphere is divided into several areas: troposphere - height of 7-10 km - poles and 16-18 km to the equator; tropopause - interlayer height 1-3 km; stratosphere - a height of 50 km; mesosphere - 50-80 km (about 5% of the mass are the atmosphere); ionosphere - 80-500-1000 km (upper limit strongly influenced by solar activity); exosphere - up to 3000 km. Over the gas envelope of the Earth is magnetosphere forming of the geomagnetic field of the Earth and the charged particles flow with high energy from the sun (i.e. "Solar wind") - with a height of 70-80 thousand km. toward the Sun and up to 5 million km in the opposite side. There are so called radiation zones of the Earth and "magnetic trap" that protects the Earth's atmosphere. There are other divisions of the layers of the atmosphere: 50 km - 3,000 km ionosphere, covering mesosphere, thermosphere and exosphere; neutrosfera - up to 80 km, and ionosphere - over 80 km.

Troposphere has an average height of 10 to 12 km. It includes about 80% of the atmospheric air mass and is vital environment of people. The air is necessary for human breathing. It plays significant role in the heat exchange processes of the body. Adverse changes in the air can cause significant disturbances in the body, such as overheating or overcooling of the body, hypoxia, decreased performance, the occurrence of infectious and other diseases. Ambient air is the major climate-forming factor that can have a direct and indirect impact on humans by altering the hygienic properties of lodgings, clothes soil. In settlements and indoor, air constantly become soiled and changes its properties.

For the troposphere is called characteristic a so called temperature gradient, whereby when climbing height, temperature drop on average by 6,5 ° C per 1000 m.

Other areas of the atmosphere have much less importance to hygiene practices and science. They have great importance for aviation and aerospace hygiene and foremost because of the protective effect of the ozone layer in the stratosphere by shortwave ultraviolet rays and magnetosphere - the primary cosmic ionizing radiation.

1.1. HYGIENE CHARACTERISTICS AND IMPORTANCE OF PERMANENT INGREDIENTS OF ATMOSPHERE

Ambient air as a permanent gas mixture containing nitrogen - 78.09 vol.%, oxygen - 20.95 vol%, carbon dioxide - from 0.03 to 0.04 vol.%. The amount of remaining gases is less than 1 vol.%. They include

argon, helium, neon, krypton, xenon, radon, hydrogen, ozone. The constant admixtures from natural origin are some gaseous products formed as a result of a number of chemical and biological processes. Among them deserve special attention ammonia concentration of which over settlements reached 0,005 mg/m^3, methane, which reached 0.0002%, nitrogen oxides (NO, NO_2) - up to 0,015 mg/m^3, hydrogen sulfide and others. Breathing ambient air significantly alter its composition. In the expired air oxygen reduced by 25% - reaches about 16 vol.%, The content of carbon dioxide increased by about 100 times - up to 4.5 vol.%, water vapor concentration increase four times - reaching 1 vol.%. Expired air is "dead air" - does not contain ions, its temperature is increased to the temperature of the human body and is the cause of air indoors spoling.

◆ **Oxygen**

Oxygen is the most important constituent of the air for the vital functions of the body. Its content in the atmosphere - about 1.18. 10^{15} t, provides a constant circulation between the atmospheric air and oxygen in living organisms - ground vegetation removed at about 0.5 10 mil. t by photosynthesis, which covers its consumption. Under natural state utilities do not exist significant differences in partial pressure of oxygen (the percentage content fluctuates in tenths of a percent in different regions). The currents equalize chemical composition of air masses.

Oxygen provides oxidation processes in cells, in which the decomposition of nutrients necessary for the body releases energy. When oxygen deficiency - ie. "oxygen starvation" (hypoxic hypoxemia) possible development of severe pathological processes as particularly sensitive is the central nervous system. Lack of oxygen begins to feel at reducing its concentration below 17 vol.%, it is so on critical concentration, which is important in hygiene assessment of air. Long-term stay in an atmosphere with low oxygen content reduced (about 17-18% vol.) In overburdened, with insufficient air space, poorly ventilated housing, workshops, classrooms, offices leads to accumulation in the body of acid products, which cause fatigue, mental agitation, delayed physical and mental development in children. Under such conditions, increasing the overall morbidity and mortality, truncated gene program for longevity. When oxygen concentrations up to 12 vol.% was observed severe fatigue, dizziness, suffocation; to 10 vol.% - loss of consciousness, at 8% vol. - death. In any case, the worst suffer from oxygen depletion patients with anemia, cardiovascular, pulmonary and neuro-psychiatric disorders.

It should be noted that for hygienic practice much more important is not the percentage of oxygen in the inspired air as its partial pressure. In a climb the partial pressure of oxygen, which at normal atmospheric pressure is about 21.28 kPa, may decrease significantly. After 8 km altitude partial pressure of oxygen is aligned with that of water vapor and carbon dioxide in the alveoli and therefore the absorption of oxygen from the air practically becomes impossible and quick death set in. Occurs manifestations of oxygen starvation strongly depend on the fitness level, physical and health status body. Long life at high altitudes - from 3000 to 4500 m in Tibet, the Andes (Peru), is possible due to the onset of permanent adaptation. By somatic changes in the body can result and increased oxygen partial pressure in the atmospheric air - i.e. "oxygen poisoning". It is observed when operating in the caissons, in divers when increasing the partial pressure of oxygen over 79 kPa (600 mmHg) - pneumonia, pulmonary edema, oxygen convulsion; miodystrophic and atherosclerotic changes in chronic effect.

◆ **Carbon dioxide**

Carbon dioxide is a relatively permanent component of the ambient air. Despite the many sources (combustion, respiration, fermentation, volcanic activity) in the free atmosphere, the carbon dioxide concentration changes slightly due to the use of a large part of it in photosynthesis of plants. In confined or poorly ventilated areas, however, its quantity can be significantly increased. Today it is found that even in short stay in rooms in which the content of the $C0_2$ reaches 0.5 percent, to observe changes in breathing, peripheral circulation and bioelectric activity of the brain. In this respect admissible concentration is taken from 0.07 to 0.1%.

The carbon dioxide content in the air of residential and public spaces used by practical hygiene assessment of air purity in them. When it is found in parallel with increasing the concentration of $C0_2$ in the space increases the concentration of other harmful substances, increases the amount of microorganisms, vary unfavourably microclimatic conditions, the ionization of the air.

Carbon dioxide is used as a criterion for hygienic assessment of the effectiveness of the ventilation, size of housing, work, and school size and volume, of their workload, and is used here for hygiene standards C02, 0.07 to 0.1% vol., above which begins the pollution of the air.

Albeit in small concentrations in the air, it has significant physiological importance. In the body

is formed by oxidative degradation of fats and carbohydrates and serves as the "hormone of breath" while maintaining the respiratory rate, excite the respiratory center. When the amount in the air increases above the permissible norm, is difficult separation from the lungs, which leads to increased amount in the blood and tissues. His detention in the tissues leading to respiratory acidosis, which hinders oxidation processes, accumulating acid products, creating conditions for the development of metabolic acidosis. Concentration of $C0_2$ than 2 vol.%. causes severe disorders - shortness of breath, rapid breathing; at 5 vol.%, a loss of consciousness, and in 8-10% vol. - death. Such high levels of $C0_2$ can be found in some deep cellars, drainage shafts, places, where alcoholic fermentation occurs.

Furthermore, the carbon dioxide in the atmosphere plays an important role in the formation of climatic processes. He fails to ground solar radiation absorbing infrared (heat) radiation, i.e. creates so called. greenhouse heating effect. According to the forecasts and mathematical models, if not substantially reduce the annual burning of huge amounts of liquid and solid fuel, if not halt the rapid destruction of forest plantations in the Amazon and other areas of the planet, the content of $C0_2$ in the atmosphere will increase. This in turn will lead to a global temperature increase on Earth, which will cause serious climatic consequences: melting ice of Antarctica, Greenland and the Arctic, raising the sea level, redistribution mass of the planet, strengthening the volcanic activity, earthquakes , flooding, etc.

The concentration of CO_2 in the atmosphere is on average 0.3% or 2330 billion. t. But this is only 1.8% of carbon dioxide on earth - the remaining 98% (102, 000 bln. t.) are dissolved in the oceans, appearing as the primary regulator for its relatively constant content in the ambient air.

◆ **Nitrogen**

Nitrogen is the predominant constituent of the air, but he has no immediate impact on the physiological functions of the body. At normal atmospheric pressure, it is important as a diluent of the oxygen and is completely inert gas. Upon increasing the nitrogen partial pressure above 505.6 kPa in the beginning agitation was observed, and then the drug action change in psyche - hallucinations, lethargy, and incoordination of movements. Complete narcosis occurs when increasing the partial pressure up to 3040-4043 kPa.

However, these phenomena do not occur in an open atmosphere, but only in manufacturing and research facilities - divers, caisson work, training and research in pressure chambers. Besides toxicity, there nitrogen is a factor called. decompression sickness - gas embolism during rapid decompression.

◆ **Ozone**

Ozone is formed in the atmosphere under the influence of shortwave ultraviolet rays and storms with intense electrical discharges. The greatest amount of gas accumulates over seas height of 20-30 km general biological action is related to absorption and shielding above the ground of short-wave ultraviolet radiation, proved disastrous impact on living creatures. Furthermore, ozone is retained partially the infrared radiation and thereby contribute to maintaining the heat balance of the ground layers of the atmosphere. Ozone concentration may increase in radiological departments and physiotherapy to 1 mg/m^3, which can cause irritation in the personnel of the mucous membranes of the eyes, nose and throat, fatigue, headache, strong nervous agitation, dizziness.

Pollutants (e.g. primarily CFCs used in refrigeration systems, aerosol propellants, production of plastics) reduce the concentration of ozone, and are considered cause of so-called "ozone holes". Conversely, however, some of them - NOx (NO and NO_2), due to their photochemical decomposition (intense ultraviolet radiation) is significantly increased ozone concentration.

Other permanent gas components of atmospheric air under natural conditions can be found in small amounts and not of particular interest to practical hygiene.

1.2. HYGIENE CHARACTERISTICS OF ATMOSPHERIC POLLUTANTS

The sources that pollute the air over populated areas are characterized both by its diversity and different types of harmful substances into the atmosphere. The sources of air pollution can be classified into two groups:

1.2.1. NATURAL SOURCES

They have little relevance to air pollution compared with sources related to human activities. These include products of volcanic activity, desert sands, sea (salt) dust, cosmic dust, aerosols plant, microorganisms and spores. Volcanic dust as highly dispersed, rises at high altitude - up to 5-10 km and settles very slowly. When the eruption of the volcano Katmai in Alaska in 1912, atmosphere across

Northern Europe was so contaminated that for several months to Earth have reached only 20% of solar radiation. In sandstorms over the deserts in various regions of the world observed phenomenon known as "color rain" or snow. The surface of the seas and oceans is a source of crystal salt. The wind off from the crest of the waves sea foam bubbles which burst, harden and form a dispersed particles. They in turn react easily with airborne sulfur dioxide to form sulfates. According to UN experts, global emissions of sulfur contaminants from natural sources (volcanic activity, fires, putrefactive processes), converted to sulfur ranges between 50 to 120 mil. tons per year in the aggregate amount of sulfur into the atmosphere in the form of natural and artificial pollutants equal to 160 mil. t.

1.2.2. SOURCES RELATED TO HUMAN ACTIVITIES

These include industrial and thermal power plants, transportation, domestic sources, application of chemicals in agriculture, testing atomic and thermonuclear weapons.

In developed countries the role of road transport as a source of air pollution is much more significant in comparison with the industry and energy combined. In the US, 60% of air pollution is the result of transport, 17% - industry, 14% - of energy and 9% are related to domestic heating.

Characterization of pollutants determined by the type of enterprises and objects. It indicates that energy in the world have allocated over 3 billion tons solid fuel, 4 billion tons fuel oil and over 1.5 trillion tons of natural gas. Over 70% of this amount covers the energy needs only two continents - North America and Europe. Furthermore, 20% of the fuel is burned in limited regions of Western Europe, with a population of only 1% of the Earth population.

The gaseous air pollutants leading position have sulfur oxides. They are released during combustion of fuels containing sulfur, such as coal, oil, fuel oil, from thermal power plants, factories of ferrous and nonferrous metallurgy, boilers, diesel engines in transportation, residential heating equipment. When using low-calorie coal with high ash content in individual dust found significant amounts of free silica. In regions of the electric heating plant (EHP) to establish high concentrations of highly dispersible powder - from 5 to 33 mg/m^3, with an average content of free silica from 15 to 32 percent and sulfur dioxide - up to 5 mg/m^3. In regions of the EHP that work with solid fuel, are detected and high concentrations of heavy metals - lead, mercury, arsenic and others.

Enterprises of ferrous and nonferrous metallurgy except dust pollute the air with carbon monoxide, carbon dioxide, sulfur and nitrogen oxides, arsenic, lead, benzene, phenols, acting carcinogenic hydrocarbons. It is noted that in areas of large metallurgical plants, even at a distance of 10 km carbon monoxide, carbon dioxide and dust exceed 3 times the limit concentration (MAC). An important source of air pollution is the cement industry. Emits cement dust is of highly dispersed and sometimes contain large amounts of free silica and certain heavy metals such as lead, mercury, manganese, cadmium, chromium, arsenic and others.

From the refinery in the atmosphere do phenols, carcinogenic hydrocarbons, sulfur gases, which in many cases prove to be more than 10 km from the place of the source.

The chemical industry is a source of many pollutants, some with high toxicity. Main pollutants are dust, sulfur gases, nitrogen oxides, ammonia, chlorine, fluorine. With fluorine pollute enterprises for the production of superphosphate, ceramics. With chlorine pollute enterprises producing chlorine products, soda, manganese, hydrochloric acid. Atmospheric pollution and with minor amounts of chlorine acts screening of ultraviolet rays (narrow band or UVB) - for example, at 1 mg/m3 concentration of chlorine in the atmosphere, ultraviolet radiation reduced by 60%.

In chemical industry many aerosols contain fluorhlormetani that under the influence of narrow band or UVB release chlorine, which is the cause of ozone depletion in the atmosphere.

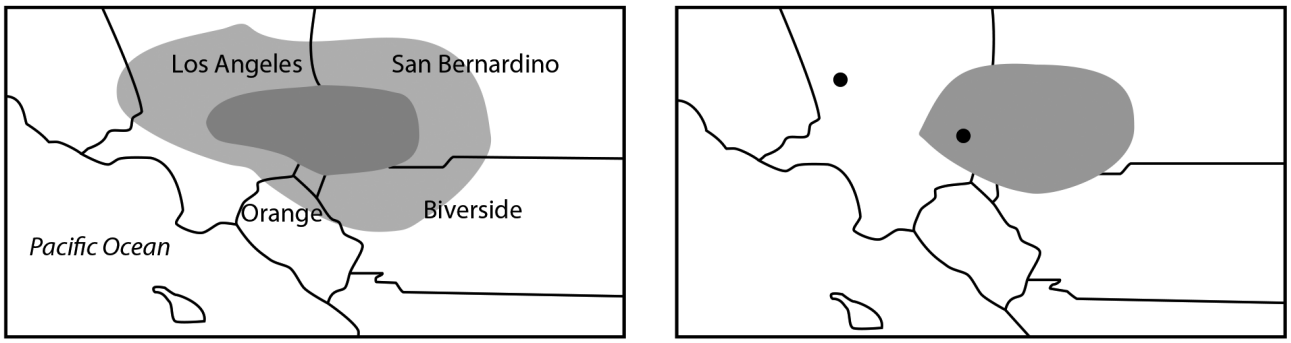
The gases of diesel and petrol engines contain mostly CO (up to 13%), nitrogen oxides, formaldehyde, 3-4 benzpiren, soot, depending on the fuel quality.

Emissions from the atmosphere cause formation in the air of large cities, mainly in the summer, so-called secondary photooxydants. They are formed from nitrogen oxides, hydrocarbons, aldehydes, emitted by motor vehicles, under the influence of UVR. To highly toxic photooxydants concerning organic peroxides (peroxyacetyl nitrate-PAN and many others), ozone. They characterize the so-called photochemical smog. In larger concentrations photooxydants were observed in the cities of Los Angeles, Toronto, Tokyo **(Fig. 2.1)**.

1.2.3. CONDITIONS AFFECTING ATMOSPHERIC POLLUTION

Atmospheric concentrations of air pollutants depend on the following factors:

- *The amount of waste*.



Note: Exposure to ozone concentration of 200 ppb adopted state one of danger in California

Fig. 2.1. Number of days in which ozone exceeded 200 ppm in the region of Los Angeles (no J. M. Lents and W. J. Kelly)

- *Direction and wind speed.*
- *The air temperature.*
- *Humidity.*
- *The distance from the source.*
- *The height of the chimneys.*

The greatest concentration of pollutants is set in the direction in which the prevailing winds blow. This law is of great importance in solving issues for location of industrial zone to residential. The air temperature decreases naturally when climbing height. Most often in the winter, however, there is a reverse phenomenon - temperature inversion, where the air temperature with a climb of increases. Then smoke and other pollutants not dissipate up and distributed in the surface layer in which significant concentrations are rising in the lower atmosphere. This is the reason for the emergence of so-called smog or toxic fog. It is a mixture of toxic gases, smoke and water vapor. The literature describes many such events - in 1930 in the river valley Meuse, Belgium, in the US city Donora - 1948, in London - in 1952,1956,1957,1962 **(Table 2.1.)**.

Important for concentration of pollutants render the height of the chimney. As chimney stacks are higher, the concentrations are lower. Furthermore, at high factory stacks were observed significantly lower concentrations of the pollutants and the temperature inversion **(Fig. 2.2)**.

Reducing the concentration of the pollutants becomes apart to their dilution, but also as a result of the continuous self-cleaning of the atmosphere. This process is carried out by various physical and chemical processes:

- *by vertical, horizontal and turbulent motion of dust particles on the ground;*
- *by sedimentation* - precipitation of particulate matter on the ground;
- *atmospheric precipitation* - rain and snow;
- *of chemical and photochemical processes;*
- *of green plantations*.

Green plants act as a mechanical filter for dust particles and some gases - as a "chemical laboratory" ("breathing plant"). Most active in this respect are maple, fir, lime-tree. In these concentrations of $C0_2$ and CO is reduced by 10 to 30%, sulfur gases - from 50 to 70%, and nitrogen oxides - 15 to 35%.

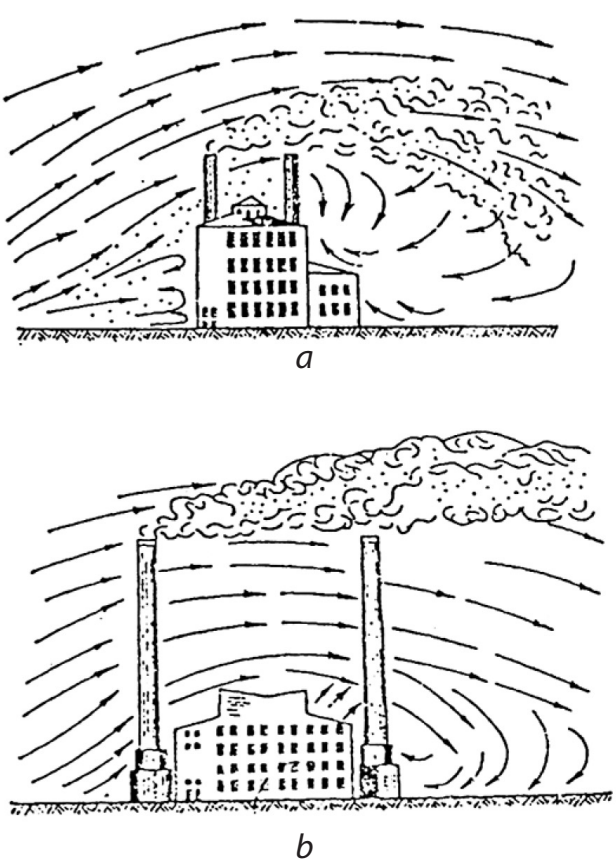


Fig. 2.2. Effect of the height of the chimney-stacks the spread of flue gases (by D. Minkov)

REGION	ORIGIN	TOXIC AGENTS	EFFECTS
Valley of the Meuse (December 1930)	Manufacture of coke, blast furnace various industries (zinc, sulfuric acid)	Smoke, sulfur oxides	60 deaths, thousands of cases of respiratory diseases
Donora - Pennsylvania (october 1948)	Steel mill, rolling, producing acid	Sulphur oxides, zinc particles	16 deaths, 6 to 14000 patients (with respiratory disorders, nasal irritation ...)
Pose Rica - Mexico (1950)	Petrochemical plant release hydrogen for 25 min	Hydrogen sulfide	22 deaths, 320 patients
London (December 1952)	"Smog"	Smoke and sulfur oxides	3500-4000 deaths from chronic bronchitis ("more")
London (January 1956)	"Smog"	Smoke and sulfur oxides	1000 deaths ("more")
London (December 1962)	"Smog"	Smoke and sulfur oxides	700 deaths ("more")
Seveso - Italy (07.10.1976)	Chemical factory, explosion at reactor	Dioxin	134 cases of chlorine acne, 600 suspicious, 5,200 people evacuated from the area of 300 ha
Bhopal - India (05.12.1984)	Chemical factory, out gassing	Methyl isocyanate	200,000 affected 2000 deaths
Mexico (1984)	A gas explosion in a factory		270 deaths, 2000 injured
Chernobyl (1986)	Explosion of a nuclear reactor	Radioactive cloud	Dozens of deaths. Long-term effect.

Table 2.1. Major accidents in the world due to air pollution

1.2.4. EFFECTS OF AIR POLLUTION

They are divided into two major groups:

1. Direct impact of atmospheric pollution on the body of man. Direct effect relate:

- *The phenomena of local irritation of the mucous membranes and skin.*
- *Intoxication certain clinical picture:*
- *Teratogenic, mutagenic and gonadotrophic action.*
- *Carcinogenic effect.*
- *• Non-specific effects on the respiratory system.*
- *Allergenic and immunogenic action.*
- *Non-specific effects resulting in reduction of adaptation capabilities of the organism and the immunological activity against environmental factors and infectious agents.*

Numerous literature data devoted to the mechanism of nonspecific reactions of the organism against the small, close to the threshold, concentrations of atmospheric pollutants. It is determined that the first change observed are in the synthesis of nucleic acids, enzymes, proteins. In areas of intense air pollution establishes a sharp increase in the incidence of cardiovascular, respiratory, endocrine and cancer diseases. Studies in Bulgaria have also established the correlation between the concentration of some pollutants and prevalence of allergic diseases and cancer.

Epidemiological studies of American authors show that in cities with over 500,000 inhabitants content of 3,4 - benzpyrene in ambient air is three times above the TLV (0,001 μg/m^3), while three times higher frequency of cancer in compared to smaller settlements, where the content of 3,4-benzpyren not exceed regulated normes.

2. The impact of atmospheric pollution on the environment.

The impact of atmospheric pollution on the environment in several ways:

- *On the sanitary conditions* - dust and soot deposited on the windows, reduce the brightness of the premises, penetrate the housing.
- *On insolation and the microclimate* of the region - in the summer when air pollution direct solar radiation is reduced by 1/3, and in winter -

2/3. UV radiation also reduced by 60%. Daily temperatures are decreased, and the night is rising, due to the reduction of reverse IR radiation from the earth.

- *Economic, cultural and historical damages* - associated with disposal in the atmosphere of thousands of tons of cement, sulfur and other valuable products. The economic losses are related to rapid corrosion of metals, and cultural and historical damage by the destruction of historical monuments.
- *bio-economic, biological and health biological damages* - beyond all else. Yields of crops near metallurgical plants are below normal, to the extent that obviously compromised. Example with us in this direction were the regions of the metallurgical plant Kremikovtzi, Pirdop, Plovdiv. Air pollution adversely affects on livestock. Slowed down their development, impairs the quantity and quality of wool, meat and milk. So called "acid rain" (pH <7) impairs and causes destruction of plants and animals (forests, fish, amphibians) of vast areas **(tabl.2.2)**.

1.2.5. EVENTS FOR SANITARY ATMOSPHERIC AIR

Sanitary for atmospheric air already existed in the early Middle Ages. For example, back in 1273 in England was adopted Law on protection of air pollution in London.

The law prohibits the use of coal for heating. Violators are punished with death.

Prevention of air pollution includes three main areas:

1. Creation of science-based standards for permissible levels of contaminants.

2. Control of the state of pollution of the atmosphere and the impact on health.

3. Preventive measures to reduce the separation, capture and removal of air pollutants.

The assessment of air pollution and the need for appropriate measures for sanitary place according to the limit concentration (MAC) of individual pollutants.

In hygienic regulation of air pollutants maximum single MAC protects the body from the reflecting effect, and daily average and the average MAC protect against resorbtion effect of atmospheric pollutants.

In normalization of LV of air pollutants must meet the following basic principles:

- *MAC is below the acute and chronic effects on humans, animals and vegetation.*
- *MAC is below the smell and irritation to the mucous membranes of the eyes and respiratory tract.*
- *MAC for ambient air are significantly lower than the accepted MAC according of chemical contaminants of industrial enterprises.*

Table 2.2. Effects of air pollution sulfur dioxide on the environment and human (K. Work, S. Warner)

CONCENTRATION (μg/m³)	TERMS IMPACT	RESULTING FROM THE IMPACT
50	daily average concentration - lower threshold	norm for air quality in Bulgaria
80	average concentration	norm for air quality in the United States, chronic damage to vegetation
100-200	average concentration	in the presence of a powder at a concentration of 185 μg/m3 leads to increased incidence of respiratory complaints and may cause diseases of the lungs
287-500	daily average concentration	at low concentrations of suspended dust can lead to frequent hospitalization of older people with respiratory diseases; accelerates the corrosion of the metals
500	daily average concentration	at low concentrations of suspended dust can lead to increased mortality
650	daily average concentration	in the presence of a powder at a concentration of 750 μg/m³ may lead to an increase in deaths; a sharp increase in the number of patients
800	mean concentration for 8 h	visible damage to some trees
1350	daily average concentration	in the presence of suspended dust can lead to fatalities

- *MAC are lower than concentrations that reduce the transparency of the air, natural light, ultraviolet rays.*

In the fight against pollutants, the following main groups of activities:

1. Organizational and administrative activities. These include decentralization and appropriate shift of enterprises on the territory of the country, close to the raw material base and further away from densely populated centres; appropriate network device and output of transit outside the settlements; replacement petrol motor vehicles with electric motors, using filters to reduce pollution from exhaust gases replacing gasoline with diesel, ethanol, methanol, natural gas, the use of so-called ecological electrical sources such as geothermal and termogradient generators, wind - and helioelectric generators.

2. Planning and architectural public works. They include: zoning in villages with a view to location of residential, industrial and storage areas; proper distribution in the settlements of motor depot, communal projects and energy sources; providing sufficient green areas and their proper distribution and connectivity into a single settlement and rural system; ensuring sufficient water areas; rehabilitation of streets and vacant land in the settlements and organizing their regular cleaning; enlarge of district heating of homes and so on.

3. Technological events. These events are of great importance to the work environment, but contribute significantly reducing atmospheric air pollution. They include the development of rational technology, replacing harmful substances with less harmful, hermetically and automatic technological processes, organization of a continuous production process, in order to implement waste-free technologies.

4. Sanitary-technical events. They appear in addition to the listed events and are directed mainly to capture and utilization with the production process contaminants. These concerns and training of technical personnel who are involved in the operation of production plants and sewage treatment facilities. As a major dust extraction and gas collection equipment can be identified:

- *Ordinary conical cyclones* - consisting of a cylinder with a different diameter and efficiency (CE) up to 50% of coarsely dispersed particles.
- *Multicyclones* - systems are connected in parallel cyclones with smaller size and efficiency of up to 75%.

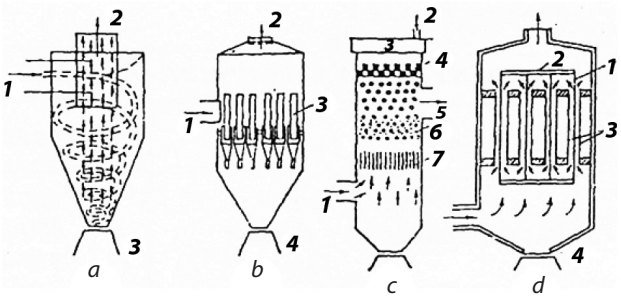


Fig. 2.3. Equipment for cleaning the waste gases from dust and aerosols

a - cyclone: 1 - receiving gas, 2 - stripped gas, 3 - bunker;
b - multi cyclones: 3 - cyclonic separate elements;
c - scrubber: 2 - receipt of water, 3 - a spray court, 4 - splitter, 5 - stripped gas, 6 and 7 - filtering wet nozzle;
d - ESP: 1 - central (loaded) electrode, 2 - electrode frame, 3 - parietal (sedimentation) electrodes, 4 - bunker.

- *Scrubbers* - in their incoming polluted air passes through the liquid, that keeps dust and harmful gases.
- *Sorbents* - special chambers filled with solid sorbent, eg. activated carbon, that traps harmful gases.
- *Electrofilters* - are large chambers in which are mounted two kinds of electrodes - central and parietal loaded respectively with the negative and positive electricity. Negatively charged dust particles are attracted to the positively charged electrodes and are deposited into the hopper dust. Cottrell have the highest efficiency - 95 to 99% **(Fig. 2.3)**.

Protection of air pollution in the country, the Ministry for Environmental Protection and Water (before and the Ministry of Health) operates a national monitoring system for the registration, monitoring and information for air, water and soil pollution.

2. PHYSICAL FACTORS OF THE ATMOSPHERE

Like any material, atmospheric air is characterized by certain physical properties. Unlike relatively constant chemical composition of the air, his physical factors are many variables which inevitably affects the functioning of the human organism. In general, these factors are divided into:

1. Space - solar radiation, cosmic rays, heliogeomagnetic factors.

2. Weather - temperature, humidity, airflow, air pressure, atmospheric electricity, air ionization.

2.1. SOLAR RADIATION

Solar radiation is an integral flow of radiant energy that is emitted as a result of nuclear fusion in the sun. In essence this radiation is a stream of electromagnetic fluctuations and simultaneously stream of photons.

Biological and hygienic importance of solar radiation is exceptional. Life on Earth is possible precisely because of solar radiation, heat and light. They significantly affect the physical properties of the atmosphere, to a certain extent determines the weather and electrical phenomena in it.

The intensity of the emitted radiation from the sun has been relatively constant. In its passage through space and the Earth's atmosphere, however, it absorbs, reflects and disperses. The ground layer reaches only a two billion part of the energy, and with revised range: 1% UV, 40% - visible and - 59% - infrared range, of 290 nm to 1000 nm. The spectrum of the solar radiation is presented in the **Table. 2.3.**

Table 2.3. SPECTRUM SOLAR RADIATION

TYPE RAYS		RANGE (nm)
UV	short	below 280
	medium	280-315
	long	315-400
Visible rays		400-760
Infrared	short	760-1500
	long	over 1500

2.1.1. ULTRAVIOLET RADIATION

Although the smallest share in solar flow, ultraviolet radiation (UVR) is characterized by the highest biological activity. Its *intensity* depends on the following factors: latitude, season of the year, cloudy, transparency (resp. dustiness) of the atmosphere, reflectivity (albedo) of the surface and others.

The *sensitivity* of human skin to UV rays is non-uniform during different seasons of the year. Maximum sensitivity is defined in the winter and early spring, and the minimum - in summer and early autumn. Individual skin sections have different sensitivities. It is the largest of the closed parts of the body (back, breast) and the smallest of the face, neck and forearm. Children's skin is more sensitive than that of adults.

The specific activity is determined by the wavelength of the radiation.

◆ **Short UV**

UV light (to 280 nm) are mainly bactericidal action, they recover the air, the surface layers of soil and water basins. Well absorbed by the ozone layer and air pollutants and almost don't reach the ground. Practically their primary source are different types of mercury-quartz lamps, which are used for decontamination of air in operating rooms, hospital rooms, microbiological laboratories and others.

◆ **Medium UV**

UV (280 to 315 nm) are distinguished mainly expressed their vitamin generating (photochemical) effect. Under their influence in the surface layers of skin 7-dehydrocholesterol form vitamin D_3. It is assumed that for the prevention of rachitis is necessary exposure 1/8 - 1/10 of erythema dose of the area as a palm. The shortage of UV of this spectrum area leads to disorders in calcium phosphoric exchange, lowering the resistance of capillaries, exudative reactions, rachitis in children and osteoporosis in adults.

◆ **Long UV**

UV (315-400 nm) have expressed erythema, sunburn action. UV erythema is aseptic inflammation, which occurs usually after 1-3 h and subsided spontaneously after 2-3 days. Unlike thermal erythema, which is caused by infrared rays, UV erythema has a latency period, arises only irradiated skin area, has clearly defined boundaries and often goes into tan. Darkening of the skin (tan) is the accumulation of melanin in the basal cells of the skin and has a protective role against solar radiation.

UVR is helpful factor, necessary for normal functioning of the human. Overdosage occur, however, unfavourable changes: increase skin and body temperature, swelling of the skin, headache, fatigue and others.

If the body is pre-photosensitising, due to excessive exposure to UV rays can occur *photodermatitis*.

Eye exposure may cause *photo-ophthalmia* (ophthalmia electrica).

UVR is a factor with relatively high biological activity, which is some diseases require abstinence from UV radiation. Contraindications for exposure to UVR are acute infectious diseases, pulmonary tuberculosis in the acute stage, some nervous and respiratory diseases. Debatable question is the role of UV radiation for the occurrence of skin cancer.

2.1.2. VISIBLE/LIGHT RAYS

Visible rays are having a wavelength of 400 to 760 nm. They have a specific stimulus, by means of which is performed vision. Proven their role as synchronizer of circadian biological rhythms. Light is essential for normal functional status of the nervous system and through it the other organs and systems.

It is not only the degree of illumination, but also the spectral composition of light. Psychophysiological effect of different colors and their combinations successfully used for color design of interiors, for the purposes of industrial design and color therapy.

2.1.3. INFRARED RADIATION

Infrared (IR) rays are prevalent in ground solar flux - 59% of the energy of solar radiation. Well they pass through human skin and have a primary heat action. Under their influence cutaneous vessels dilate and hyperemia occurs. In certain degree Infrared increase metabolism and potentiate the biological effects of UV radiation. Overdose of IR radiation in combination with high temperature and humidity can occur states of solar and heat stroke.

2.2. HELIOGEOMAGNETIC FACTOR

To heliogeomagnetic factors concerning solar activity and geomagnetic field.

◆ ***Solar activity***

Solar activity is a concept that summarized appearance and changes in the number of solar phenomena - protuberances, chromosphere explosions, spots, torch, floccules, granules and others. The activity of the sun is rhythmic process, with a mean period of 11 years. It occurs as electromagnetic radiation and corpuscular flows.

The effect of solar activity on the biosphere, respectively humans, is both direct - by electromagnetic radiation (ultraviolet, visible, infrared, radio waves), and indirectly - by changes to the geophysical factors **(Fig. 2.4)**.

It has been found that the energy of corpuscular solar radiation changes geomagnetic background level, ionization of the air, atmospheric electricity, atmospheric pressure, air flow, the formation of a weather fronts, cyclones and others.

◆ ***Geomagnetic field***

Geomagnetic field (GMF) has a substantial protective function. As a kind of screen, it retains high energy cosmic corpuscular streams and thereby ensures the existence of biological objects. GMF prevents the penetration of charged particles in the biosphere and reduces background radiation, keeps it within the range in which living beings are evolutionarily adapted.

The total value of the GMF is not constant. Its variations are of different types. In some cases they have a smooth ride ("magnetic calmly" days), while in others - messy way, in which the amplitudes, phases and periods of sharp fluctuations and constantly changing ("magnetic active days").

The dynamics of the GMF has a certain relation to changes in climatic and meteorological processes. Sudden sharp fluctuations of GMF, called magnetic storms, affect the atmospheric precipitation, the availability of drought, the amount of ozone and cosmic dust in the air, the radioactive emanation in the ground layer and others. The main reason of significant variations accepted the dynamics of solar activity, ie GMF is its "mediator". The correlation coefficient between the two phenomena t reaches +0.96.

Variations of solar activity and GMP in humans changes similar to those observed under the artificial weak magnetic fields. Experimental, medicobio-

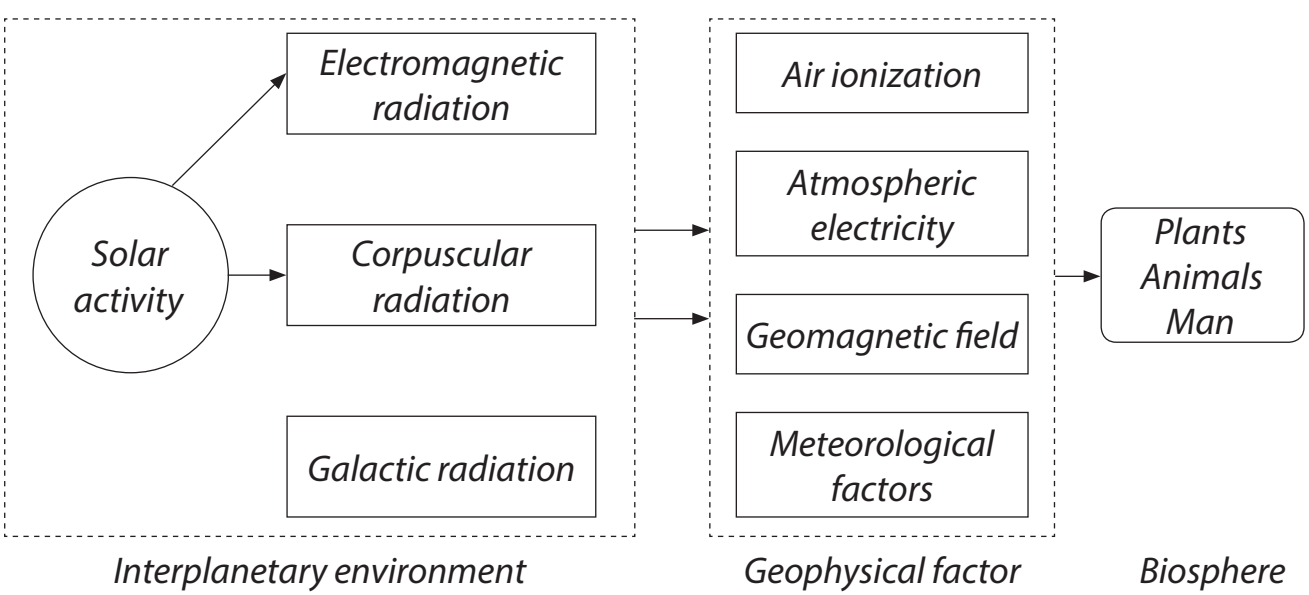


Fig. 2.4. Scheme of the "Solar activity - Biosphere"

logical and statistical studies have shown the effects of GMF on the central nervous system primarily with retentive character. Affected are the functions of the autonomic nervous system and cardiovascular system. It was found that by increasing the solar and geomagnetic activity, status of patients with hypertension and atherosclerosis deteriorates, occur disturbances in the coronary circulation, frequent incidence of myocardial infarction. Changes occur in blood and hemoclotting - reduce the number of leukocytes and platelets and a relative increase in the number of lymphocytes. Amend and bactericidal activity of blood and saliva.

Significant variations of solar activity and GMF well correlated with the incidence of many infectious diseases, and other pathological processes: pulmonary embolism and haemorrhage, cerebrospinal meningitis, tuberculosis, eclampsia and preeclampsia, psychosis, stroke, acute attacks of glaucoma and the like. **(Fig. 2.5).**

Changes in solar activity are not immediate cause for the emergence and development of diseases. They play the role of an external impulse factor that changing the geophysical processes that essentially creates the conditions for more rapid realization of an etiologic factor.

Studies show that a man is not indifferent as weakened GMF (creating hypomagnetic environment), and the presence of a magnetic field strength

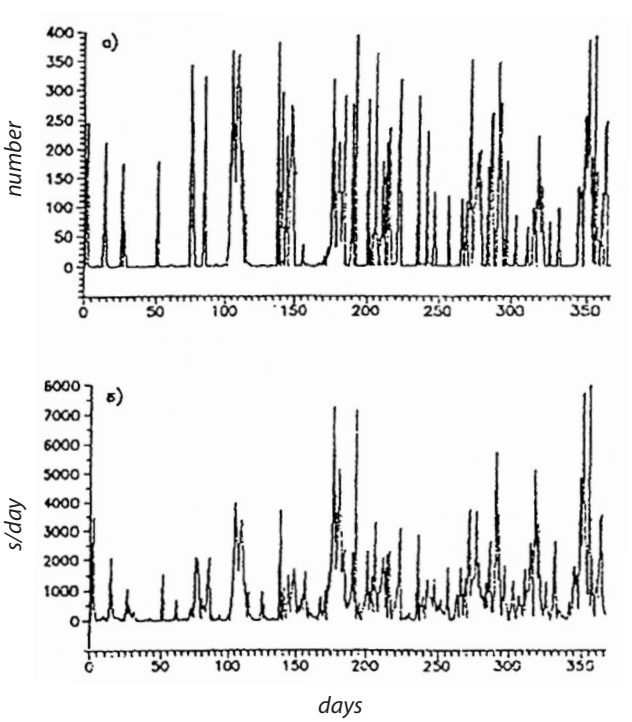


Fig. 2.5. Dayly dynamics of the number of deaths from stroke (a) and the total length of the solar radiation (s/day) in the range of hard X-rays (b) 1988 (by L. and R. Doukov, L. Tsaneva).

over the natural (at regional anomalies of GMF). For example, in the area of the Kursk magnetic anomaly (especially near Belgorod, Russia), the field strength is about 3 times more than normal. Longtime observations show that there level and structure of morbidity reliably differs from that in similar areas but with normal GMF.

2.3. NATURAL RADIOACTIVE BACKGROUND

Natural radioactive background is the total dose of radiation, determined by cosmic radiation and natural radioactive substances. The radiation background in the surface layer is determined mainly by solar and galactic radiation, *called primary cosmic radiation (PCR)*.

Cosmic radiation falls to the ground from all directions with approximately the same intensity. In the upper atmosphere it reacts with the air environment, forming electron-photon and electron-nuclear flows. As a result of nuclear transformations in the cosmic flow occurs *secondary cosmic radiation (SCR)*. While PCR is registered outside of the atmosphere and hardly reaches the Earth's, SCR is determined and at sea level.

On ground level SCR consists of soft and hard component, which vary considerably in their properties. Particles of the first highly absorbed by the substance and the effect depends mainly on the serial number of the substance in the periodic table. This component of cosmic rays is represented mainly by electrons. The hard is characterized by low absorption, great penetrating power and is mainly represented by mu-mesons. Its relative share in the full intensity SCR is around 70% and the soft components - 30%.

Power of SCR depends on altitude and latitude. By increasing the height of the layer of shielding atmosphere decreases, and the power of SCR increases. Since tropospheric layer of air at the equator is larger, shielding there is more significant than the areas around the poles of the earth.

Another natural source of radiation are radioactive elements and gases, which are contained in various natural environments. In normal conditions the air may be present in very small concentrations all natural radioactive substances. Relatively larger the quantities of radon (^{222}Rn) and thoron (^{220}Tn). They enter the air from the soil, rocks and water basins, as products of the natural decay of radium and thorium. In the troposphere dominates radon and just above the soil - thoron. Irradiation respiratory most important subsidiaries have decay products of radon - RaA, RaB, RaC.

The radioactive background is determined by natural radionuclides - ^{40}K, ^{232}To, ^{226}Ra, ^{238}U and their products. They enter the air when "weathering" and the erosion of the rocks and the decay of organic matter in the soil.

Natural radioactive background is not uniform across different regions of the world. For example, in India (Kerala) and Brazil (Minas Gerais and Goiás) it substantially exceeds the average (6-10 times). Extensive research showed no changes in the demographics and health status of native peoples.

2.4. WEATHER FACTORS

Complex of meteorological factors include temperature, humidity, airflow, air pressure, infrared radiation, atmospheric electricity and air ionization. Its condition at a time and its dynamics are in close contact with the space factors. Hygienic importance of meteorological complex is determined by its effect on the human organism by weather and climate.

2.4.1. AIR TEMPERATURE

Direct heated air from the Sun is negligible - to 0,02° C/h. Primary air is warmed by the heated earth's surface that absorbs solar radiation and then given by radiation and convection.

The main factors that determine the air temperature are: latitude, altitude, season of the year, atmospheric circulation, terrain, presence of water areas and other vegetation. Basins, due to its greater heat capacity accumulate heat during the day. energy and overnight attributes it. In this way they reduce the diurnal amplitude. Have a similar effect and plant arrays.

The biological action of the air temperature is relatively well studied. High temperatures cause dehydration, loss of mineral salts and vitamins, alterations in the quality and quantity of gastric acid secretion, it is possible that the occurrence of so-called heatstroke.

Low air temperatures reduce skin temperature, tactile sensitivity worse, violate the coordination of fine movements. It is well known narcotic effect of cold (leading to so-called. "white death") and the role of overcooling for the occurrence of cold illnesses.

2.4.2. HUMIDITY

Humidity is its degree of saturation with water vapor. They distinguish the following terms:

- *Absolute humidity* - the amount of water vapor (g) contained at a given temperature and pressure in 1 m air.
- *Maximum humidity* - the maximum amount of water vapor (in g) that may be contained in 1 m in air at a given temperature and pressure.
- *Relative humidity*, the ratio (in%) of the absolute humidity to the maximum humidity, the air would have at the temperature and pressure at the time of the study.
- *Physiological relative humidity* - the ratio (in%) between the absolute humidity at a given air temperature and maximum humidity at a temperature of 37 ° C.
- *Saturation deficit* - the difference between the maximum and absolute humidity, ie the amount of water vapor does not reach full saturation for a given volume of air.
- *Physiological deficiency saturation* - the difference between the maximum humidity at 37° C and absolute humidity, i.e., characterized the conditions (options) for the evaporation of moisture from the skin surface or the respiratory tract.

Sources of air moisture are: water areas (basins), precipitation, evaporation from soil and vegetation and indoors - people breathing and evaporation from plants.

The importance of humidity is expressed in the formation of precipitation, maintenance of ground water, cleansing (washing) of the atmosphere of harmful impurities, improve hygiene air quality.

The humidity adjusting for the impact of temperature on the body. In the presence of high temperature heat transfer by conduction (convection and conduction) and radiation is difficult. Effective loss of heat is possible only through evaporation (sweating), but if the humidity is low. In high humidity, it is difficult, and the body is overheated. When the air temperature is low and the humidity is low occurs only cooling. If the humidity is high (humid air is a good conductor of heat), cooling passes into hypothermia. It is evident that in each case the corrective action of high humidity is less favourable.

The air temperature is a physical factor expressed dayly dynamics. Minimum values are measured approximately 4-5 h, and maximum - between 13 and 15 h, when the warming of the soil is the hardest.

The average annual temperature in Bulgaria was 11,5° C. The highest in the area of Petrich (13,6° C), and the lowest - in Gabrovo (10,0° C). Maximum annual amplitude is measured in Knezha (25,9° C) and the minimum - in Tsarevo (former Michurin) -19,9° C.

Typical of the troposphere is the presence of a vertical temperature gradient - a decrease in the temperature average of 0,6° C per 100 m high above the ground.

The dry air is relatively well tolerated. It is also used for medicinal purposes. For example, in chronic nephritis he contribute in spreading the hidden edema, decreased urination and create better conditions for recovery of the renal parenchyma.

Significant air drying adversely affects the health, confidence and efficiency of people. Arises thirst, dry mucous membranes, occurrence of cracks capable of infection. In young children, especially in nurselings can cause dehydration.

Optimum is the relative humidity within 30-60%. At normal temperature (18-22° C) is recommended a relative humidity of 50-60%, and at higher - 30-40%.

2.4.3. AIRFLOW

Air masses move due to uneven heating of the earth's surface and the difference in air pressure in the neighboring areas. Air movement is characterized by speed and direction and the structure of the air flow (laminar or turbulent).

The importance of this factor in the atmosphere is the transfer of heat and moisture from one area to another in the ventilation of residential areas, in the diffusion of pollutants, which helps self-cleaning air over the territory. While air movement is the reason for the transfer of pollutants (transboundary pollution) even over relatively clean areas.

Graphic representation of the movement of air masses (winds) in a given territory is called *wind rose*. Obtained by painting the coordinate system (cardinal points) of segments corresponding to the number of days where the winds are blowing in a certain direction for a certain period of observation. The ends of the segments are joined by a straight line **(Fig. 2.6)**.

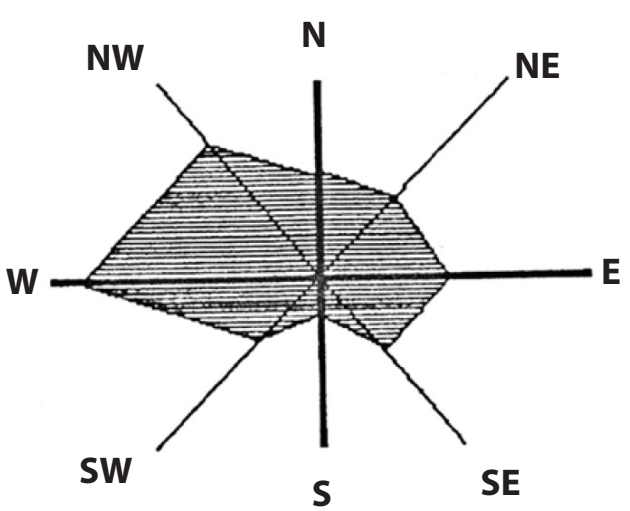


Fig. 2.6. Rose of the Winds

Rose of the Winds to determine which is the predominant direction of air masses. This is important in the development and urbanization of settlements - the correct positioning of the industrial zone, childcare and medico-prophylactic establishments, recreational area and others.

Winds are global, regional and local. The first is better known monsoons, trade winds and antitrade. Regional and local winds here are: breeze, bora, foehn, night breeze and spriya.

The breeze is a coastal sea wind that is generated by the temperature difference sea - land: the day is wet and spirit from the sea to land at night - back. Contributes to the smaller daily variations of air temperature in the Black sea climate. There is in the region of tens of kilometers from the coast.

Bora is a wind that blows in the sub-Balkan valleys. It is falling cold wind, typical example bora in the area of Sliven.

Foehn is a warm, dry, usually strong and gusty wind. It is rich in positive ions, therefore, acts negatively on the confidence of the people. Typical for Fore-Balkan, northern foothills of the Rhodope, Rila, Belasitsa, Osogovo and Vitosha, in Sofia, Kyustendil and Petrich field.

Night breeze is a mountain-valley winds. Formed at the outlet of river valleys in the evening hours. Characteristic for the region of Asenovgrad, Gabrovo and others.

Spriya is strong, short wind with rapidly changing direction. It occurs on hot summer days, usually prior to the passage of a cold front. It manifests as a swirl thunderstorm and rain.

2.4.4. ATMOSPHERIC PRESSURE

Atmospheric pressure is a major climate-forming factor. The pressure that the atmosphere has on the bodies and surfaces is determined by weight of air layers due to gravity. Sea level pillar atmospheric air with an area of 1 cm^2 has an average weight 1013 g, and is balanced by the pressure of mercury pillar in height 760 mm.*

For parameters of the standard atmosphere at sea level at latitude 45° are adopted values: atmospheric pressure - 1013 hPa (760 mm Hg), air temperature - 15° C, air density -1, 225 kg/m^3.

Atmospheric pressure has a significant influence on other meteorological factors. The difference in adjacent areas determines the speed and direction of winds, the frequency and amount of rainfall, tem-

* In the SI unit of atmospheric pressure is Pascal (Pa) and its multiples - hectopascals (10^2 Pa) and kilopascals (10^3 Pa):
1 kPa = 0,1333 mm Hg: 1 hPa = 1 mb (millibar) = 1,333 mm Hg.

perature fluctuations of air, changes in the weather. Particularly important is the development of cyclonic and anticyclonic activity of neighboring territories.

*Cyclone** (**Fig. 2.7)** is a vortex movement of atmospheric air masses with low atmospheric pressure. Airflow is from the periphery to the center in the direction counterclockwise. *Anticyclone* vortex is circular motion with inverse properties - the center is high a pressure and air flow from the center to the periphery in a clockwise direction. Between adjacent cyclone and anticyclone arises so called synoptic front, whose appearance is crucial to the emergence of meteotropic reactions and diseases.

The pressure, which has the earth's atmosphere to the surface of the human body is 16-18 t. It is counterbalanced by intracorporal pressure and severity of the atmosphere is not felt. Normal changes in atmospheric pressure (10-30 mmHg - 1.33 to 4.0 kPa) do not cause disturbances in the human body.

The importance of pressure becomes clearer in conditions of high plains and mountains.

At altitudes up to 1200 m above sea level observed stimulation of hemapoiesis, which is used for climatotherapy of anemic conditions. It is known that the oxygen partial pressure decreases in proportion to the reduction in atmospheric pressure. By baric compensation and adaptation organism adapts well to a height of about 4000 m. Above these heights develop hypoxia, oxygen starvation of the body and death.

In alpine environment possible violations of the physiological functions of the body and the emergence of so-called mountain or altitude sickness. The immediate reason its is reduced partial pressure of oxygen in the inspired air, blood and tissues.

In a dramatic reduction in atmospheric pressure dehermetisation of aircraft, occurs *disbarizam*, also called "disease of pilots." The events are mainly from the central nervous system, the cardiovascular system and the functions of analysers. Exhibit and so called "Barotrauma" or "explosive decompression" - ear and paranasal sinuses, lung and skin ruptures and the like.

When working in conditions with increased atmospheric pressure (below sea level) and rapid decompression (ascent from elevated to normal pressure) with divers, diving, decompression workers

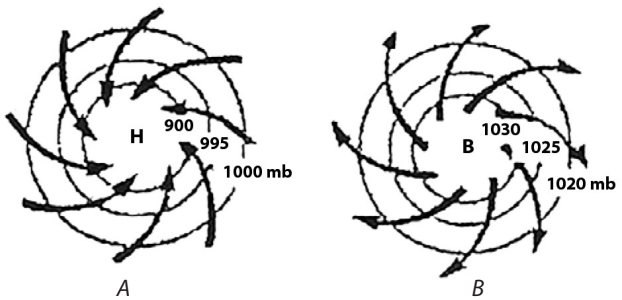


Fig. 2.7. Movement of air masses in the cyclone zone (A) and anticyclone (B)

and others may occur professional Caisson (decompression) illness (DCI).

2.4.5. ATMOSPHERIC ELECTRICITY

Atmospheric electricity is a combination of electrical phenomena occurring in the atmosphere (the electric field, electric charges in clouds, polar aureoles, etc.). Electric field around ground arises from the negative charge of the earth and positive charges in the ground atmosphere. The last shall be spread uniformly throughout space and time. Therefore, the electric field (EF) is erratic and at a point and time there is an electrical potential, which is characterized by strength of EF in V/m.

EF strength under normal weather conditions averaged 130 V/m. With increasing height it reduces - 50 m is 50 V/m, 100 m - 25 V/m. This pattern is valid for lowland areas. In the mountains EF strength is higher, especially in steep slopes and sharp peaks. Increases from natural and bumps - trees, buildings, towers and others. In mid-latitudes minimum quantities of atmospheric electricity is set in the early morning hours and during the summer months.

On the atmosphere EF exert great influence meteorological conditions. The vertical electric current is altered by movement of air masses that bring different in magnitude charge, different amounts of dust, gases and moisture. In polluted air strength EF is to 500 V/m, fog and precipitation increase it by 2 to 5 times, and in lightning reaches 100 000 V/m.

2.4.6. IONIZATION OF AIR

Conversion of neutral gaseous molecule in the ion, ie in a molecule (atom) with a positive or negative electrical charge is called aeroionization. Common term ionization of the air is not quite correct, because the air is a gas mixture and can not exist air ions at all. Usually it is a mixture of atomic and molecular ions gas, but also a charged solid and liquid aerosol particles. Decomposition are subjected mainly molecules with less energy, especially of the oxygen molecule.

* "Cyclone" is a meteorological term that includes various processes of atmospheric circulation: storm (stormy wind) and speeds up to and over 100 km/h; hurricane and typhoon - speeds over 200 km/h; tornado ("smerch") - speeds up to 500 km/h.

The elementary ions are joined in the air to dipole water molecules and form a *light* (normal) ions (n^+ and n^-). They exist a short (up to hundreds of seconds), moving quickly but the settle more slowly. Inhalation keep well in the upper respiratory tract.

When light air ions to join solid or liquid particles from the air (mostly water droplets, dust and smoke particles), forming *heavy* ions (N+, and N–). They move in the air flow more slowly, precipitated more rapidly, by inhalation reach the alveoli. After about 10 -12 min ions recombine.

Major natural air ionizers are cosmic radiation, X-rays and ultraviolet rays, electrical discharges, natural radioactive substances (especially soil emanation of radium - a radioactive radon).

Ions are formed and very hot surfaces (thermionic emission) and some mechanical processes (disintegration, sputtering). Negative air ions actively formed by the so-called baloelectric effect - resulting dispersion spraying water, such as fast flowing water, waterfalls, waves breaking on the sea shore, rain, etc. Local significance for the ionization of the air have plantings. Following the photoelectric effect of the leaves and through the separation of ethereal oil and phytoncides amount of light ions over grassed areas increases.

Indicators ionization state of the atmosphere are:

- *Degree of ionization* - number of ions in 1 cm^3 air.
- *Unipolar ratio* - the ratio of positive to negative ions, respectively light and heavy ($R = n^+/n^-$; $R = N^+/N^-$). The amount of ions in the air depends on the geographical and relief features of the area, radioactivity of the soil, the weather conditions, availability of showers and thunderstorms, air pollution and other factors.

Usually in clean ground atmosphere prevailing negative light ions (about 1000 pairs of ions - + and –, in 1 cm^3). Their number increase in the vicinity of forests, fountains, waterfalls, near the rocky beach. In residential and industrial areas especially, the greater the number of positive ions. It is the same in closed, unventilated rooms.

Clean air can be judged by the unipolar ratio. Presence of moisture, carbon dioxide, dust, smoke and other pollutants increases the number of positive heavy ions, respectively the magnitude of this factor.

The mechanism of action of ionization of air has not been studied enough. It was found that when passing through the airway air ions give its charge. According to some of the older hypotheses that volume of charge amended magnitude of the natural negative charge of the plasma biocoloides and formed blood elements. Consequently, electric equilibrated colloidal systems of the body inbalance and occurring relevant physiological changes. More recent data argue that air ions reach the alveoli and can perform exchange of charges, which is the basis of those hypotheses. Perhaps the effect of air ions is determined by the surface electric charge, which influences the nature and extent of reactions.

Overall *negative* ions act stimulating and tonic - reduces fatigue, increases excitability of muscle tissue and skin receptors, improve sleep, eliminate some disturbances in the autonomic nervous system, increase rhythm of brain biocurrents. These ions contribute to the normalization of blood pressure and to increase the acidity of gastric juice.

The effect of *positive* air ions, in most cases it is evaluated unfavourable. Upon prolonged their inhalation is observed slowing rhythm of the brain biocurrents, a decrease in phagocytic index of the blood and globulin fractions, increasing blood pressure. All this applies to higher concentrations generated by artificial sources, as well as the heavy air ions.

Artificial ionization of air is also used as a therapeutic factor in the complex of therapeutic agents. There are many data on beneficial its action in trophic ulcers, dermatitis, atherosclerosis I deg., hypertension I and II st., bronchial asthma, chronic gastritis, early form of peptic ulcer disease, chronic rheumatic arthritis, neurasthenia, pulmonary tuberculosis, insomnia, fatigue and others.

In hygienic assessment of this factor should be noted that the ionization of air may serve not only as an indicator of air pollution, but also as a means for its purification. Using electric iongenerator to some extent reduces the concentration of the powder (mainly on the fine fractions) and reduces bacterial contamination of the air. Ionization of air is particularly appropriate in rooms with air conditioning, since it processing its deionize.

2.4.7. RADIOFREQUENCY ELECTROMAGNETIC FIELDS IN THE CITIES

Major source of natural radio-frequency electromagnetic fields (EMF) are atmospheric discharges, also called atmospherics. The range of these radio waves from a few kHz to tens of MHz. Their e intensity inversely related to frequency - as it is the greater, the smaller the strength of the natural radiotransmission.

Atmospherics originate mainly in tropical areas and operate all year round and are spread over the entire surface of the earth. During the summer peri-

od in the mid-latitudes arise additional atmospherics in thunderstorms. They are responsible for the characteristic disturbance (pop) during radio reception.

Naturally radio emission generates and sun. The range is from 10 to 100,000 MHz. To reach the earth's surface only radio waves with a wavelength of - 0.8 to 30m.

The total intensity of natural radio waves (from atmospherics and sun) is called natural radio background. Nowadays the intensity of radio waves in the settlements is hundreds of times more than natural radiobackground.

In terms of settlements the main *sources* of RF energy are antenna systems to radio stations, TV transmitters, radio relay stations, radar, fixed and mobile telephone communications, etc.

The magnitude of the EMF in a given area depends on many factors, chief of which are: frequency radiation, transmitter power, antenna type (circular or directed), type of soil, topography, availability of large buildings and others.

Close to sources of intense radio waves should not have kindergartens, schools, hospitals, etc., in which a long time resident contingents most vulnerable (children, sick, elderly).

The buildings closest to strong sources is advisable to shield (metal mesh, metal foil, metal-containing dyes), which weakens the EMF. Important protection and height of placement and focus the radiation.

The exposure level (TLV) of public exposure to RF EMF is presented in **Table. 2.4.**

Table 2.4.

TLV FOR CONTINUOUS RADIO-FREQUENCES PUBLIC EXPOSURE	
Frequency range	***TLV***
30-300 kHz	25 V/m
0,3-3 MHz	15 V/m
3-30 MHz	10 V/m
30-300 MHz	3 V/m
0,3-30 GHz	10 μW/cm^2

3. COMPLEX ASSESSMENT OF MICROCLIMATIC FACTORS. THERMOREGULATION

Thermoregulation of the organism is a physiological process in which body temperature is maintained within certain limits – 36,1-36,9° C. This temperature homeostasis is a necessary condition for maintaining the setled in phylogenesis speeds of biochemical and physiological processes in the body. Thermoregulation mechanisms are complex physiological, biochemical and biophysical processes and hormonal and reflex reactions. Biochemical processes of thermoregulation expressed in strengthening or weakening of metabolism. Biophysical and physiological processes include primarily reflexly dilatation or contraction of peripheral blood vessels and other effects of the cardiovascular and respiratory system.

Thermoregulation is determined by changing the two main processes - heat production and heat render. Heat production is performed by all organs, but most in its implementation involved the liver and muscles.

At low temperatures - below 15° C, there is an increase in heat production. It is accompanied by an increase in oxygen consumption. This is called. "low zone of increased metabolism". At an air temperature of 15 to 25° C, heat production, oxygen consumption, respectively, remain at the previous level, i.e. the level of the main metabolism - "indifferent zone". At a temperature of 25-35° C has been some reduction of heat production and oxygen consumption - "zone of reduced metabolism." At an air temperature over 35° C is established sharp rise in oxygen consumption, there is the "upper zone of increased exchange". While increasing heat production at low temperatures can be considered as an adequate response, the sharp increase metabolism and oxygen consumption at air temperature above 35° C is an expression of the disorder of thermoregulation, on hard sweating and stress the cardiovascular system, which often creates conditions for the occurrence of pathological states.

Transmission and render of heat between bodies is carried out in three main ways:

1. By heat transfer (convection) - heat is transferred by the movement of air molecules.

2. By conducting (conduction) - the transmission of heat takes place in intimate contact of the molecules of the bodies (or a liquid/solid medium).

3. By emitting thermal radiation - heat transfer is through the dissemination of electromagnetic (IR) rays in space.

The body releases its heat by radiation, convection, conduction and evaporation. In conditions of rest at 18-22° C, relative humidity 40-60% and air movement 0,3-0,4 m/s, 45% of the heat given by thermal radiation, 30% by convection and conduction and 25% by evaporation. Moreover, 80% of heat is given through the skin, 13% - through the lungs, and 7% is spent on heating water and food taken into the body. When air temperature higher than the body temperature, the only way to heat the evaporation of the sweat remains. The intensity of evapo-

ration depends solely on the speed of movement of the air and its humidity. At high temperatures and greater air speed heat transfer is carried out only if the air is dry. Otherwise - at high relative humidity and higher air speeds - creating conditions for the accumulation of heat from the environment, and this is the reason for the occurrence of overheating and heat stroke. Overtemperature conditions by neuroreflex tract is performed vasodilation in the periphery, resulting in an increase in skin temperature and heat transfer increases. Viscera (organs) adverse functional changes occur due to bleeding. In tissues increase anoxemic processes, create conditions for the formation of oxidants (free radicals) and acidosis, which are the main causes of premature aging of tissues. Prolonged thermal effects on the body leads to dehydration, loss of minerals and water soluble vitamins, disorder of functions of the nervous, cardiovascular and digestive system.

At low temperatures of indoor air, heat release is mainly done at the expense of convection, conduction and thermal radiation. Under these conditions, the heat release depends on the humidity and speed of air movement. As the speed and humidity are higher, the heat dissipation from the body is greater. This combination of adverse weather factors leads quickly to overcooling of the body.

In hygienic practice complex judgments of microclimatic complex (temperature, speed, infrared radiation and humidity) is carried out by three groups of indicators:

1. Subjective (heat sensation indicators Fanger (PMV and PPD - ISO 7730).

2. Physiological (temperature of body and skin, heart rate and breathing, changes in blood pressure and gas exchange, sweating - heat stress index (HSI) - ISO 7933 and others).

3. Physical (resulting and effective temperature, WBGT index - ISO - 7243 and others).

4. CLIMATE AND WEATHER. ACCLIMATIZATION.

The impact of various types of climate, weather types and their changes are important for health, performance and self-esteem of man. Learning from positions of hygiene and medical climatology allows to predict and prevent meteopathy (meteotropic reactions and diseases), allows the use of climatic factors for the purposes of prevention and treatment (helio-, balneo-, thalassotherapy, etc.). Knowing the peculiarities of climate and weather in a given area contributes to a more rational organization of the climatic environment in the village and the microclimate in the premises, of acclimatization people in changing climatic and geographical environment.

4.1. HYGIENE CHARACTERISTICS OF CLIMATE

Climate is a perennial standby weather,inherent in a given area. It is a dynamic combination of meteorological and cosmic factors for prolonged periods and are characterized by average markedness of individual factors - pressure, temperature, humidity, wind, solar radiation, ionization of air, GMF, atmospheric electricity, clouds and rainfall.

The climate is determined by atmospheric circulation, latitude and physical and geographical characteristics of the territory (relief, altitude, soil, water basins, vegetation, etc.). Significant modifying effect on the climate has varied production activities of mankind.

For a more accurate characterization of climate differ following terms:

- *macroclimate* - the climate of a given geographical area or region;
- *mezoclimate* - climate in a specific region (territory or territorial sea);
- * *microclimate* - a collection of meteorological and cosmic factors on limited area or room.

4.1.1. CLIMATIC ZONES

Climatic zones are limited by respective isothermal lines - lines that connect the points on the ground with the same average temperature. 5 different climatic zones:

1. Tropical zone - on both sides of the equator between the isothermal lines 25 ° C.

2. Subtropical zone - isothermal lines between 25-15 ° C.

3. Moderatezone - between the isothermal lines 15-5 ° C.

4. Cold zone - between the isothermal lines of + 5 ° to -5 ° C.

5. Polar belt - from -5 ° isothermal line to the poles.

In our northern isothermal line is 11 ° (Svishtov, Rousse) and the south -14 ° (Petrich). This defines our country in the temperate climate zone, near subtropical.

* The term microclimate used also to evaluate thermal condition environment - see microclimate factor

4.1.2. CLIMATIC AREA

Climatic area is territory, region of the country, differentiated by their climate-forming characteristics (average markedness of meteorological complex, surface, topography, etc.). Our country has five climatic areas with respective subregions **(Fig. 2.8)**:

1. Moderate continental area - Danube, The Northern plane, Ludogorie, Fore-Balkan and South-Bulgarian hollow subregion.

2. Transient continental region - Fore-Balkan valley, the Upper-Thracian and Mid-Struma subregion.

3. Transient Mediterranean region - Sakar - Strandja, East-Rhodopa, Mesta and Petrich-Sandanski subregion.

4. Black Sea area - Dobrudzha-Varna, East Balkan, Bourgas and Strandja coast.

5. Mountain climatic area.

The first three regions are characterized by large amplitudes of meteofactors. Summer in them is hot and winter - cold (area 3 - softer).

The Black Sea region is characterized by smaller annual amplitudes of all meteofactors. Summer is relatively cool, sunshine is strong, intense ultraviolet radiation. Winters with a higher average temperature compared to the first two areas. Due to the higher relative humidity and strong winds in the winter there are conditions for hypothermia of human body.

In mountainous climatic region the atmospheric pressure is lower, respectively altitude. Temperature and humidity are large daily variations. The air is drier, cooler and cleaner - without additional impurities and allergens. Solar radiation is high average duration, with intense ultraviolet component.

The variety of climatic conditions in Bulgaria gives good opportunities to use the effect of climatic factors for prophylactic and therapeutic purposes.

Lowland and low-mountain climate act favourably with kidney disease, rheumatism, rheumatoid arthritis, radiculitis, nephritis, chronic inflammatory gynecological diseases and others. . The wealth of mineral springs in those climates further expands the range of well-influenced diseases.

Recreation and climatic conditions in the Black Sea coast are particularly useful during the period from May to October. Great healing effect was observed in individuals with chronic bronchitis, diabetes, myxedema, obesity, early atherosclerosis, extrapulmonary forms of tuberculosis, silicosis and many others. In this area there is conditions meteorological effects to be combined with helio-, balneo and thalassotherapy, which potentiates the bene-

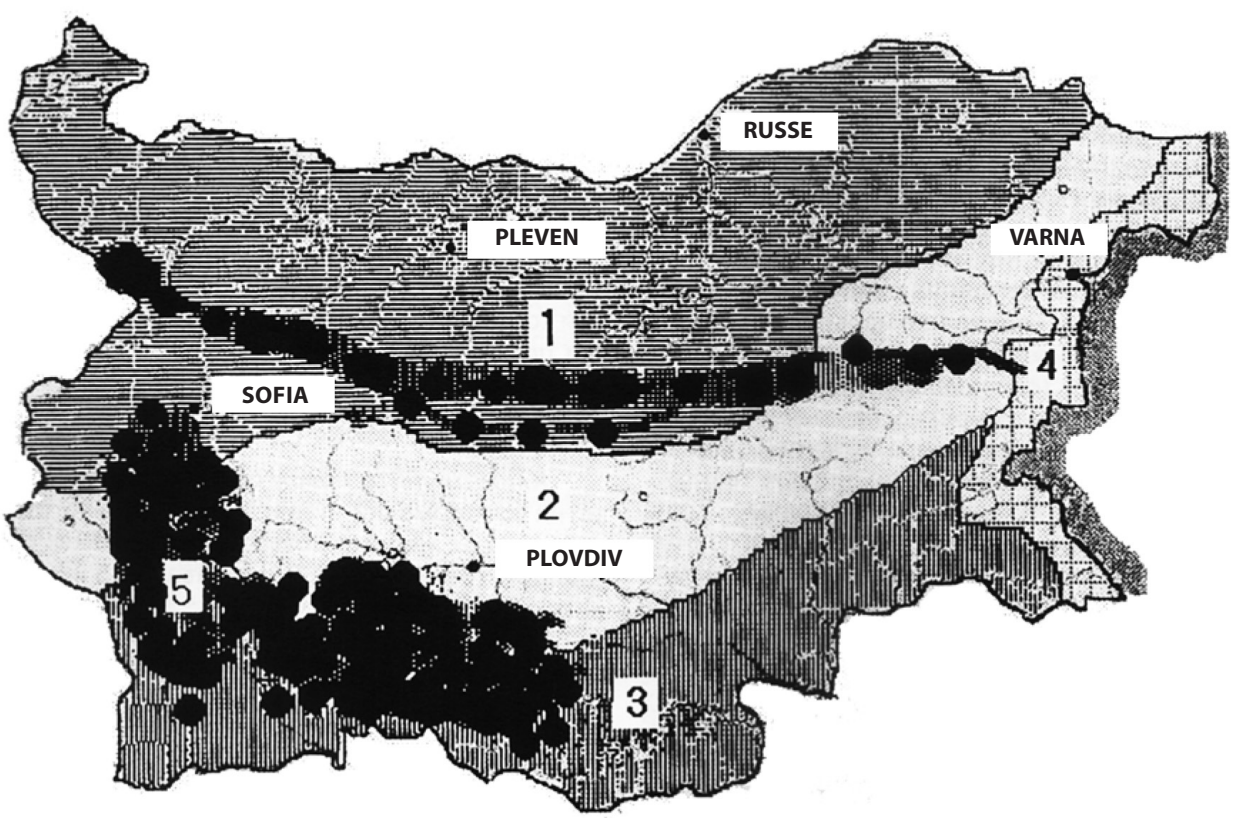


Fig. 2.8. Climatic areas in Bulgaria: 1 moderate continental; 2 transient continental; 3-transient Mediterranean; 4 Black sea; 5 - mountain

ficial effects. The coast provides excellent opportunities for helioprophylaxis and hardening, of course taking into account the contraindications against intense solar radiation.

During the winter period in the Black Sea region has high air humidity, strong (but mainly pre-Northeast) winds and significant fluctuations in atmospheric pressure. These factors may affect persons with diseases of the upper respiratory tract, lungs, the nervous and cardiovascular system.

The mountain climate is indicated for persons at who do not tolerate overheating. Rest and treatment in highland climate (altitude up to 1200 m) is recommended for people with neuroses, chronic bronchitis, bronchial asthma, hypertension, anemia, thyrotoxicosis, rachitis, certain skin diseases. It is preferable to choose places and villages on the southern slopes of the mountains. The high mountain relaxation may adversely affect sick people. It recommended only for tourism and alpinism.

4.2. HYGIENE CHARACTERISTICS OF WEATHER

Weather is a dynamic combination of meteorological and cosmic factors on a certain area in a short period (hours, days). Depending on the condition, it may be optimal for the functioning of the body but can cause disorders of thermoregulation and thermal exchange and predispose to acute and chronic diseases.

From hygienic-physiological point of view in severity and dynamics of weather are three type (G.P. Fedorov):

1. Optimal - mainly clear (sunny), which is characterized by the presence of moderately humid or dry air with speeds up to 3 m/s, small daily fluctuations in air temperature (to 2° C) and atmospheric pressure (up to 4 hPa).

2. Irritant - one or several weather factors are beyond the optimum for human values. It is characterized by transitions from sunny to cloudy weather, dry air to fog and high relative humidity. Daily variations in temperature and atmospheric pressure are more significant, respectively, to 4 ° C and to 8 hPa, the wind speed reaches to 9 m/s.

3. Acute type weather - with sudden changes of weather factors and high daily amplitudes - more than 4° C air temperature, above 8 hPa for barometric pressure, relative humidity is above 90%, the wind is strong, often accompanied by rain.

Air masses are always in motion. The currents in the zones with a lower atmospheric pressure (cyclones) are generally at a higher temperature, and in areas with a higher pressure (anticyclones) air is cooler. The zone of contact of two adjacent air masses with contrasting physical properties (temperature, humidity, atmospheric pressure, atmospheric electricity, etc.) is called a s*ynoptic front*.

When over a territory occur or pass a synoptic front, all the electrical properties of the atmosphere change significantly. At first, a few hours before the passage of the front, began a sharp variation of the geomagnetic field, the electrical conductivity of the air and the intensity of EMF. Then, for about 6 h occur changes at the temperature, the air flow and pressure. After one day, the values of electrometeorological factors gradually returned to baseline levels.

4.3. METEOTROPIC EFFECTS AND DISEASES

The human body is better adapted to the smooth and periodic (daily and seasonal) changes in the weather. In some persons, the most often with chronic diseases, fatigue, etc., there is meteolability - increased sensitivity of the organism in weather modification or change climatic regions. The sudden change in the weather already is a strong irritant that can cause a number of disorders. Violations in the body that are caused by sudden, periodic changes in weather and the passage of a synoptic front, called *meteotropic reactions or illnesses*. Synonymously used more concepts meteopathic reaction, meteoropathy, meteopathy, meteotropism. These are rheumatic reactions, asthma attacks, arthralgia, myalgia, neuralgia, migraine, provocation or exacerbation of ulcer and hypertension, thrombosis and others. In periods of sudden change of weather, no matter from warm to cold or vice versa, frequent strokes, heart attacks, spontaneous abortes, nephro- and cholelithiasis crises.

When switching on the weather front, in a sensitive individuals occurs increased irritability, headaches, insomnia, lethargy, weakness, dizziness, suffocation, tachycardia, depression, feelings of tension, nausea and vomiting.

Meteotropical effects are is most pronounced when the atmospheric circulation change air masses of contrasting physical properties. For example, in the passage of the warm front, in people with chronic heart and lung diseases, appear complaints of general weakness, fatigue, drowsiness and oxygen deficiency. The reason for the hypoxic effect is reduced density of oxygen in the air, due to hypobaric and hyperthermic effect and increased humidity, typical of cyclones and the warm fronts.

Invasion over a territory of cool air masses can cause spastic reactions, especially in patients with

hypertension, bronchial asthma, nephro- and cholelithiasis. Such a response has sometimes in the presence of a warm front.

It is important to know that meteotropic effects, provoking pathological reactions and exacerbation of chronic diseases arise not only in the passage of a weather front, but hours before and after its presence in a territory.

Prevention meteoropathy require primarily qualitative weather prognosis and announcment. In periods of abrupt changes in the weather, weather-sensitive people and the chronically ill should have a sparing regime, to avoid major physical and neuro-psychological tensions. Important is specific, antireccurent treatment in such periods, the creation of micro-climatic comfort in the premises. Prophylactic effect have also timely hardening, rational nutrition and appropriate clothing.

4.4. FEATURES OF COLD POLAR AND TROPICAL CLIMATES. ACCLIMATIZATION

Acclimatization is the process of adapting the body to new climatic conditions. It is a special case of adaptation and from physiological point of view is the process of formation of new dynamic stereotype. It is expressed with a strain of several functions, mainly in the central nervous system, the cardiovascular system and metabolic processes.

Depending on the individual characteristics of the organism acclimatization requires a different duration. Sustainable adaptation to new weather conditions occurs after no-less than 7-14 days. This should be considered in the short-term residence in different climatic areas (e.g. a combined cruising holiday), which in some people can cause pathological manifestations.

Reacclimatization is readjustment to earlier habitual weather, then stay in another climatic zone. Essentially changes in the body are as in acclimatization.

◆ **Extreme North End.**

For the so-called "Extreme north" - large areas in Russia (Siberia), Canada, Sweden, Norway, north of 66 ° latitude, is characteristic the long polar night, the considerable tension of the magnetic field (magnetic storms, auroras), "ultraviolet hunger" (at the height of the sun 25° above the horizon, to the ground do not reach rays below 304 nm, and at frequent cloudy direct UV radiation fully retained). The polar day and polar night at latitude 70° are respectively 71 and 53 days, and the width 78° - 127 and 111 days. Rainfall is less, but permanent frozen ground creates conditions for swamping summer. Water is slightly mineralized.

◆ **Polar climate conditions**

In the polar climate of Antarctica (average altitude of over 2,000 m and a layer of ice with a thickness of about 4 km) in winter temperatures reach -70 - 80° C in summer in just two months the average temperature ranges from +2 to -2°C. Frequent hurricane winds, only about 20-30 s open areas of skin may freeze and save inflammation can get frostbite parts of the lung (in the absence of protection, as 50% or more of the heating losses of body is inhaled cold air). The atmospheric pressure is low - 613 640 hPa (hypoxia). Cosmic ionizing radiation is 600-700 μSv (about 6 times more than in mid-latitudes). Voltage electric field up to 90,000 V/m over certain periods (permanent - 500-600 V/m, also 5-6 times more than that of the middle latitudes). In extreme conditions of the polar climate during the winter period (lasting eight months - from April to October for Antarctica) people are almost isolated throughout premises. The rooms are without natural light, the contents of $C0_2$ is constantly above normal, the temperature gradient is up to 8-15 ° C/m and condensed moisture or ice formation in the corners of rooms.

When living in a cold and polar climate basal exchange was increased by 15-30%, and has accelerated the metabolism of lipids. The average surface temperature of the skin is decreased - 29-30° C. Decreased content of Vit. C, B_1, B_2, PP, rutin. Increased level of triglycerides and total cholesterol levels (increased fat consumption). Blood pressure is also increased and is a common arterial hypertonia. Breathing is difficult - i.e. "polar suffocation", due to low temperatures and high wind speeds - reduced volume of respiratory air, the vital capacity, pO_2 in venous blood, increases-acid metabolites in the blood. Consequently, reduced intake of Vit. C, small amount of fluoride and minerals in the water and disturbed ratio Ca/Sr, are common dental caries and parodontitis. High is a psycho-emotional tension and depressed mental state - the so-called "disadaptation meteoneurois." Noted delays in physical development, frequent rachitis in infants and young children, infectious diseases are rare but occur more severe (weak natural immunity due to an isolated life - small groups of people). Frequent eye damage from UV rays during the summer season, and the high brightness of visible light (reflected by snow and ice).

To speed up the acclimatization is needed thermal comfort in the premises (at an elevated air temperature - 22-23° C). Protection of buildings from strong winds (perimetric built-up area), good thermal isolation of homes from the air and the frozen soil (ground floor is not desirable residential). Nutri-

Table 2.5

TYPES OF TROPICAL CLIMATES (by M. GENTILINI, 1989)

Equatorial climate

T°:	High average annual temperatures: 26° C
	Annual temperature amplitude: 1-2° C
	Diurnal temperature amplitude: 5-7° C
Rainfall:	Heavy rainfall: 2000-4000mm
	Rain throughout the year (not month <50 mm)
	Heavy rain during the day
	Constantly on year clouds
Types:	Classic equatorial: two annual maximum and minimum rainfall (b. Fig. 2.9)
	Equatorial "polished" with more maximum and minimum of rainfall (a. Fig. 2.9)
	Subequatorial: both maximum and minimum rainfall are not equal (c. Fig. 2.9)

Tropical climate

T°:	Average annual temperature: 24-28° C
	Annual temperature amplitude: 3-10° C
	Diurnal temperature amplitude: 8-10° C
	Temperatures drop during the rainy period
Rainfall:	Annual rainfall: 600-1500 mm
	Dry period in June-September for the northern hemisphere during November to February for the southern
	Pluvial period
Types:	Long tropical: one dry month and one maximum rainfall (d. Fig. 2.9)
	Average tropical, dry season by several months, but less than 8 mm (e. Fig. 2.9)
	Tropical short: dry tropical climate (semiarid) (f. Fig. 2.9)

Climate tropical dry or semiarid

T°:	Average annual temperature: 24-30° C
	Annual temperature amplitude:> 10° C
	Diurnal temperature amplitude: 10-20° C
Rainfall:	Annual rainfall: 150-600mm
	Long dry period - 8-9 months and a short rainy
	Big difference in precipitation during the cold years (e.g. catastrophical drought Sahel in 1973)

Tropical arid climate

T°:	Average annual temperature: 25° C
	Average temperature in the hottest month: 30-35° C.
	Annual temperature amplitude: 15-25° C
	Diurnal temperature amplitude:> 20° C
	Cold and frosty nights, hot days with temperatures up to 50° C
	Low clouds, strong solar radiation
Rainfall:	Annual rainfall: 0-150 mm
	Large variability in rainfall by areas, time and characteristic

Mountain climate

T°:	Temperature - reducing the temperature by 1° C per 180 m height
	Diurnal temperature variations are greater than those in moderate climate at the same height
	Frosty nights and freezing water all year round. Intensive UV radiation (shortwave)
Rainfall:	Increased rainfall throughout the year

tion is a high-energy (over 16,7 mJ -4000 kcal), more fat (correlation 1: 1: 3.5), vitaminous food and beverages (fruit, vegetables, fruit juices - vit. C - 200-250 mg per day for adults and 150-200 mg for children). In the summer it is recommended annual holiday in moderate (not hot) climate. Special requirements for clothing - outerwear to be with wind-protecting properties and prevent moisture and frost - the best is leather garments, wool and down. Head protection hoods are suitable leather, lined with down. Gloves and shoes are also made of leather with wool lining. Hardening procedures, sport and fitness, good health status (preliminary and periodic medical examinations) also significantly accelerate acclimatization.

◆ **Hot climates**

The main feature of the hot (tropical) climates - equatorial, tropical, subtropical, is the high air temperature - average temperature above 25 ° C, reaching up to 50-60 ° C in the shade in the desert climates. Depending on the combination of climate-forming factors are quite different in the different continents and regions in relation of seasons (dry/wet period, four seasons), maximum and minimum temperatures and temperature variations (daily, monthly, yearly), humidity, cloudy , quantity and nature of rainfall, long dry periods, nature of air currents and more. **(Table. 2.5, Fig. 2.9)**.

In these conditions thermal balance is maintained with high strain thermoregulating apparatus (e.g. In a desert climate receipt of heat by convection and radiation exceeds 10 times endogenerated). Greatly reducing the basic metabolism and thyroid functions. Decreases in blood pressure, accelerated pulse and increases minute cardiac output. The average skin temperature reaches 39°C. Heating losses is only through evaporation of sweat, but it is very difficult at high relative humidity (e.g. on climates in Bangkok, Calcutta, Mumbai, Colombo). Conversely, the dry hot desert wind causes frequent rhinitis, laryngitis, bronchitis, conjunctivitis. The body loses a lot of fluids, vitamins and water soluble salts. To suppress gastric acid secretion, reducing the acidity of gastric juice, are often chronic gastritis. Frequent and skin damage from sweating - miliaria, intertrigo, heat urticaria. Very often the so-called heat exhaustion. In no acclimatized persons may develop extreme conditions of heat- and sunstroke.

To accelerate the acclimatization is necessary to protect the premises from overheating - thick walls (50-60 cm) or materials with high thermal isolation.

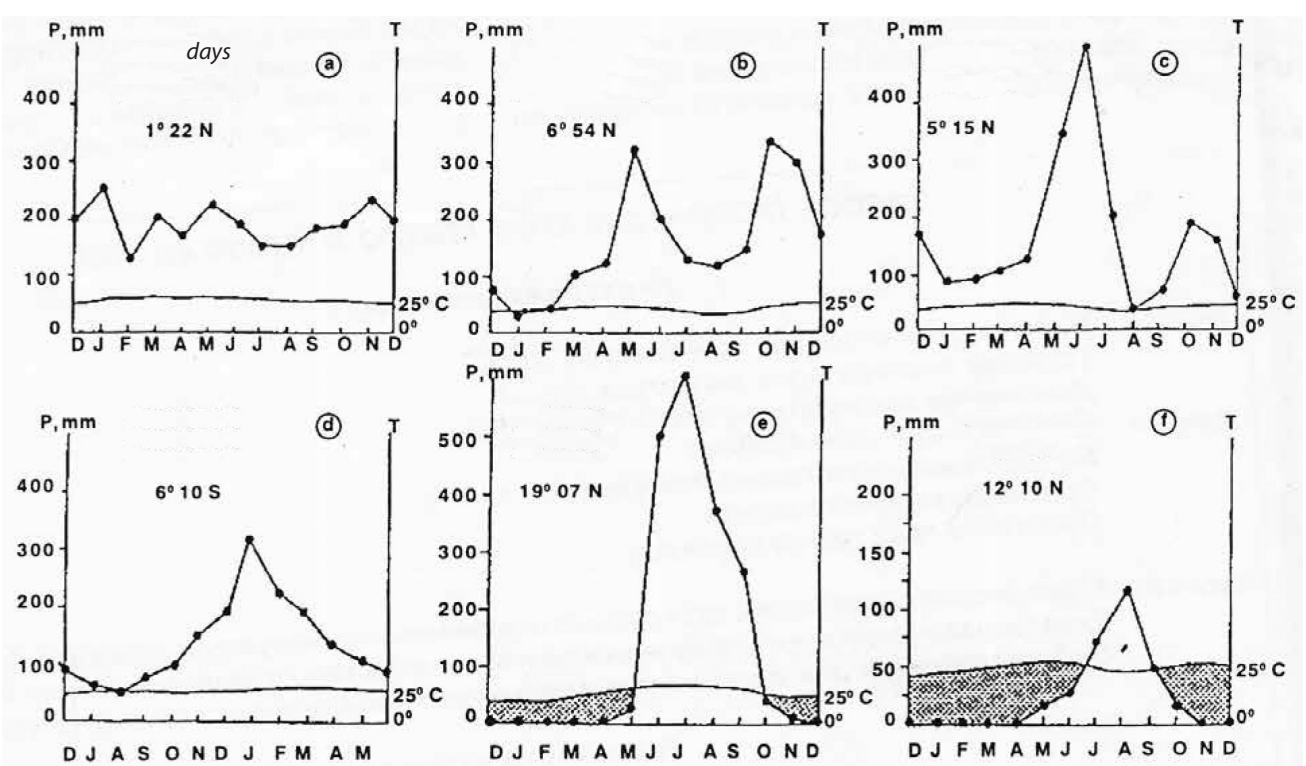


Fig. 2.9. Types tropical climates (climate graph):
average monthly temperatures;
– Average monthly rainfall; a – equatorial "atypical" b – classic equatorial;
c – subequatorial; d – long tropical; e – medium tropical; f – tropical short.

The orientation of windows to the south (or north) and not east and west in particular. The buildings to be built free and low-floors, low-density building area (better ventilation), with plenty of greenery (more than 50% of the settlement), and water. Wide use of conditioning devices, as here is a thermal comfort at lower temperatures - 17-18°C. Food and drinking regime - low-energy food with less fat and plenty of fruits, vegetables, milk, tea, fruit juices, chilled mineral water with additives of energizing substances and water soluble vitamins. Mode of work - morning and evening 7-13 h -18-21 h, in the cool time of the day. Clothing is slightly, loosely sewn, airy, thin cotton fabric or specially treated (tropical) thin cloth reflecting solar radiation (light colors). Head protection caps with suitable protecting against infrared radiation, and at the same time ventilated. Hardening treatments, fitness and sports are also useful. Required here is preliminary and periodical medical control for health status. Normal body weight and avoiding mental stress - poor awareness, impaired communication with relatives and colleagues, poor psychological climate in the family and workplace, disincentives to work and so on - improve acclimatization. In tropical conditions of high temperature and humidity and is an important protection of the enormous variety of biological factors and carriers (especially insects), causing the development of tropical infectious diseases.

REFERENCES

1. **Basmadjieva, K., C. Tabakova, D. Tsonevski** et al. Effects of air pollution in Rousse on the morbidity of the population. In: Proceedings of I Conference "Current Problems in Environmental Protection in Razgrad region" Ruse, 28-29.10.1988, 250-259. (in bul.)

2. **Basmadjieva, K.** Hygiene-toxicological problems of atmospheric pollution and its impact on health. DSci. thesis, Sofia, 1985. (in bul.)

3. **Bobrov, N., O. Lomov, V. Tikhomirov.** Physiological-hygienic aspects of acclimatization for person on north, Leningrad, "Medicine", 1979. (in russ.)

4. **Boyadzhiev, Vl.** et al. Tropical Hygiene in Tropical Medicine, ed. B. Zografski. Sofia, Med. and phis., 1984, 386-399. (in bul.)

5. **Gurjar B.M., Molina L.T., Ojha C.S.** Air Pollution - Health and Environmental Impacts, 2012, CRC Press.

6. **Gentilini, M., C. Duflo.** Geografie tropicale: in Medecine Tropicale, Paris, ed. Flamarion, 1991, p, 1-16. (in french)

7. **Hashimoto, T.** Res. Environ. Disrupt: Interdiscpi -Ccop., II. 1981,1,41-50.

8. Ministry of Health. State Sanitary Control - basic regulations acts. Sofia, Fund "Health prevention", 1994. (in bul.)

9. **Mikhailov, Ts., L. Raikov, P. Petrov, V. Grozdanova.** Annual Status of the environment of the Republic of Bulgaria. Sofia, 1991, 177-217. (in bul.)

10. **Namekata, T.** Models to estimate air polution effects on respiratory morbidity. Environ, Int., 4,1980,1, 3-13.

11. **Nikiforov B.** Sanitary-epidemiological and toxicological investigations for risky importance of atmospheric pollution in Bulgaria for the emergence and spread of cardiovascular diseases, DSci. thesis, Sofia, 1988. (in bul.)

12. Ordinance № 14, SG. 88/1997 (rid. 1999-2004) - Standards for permissible concentrations of harmful substances in the ambient air of the settlements. (in bul.)

13. Ordinance № 7, SG. 45/1999. To assess and manage ambient air quality. (in bul.)

14. Ordinance № 8 and 9, SG. 46/1999 - Standards for ozone, sulfur and nitrogen dioxide, particulate matter and lead in ambient air. (in bul.)

15. **Rumyantsev, G. I., E. P. Vishnevskaya, T. A. Kozlova.** Climate and Health population. in General hygiene, Moscow, Medicine, 1985.151 167. (in russ.)

16. **Sartwell, P. E.** et al. Preventive Medicine and Public Health. Appleton, Gentury, Crofts, New York, 1973.

17. **Tsonevski D.** Changes in ecosystems of the country before and after 1989 and their impact on health. Social Medicine, 1997, N1, p. 7-9. (in bul.)

18. **Tsonevski, D.** Ecological and health problems. Hygiene and Public Health, 1994, N 6,23-26. (in bul.)

E. Vodenitcharov D. Tsvetkov, C. Vodichenska,
R. Kaynakchieva N. Stamova A. Agovska

3 WATER

1. WATER - ECOLOGICAL PROBLEMS. A. Agovska D. Tsvetkov

Water is one of the most essential components of the great natural biological cycle. It is crucial for life - meets environmental, physiological, health and hygiene needs of human beings.

Water enters into the composition of all living organisms. Participate in the structural elements of the human body, without it the existence of organic matter is impossible.

Water needs in the household and farm another form - i.e. "civilizing circle" of water.

In environmental terms water is one of the key elements of the ecosystems, through the evaporation of water from the large water areas and by sea currents influencing the formation of climate.

Ecosystems are relatively independent parts of the Earth's biosphere. They are characterized by: a regulated flow of mass and energy; grouping of species that interact (are interrelated) with each other and with their environment; distinct plant communities that support certain populations of species and organisms. In this complex system living things interact with each other and to all the nonliving factors that form the environment - temperature, chemicals, climate, etc.

Biome - geographic aggregation of smaller ecosystems with the same energy sources and an intense exchange of energy between them.

1.1. ECOSYSTEM COMPONENTS

Biotic component of ecosystems

Producers - these are mainly plants performing photosynthesis - the process of capturing light energy and chemical transformation into such:

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 \text{ (sugars)} + \text{chemical energy} + 3O_2$$

or

Solar Energy + Chlorophyll + Minerals + Water + CO_2 = Organic matter + oxygen

Producers generate organic matter from inorganic raw materials, such utilize solar energy. They have the greatest biomass in the ecosystem, which can not exist without producers. They are organisms that carry inputs of energy in ecosystems. Major producers are green terrestrial and aquatic plants, including algae and some bacteria.

Consumers - these are all animals and parasites that feed on photosynthetic organisms:

- Vegetarian (phytophaga) - is fed directly to the producers;
- Carnivorous - eat only animals (herbivores or others).
- Omnivorous - feeding on plants or animals;
- Scavengers - feeding on dead animals;
- Parasites - fed by host
- ***Reducers*** - mainly micro-organisms (bacteria), insects and fungi that can decompose decaying organic matrix (dedrit). They treat waste from the food levels and are a major cause of soil formation. Have little energy efficiency, their very important function is the assimilation of waste from the food chain.

Abiotic components of ecosystems

Physical and chemical environmental factors, which are mainly associated with soil (lithosphere), water (hydrosphere) and air (atmosphere). Abiotic factors are solar energy, temperature, humidity and more. defining climate; water with its pH, nutrient content, salinity, etc.

Act of optimal coverage - if only one of the factors (abiotic, biotic) is outside the optimal range, the species falls in physiological stress or zone or intolerance (death).

Artificial (anthropogenic) ecosystems is the functioning of agriculture, where human intervention is a determining factor in them.

1.2. BIOGEOCHEMICAL CYCLES

Water cycle

Water is a very important component of living things and is a limiting factor in the productivity of

many ecosystems. The elements directly affected by this cycle H and O, also a molecule of water is vital for living beings, and various substances dissolved in it.

The water cycle - **Fig. 3.1** (natural water cycles) is a continuous process of repassage of natural waters in the geospheres and their phase transitions (transformation of the conditions). The driving forces of the water cycle is solar energy and gravity. Solar radiation determines the snow melting, snow heaping, evaporation and gravity - rainfall, the movement of surface water as and groundwater.

Stages of the water cycle:

Evaporation of water vapor from water basins - this is considered the beginning of the hydrological cycle - **Condensation in the atmosphere** - water vapor condenses on a certain surface with a low temperature or the balance of water vapor in the air, i.e. moisture content exceeds certain limits. Condensation on a surface, it is heated until the temperature of air falls. In the atmosphere condensation causes appearance of clouds, fog and precipitation, as these phenomena are conducive to the presence of condensation nuclei. It is the result of condensation and the formation of dew. Deposition is a type condensation as a result of which form the snow and frost. It represents the direct passage of water vapor to ice.

Falling water vapor on the ground - in the form of precipitation.

Distinguished two sub water cycles:

- small water cycle - implemented entirely over Earth ocean
- inland water cycle - be carried over land

Oxygen cycle

Oxygen is a chemical element with the highest content in living organisms. Contained in the water and in all organic molecules. As a molecule in the form of O_2 is in the atmosphere through photosynthesis.

At the beginning it should be toxic to life, because of its oxidizing function. Even today an environment of pure oxygen may irreversibly harm the cells, but over time the cell metabolism is adapted to the use of a molecule of oxygen achieving a new process for the preparation of energy much more effective than anaerobic. The main depot of oxygen is the atmosphere. His cycle is closely linked to carbon. In photosynthesis, carbon assimilated by the plants is returned as the oxygen in the atmosphere, whereas when breathing induce the opposite effect. Another part of the cycle of oxygen with special interest for the existence of living beings on Earth is transformed into ozone **(Fig. 3.2)**.

Carbon cycle

Circle of carbon is the most intense of all biogeochemical cycles. Its existence in nature is limited to two mineral manifestations - limestone ($CaCO_3$) of biological origin and carbon dioxide (CO_2), circulating form of inorganic carbon.

Carbon is an essential element in building molecules of carbohydrates, lipids and proteins, all organic molecules are composed of carbon chains linked in between. The main depot carbon in molecules of

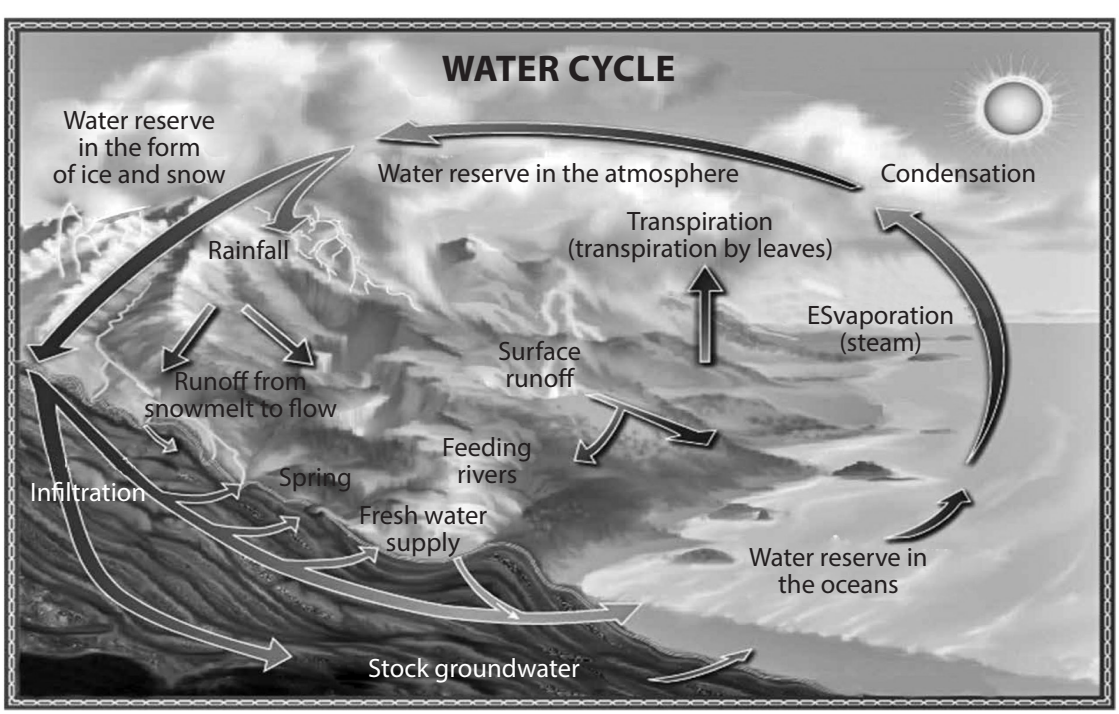


Fig. 3.1. Water cycle

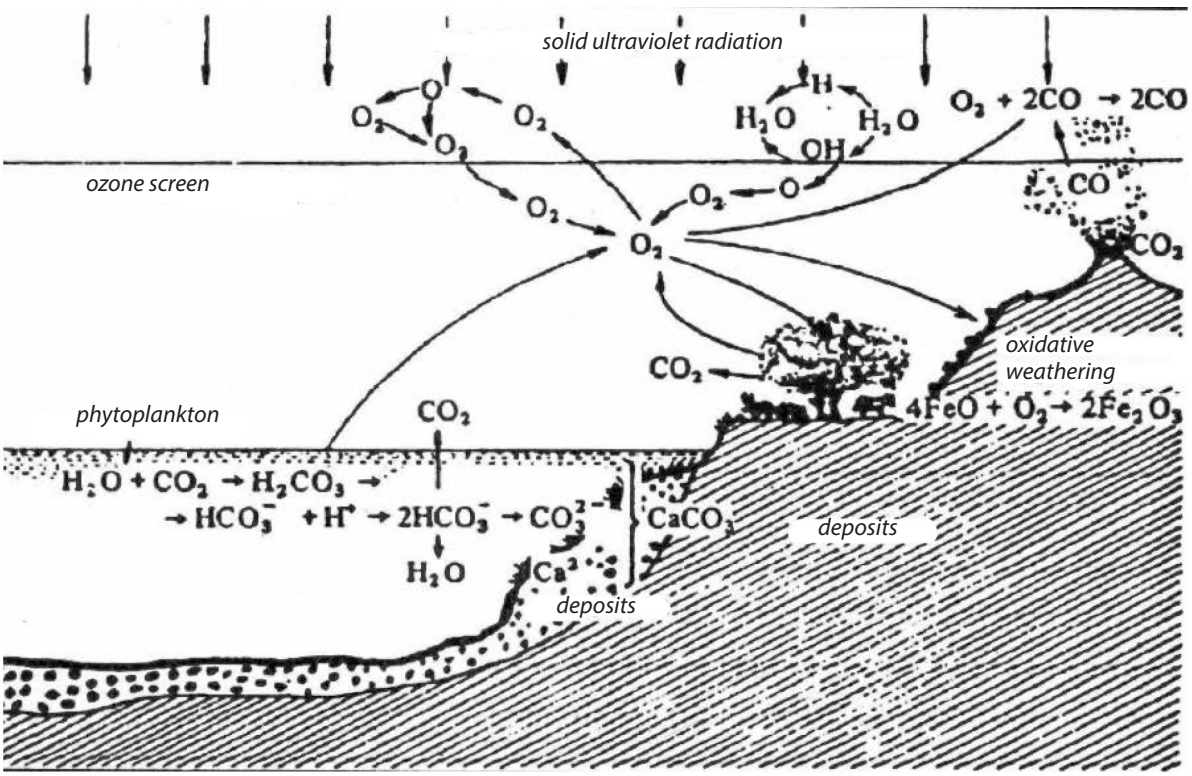


Fig. 3.2. Circulation of oxygen

CO_2 that living beings can assimilate is atmosphere and hydrosphere. This gas is located in the atmosphere at a concentration of less than 0.03%, and each year, about 5% of these reserves are consumed by the process of photosynthesis.

The reserve of CO_2 in the ocean is about 50 times more than that in the atmosphere. Exports of CO_2 from the atmosphere is recovering from CO_2 dissolved in the ocean, the return of CO_2 in the atmosphere is done in the process of respiration of living beings (CO_2 production is carried out by oxidation of food).

The exchange of CO_2 between water, air and land is given by the: $CO_{2\ (air)} => CO_{2\ (water)} + H_2O => H_2CO_3 => H^+ + HCO_3$ - Even with low and with low acidity, H_2CO_3 of dissolved CO_2 in continental waters react with the surface minerals **(Fig. 3.3)**.

Two fundamental process of photosynthesis and respiration, determine the circulation of carbon in

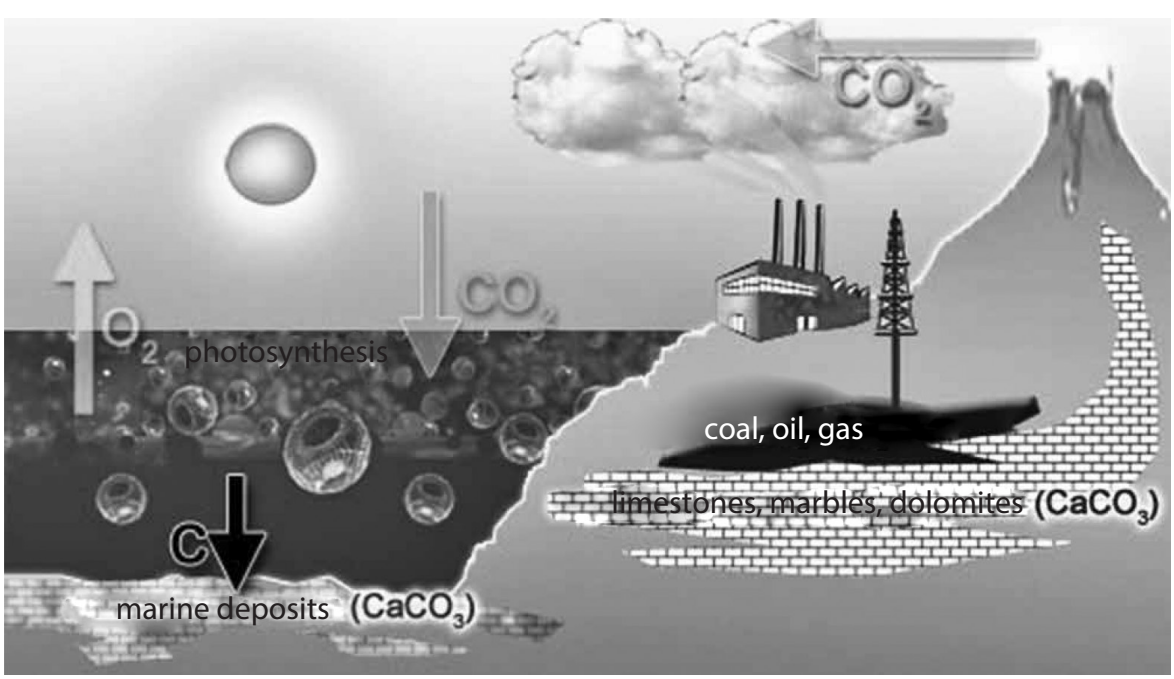


Fig. 3.3. Carbon cycle

the biosphere. Unite as two reversible process on equation:

$6CO_2 + 6H_2O \leftarrow$ respiration $\longleftrightarrow$ photosynthesis $\rightarrow C_6H_{12}O_6 + 6O_2$ glucose

1.3. WATER RESOURCES AND WATER CONSUMPTION

Water stocks on Earth

They are about 1.4 billion km³. Of these, approximately 97.2% fall on the salty sea and ocean water, which is not yet suitable for drinking and industrial purposes. Fresh water is about 3% of water resources, as most of it is concentrated in the ice of Antarctic and Greenland. Furthermore, atmospheric precipitations are not evenly distributed in different areas on earth.

To humid (moist) zone where rainfall exceeds the amount of evaporation from land and water basins, concern central and northern regions of Europe, Russia, Canada, USA, tropical areas of Africa, South America and others.

In arid (dry) and semiarid (semidry) area includes desert and shallow areas where evaporation exceeds precipitation. The uneven distribution of water resources, along with the rapid increase in world population, the development of industry and the accompanying pollution of water basins by industrial and domestic waste waters, are the reason for the shortage of fresh water in many regions of the world and create a problem for the item. called. "Water famine".

One third of the world's population is **directly threatened** by the current water crisis, which according to estimates has been expected only in 2025. From Southern Spain to London, in the major cities of Australia and North America water scarcity threatens not only developing countries, but rich nations.

The reason for this state point to mismanagement of scarce resources, increasingly dry winters, reducing the water level in tanks, leaks in the water system. Furthermore, the pollution caused by industry, agriculture, mass tourism and the consequences of climate change can lead to increased water consumption to 2070.

Currently, the water sources that feed the world's major cities and economic centres, without difficulty meet the immediate needs of residents. Indicates, however, that cheap and efficient storage of water collected from rainfall will be **crucial for the survival** of the population in the poorest countries.

Priority will be given to increasing the efficiency of storage and use of rainwater to the problems of irrigation for agriculture. While the expansion of irrigation systems implies major investments and large-scale construction activity takes years, many of the steps involved in improving the system for storage and use of rainwater can be taken immediately. Also, many sectors reduce water consumption through measures such as increasing the reuse of water, improved efficiency of appliances and others.

Water reserves of Bulgaria

Bulgaria is poor in water resources - about 2,400 m³ per capita surface water, which is 2 times less than in Europe.

The average water flow of the inland rivers (the main source of water for drinking and industrial purposes) is about 20 billion m³ for an average wet year to 9.3 billion m³ for very dry year.

From the waters of the Danube Bulgaria can use about 6-7 billion m³ (actually 1 billion m³), and groundwater - about 3.5 billion m³ (real usability - 1.7 billion m³).

The average annual water consumption is about 10-12bill. m³/year. Individual sectors of the economy it is distributed as follows:

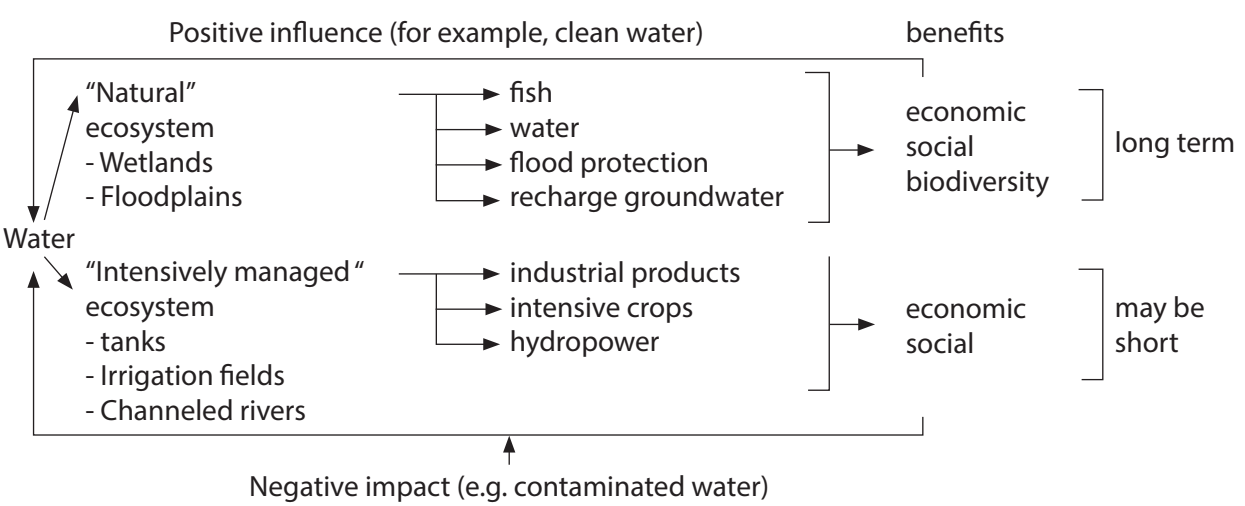


Fig. 3.4. "Natural" and "intensively managed" ecosystems - advantages

- Drinking water - 8-10%
- Irrigation - 5-35%
- Industrial water - 20-26%
- Hydropower - 15-35%

Average annual water consumption per person in the country is high - about 885 m^3, which is fourth in Europe - after Russia, Portugal and Sweden. Given the low water stocks, higher consumption, the lack of "culture, education and ethics" in terms of water and its use, having quality redefine the behaviour of the entire population and the individual in relation to water protection, preserving its quality, economical use and quality management of water resources.

Main question is "At what level should be maintained ecosystems on Earth?". The concept of sustainability suggests that we need to maintain our terrestrial ecosystems so that they can provide the greatest benefits to current generations and at the same time to provide the potential to meet the needs and views for that of future generations - ie correct and sustainable combination of natural processes and human social activity.

Water distribution, sustainability and ethics

Regarding human needs, they can be divided into three main areas:

- Economic security, for example. needs for drinking water, shelter, food and other consumable things;
- Social security, for example. protection from natural disasters such as floods;
- Moral security ("ethics"), for example. protect the rights of humans and other species to water

Fig. 3.4 summarizes the inclusion of water distribution for indirect (naturally) use of man by maintaining natural ecosystems and through direct (controlled) use.

1.4. WATER - ECOLOGICAL LAW AND ETHICS

Ecological Law includes the EU legislation in the field of environment, which must be implemented in national legislation in all countries - members. It consists essentially of about 70 directives and 21 regulations. Water is one of the main regulated areas of environmental legislation. The environmental objective of Directive 2000/60/EU is to achieve "good status" of all underground and surface water by 2010. In this connection, it establishes river basins management based on an assessment of the characteristics of the basin, condition monitoring its surface water and groundwater, measures to achieve a certain quality of water.

In 2007 the European Environment Agency reported an improvement in quality and protection of water thanks to the adopted laws, national and international activities to maintain and improve the aquatic environment in relation to the Framework Directive on Water (2000/60/EU)

Areas in which progress has been made:

Pollution of rivers with oxygen-absorbing substances and phosphorus - as a result of improved wastewater treatment in cities, the introduction of phosphate-free detergents, reducing the use of phosphate fertilizers in agriculture.

- **Pollution of the seas** by the penetration of nutrients in rivers and by direct discharge
- **Reduce pollution of rivers with hazardous substances** (heavy metals and some regulated chemicals from the List of Dangerous Substances Directive -76/464/EEC) - in connection with it declined and the concentration of these substances in the marine biosphere of European seas.
- **Reduce the amount of oil spills** - probably related to the introduction of double-hull ships and improvements in shipping.

Areas in which no progress has been made however:

- **Nitrate pollution** - nitrogen pollution from agriculture is a major problem. The presence of nitrates in the water is a problem for almost all European countries, especially water from shallow wells.
- **Contamination with pesticides** - pesticides from agriculture reaches the surface, ground and drinking water alarmingly high level.

In the future continues to work on the 4 main objectives of european policy in the field of water:

- Provide enough drinking water
- Ensure enough water for other economic needs
- Environmental protection
- Prevent the negative effects of droughts and floods

2. THE IMPORTANCE OF WATER FOR HUMAN. E. Vodenitcharov

2.1. BIOLOGICAL SIGNIFICANCE

Water is a major factor of the environment to sustain life. She participated in the structural elements

of the human body - an average of 65% of body weight. Also, biochemical processes in the body occur primarily in the aqueous phase. Water is involved in the processes of hydrolisis and oxidation in metabolic chains. It is a regulator of the osmotic pressure and salt concentration. Tissues are aqueous colloidal systems. The absorption of food in the gastrointestinal tract also occur in aqueous media. Water is involved in the transport of metabolic products in the body. 75% of the volume of blood is water and the water content in other biological fluids - lymph, saliva, sweat, gastric juice, cerebrospinal fluid is 90 - 95%.

Water is an important factor of physical thermoregulation - the evaporation of sweat from the skin and respiratory water (lungs) takes about 581 cal of heat per gram of water. Daily needs of people of water are about 2.5 - 3 l, which are supplied mainly by fluid - 1 - 1.5 l, the food - 1 l, and is formed in the body of water in the oxidation of nutrients - 0.3 - 0.4 l.

The daily needs of potable water, depending on the age, are: (a J.Borneff, M. Borneff):

- 2-4 years - 75 ml/kg;
- 5-7 years - 65 ml/kg;
- 8-10 years - 57 ml/kg;
- 11-14 years - 43 ml/kg;
- 15-18 years-32 ml/kg;
- over 18 years - 35-45 ml/kg;

Water is excreted in urine and faeces - 1 - 1.5 l, lungs - 0.5 l and pot depending on the thermal conditions of 0.5 - 1 l to 6-10 l daily.

The human body is very sensitive to water loss. The loss of about 10% water by weight prejudice significantly the metabolic processes; at 15-20% loss and high air temperature this loss is deadly; at 20 - 25% and at a low temperature of the air - also lethal. Completely devoid of water a person can be alive depending on the thermal conditions on average 2-5 days.

2.2. SANITARY IMPORTANCE

Water is necessary for maintaining personal hygiene, clean clothing, housing. Is needed for food preparation and cleaning kitchen utensils. Water is important for the cleaning of settlements, planting, the formation of local climate.

Water is an important factor for hardening of the body for physical activity and sport.

2.3. ECONOMIC IMPORTANCE

Water is an important economic factor and as such, it can provide an additional indirect impact on the health status of the population. It is essential for agriculture, for example 1 ha area under crops in artificial irrigation takes an average of 2000 m^3 of water per year, to yield 1 t of wheat were on average 1,000 m^3.

Water is essential for industry, for example. for the preparation of 1 t of paper are required 900 m^3 of clean water, for 1 t of aluminum - 1500 m^3, 1 t synthetic fibres - 2000 m^3 of water. Statistical data for the needs of industry and agriculture per capita in France are required 1200 l/24 h, and the US - 6500 l/24 h.

3. IMPORTANCE OF MORBIDITY.

E. Vodenitcharov,
Ts. Vodichenska,
D. Tsvetkov, R. Kaynakchieva

3.1. EPIDEMIOLOGICAL IMPORTANCE

In antiquity admitting that the water may be the cause of the spread of some diseases. Cholera and pestis in the Middle Ages that killed thousands of people, is spread mainly through water. In our worst water cholera epidemic was during the Balkan War (1912) when of front ill over 40 000 soldiers. According to the WHO currently in developing countries from infectious diseases related to water annually suffer 500 million people worldwide and approximately 5 million children die from the use of poor quality drinking water.

Sources of contamination of the waters of the open waters are most often nondecontaminate fecal and agricultural (livestock from farms) water. Ground water can become infected when contaminated water from seeping through the soil, improper technical device and maintenance of water sources and others.

Trapped in water basins pathogens usually do not find favourable conditions for development, which is why some of them died but others survived and retain virulence their biological properties/e.g. ability to sporulation/. As greater initial infection, as are longer periods of survived. It was found that cholera vibrios can maintain its viability up to 5 months, to multiply in river water and are stable at temperatures below 0° C. Some viruses (enteroviruses, exciters of infectious hepatitis) possessed increased survival in the water of ponds **(Table . 3.1)**.

By water transfer agents of gastrointestinal infections - typhoid, paratyphoid, cholera, dysentery.

Through it transferred some viral infections - epidemic hepatitis, poliomyelitis, epidemic conjunctivitis (adenovirus).

Table 3.1. STABILITY OF INFECTIVITY OF MICROORGANISMS (By J. BORNEFF, M. BORNEFF)

TYPE OF THE CAUSATIVE	DISEASE	SURVIVAL TIME IN DAYS			
		Plumbing	River water	Sea water	Sewage
Vibrio cholerai	Cholera	4-28	1-92	to 47	1-213
Salmonella typhi	Typhus	2-93	4-183	3-28	2-115
Salmonella paratyphi B	Paratyphus	27-37	-	4-9	2-500
Salmonella enteritidis	Salmonelloses	-	-	-	23-36
Shigella dysenteriae	Shigelloses	15-27	12-93	5-72	2-4
Shigella sonnei	Shigelloses	20-50	-	-	to 310
Brucella abortus	Brucelosis	5-85	-	-	2-77
Leptospira sp.	Leptospiroses	-	to 150	-	to 60
Mycobacterium tuberculosis	TBC	-	-	-	48-197
Clostridium tetani	Tetanus	As spores almost unlimited			
Bacillus anthracis	Anthrax	As spores almost unlimited			
Enteroviren*	Poliomyelitis and other enterovirus infections	200	-	-	-
Vacciniavirus*	-	200	-	-	-
Reovirus*		150-175	-	-	-
Herpesvirus*	Herpes	15-25	-	-	-
Rhabdovirus*	Stomatitis vesiculosa	25	-	-	-
Eggs askaris	Askaridosa	-	-	-	30

* In Mayr, reducing the infectivity of about 99% at 9-15° C.

Water is a factor in the transmission of anthrax and tuberculosis.

By water transfer and zoonoses (common to human and animal diseases) - tularemia, brucellosis, Q fever and others.

Some types of E. coli contained in the water can cause acute enterocolitis in infants with epidemic character.

By the water is transmitted to humans and some parasitic diseases and helminth infection.

Of parasitic diseases - amoebic dysentery, balantidiaza.

Helminthoses - by water falling into human eggs of roundworms - Askaris and Trihocefalus trihuris. Can directly penetrate the body Schistosomes Bilharzia - typical for warm countries.

Water as an indirect factor is important for the spread of fish tenia (Diphyllobothrium latum) and fluke (Fasciola hepatica) - aquatic pass through the cycle of development. Also such indirect importance water has for the spread of malaria and filariasis (mosquito - Culex, Anopheles).

Causings of infectious diseases may end up drinking water in the human body for infringement of the technology of purification and desinfection of water treatment plants, pollution of fresh water in plumbing, bathing, use of contaminated water in decentralized water supply.

Typical of outbreaks of aquatic origin is beginning steep curve of incidence, which can have character of "epidemic explosion" - both very ill people using water from water sources, while the rest of the population has no diseases; rapid fall in the incidence of disease after rehabilitation of water sources; "epidemiological tail" with a small number of new patients as a result of new contact infection or delayed incubation. When receipt of the causes of infectious diseases in the water is not solid and self-purification processes are intense, the curve of incidence can be flat.

Table 3.2. Major factors causing infectious and parasitic diseases transmitted by water, food and humans (by M. Gentilini, 1989).

Factors	Important reservoir carrier	Carrying			Development through food	Examples of incriminated foods
		By the water	Through food	Between people		
Bacteria						
Bacillus cereus	Soil	–	+	–	+	Boiled rice, meat, vegetables, pastries
Brucella sp.	Cattle, goats, sheep	–	+	–	+	Raw milk, milkproducts
Campylobacter jejuni	Chickens, dogs, cats, cattle, pigs, wild birds	+	+	+	–	Raw milk, chickens
Clostridium perfingens	Soil, animals, people	–	+	–	+	Meat and poultry - boiled juice of meat, beans
Escherichia coli - enterotoxic - enteropathogenes - enteroinvasive	 Man Man Man	 + + +	 + + ?	 + + +	 + + +	Salads, raw Fruits vegetables Milk Cheese
Mycobacterium bovis	Cattle	–	+	–	–	Raw milk
Salmonella typhi	Man	+	+ –	+	+	Milk products, crab, raw fruits, vegetables
Salmonella (non – typhi)	Man and animals	+ –	+	+ –	+	Meat, poultry, eggs, dairy products, chocolate
Shigella	Man	+	+	+	+	Salads of potatoes and eggs
Staphylococcus aureus (enterotoxin)	Man	–	+	–	+	Ham, poultry and egg salads, cakes with cream, ice cream, cheese
Vibrio cholerae 01	Man, seafood	+	+	+ –	+	Salads
Vibrio cholerae non – 01	Man and animals, marine products	+	+	+ –	+	Shellfish
Vibrio parahaemolyticus	Seawater, marine products	–	+	–	+	Raw fish, crabs and other crustaceans
Yersinia enterocolitica	Water, wildlife, pigs, dogs, birds	+	+	–	+	Milk, pork, poultry
Viruses						
Virus hepatite A	Man	+	+	+	–	Shellfish, fruit and raw vegetables
Agents de Norvalk	Man	+	+	?	–	Shellfish
Rotavirus	Man	+	+	?	+ –	
Protozoa						
Entamoeba histolytica	Man	+	+	+	–	Raw fruits and vegetables
Giardia, Lamblia	Man, animals	+	+ –	+	–	
Helminths						
Taenia saginata, Taenia solium	Cattle, pigs	–	+	–	–	Insufficiently cooked meat
Trichinella spiralis	Pigs, carnivores	–	+	–	–	Insufficiently cooked meat
Trichuris trichiura	Man	?	+	–	–	Products contaminated of soil

Table 3.3. Importance of preventive interventions related to the use of water and cleansing of waste (in R. C. Balance and R. A. Gun).

Diseases	Intervention:					
	Water quality	Amount of water/convenience access	Removal of used water	Removal of excreta	Food hygiene	Personal hygiene
Diarrhea:						
• viral	●●	●●●	□	●●	●●	●●●
• bacterial	●●●	●●●	□	●●	●●●	●●●
• protozoan	●	●●●	□	●●	●●	●●●
Poliomyelitis and hepatitis A	●	●●●	□	●●	●●	●●●
Helminthoses:						
• ascaridosis, trihotsefaloza	●	●	●	●●●	●●	●
• ankilostomiaza	●	●	□	●●●		●
• oksiuroza, parasitism by Hymenolepis nana	□	●●●	□	●●	●	●●●
• helminthoses due to other cestodes	□	●	□	●●●	●●●	●
• schistosomiasis	●	●	●	●●●	□	□
• drakunkulozis	●●●	□	□			□
• infestations due to other worms with water hosts	□	□	□	●●	●●●	□
Skin infections	□	●●●	□	□	□	●●●
Eye infections	●	●●●	●	●	□	●●●
Diseases transmitted by insects:						
• malaria	□	□	●	□	□	□
• urban yellow fever, dengue	□	□	●●	□	□	●
• filarioza of Bancroft	□	□	●●●	●	□	□
• onchocerciasis	□	□	□	□	□	□

Importance of intervention: ●●● - great; ●● - average; ● - weak; □ - slightly

3.2. THE CHEMICAL COMPOSITION OF THE WATER AS THE CAUSE OF DISEASES

Chemical composition of the water affects the human body in three main areas:

1. Participation in so-called biogeochemical diseases associated with a deficiency or excess of trace elements.

2. Impact of the high salt content - macroelements.

3. Toxic effect of chemical substances over threshold concentrations.

3.2.1. IMPORTANCE FOR THE EMERGENCE OF SO-CALLED BIOGEOCHEMICAL DISEASES.

Water is the cause of so-called endemic diseases resulting from low or high levels of certain trace elements. These diseases are called by N. A. Vinogradov biogeochemical diseases.

Microelements - 65 found in animal and plant organisms, are present in trace amounts in them - in concentrations thousands and less than percent. For most of them at all obscure their biological role, and in the other it is partially understood. It is known that trace elements are involved in numerous metabolic processes: in the composition of enzymes (arginase - manganese, carboanhydrase - zinc), hormones (thyroxine - iodine, insulin - cobalt and zinc), influence certain functions and structures of bodies - eg. copper, cadmium, cobalt, on the action of adrenaline; bromine weakened thyroid function; boron affects the blood-forming system and the exchange of protein and others.

Receipt of trace elements in the body in insufficient or in large quantities leads to various diseases.

The trace elements are unevenly distributed in the Earth's crust due to which conditions are created in certain areas to accumulation or back given the lack of micro elements. Through water and food (plants and animals), they can have an impact on people. Biogeochemical diseases as typical modern science indicates endemic fluorosis, caries and endemic goiter. While endemic fluorosis, the etiological significance of water is specified as a funda-

mental and paramount, the dental caries is not only the shortage of fluoride in the water, and other food factors - trace elements, carbohydrates and more. In endemic goitre low iodine content in the water is only an indication of the low content of this trace element in soil and hence in food.

Endemic fluorosis. In fluorine content in the water above 1.5 mg/l appear small yellow spots on tooth enamel that gradually cover purposes teeth. The teeth become fragile. Strike and the bones of the skeleton worsened calcium and phosphorus exchange bones. For the onset of the disease is required a minimum period of 2 - 2.5. The high concentration of fluorine causes a reduction in the activity of certain enzymes - phosphatase, cholinesterase ATPase. Reduced immunological reactivity and suppressing hematopoiesis. All this define fluorosis as disease throughout the body, not just the teeth.

Caries of teeth. At concentrations of fluorine in the water below 0.5 mg/l develop dental caries. In surface water sources fluorine is typically at concentrations below 0.6 mg/l. In Bulgaria it is below the concentration at 85% of all water sources. Many studies have found a correlation between low fluoride content in the water and the incidence of tooth decay while back fluoride prevention (water fluoridation, fluoride toothpastes) significantly reduces the incidence of caries. It was found recently that in addition to the low content of fluorine and other trace elements influence on the incidence of dental caries.

Goiter. It is best studied endemic disease presenting with living in areas with low iodine content in soil, water and plants. The disease is due to underactive thyroid gland due to iodine deficiency and the development of compensatory increase it - goiter. In more severe cases reaching retention of physical and mental development, short stature, cretinism.

According to the WHO, the disease in the world is in third place - 200 mil. sick, after trachoma and filariasis. The disease occurs mainly in mountainous areas. In Bulgaria in the past it was widely spread in some villages in the Rila (Radoil, Pastra) and Vitosha (Bistritsa).

Daily needs of the person from 200-220 μg iodine are supplied mainly food - about 90%, and only about 5% of water and air, i.e. cause of goiter is not a low iodine content in the water and its low content in foodstuffs due to the low content in soil - in this case the water is only an indicator of low iodine content in the soil. Endemic goiter is closely related to the social conditions of life feeding. Prevention includes iodization of food - iodized salt, tableted iodine drug.

3.2.2. DISEASES ASSOCIATED WITH THE SALT CONTENT OF THE WATER

High content of sodium chloride in water leads to an increase in the incidence of **hypertension**.

It is believed that water with high hardness influence the emergence and development of **urolithiasis**. This fact was also noticed by the ancient healers. There are many areas of land where urolithiasis are endemic - areas around the Mediterranean, some regions in Central and South America, in Russia, China and others. These are usually areas with dry climates and waters with high hardness. Experimental studies have shown that water with a high content of calcium and magnesium affect the formation of concretions in the kidney and gall bladder.

Debatable and availability of contradictory data is the role of salt leads to **endemic nephropathy** and **cardiovascular disease** - **atherosclerosis, hypertension**. Not confirmed previously thought for the beneficial effects of hard water on rachitis.

Water-nitrate methemoglobinemia - first reported by Comly, in 1945 (later Walton, 1951) two cases of toxic cyanosis, accompanied by methemoglobinemia in infants artificial feeding. It was due to water with high content of nitrates, used to dilute the milk. The occurrence of water-nitrate methemoglobinemia require several conditions:

- The etiological factor is the high content of nitrates in the water - above 60-70 mg/l
- The disease only occurs in young children - infants artificial feeding, in addition to taking large quantities nitrates have dyspeptic disorders in which altered intestinal microflora - develop in large quantities in the upper small intestine nitrate-reducing microorganisms (reducing nitrate to nitrite). Nitrite ion penetrating into the blood, causing the formation of methemoglobin.
- Insufficient activity of enzymes recovering methemoglobin in the hemoglobin and the higher sensitivity of hemoglobin to nitrite ion in infants is an important factor for the development of the disease.

In adults, the disease is not described, only in older children have been found mild, clinically asymptomatic forms.

3.2.3. DISEASES ASSOCIATED WITH TOXIC EFFECTS OF CHEMICALS

In the water falling number of toxic substances from industry, agriculture (fertilizers, pesticides), research on humans. These are a number of metals - lead, chromium, mercury, manganese, copper, etc.

phosphate and nitrogen fertilizers, pesticides - organochlorine and mercuryorganic, radiotoxic substances and other. Toxic relevance of water is very large, because besides the direct effect of it contains toxic substances, their accumulation in aquatic micro - and macro organisms in so-called "food chains" may have very toxic effects due to increasing concentrations.

Each of them causing characteristic toxic damage to the body. Many substances, chromium, nickel and others, can cause the development of malignant neoplasms. Others have an allergic effect. Some substances **have a radiotoxic effect** - ^{90}Sr, ^{220}Ra, ^{238}U, ^{232}Th, ^{137}Cs, ^{14}C, etc. The latter can cause chronic radiation damage to the body, especially dangerous to their genetic consequences.

4. HYGIENIC ASSESSMENT OF WATER QUALITY. E. Vodenitcharov D. Tsvetkov, Ts. Vodichenska

Order to respond to biological, hygienic, epidemiologic and business requirements, the water must have certain qualities. These water requirements for drinking and household economic goals can be summarized as follows:

1. To satisfy the taste needs with their organoleptic properties.

2. Do not contain toxic and radioactive substances, agent cause infectious, parasitic and helminth diseases.

3. Contained in its minerals and trace elements to meet the biological, economic and hygienic requirements.

Quality of water can be divided into the following groups:

1. Organoleptic qualities.

2. Physical and chemical properties: normal components, sanitary-chemical indicators of organic matter, sanitary-toxic indicators.

3. Microbiological quality indicators: total microbial contamination; microorganisms - indicators of faecal contamination; pathogens microorganisms and viruses .

4. Biological qualities: parasites, helminths, higher aquatic organisms.

5. Radiological qualities.

4.1.ORGANOLEPTIC WATER QUALITIES

Man has a certain aesthetic and taste needs of water. Organoleptic properties of water (color, turbidity, taste, odor) must meet certain requirements in order to consume water with pleasure and quenches thirst. Variation in the organoleptic properties of water also directed to search, using laboratory methods, deviations in other indicators specific to contamination of the water.

Turbidity of the water. Water turbidity depends on the suspended organic and inorganic substances - soil and humus particles, clay, single-celled plant organisms. Murky waters are indications of contamination by sewage or poor treatment. They shall be decontaminated harder and create conditions for longer survival of the microorganisms.

Color. Pure natural water is colorless up to 2 m, as at greater depths becomes bluish-greenish color. In natural conditions, the water can change color: humic substances, iron, manganese make yellowish brown; some algae and microplankton - blue-green. Wastewater of industry can give different colors of the water.

Taste. Drinking water should be free of sense of taste. Flavor is due to a greater amount of gases dissolved therein and other substances. Under natural conditions the flavor of the water is obtained from: very organic matter - a flat, swampy taste; iron salts - metallic taste; sulphates and chlorides - a bitter-salty taste. Pollution industrial wastewater taste of the water changes highly and is unpleasant.

Smell. Pure natural waters are odorless. The odor occurs in the presence of decay of organic substances (ammonia, hydrogen sulphide, methane, mercaptans); development of plankton; pollution by industrial and agricultural products - phenol, cyanide, benzene, pesticides and others. As a general hygienic requirements to the organoleptic properties of water can indicate that they must have no significant fluctuations against the usual value of the indicator.

4.2. PHYSICO-CHEMICAL PROPERTIES OF THE WATER

Physico-chemical properties of water have different meanings. Some of them are indicative primarily for the sanitary condition of the water source - the extent and nature of contamination with organic matter. Others are mostly related to economic and organoleptic qualities of water. Third are indicative of the danger of toxic water, quarters - of the possibility of occurrence of biogeochemical diseases.

Temperature of the water. It varies greatly depending on the conditions of the water source and climatic factors. When groundwater annual temperature amplitude is small - from 1 to 10° C depending on the depth. In the surface water annual temperature range is - 0-25° C. Most temperature range in groundwater is an indication of significant contami-

nation of surface waters. Most favourable and satisfy thirst is temperature - 6-16° C.

Alkaline water (pH). It is determined by dissolved gas in it and of its chemical composition. In our natural waters have a pH of 6.5 - 8.0. Hygiene standards for drinking water are 6.5 - 9.5.

Dry residue. Usually it is in direct correlation with the amount of calcium and magnesium salts. For fresh water, is considered one with solids up to 1 g/l. With higher contents is marine and mineral water. Rainwater is low in salts.

Water hardness. Conditioned by the presence of calcium, magnesium and strontium salts - in practice calcium and magnesium salts, mainly carbonates, bicarbonates and less sulfates, chlorides, nitrates. Water hardness is total, bicarbonate (removable) and sustained (constant). By boiling water, its total hardness is reduced due to the precipitation of bicarbonates as carbonates. Hard water has a bad taste. It is inconvenient for business and household purposes - crosses soaps forming alkaline soapits which impregnated skin and with organic impurities pollute skin pores, skin becomes dry, rough and easily damaged. Hair become hard and greasy. The hard water is unsuitable for the preparation of distilled water for the preparation of drugs.

The high hardness is related to nephrolithiasis and likely to hypertension and atherosclerosis, the deposition of dental tartar, gastrointestinal disorders. The rate for total hardness of the water is 12 mg,eqv/l.

Organic matter in the water. It can be of animal or vegetable origin. The first is a sign of water contamination most often from household wastewater and is an important sanitatary indicator of the chemical purity of the water source. The presence of many organic matter in the water is an indication of submission and good condition for maintaining the vitality and high content of microorganisms, including pathogenic microorganisms, viruses, eggs of helminths. causing gastrointestinal, infectious and parasitic diseases, i.e. organic matter is an important indirect indicator of the epidemiological danger of the water. The amount of organic matter is expressed by the amount of oxygen necessary to oxidize it (permanganate oxidation - rate up to 5 mg/l).

Ammonia. It may also be of different origin - organic and inorganic. Sanitary matter ammonia from organic, animal origin, as indicated on putrid decay - Ist phase of the anaerobic decomposition of organic matter, i.e. for imported fresh organic matter. The latter is an indication of the risk of the presence of vital pathogenic microorganisms. If ammonia is decomposition product of the plants, for example algae in the water basins, it does not really sanitary matter. Ammonia can be of inorganic origin - demineraliziation processes by reduction of nitrates from demineralized (denitrification) microorganisms. It may fall into the water and fertilization with nitrogen fertilizers. As yet no sanitary standards for allowable ammonia content in the water of inorganic origin, but principally ammonia in drinking water is not allowed.

Nitrites. Under the influence of nitrifying microorganisms (B. nitrosomonas) in the presence of oxygen than the ammonium salts (ammonia) to afford nitrites. Possible and reverse processes. If nitrites are of organic origin (from ammonia), they are not allowed in drinking water because they receive very quickly after the formation of ammonia and have the same sanitary indicative value.

Nitrates. They are the end product of the mineralization of organic matter (nitrogen) derived from nitrite, oxidized featuring nitrifying microorganisms. The presence only in the water of organic nitrates, organic, without the presence of ammonia and nitrites, indicative of past contamination with matter, i.e. no epidemiological risk (of course assess and other sanitary-chemical parameters).

Nitrates can be of natural mineral origin, for example deep groundwater passing through layers or saltpeter often than fertilizer - ammonium nitrate. Levels for nitrates is 50 mg/l. Nitrate levels above the limit values have a toxic effect in young children, so-called water-nitrate methemoglobinemia.

Chlorides. It is believed that water with a high chloride content are a factor for the development of hypertension. Allowable chloride content is 250 mg/l.

Sulphates. May be of organic or inorganic origin. Rich in sulphates are hard waters. Organoleptic influence of water as impart a salty-bitter taste. Sulphate ion has a laxative effect. The permissible content of sulphates is 250 mg/l.

Phosphates. Their appearance in larger quantities is considered an indicator of organic pollution, but can also be of natural origin or inorganic artificial phosphate fertilizers. The allowable content is 0,50 mg/l.

Iron. The iron is in the form of inorganic compounds, - sulphates, bicarbonates, and organic compounds - humates. The high content of iron worsens organoleptic properties of water (gives a yellow-brown color), deteriorating transparency and it taste. In water with a high iron content developed specific microorganisms - algae, that can clog plumbing pipe. However, iron is an important bio-element required in small quantities for metabolic processes entering the body through food and water negligible. Permissible iron content was 200 µg/l.

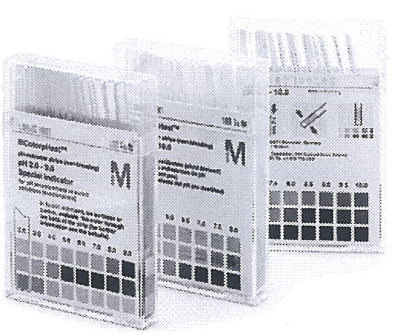
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Fluorine. The content of fluorine in drinking water is quite different - from 0 to 10-12 mg/l. In our most water basins (85% of all sources) the amount is below 0.6 mg/l and rarely exceed 1-2 mg/l. At least amount of it in surface waters. The purification and decontamination of water quantity decreases. In higher concentrations of fluoride in the waters of Burgas and Dupnitsa area - up to 3 mg/l.

Fluoride is a bio-element, which is deposited at most in the teeth, bones, hair and nails. When the water content above 1.5 mg/l causes the disease fluorosis. At concentrations below 0.5 mg/l is developing dental caries. Hygiene standards for optimal content of fluoride in the water is 0.7 - 1 mg/l.

Iodine. Iodine is a trace element vital to man. Daily needs are 200-220 μg iodine. Its content in the water is low - in Bulgaria average of 10 μg/l. Through water the human body procure only about 5-6% of its iodine. Reduced receipt of iodine in the body leads to the so-called goiter.

Water contains many other elements and compounds in natural conditions are in trace amounts and appear necessary trace elements for the structures and functions of the human body, but water pollution by waste industrial water, agricultural fertilizers and pesticides, they are sanitary-toxic indicators - zinc, copper, barium, lead, chromium, cadmium, strontium, mercury, nickel and others. and metalloid - arsenic, selenium; organic compounds - phenol, pesticides, polycyclic aromatic hydrocarbons (PAHs), detergents and others.

While regarding the biological role of trace- and microelements there are many unclear moments, when all of them established a stronger or weaker toxic effects, in over-threshold concentrations.

4.3. MICROBIOLOGICAL WATER QUALITIS

Microbiological indicators of water are essential for the assessment of the epidemiological risk in its consumption.

Total microbial number. The total number of microorganisms in 1 cm^3 of water taken into account in setting the meat-peptone agar, 24 hours of incubation at 37° C is referred to as total microbial number of the water. It shows the total bacterial contamination of water sources - mainly or exclusively water saprophytic microorganisms. In pure natural interstratified deep waters, eg. in so-called. artesian wells microbial number is - 10 - 30 and in surface clean waters - 1000 - 1500. Microbial number of water only indirectly indicates a higher or lower water pollution with organic matter by which are imported microorganisms (and possibly pathogenic) and created conditions for their long survival and preservation of virulence. Norm - 50 microorganisms in 1 cm^3 water.

Amount of E. coli. The presence of E. coli and its quantity in the water indicates the presence and degree of its faecal pollution thereby fall into the water and pathogens. As the microbial number and the amount of E. coli are lower, as is fewer epidemiological risk of water. In many studies known parallelism between the quantity of E. coli and pathogenic microorganisms and viruses. It must be stressed, however, that some of them (poliomyelitis virus, hepatitis, Bc. tuberculosis) are more resistant than E. coli in a water environment, i.e. requirements for low E. coli in water does not mean the absence of any epidemiological risk.

Amount of E. coli in the water is expressed by the indicator coli-titer - the least amount of water, which has one Bac. coli - over 100 cm^3 (or resp. coli-index - the number of E. coli in water in 1 cm^3). As additional indicators for microbiological water quality research available bacteriophage of E. coli and the cause of dysentery (Shigella).

4.4. BIOLOGICAL PROPERTIES OF WATER

To biological indicators for cleanliness or water pollution related data of hydrobiological study - the complex of lower and higher organisms characteristic of the water basin.

Aquatic organisms - hydroflora and hydrofauna are divided into plankton and benthos. Benthos are organisms whose life is connected primarily with the bottom, shore, underwater objects. Plankton, are constantly lower organisms suspended in the water and unrelated to the bottom (differs phyto- and zooplankton).

Biological water quality are determined primarily in open waters, whose water more easily subject to contamination. In contrast to the microbiological and physico-chemical properties that give the instantaneous characteristics of the state of the water, the biological properties indicate the nature of the water source for a much longer period of time, i.e., they complement each other with chemical and microbiological indicators and speak to how their results are not random and short.

In hygiene assessment of biocenosis of the water source is considered the so-called sanitary indicative organisms whose existence is closely connected with the chemical properties of water and the degree of contamination with wastewater, i.e. they are an indicator of purity, respectively contamination of water.

There are three groups of sanitary indicative organisms:

- Polisaprobic organisms. They are typical of heavily polluted water without dissolved oxygen, decaying, with in many organisms.
- Mesosaprobic organisms. They are divided into:

A) Alpha-mesosaprobic. They develop at semi-anaerobic conditions, content of many organic matter, hydrogen sulfide, many microorganisms.

B) Beta-mesosaprobic. They develop in less polluted water with aerobic decomposition of organic matter, the number of species is large to include certain types of crustaceans and fish.

- Oligosaprobic. They grow in clean water without ammonia and hydrogen sulfide. They include many species of fish and colourful algae.

Table 3.4. Regulatory requirements to the quality of drinking water

Indicators	Unit	BDS 2823-83	WHO 1993	EU KI 1994	Ordinance 9/2001 Ordinance 7/1988 Ministry of Health
1. Colour scale	degrees	15	(15)	bearable	acceptable
2. Odour at 20° C	ball.	2	bearable	bearable	acceptable
3. Taste at 20° C		without flavor	bearable	bearable	acceptable
4. Turbidity	mg/l	1.5	(5)	acceptable	acceptable
5. Temperature	°C	6-16	–	–	–
6. Total hardness	mg eqv/l	12	–	–	12
7. Active reaction - pH	pH units	6,5-8,5	–	6,5-9,5	6,5-9,5
8. Oxidisability	mg O_2/l	2,6	–	5	5
9. Ammonia	mg/l	It is not allowed	(1,5)	0,5	0,5
10. Nitrites	mg/l	It is not allowed	3	0,1	0,5
11. Nitrates	mg/l	50	50	50	50
12. Chloride	mg/l	250	(250)	–	250
13. A dry residue at 105 ° C	mg/l	1000	(1000)	–	–
14. Phosphates ($RO4^{3-}$)	mg/l	0,5	–	–	0,5
15. Sulphates	mg/l	250	(250)	250	250
16. Magnesium	mg/l	80	–	–	80
17. Calcium	mg/l	150	–	–	150
18. Total iron	mg/l	0,2	(0,3)	0,2	0,2
19. Zinc	mg/l	5,0	(3)	–	5
20. Copper	mg/l	0,2	2 (1)	2	2
21. Manganese	mg/l	0,1	5 (0,1)	0,050	0,05
22. Fluoride	mg/l	1,5	1,5	1,5	1,5
23. Barium	mg/l	1,0	0,7	–	–
24. Lead	mg/l	0,050	0,010	0,010	0,01
25. Arsene	mg/l	0,050	0,010	0,010	0,01
26. Hexavalent chromium	mg/l	0,050	–	–	0,05
27. Selenium	mg/l	0,010	0,010	0,010	0,01
28. Cadmium	mg/l	0,010	0,003	0,005	0,005
29. Uranium	mg/l	0,6	–	–	–
30. Residual active chlorine after 30 min contact	mg/l	0,3-0,4	–	–	0,3-0,4
31. Strontium 90	mBq/l	3700	–	–	–
32. Radium 226	mBq/l	150	–	–	150
33. Total ß-radioactivity	mBq/l	750	1000	–	2000
34. Microbial number	number/cm^3	to 50	–	–	to 100/20
35. Coli-titer	cm^3	over 100	–	–	–
35[a]. Coli index	number/cm^3	–	–	–	to 100
36. Visible organisms	number	it is not allowed	–	–	Biol. indicators
37. Round worms Nematodes	number	it is not allowed	–	–	identified in surface
38. Phytoplankton	number/cm^3	100	–	–	waters -
39. Seston	cm^3/m^3	1	–	–	I – III category

Note: () - Substances and parameters in drinking water, which entitle the consumer discontent or protest; – the indicator is not controlled

4.5. RADIOLOGICAL PROPERTIES OF WATER

Natural radioactivity of the water due to the constant exchanges with radioactive elements contained in the soil. In natural waters contain salts of uranium, thorium, radium, radioactive potassium. The degree of radioactivity of water and type of contained therein radioactive elements depends on the radioactivity of the earth layers in which the pass. The higher the radioactivity in the mineral waters. Average radioactivity of natural water is 1,5 - 22,10^{-3} Bq/l.

Currently waters are radioactive substances and artificial origin - radioactive waste.

It is particularly important in the standardization of radiotoxic substances in water (this applies also to the toxic substances) to consider not only their direct entry through the water in the body, but also indirect receipt, by nutritional or biological chains, whereby they can be deposited in the final concentrations in a biological host hundreds of times higher than those in the water.

5. SOURCES OF POLLUTION OF THE WATER AND EVALUATION INDICATORS OF POLLUTION. SELF-PURIFICATION. E. Vodenitcharov, Ts. Vodichenska

Expansion of cities and towns, the development of industry and agriculture lead to continuously increase the quantity and change the composition of the wastewater, which previously purified or not, fall into surface water intakes and contaminate the water.

The main types of water pollutants are: to domestic, industrial and agricultural wastewater.

Pollution of water sources in the twentieth century is very high in developed countries - Western Europe, the United States. Eg. Thames downstream water was devoid of oxygen. At the bottom of the Potomac River, Washington was 3m thick layer of sludge on the banks and reading "Beware of contaminated water." Lake Erie, Canada is not used for bathing, flora and fauna dying.

In Bulgaria result that large quantities of faecal water without purifying, large amounts of industrial waste water (from the companies are not always relevant or faulty treatment facilities) and resulting small flow of water intakes (especially in summer), these are highly contaminated. Eg. rivers Maritsa, Iskar, Struma, Yantra, Osam and others clean only small sections of the upper reaches, then the first large settlements or enterprises to the mouth, they can not adequately be self-purification.

5.1. CHARACTERIZATION OF POLLUTANTS AND SOURCES OF POLLUTION OF THE RECEIVING WATER

Faecal water. They are dull, slightly alkaline - pH 7.2-7.6, with many inorganic and organic matter mainly in soluble or suspended state. Their coli titer is extremely low - 10-5 - 10-7 cm^3, and the total microbial number - millions and tens of millions in cm^3. They contain pathogenic microorganisms, viruses, helminths and eggs. Large amounts of organic matter deplete the oxygen regime of water and can cause decay.

Industrial wastewater. The nature and extent of contamination in them depends on the process and production capacity.

Major polluters appear enterprises:

Food industry - large amounts of organic matter, much ammonia, hydrogen sulphide, nitrites.

Chemical industry. Wastewater contains a variety of toxic chemicals - metal ions, acids, alkalis, paint. They contain less organic matter and most of them bacteria count is low, due to bactericidal action of toxic substances.

Machine-building and Metalworking. Wastewaters contain various metals - lead, iron, manganese, zinc, copper, chromium and also arsenic and free mineral acids.

Petrochemical. It contaminates the water with oil and oil products. They are very persistent, very slowly degrade and distributed large surfaces.

Paper pulp industry. It consumes large amounts of water, up to 900 m^3 per tonne of paper. Wastewaters contain many organic matter.

Agricultural effluents

Animal complexes. Their waste waters are rich in organic matter, many microorganisms including pathogens for zoonotic diseases - tularemia, brucellosis, tuberculosis and others.

Fertilizers and pesticides. Fertilizer, mostly nitrogen and phosphate, causing a significant increase of nitrates and phosphates in water sources. High-strength especially dangerous organochlorine pesticides, whose hydrolysis and oxidation in water is slow and they remain long in it.

Indicators to assess the contamination of water sources.

Used set of indicators tailored to the type and nature of the pollution.

A) To assess the epidemiological risk of contamination with faecal water, wastewater from livestock complexes using microbiological and chemical parameters.

B) To assess toxic hazard pollution industrial wastewater and chemical products used in agriculture - use chemical indicators to determine the concentrations of various toxic substances.

C) To make an assessment of the epidemiological, toxic and radiotoxic risk contamination of the water source is used and biological methods for determining water biocenosis.

In the open water intakes undergoing processes of natural **self-cleaning of pollutants become trapped**. These processes include:

- physical and mechanical processes: dilution, precipitation of large particles, coagulation of small particles and precipitating.
- chemical and biological processes: hydrolysis, oxidation, mineralization of organic and inorganic substances involving saprophytic aquatic organismes.

Processes of self-purification are crucial factor approaching water composition, after it pollution, to its original natural qualities. These processes undergo seasonal changes, influenced by water temperature, type and quantity of the pollutants, microbial antagonism and others.

Self-purification of water is effective when predetermine the quantity and composition of pollutants, flow and quality of water sources.

Key indicators, which assess the purifying capacity of water sources are: flow (volume) of the water source, availability of water flows, content of dissolved oxygen and deficiency of oxygen, biological demand of water of oxygen, relative stability, time for decay. These indicators are complemented with chemical indicators determining the amount and rate of decompose of organic matter, and with microbiological and biological indicators.

6. WATER SUPPLY.
E. Vodenitcharov, Ts. Vodichenska
D. Tsvetkov, N. Stamova

6.1. NECESSARY QUANTITIES OF WATER FOR DRINKING, DOMESTIC AND INDUSTRIAL PURPOSES

Needs water to settlements are determined per capita and vary according to the size of the settlement. Standards for water consumption in the country until 1990 provide:

1. Places to 5,000 people - 80 l/24 h.
2. Places - 5000-10000 people - 100 l/24 h
3. Places - 10000-25000 people - 100 l/24 h
4. Places - 25000-50000 people - 200 l/24 h
5. Places over 50,000 people - individually

Above rules are needed drinking water for household needs of the population. Apart from these general standards for water consumption of the settlement, there are norms for water consumption for different activities in different utility objects, hospitals and sanatoriums, livestock and poultry. These amounts of water along with the required amount of water for sanitary needs of workers in enterprises must be provided to the settlement. Water needs of industrial enterprises rely individually and must be met by separate industrial water supply of the settlement or from own enterprise sources. In these standards is reported and unevenness of water consumption during different seasons and during the day.

In the major capitals - Moscow, Rome, Paris, provided a day over 1000 l of water per day per person (including the one for industrial purposes).

In Bulgaria are provided with the necessary amounts of water according to the standards for public utility needs - central are water-supply cities and almost all the villages, but the needs of the industry take 40-60% of this amount, which often leads to the introduction of water-supply restrictions.

6.2. TYPES OF SOURCES - HYGIENIC CHARACTERISTICS

Differ: rainwater, groundwater and surface water (open waters).

Rainwater

They are the source of water for underground and open waters, but as a direct source of water supply for the population they are used in areas with a lack of other sources - tropical and desert regions, northern and polar regions.

Atmospheric waters are clean (provided that the air is clean), weakly mineralized, very soft, contain very little organic matter, contain no pathogens, have no good taste. Their properties affect the way the capture and storage. Usually capture facilities are developed on the roof of buildings or specially fenced separate sites. The collected water through a duct passing through the sand filter and stored in underground concrete tank, fitted with a vent pipe and a pump for removing the water. It requires periodic cleaning of drainage areas and tanks with a 3-5% solution of chlorinated lime. The water in the tank can be made more firm by placing the soft limestone.

In the Northern areas snow melts for the preparation of water. The resulting water should definitely be decontaminated (to be boiled or chlorinated) before consumption.

Groundwater

They are divided into: soil, ground and interstratified.

Soil water are hygroscopic and capillary moisture at the surface soil layer. Their amount depends on rainfall, the season, the temperature of the soil. They have great importance for agriculture, but not as a source of water supply **(Fig. 3.5)**.

Groundwater. Form after filtration through porous soil layers (water permeable are sand and gravel soils) of atmospheric precipitation or surface water sources - rivers, lakes. When the filtered water reach the first waterproof layer - rocks, clay, they form the aquifer from Ground water. The direction of its movement depends on the slope of the watertight layer. He can go in depth or to surface - obtained springs. The regime of groundwater is volatile and depends primarily on rainfall patterns. Fluctuation in the level could reach 3-4 m. Groundwater feature diverse and variable composition - more stable than surface water, but less stable than interstratified. The composition depends on the composition and properties of the water permeable layer - for example, of sand they have a small overall and bicarbonate hardness, slightly acidic, often of a high iron content. Following filtration is greatly reduced bacterial contamination of the water, but this reduction depends on the contamination of topsoil and the depth of ground water (layers of filtration). Usually coli titre them is over 300. The content of organic matter and the mineralization in surface soil layers influences the content and type of nitrogen - ammonia, nitrites, nitrates, in groundwater.

Interstratified water. They are underground waters, which are between two watertight layers. Come from groundwater, which when moving underground may be under another waterproof layer. Depending on the geological conditions of the given location can form several aquifers. If, following the slope of the watertight layers when drilling - drill a well, the water rises above the ground (water pressure), this is called artesian well (from the area - Arthez in France).

They are distinguished by the groundwater flow to the constancy of the composition and a lower and constant temperature - 5 - 12° C. They have very good organoleptic qualities. The mineral composition is constant and determined by the structure and type of soil layers. Often, however, water is a highly mineralized - by the presence of iron sulfide, etc. and can not be used as drinking water. Due to continuous filtration interstratified waters are almost no microorganisms, so they may be used without prior decontamination. However, cases are possible contamination of in interstratified water: ground water entering cracks in the upper waterproof layer; through abandoned deep mine galleries and placing them in waste water; defects in technical equipment of artesian wells and boreholes, etc. It is interstratified waters have high content of organic matter from plant origin passing through soil layers. The latter is not unfavourable sanitary indicator unless affect the organoleptic properties of water.

Interstratified water, especially under pressure, are very good sources for supply of medium and small towns as the water is fed into a natural state - without pre-cleaning and decontamination.

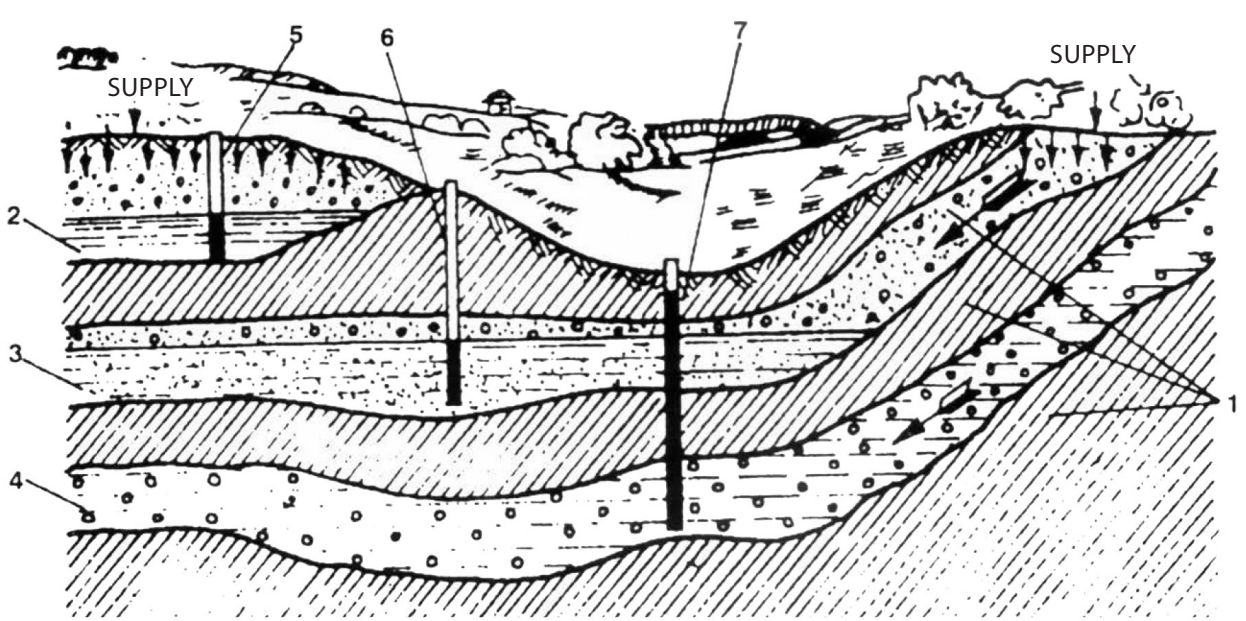


Fig. 3.5. Location of water-carriers soil horizons:
1 - waterproof layers; 2 - layer of groundwater; 3 - interstratified nonpressure water-carrier; 4 - pressure interstratified water-carrierhorizon - artesian water-carriers; 5 6.7 - pipes, reaching the three water-carriers

Springs. Groundwater can go and alone on the land surface as springs. They are low, for example on the slopes of mountains or ravines or high - in defects upper impervious layer and come up of interstratified pressurized water - artesian springs.

The water quality of the spring depends on the water quality of the aquifer, its protection of waterproof layers, of filtration duration of water leads him and his equipment for water catching. The springs are used for direct water supply (at a sufficient flow) after water catching in small settlements. Contamination is usually done in water catching. In our sources are mainly karst, causing them to water with high mineral content - with a lot of calcium, magnesium salts, sulphates, but also create conditions for contamination of surface water through the many cracks. The flow of karst springs is inconsistent and depends on precipitation and snowmelt.

Open water intakes

Surface water sources - rivers, lakes, water basins fed by both underground and directly from rainwater. Their flow is very different, characteristic is variable composition of the water as well as chemical and bacteriological. From an epidemiological point of view, they are always potentially dangerous, which is why their water can be used only after the decontamination (alone or combined with purification). The composition of the water depends on many factors: the season - the melting snow reduces the mineral composition and increases the microbial count; geological structure of the bottom and banks, for example peat layers change the colour of the water, clay layers increased turbidity; rainfall; natural processes of self-purification; confluence of other rivers; sewage etc.

Large dams and lakes with water similar in composition of fertilizing them rivers. They are, however, natural treatment ponds, which helps to better water quality.

Currently, large open water intakes are the main source of water supply of settlements due to the large and ever-increasing water consumption. Despite great opportunities for contamination in good sanitary and modern methods of purification and disinfection of water, the latter has very good qualities. It is preferable to use water supply dams in mountainous areas, away from populated areas.

Small dams can not provide water with relatively constant composition, is very easy to pollute, difficult to guard and therefore not suitable for drinking water supply to the population, but only for commercial and sport purposes.

Since water quality of underground water sources are much better and more stable than those in surface waters, in many countries, groundwater sources are used almost completely - Denmark - 100%, Belgium - 90%, the Netherlands – 75%. In Germany 52% of the population uses water from groundwater sources, and 25% - from filtering wells.

In order to increase the flow of the ground water may be used to power the surface waters (after filtration through the soil layer). Maintaining a good water quality, increases its flow, water costs 1.5 - 2 times cheaper because they do not build treatment facilities, but only those for decontamination.

6.3. SANITARY AND EPIDEMIOLOGICAL STUDY OF SOURCES

When choosing a source for water supply - local or central, always make sanitary inspection, which includes:

Sanitary-topographic survey - to examine the topography of the area; occurring near other surface water sources; sources of possible contamination of water sources - industrial sewage, fecal, liquid and solid waste cleaning facilities, use of pesticides and fertilizers for agriculture, assess and distance to audits source and topographical conditions of the area, favouring or not its pollution.

Sanitary-geological survey - explore the structure and properties of the soil; water carriers; the possibility of penetration of pollutants through wastewater in soil layers.

Flow of water sources - sources of supply; hydro-geological and climatic conditions; changes in the volume and flow during the year.

Sanitary-epidemiological investigation - is studying the incidence of the surrounding population; cases of gastrointestinal infections and their origin; biogeochemical diseases; presence of zoonotic diseases among animals; parasitic diseases and helminth infection transmitted through water, etc. The health status of the population is an indication for taking measures to protect water sources from contamination on the one hand and on the other – for possible future failures in the use of water from the water source.

Sanitary-technical inspection - if the water source is already being used or used as such, look around and consider all technical facilities - wells, pumps, reservoirs, water mains, etc., with a view to possible contamination due to poor technical condition or poor maintenance as well as the efficiency of operation of the purification and decontamination of equipment.

Water quality - in selecting the source, this is one of the most important hygiene audits as it shows: can water be used as drinking; sanitary measures

of what is needed – purification, decontamination, improve water quality; how contaminated and with what; what is the nature and extent of pollution, etc.

6.4. WATER SUPPLY SYSTEMS - TYPES, STRUCTURE, SANITARY REQUIREMENTS AND NORMS

There are two types of water supply – decentralized (local) and centralized (plumbing).

I. Local water supply

For local water supply using only ground water – wells, springs.

General requirements for the site and the technical equipment of local water sources are: the choice of location for a well, it can be a higher place; not swampy or to him running surface water; domestic sources of faecal contamination – litter, manure, garbage pits, compost, etc., are off over 30 m, if the water sources and below and 80-100 m, if the over water sources; the walls of the well or catchment to be watertight with the exception of the place from where the collected water (bottom); around the upper part of the well or catchments to prepare watertight bulkhead (site) to prevent contamination by surface water; the well or catchment to be well covered with a lid, if need be removed - for cleaning and repairs.

Draw - wells. They are most often used for local water supply. Requirements to drive them to deeper - up to 30 m, to take water from the lower water-carrier; its walls are waterproof – concrete rings cement from cement joints between them and the bottom - open, paved with stones or gravel layer; to prevent surface water spilled to suit rammed clay belt of 1 m wide and deep - 1.5 - 2 m at the top of the well, and concrete pad with a diameter of 3 - 4 m, and slope away; to be covered with dense cover; to draw water pump (if not - with a bucket, but it can only be used for well). Draw-wells are contaminated very easily. Periodically, according to a plan they should be tested, the well clean - the water is drained, the walls are washed, then the water is chlorinated (hyperhlorinated).

Tube wells. If the groundwater is located at a depth of 10 m, use so-called **tube wells with small diameter** (i.e. type Norton wells). Represent a tube with a diameter of about 10 cm, which is stuck in the soil as its lower end is pointed and close above it has openings for ingress of water. On top is placed pump and builds waterproof ground, as in the draw-wells, but with a smaller diameter. Their flow is small - up to 1 m^3/h. Often the water is cloudy, because they can not settle the sand.

If the water carrier is deeper using deep **tube wells with large diameter** (i.e. - type Brooklyn wells). Their depth reaches from 10 to 1000 m, their diameter is from 10 – 60 cm, the walls are strengthened with outer metal walls. Water is pumped by pumps with different types under pressure, the flow rate may be 100 m^3/h or more depending on the power of the pumps and the flow rate of the aqueous layer.

The water of these wells has very good qualities – are interstratified deep water layers and high capacity. It can be used for water supply of small settlements without prior purification and decontamination, of water supply enterprises, farms, etc.

Danger at deep tube wells exist only in the presence of a link between the soil and groundwater and the deep layers interstratified - most often in corrosion of the outer metal walls or leaking between the ground and drilled shaft.

II. Central water supply

Supply network of the settlements has a number of advantages. These advantages are: select source with the best water quality; water source and the facilities are secured and monitored continuously and maintain qualified; water is purified and decontaminated best; water quality is high and stable and the least risk of contamination; water is fed directly into the apartment, public institutions and thus place a much higher sanitary culture of the population, personal and public hygiene.

Central water supply consists of capital equipment and water supply net.

In central water supply from groundwater sources main facilities include: the abstraction of water sources (if the water source is an artesian - pressure tube or well of a pumping station of so-called first upturn, rising water tanks) with facilities for disinfection of water (if necessary); pumping station from so-called second boom flow of water in the pressure tank, where gravitationally through the water supply net is distributed to consumers.

In central water supply from open water sources (Fig. 3.6) the main facilities include: water intake facility open source (mostly large dam). These are the water towers with holes equipped with net allowing taking of water from different depths. It is in good filtering properties of the soil of the receiving water to be built next to it infiltration wells from which to draw water (i.e. to achieve a more economical water purification). If the water source is located high and consumers lower it by gravity water moves from the water tower through the main pipeline to the facility for treatment and decontamination - treatment plant, then also by gravity to gravity-fed

reservoirs. Them through the water supply net is distributed to consumers.

If the water source is located lower, then pumping stations include first and second boom.

Water pressure tanks are regulator for irregular use of water during the day. Especially important is the good technical condition of the water pipe from the treatment plant to the tanks (not to be allowed ingress of pollutents, since water is already disinfected) and the technical condition and cleanliness of the tanks (periodically cleared of silt and disinfected with 0.2 % solution of chlorinated lime).

In the water treatment plant water usually goes through the following stages: precipitation, coagulation, filtration and disinfection by physical and chemical methods.

The water supply net should be available in the soil to a depth below the freezing - in the country less than 1 m, and always above the sewer net - not closer than 0.5 m to it. Not permitted facilities for communication between drinking water supply and that for industrial use. Before commissioning mains disinfected ex. omitting the 2 - 3 h of water with an active chlorine content 75 - 100 mg/l or 24 h - with active chlorine content of 25 - 30 mg/l. The net is tested for strength before placing water consumers need to take water samples for testing (the net is filled with water, then included in the regular operation of the purifying facilities).

The water supply net should be determined under constant pressure. Frequent braking and release of water (water supply restrictions) can cause, consequence of so-called "water hammer", damaging the integrity of the net.

6.5. PURIFICATION AND DISINFECTION OF WATER

Purification consists in the consistent implementation of the precipitation and filtration of water in special decanters and filters. These processes are relatively slow. In sewage treatment plants, to accelerate the filtration after precipitation, applied auxiliary processes - coagulation with chemical reagents (aluminum and ferric sulfate, ferric chloride, etc.) And then filtered through a so-called rapid filters. The filtered water is clear, colorless, odorless, without eggs of helminths and decreased in about 90% of microorganisms.

In water treatment can occur and need **softening**, **iron removal** or **defluorination**. In the first case is inserted grout or used ion-exchanges filters, and in the second apply aeration. Defluorination is achieved by filtering the water through ion-exchange resins or through activated alumina, as well as by dilution with water, poor in fluorine.

Decontamination of water with increased radioactivity using ordinary means of purification - precipitation, coagulation and filtration. Methods for softening and iron removal may also remove its radioisotope of calcium, magnesium, iron and manganese. Much more complicated is the deactivation in the presence of other radioactive elements.

Desalination (refresh) of water is required in cases when you need to use water with very high saline content (ex. seawater). Removal of the salts can be achieved by distillation, freezing and subsequent thawing of the water in an electrochemical manner and ion-exchange method.

Water disinfection.

This is the safest prophylactic water to be epidemiologically safe. Apply physical or chemical methods for decontamination.

Physical methods: boiling, UV irradiation, irradiation with gamma rays, super sonication, heating with high-frequency currents. Boiling water for small amounts used in emergency and field conditions. In this method, water is boiled 3-5 min., whereby to destroy all pathogens. In over boiling water compromising its organoleptic qualities and should be left 1-2 h to cool and aerated, they are to be partly restored.

UV irradiation. It is known bactericidal action of UV rays. This method is applied in the United Arab Emirates. There are tunnels with concrete channels

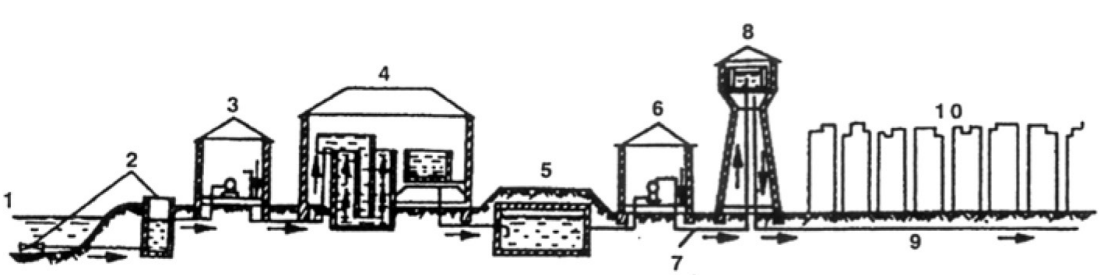


Fig. 3.6. Power supply - circuit: 1 - water supply and water intake; 2 - tank dregs to collect the water from the water source; 3 - pump (of I upswing) to move the water through treatment plants; 4 - filters and coagulators; 5 - tank purified and decontaminated water; 6 - pump (from II boom) lifting the water catchment to the towers, where moves by gravity; 9 and 10 - water net and populated areas.

support height of 30 cm. of flowing water and UV lamps located above the water. The length of the tunnel is calculated so that it enters contaminated water and in passing it decontaminated. This method is epidemiological and physiological best, but it is expensive and rare applicable.

Chemical methods. Chlorination of water/with chlorited lime and chlorine gas, and so-called katadinic and electrokatadinic methods (using oligodynamic - bactericidal, action of silver), ozone (such stations are with us in Sofia, Stara Zagora, Gabrovo), using iodine tincture, crystals of potassium permanganate, hydrogen peroxide.

The most widespread chemical method for the decontamination of water is chlorination. For large quantities of water as needed to meet the needs of the population of the cities used chlorine gas, liquefied under pressure in metal cylinders. Small amounts of water are applied chlorine products with different content of active chlorine: chloriated lime - 30-40% (should be stored in a dry, dark place); organic chloramines - 25-30%; tableted chlorine products: pantotsid, kaporit, perchlorate - 50-60%; potassium hypochlorite - 85%.

For disinfection by chlorination of the water affect the percentage of the active chlorine, pH, water temperature, the size of the dose (chlorine necessity), exposure time, etc..

For disinfection of water is spent 1-2% of the active chlorine contained in it, 98-99% for the oxidation of organic matter and certain salts in the water - so-called chlorine absorbtion of water. In natural clean water chlorine absorbtion is 1 mg/l, and in case of contaminated - 5 mg/l and more.

In order to ensure water disinfection residual chlorine in it must be 0,3-0,4 mg/l.

At local water sources - wells, reservoirs, water drain, build a mechanical filter on the bottom layer of gravel - about 10 cm., then sand, alternating until reaching a height of 1 m, cleaned the walls with a brush and chlorous lime. After filling with water hyperchlorination and allowed for 48 h. It is believed that this time is enough residual chlorine in the water to drop to 0,3-0,4 mg/l (no smell of chlorine) and it can be consumed.

6.6. SANITARY PROTECTION OF WATER SOURCES

Pollution of the water adversely affects not only the health status of the population, but also for fish-breeding, industrial water supply, irrigation of crops. Pollution of rivers in the country is significant, because annual total volume of waste water is 0.77 billion m^3 at 6.5 billion m^3 flow of rivers. However, while the volume of effluent is constant by seasons, the second - highly fluctuate. It is therefore necessary advance cleaning of the wastewater and the degree of purification to increase in parallel with the degree of increase of the amount thereof.

Depending on the use of water sources are divided into three categories:

I - water used for drinking, food industry and swimming pools.

II - for water sports, cultural needs, fisheries, livestock watering and more.

III - for irrigation and industry.

Categorization is based on water quality indicators and standards for determining the degree of contamination, according to Ordinance №7 to determine the amount of flowing surface water (SG 96/ 1986). In the Annex to the Regulation referred a total of 87 indicators and standards for them, to be met by flowing surface water, divided into five groups:

Group A - physical and inorganic chemical parameters such as temperature, organoleptika, most often in the water cations and anions and some trace elements.

Group B - norms indicators, giving evidence for the presence of organic pollutants - permanganate oxidation, chemical oxygen demand (COD), biochemical oxygen demand (BOD5) and others.

Group C - indicators and standards for inorganic substances of industrial origin such as mercury, arsenic, cadmium, lead, copper and others.

Group D - indicators and norms for organic compounds of industrial origin - phenols, detergents, petroleum products, pesticides, etc.

Group E - biological indicators, including microbial number, coli-titer, pathogens and others.

Under ordinance №12,SG 63/2002 defines the requirements to the quality of fresh surface water - the first category, which after application of appropriate treatment (a complex reference methods of treatment and decontamination) used or prospect of obtaining water for central water supply, their categorizing and conditions for measurement, sampling and determine indicators. It also specifies three additional categories - A1-A3.

Ecological law includes all European Union legislation in the field of environment, the associated countries of Central and Eastern Europe must populate and implement in their national legislation.

It consists essentially of about 70 directives and 21 regulations. Water is one of the most regulated areas of ecological legislation. In 1997 the EC Commission adopted a proposal for a Framework Directive on water quality - COM (97) 94, thereby estab-

lishing a framework for achieving the following four main policy objectives in the field of water:

1. Sufficient provision of drinking water .

2. Sufficient provision of water for other economic needs.

3. Environmental protection.

4. Preventing the negative effects of droughts and floods.

The ecological objective of the Directive is to achieve "good status" of all underground and surface water. In this connection, establishes river basin management based on an assessment of the characteristics of the basin, monitoring the status of its surface and groundwater, measures to achieve the specified water quality. The program of measures must follow a combined approach using emission standards and standards for water quality. In this context, it should be ensured full implementation of European legislation relating to emission standards, i.e.: Directive on urban waste water (91/271/EEC); Directive on integrated pollution prevention and control of pollution (96/61/EEC); Nitrates Directive (91/676/EEC); Directive on plant protection products (91/414/EEC); Dangerous substances Directive (76/464/EEC).

Furthermore must be respected and established standards for water quality under the Water Framework Directive and the relevant EU legislation in the field of water.

For sanitary protection of surface water sources, according to Ordinance №6 (SG 98/2000) to set emission standards for hazardous and harmful substances in wastewater discharged into them.

Specific event security of water sources used for drinking water are so called **sanitary zones**. They represent certain areas around the water source and the main water supply equipment, which establishes a special regime of their use in order to prevent pollution of water sources. Sanitary protection zones are developed in two zones: A - strict regime and B - restriction.

In open source.

1. Zone strict regime - A. It includes the area around the source, area of the catchment and the territory over which are the main equipment - machine stations, water treatment plants, water-lifting tanks. This territory is surrounded and strictly guarded. The area must be landscaped and improved. It authorizes the residence of service personnel. The latter is subject to periodic medical controls - especially for germ carriers and parasitifers, follow the personal hygiene, increases their health culture. This area is not allowed any other use of the waters of the receiving water, and other construction and activities beyond those associated with the water source and its facilities. This area protects against accidental or intentional contamination of the water, in which the natural processes of self-purification in practice can not occur. Usually this area is about 50-100 m below and 500-1000 m above the intake. In the zone includes a 100 m wide strip of perennial green plantations along the coast and 50 m landscaped strip around the main facilities.

2. Zone of restriction - B. This area includes the water source and its tributaries. Its size depends on the size and quality of water sources, primarily from its ability to bacterial self-cleaning. For large water sources and reservoirs zone extends up to 20-30 km upstream, at medium rivers - to 30-60 km, in small rivers - their entire catchment area. The zone extends several hundred meters - 300-500 m below the site of the catchment (if river). All these dimensions are defined specifically. In this zone or prevent or authorize the placing of municipal and industrial wastewater, but only for existing sites, after preliminary biological treatment of wastewater and bring them to a condition that meets the sanitary requirements for the release of waste water in the area. It is also prohibited within a band of 100-200 m along the lake or pond to apply natural and artificial fertilizers and pesticides. This strip must be planted. Permitted bathing, water sports, fishing, but not closer than 4 km to the intake. These activities can only be carried out at predetermined and controlled areas.

In groundwater sources

1. Zone strict regime - A. It covers all major water sources and facilities - pumping and treatment plants, pressure tanks. At the source the size of the plot depends on the topography of the area, depth and protection of the water carrier. In poorly protected water carrier radius is at least 25 m, with well protected - 15 m. Around the main facilities, build a fence at least 10 m from the walls of buildings.

2. Zone of restriction - B. It is specifically depending on hydrogeological data for the catchment area and the conditions of filtration, soil structure etc. The amount is typically above 300 - 500 m.

Terms of regime in these areas are the same as in areas where open source.

In local water sources zones of security is gone. Sanitary guards are in: properly used and well maintained technical device; sanitary inspection of water sources - topographical, geological, technical, epidemiological; control of water quality; maximum distance from the source of contamination; periodically and at indications purification and disinfection of water sources.

REFERENCES

1. **Acreman M.** Water and Ethics. Water and Ecology; World Commission on the Ethics of Scientific Knowledge and Technology. UNESCO, 2004.

2. **Cherkinskiy, S. N.** (ed.). Guide for hygiene of water supply. Medicine, Moscow, 1975, 362p. (in russ.)

3. Directive on urban waste water. 91/271/EEC.

4. Directive on nitrates from agricultural sources. 91/676/EEC.

5. Directive on hazardous substances - control emissions of hazardous and noxious substances in surface water, groundwater, coastal and territorial waters. 76/464/EEC.

6. Directive on plant protection products - pesticides. 91/414/EEC.

7. Directive on Integrated prevention and pollution control. 96/61/EEC.

8. **Hristov T. N.** Water resources - part of the ecological space of Bulgaria. Science 6.4 - 10, 1995. (in bul.)

9. **Kaloyanova, F.** (ed). Hygienic Toxicology - special part. Med. and phys., S., 1983, 249-259. (in bul.)

10. **Krasovskiy, GN et al.** Construction and analysis matematical models relation water quantity - public health. Gig. and san., 1991, 5, 11-14. (in russ.)

11. **Masironi, R.** Epidemiological studies of health effects of water from different sources. Annu. Rov. Nutr., Vol. 1, Palo Aito, Calif., 1,1981, 375-400.

12. OMS. Directives de qualite pour l'eau de boisson. Deuxieme edition, Vol. 1. Recommendations, Geneva, 1993.

13. Ordinance № 2/01.08.1989 on sanitary zones around water sources and facilities for drinking water supply. SG 68 1989 (in bul.)

14. Ordinance № 6 - SG. 98/2000 on the conditions and procedures for the discharge of industrial wastewater into the sewerage systems of the settlements. (in bul.)

15. Ordinance № 7/08.08.1986 of indicators and standards for determining the quantities of flowing surface water. SG. 96, 1986 (in bul.)

16. Ordinance № 9 - SG. 30/2001 on the quality of water intended for drinking purposes. Last amended. and supplemented. SG. 87/2007 (in bul.)

17. Ordinance № 12 - SG. 63/2002 on quality requirements for surface water intended for drinking water supply. (in bul.)

18. Proposal for a Framework Directive on water quality. COM (97) 94.

19. **Stefanov, G.** (ed.). Composition of drinking water in the country. Med. and Phys., Sofia, 1979. (in bul.)

20. **Stefanov, G.** (ed). Hygiene of settlements. Second edition. Med. and Phys., Sofia, 1985 (in bul.)

21. **Tsvetkov L.** Textbook of Hygiene, Part One; Hygiene of water, 117-199, Sofia, Med. and Phys., 1957, 611 p. (in bul.)

22. **Vodichenska, Ts.** Experimental hygienic and epidemiological studies for atherogenic effect and significance of the chemical components of drinking water (heavy metals, etc.) On the prevalence of cardiovascular diseases in Bulgaria. Doctoral. Thesis, Sofia, 1996. (in bul.)

23. Water Low - SG. 67/1999. Last amended. and supplemented. SG. 65/2006 (in bul.)

24. WHO. Nitrate and nitrite in drinking-water. WHO Press, 2007,22.

4 SOIL. ASSENISATION

Soil is the third major component of the biosphere. In its chemical composition it is a dynamic complex of mineral and organic substances that quantitative superiority of one over the other components characterize its quality. From the mineral substances contained in the soil is at most compounds of silicon, and then the compounds of aluminum, iron, calcium, potassium, phosphorus, carbon and nitrogen. Organic substances are residues of plant and animal organisms present in different stages of transformation.

One gets from the soil directly or indirectly (through flora and fauna) all necessary for life organic and inorganic nutrients. On the other hand, soil covers all waste from humans, animals and plants. By complex biochemical processes they are transformed again into mineral products that are reused by plants. Individual mineral soil as micro- and macro- elements fall through food and water in the body and affect vital creative and energetic functions.

For example, cobalt takes part in the construction of the protein of the red blood cells and nerve cells, in the synthesis of vitamins. B_{12}; molybdenum and selenium are activators of the amino acid assimilation and strontium - catalyst thermal exchange etc. A deficiency or excess of some elements in the soil can lead to geobiochemical endemic (goiter, fluorosis, caries, toxic cyanosis in infants).

In recent times it has been established and a number of other pathological conditions such as molibdenozis (known as endemic gout), lesions of the nervous system caused by the higher lead content; chondro- and osteodystrophy, known in world literature as strontium rachitis; dysfunction of the gastrointestinal tract and liver in the presence of higher levels of selenium; cardiomyopathy observed in areas with soils low in selenium, and so on.

The problem with geochemical endemic becoming more relevant importance as to natural causes affecting the chemical composition of the soil, join and artificial, such as heavy metals, mineral fertilizers and pesticides, the separation of ash from industrial and municipal facilities, waste from various industries. All this allows today to talk about the denaturation of the soil of planet, formation of so called. "cultural layer" of soil, which sometimes significantly exceed the natural thickness. The prevalence of degradation processes (erosion, acidification, salinisation and waterlogging surface) constantly and rapidly increases the areas affected in Bulgaria (degraded lands that need immediate amelioration account for over one third of the arable land in the country).

In the soil, as a huge natural laboratory, waste the lives of people, animals and plants decompose and through complex biochemical processes are reduced to humus and mineral products. This is a self-cleaning process of the soil, in which the die and the majority of pathogenic microorganisms, the eggs of the helminth, disrupted toxic substances.

With its water, heat and air regime soil affects the microclimate of settlements and housing. Soil and groundwater are important sources of water supply of the settlements. With its composition and degree of soil pollution affects water quality. Simultaneously, the soil has important epidemiological significance as those in her pathogenic microorganisms and eggs of intestinal parasites can get into water and food. Soil involved in the formation of background radiation.

1. STRUCTURE AND SOIL QUALITY. D. Tsonevski

Hygienic importance of soil is determined largely by its origin, structure and physical properties. Of these factors depend: mineralization of the organic substances; the possibility of surface water, within the soil to whack mechanically and by adsorption; the composition of soil air; food products; moist of buildings and others.

For construction and soil quality are important soil forming factors, that are more important:

- The type and composition of soil and rockformations.
- Relief of the locality.

- Climate.
- Soil organisms
- Social activity of man.

◆ **Construction of soil**

Mechanical structure of the soil. It is determined by the size of soil grains from which it is made. According to differ small and wholesale grained soils. Furthermore soils can be largestony, gravel, largesandy, clay. Construction of the soil determines its physical qualities:

- *Poriferity.*
- *Water-retention.*
- *Capillarity.*
- *Hygroscopicity.*
- *Evaporation.*

Large sandy soils, for example, retain only 20% moisture by weight, clay - 70%, and some types of peat soils are able to retain a tenfold amount of water, by weight.

Fine-grained soils are "ill" - they organic materials decompose slowly due to their weak aeration and high humidity.

Chemical composition of the soil. Driven by natural processes occurring in it of substances imported to improve soil fertility, and pollution from its industrial and household waste. In the soil contained all the elements found so far. The chemical composition of the soil is not uniform in all areas of the planet. Very often detected too large differences in the content in the soil of some important body micromacroelements, even in neighboring areas.

On the chemical composition of the soil has no less impact and modern industrialization and application of chemicals in agriculture. In Bulgaria annually imported into the soil a few hundred thousand tons of fertilizers, millions of tons of municipal waste and industrial waste. Almost all arable land in the country can be considered as potentially contaminated with pesticides and fertilizers. Many used agricultural pesticides are readily degradable (organochlorine) and persist in soil for decades.

Excessive import of fertilizers in the soil leads to a sharp increase in nitrates in food (vegetables and fruits), ground water, and with it and increase of some micronutrients such as boron and manganese. Meanwhile, some food, a decrease vitamin C and trace elements - copper, cobalt, selenium and others. According to studies made in Bulgaria for the period 1976-1990, the soil around the big industrial enterprises of ferrous and nonferrous metallurgy are intensely contaminated with heavy metals (lead, cadmium, arsenic, zinc, copper) within a radius of 5 to 10 km **(Fig. 4.1)**.

A characteristic feature of soil contamination with heavy metals is its duration, because of the great difficulty these pollutants become non toxic compounds. It was found that at higher concentrations of heavy metals in soil penetrate through the root system of the plants and accumulate in the foliage and fruits (bioaccumulation). Particularly active is cadmium, which in comparison with other elements penetrates much more easily in the vegetation barrier and accumulates in leafy vegetables, grain and meat cultures, carrots, peanuts, tobacco, lucerne. These contaminants deplete natural biological processes in soil, and some of them (strontium, cesium, organochlorine pesticides, methylmercury) by way of the biological chain reach people in relatively high concentrations as a direct toxic effect. They not only have a toxic effect, but often result in lowering reactivity of the body, until early and late genotoxic (mutagenesis, carcinogenesis, embryotoxicity, teratogenesis) and neurotoxic changes. Great danger

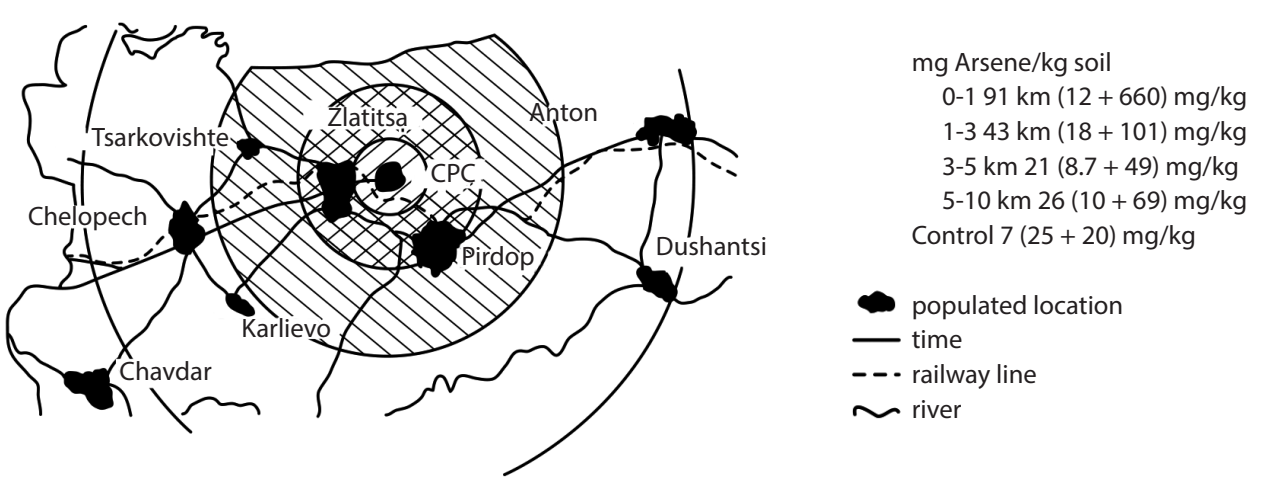


Fig. 4.1. Arsenic (mg/kg) in soil near copper production combine (CPC) - Pirdop (by F. Kaloyanova. 1985)

for the health of the population represented and soil contamination with radioactive substances having a greater half-life (^{90}Sr and ^{137}Cs). Such contamination most often occurs in the preparation of the ore (containing radionuclides) to their transportation and processing, after improper storage of spent fuel from nuclear power plants, etc.

◆ **Soil temperature**

High hygienic importance are the thermal properties of the soil. They influence the microclimate of the area and premises for habitation. Dry soil, dark in color and rich in humus is heated more quickly compared with the light and moist soil. Soil temperature shows fluctuations related with diurnal and seasonal changes in solar radiation. Diurnal changes in soil temperature in our geographical conditions reflect a depth of 1-1,5 m, and seasonal variations - up to 7-8 m, as this depth of soil temperature is lowest in May and highest in December. At a depth of 12 to 30 m temperature fluctuations are not established. Below 30 m depth of the soil temperature begins to rise an average of 1° C every 33-35 m - geothermically step, on account of the deep ground heat. In this connection, in shafts and mines at a depth of 500-600 m the air temperature can reach 40-45° C, thus creating conditions of overheating microclimate (Burgas copper mines).

In our geographical conditions rarely detected freezing temperature of the soil under 0,5 m depth. It is hygienic importance as in cold soils in winter, due to stopping the growth of microorganisms, decay and self-cleaning of the soil is slow. In permanently frozen soils corpses are preserved indefinitely and pathogen microorganisms prolong life. The thermal properties of the soil must be taken into account when determining the depth of the foundations of buildings, plumbing systems, organization of work in the mines and the need for adequate sanitary facilities.

◆ **Soil air**

In the soil penetrates air, but due to its use of soil microorganisms his composition differs from the composition of air. It contains a reduced amount of oxygen (less than 10-12%) and a significant amount of carbon dioxide (8-10%). In the coarse porous soils which contain more air, develop predominantly aerobic microorganisms that decompose organic matter rapidly to the ammonia, carbon dioxide and hydrogen sulfide.

Under the influence of oxidizing microorganisms mineralize these gases are easy, which is why such soils are favourable view of hygiene. At a reduced entry of air into the soil, where its strong pollution or insufficient porosity, to limit the development of aerobic and oxidizing microorganisms, obtained conditions for the development of anaerobic microorganisms, releasing higher levels of decay gases such as ammonia, hydrogen sulfide, indole, skatole, methane. Under certain conditions, especially in summer, due to upward movement of soil air, these gases go over the soil surface and can worsen the atmospheric composition. There are known cases of poisoning soil air in homes built within the old cemetery and landfills, and also in digging deep wells.

◆ **Microorganisms and parasites in the soil**

For hygiene assessment of soil of great importance is the presence of microorganisms in it. The number in soil is dependent on:

- amount of organic material;
- moisture;
- temperature;
- mechanical construction;
- vegetation;
- acid factors;
- microbial antagonism;
- intensity of ultraviolet radiation;
- existence of antibiosis.

Of all the environments surrounding people, the soil is richest in microorganisms. Average 1 g of soil are about 100,000 microorganism, and in highly contaminated soils their number could reach one billion. Most organisms have a depth of 10 to 15 cm, because there they are protected by the bactericidial action of ultraviolet radiation. Greater depth their number reduced and to 8 m depth almost disappeared. Soil microorganisms are characterized by certain features - high enzyme productivity, ability to sporulation, high antibiotic activity. This largely determines microbial antagonism, supporting, self-cleaning of soil pathogens. In the soil occurring saprophytic and pathogenic microorganisms.

Saprophytic soil microorganisms. They are separated into three groups:

1. Mineralization.
2. Oxidation.
3. Microorganisms involved in synthesize of humic substances in the soil.

The first two groups of saprophytic microorganisms carry out the self-cleaning of the soil.

Microorganisms from the first group involved in the mineralization of organic matter. They are aerobic and anaerobic (also sporulated and nosporulated). In the process of protein decay (ammonification) in the aerobic phase involved bacteria of the species Pseudomonas, Bacterium, also Actinomyces, and anaerobic - Cl putrificus. Cl. sporogenes, Bac. mycoides. Cellulose decay microorganisms are: Bac.

omelianski, Achromobacter, Pseudomonas, Actinomyces.

Saprophytic microorganisms carry out the second stage of conversion of organic matter (so-called. Nitrification) and are referred to as oxidation. These microorganisms are aerobic exclusively. Depending on their functions are divided into several groups:

1. Nitrification bacteria (Nitrosomonas, Nitrobacter) - oxidizing ammonia to nitrite and nitrite to nitrate.

2. Sulphate microorganisms - convert the hydrogen sulfide into sulphates.

3. Phosphate microorganisms - oxidized released of the decay of proteins phosphorus to phosphates.

4. Carbonate microorganisms - turning carbon dioxide into carbonates.

The resulting minerals are good fertilizer that can be reused by plants.

Aerobic decomposition of organic matter from hygienic point of view is more favourable - runs much faster due to increased enzyme activity of aerobic microflora, does not lead to the separation of malodorous gases (ammonia, methane, hydrogen sulfide, indole, mercaptans). That is why should always carry out activities to create aerobic decay of organic matter, taking due cultivation and dosed load the soil with organic matter.

Along with the processes of decomposition of organic substances in soil, pass and process of the synthesis, the result of which is formed the complex product humus. It is a dark, rich in organic matter mass which contains, humic acid, lignins, proteins, fatty acids, organic acids and other compounds. Thus realized the cycle of organic matter in nature.

Pathogenic microorganisms in the soil. In the soil can fall and many different types of pathogens. Pathogens fall of corpses, excreta, secretions, etc. In the soil they find favourable conditions and quickly perish. This is explained by the powerful antagonist activity of soil saprophytes microorganisms, fungi.

The most common pathogens in the soil is divided into two groups:

1. The permanent inhabiting soil. They include Cl. perfringens, Cl. tetani, Bac. septicum, Bac. antracis, various fungi and molds.

2. Temporary soil-dwelling pathogens. Which includes for the causes of intestinal infections, tuberculosis, tularemia, brucellosis, hepatitis A and poliomyelitis.

Temporary soil-dwelling pathogens retain their vitality for a few weeks or up to several months, such as the causes of intestinal infections (typhoid, dysentery, cholera), brucellosis, tularemia, plague, tuberculosis, some enteroviruses.

Much more characteristic of the soil are permanently inhabiting it sporulated pathogens stored there for years. These include agents of tetanus, botulism and gas gangrene. They are anaerobic. Domicile of Cl. tetani, Cl. perfringens, Cl. oedematiens, Cl. hystoliticum are the intestines of humans and animals, where the excreta within the soil. Here they form spores and can keep their viability to 17 years. Contamination of wounds with soil always poses a risk of dangerous infections such as gas gangrene, malignant edema and tetanus. Spores of Cl. botulinum play an important role in the epidemiology of food poisoning.

The only pathogenic aerobic spore-forming microorganism is Bac. anthracis. It falls into the soil mostly by the carcasses of dead animals from anthrax. Spores retain viability to 35 years. This requires the carcasses these animals to be buried to a depth of at least 3 m, as is covering with chlorinated lime. If you do not meet these requirements often create so-called "anthrax fields" - pastures contaminated with anthrax spores, which cause disease outbreaks among animals, and through them among the people.

Geohelminthiasis. Soil plays a role in the development and distribution of some geohelminthiasis - ascaridosis, trichinelosis, and trihocefalosis ancylostomiasis. Ancylostomiasis occurs in miners in deep mining galleries where the temperature reaches 30-40 ° C, there is a lot of water and bad sanitary regime (removal of faeces).

2. INDICATORS FOR SANITARY EVALUATION OF SOIL. D. Tsonevski

Evaluation is performed on three groups of indicators:

1. Physical.

2. Chemical.

3. Bacteriological.

Physical indicators. Of these essential are size of the soil particles, porosity, water-retention and air content. These are properties that depend on the mechanical purification of water, the development of saprophytic microorganisms, mineralization of organic matter.

Chemical indicators. Nitrogen is essential as an indicator of the total amount of mineralized and non-mineralized organic matter. The existence in the soil of ammonia, nitrites, hydrogen sulphide and nitrates judge the various stages of decay processes. Significantly important is the so-called sanitary number - the ratio of the mineralized organic nitrogen in the soil of ammonia, nitrites and nitrates to the total amount of nitrogen **(Table 4.1.)**.

Table 4.1. Indicators for sanitary assessment of soil in settlements

Characteristics of the sanitary condition of the soil	Indicators		
	coli-titer	perfringens-titer	sanitary number
Strong pollution	0,001 and less	0,0001 and less	0,7
Moderate pollution	0,01-0,001	0,001-0,0001	0,7-0,85
Low pollution	1,0 - 0,01	0,1-0,001	0,85-0.98
Clean soil	1,0 and more	0, 1 and more	0, 98 and more

Chemical indicators of primary importance are the chemical substances - pesticides, fertilizers, heavy metals, plastics etc., polluting the soil. In order to establish the dynamics of soil contamination (monitoring), identifies permanent observation points, having representation to characterize areas **(Table 4.2.)**.

Safe levels of concentrations of substances in the soil have four major quantitative indicators:

1. Translocating.
2. Migrating-water.
3. Migrating-air.
4. General sanitary.

Translocating indicator harm the ability of chemicals to pass from the surface layer of the soil through the root system of plants and to build up in their green mass and fruit.

Migrating-air indicator harm the ability of chemicals to pass from the surface layer of soil into the air, and migrating water indicator harm the ability of chemicals to pass from the surface layer of soil into surface water sources and groundwater. General sanitary - in all cases, the concentrations of toxic substances should not be higher than those that provide normal existence of soil biocenosis. Some organisms use as indicators: lichen, conifers, earthworms, terrestrial molluscs, small mammals (mountain vole), birds.

Established threshold levels of migration in plants, water and air are compared and determined a limited indicator of a pollutant. The analysis, for example, the majority of pesticides studied indicates that the limiting parameter is the translocation, i.e. migration of pesticides in plants.

Bacteriological indicators. Of these for sanitary assessment of soil most often defined microbial count - the total number of germs in 1 g of soil. The microbial count in the clean soil is in the order of a few thousand, but in contaminated soil - from hundreds of thousands to millions. Quality bacteriological analysis is limited to determining the titer of Esch. coli and the titer of Cl. perfringens. In pure soils coli-titer is in the range of more than 1 g of soil, and contaminated soils - less than 1 mg. Perfringence-titer in clean soil over 0,1 g, and in contaminated - below 0,1 mg **(Table 4.1.)**.

Increasing coli-titer serves as an indicator of self-purification of soil nospores pathogenic bacteria. Significantly matter and helmintological study of the soil.

3. ASSENISATION.
D. Tsonevski M. Sidjimov

Collection, removal, disposal and recovery of all types of waste is called assenisation. Assenisation an important sanitary and anti-epidemic, aesthetic and economic importance. The accumulation of waste within the boundaries of settlements creates anti-sanitary environment, linked to the release of toxic, foul smelling gases such as ammonia, hydrogen sulfide, indole, skatole other volatile fatty acids.

In many waste materials develop microorganisms, including pathogenic (causing intestinal infections, tuberculosis, anthrax, etc.). Infection of humans is through direct contact with the waste or pollution of these fruits, vegetables and groundwater. Pathogenic microorganisms experiencing the

Table 4.2. Standards for protective concentrations of heavy metals and metalloids in soils (defined as total content in mg/kg dry soil extraction with aqua regia)

Soil	Heavy metals and metalloids (HMM)							
	arsenic As	cadmium Cd	copper Cu	chromium Cr	nickel Ni	lead Pb	zinc Zn	mercury Hg
	Background concentrations							
Standard soil with pH (H_2O) <= 6,0	10	0,4	34	65	46	26	88	0,03
	Safety concentrations							
1. Sandy-loam and sandy soils	15	0,6	50	90	60	40	110	0.05
2. Sandy-clay	15	0,6	60	110	65	45	160	0,07
3. Loamy soil	20	1,0	70	130	70	50	180	0,08
4. Soils with high natural content of HMM	Be established, if necessary, on the basis of local background values							

often several months in waste and geohelmintes - years. Household municipal waste have indirectly epidemiological significance - as biotope for development of synantropic insects and rodents. Waste have economic importance: they derive a number of valuable secondary raw materials; can rationally be used as a natural fertilizer for the plants.

Waste of settlements are liquid and solid. Liquid waste includes rainwater, wastewater from industrial enterprises, communal sewage waters (fecal waste, waste water from kitchens, laundry, cleaning house). To solid waste include street and household garbage, industrial waste, catering establishments, institutions, human and animal corpses and others.

Purification of the settlements there are two systems:

1. Removal.

2. Sewage.

For solid waste transportation system is unique, and for liquid waste apply both systems, depending on the conditions. In some countries, sewage is used also as a receiver for solid organic waste liable to organic decomposition.

The correct organization of assenisation matter of the quantity, depending on population size, liquid and solid waste. Under rules developed in many countries the amount of solid waste is defined on average between 400 and 600 kg per person. To this amount is added and 12-16 kg waste per m^2 of streets, squares and other public places for years. Liquid waste in channeled public places is estimated to be 80% of the submitted water by the central water supply, and at nochanneled settlements liquid waste determine average of 4-6 m^3 per person per year **(Table 4.3.)**.

Table 4.3. Average amount of emitted solid and liquid waste

Type of waste	Unit	Mass kg	Volume m^3
Waste channeled housing	per capita per year	200	0,5
Waste nochanneled housing	per capita per year	200	0,25
Outdoor trash	1000 m^2/year.	10 000	12,0
Waste from catering establishments	a dish	0, 065	—
Waste from markets and squares	per m^2/weekly	0, 03	—
Waste of permeable septic tanks in homes without plumbing	per capita per year	1000	1,0
Waste imperneable septic tanks in homes without plumbing	per capita per year	4400	4,4

3.1. REMOVAL SYSTEM

Each assenisation system there are three stages:

1. Stage of collection.

2. Stage of removal.

3. Stage of disposal.

Collection of waste in the transportation system is accomplished by reception facilities for solid and liquid waste, as different types of toilets, cesspools, septic tanks, containers, garbage containers with tight lids.

Removal of solid and liquid waste is carried out with assenisation transport, and disposal of waste in the transportation system becomes different ways.

Waste collection. Hygienic collecting of liquid waste, matter proper placement of latrines and cesspools.

To latrines, regardless of their type and device are brought following requirements:

- The underground part of the latrine (bog) must be arranged so as not to pollute groundwater.
- Overhead part of the construction of latrine should be built so that they do not have access pets and sinatropic insects, and the floor is made of materials that can be easily cleaned and disinfected.
- From the toilet room should not be released foul-smelling, toxic gases. To not penetrate, the gases are discharged to the exhaust pipe above the roof. In channeled settlements best type of hygienic view are latrines arranged with facilities for washing water in the buildings themselves (WC).

In the absence of a central water supply and sanitation latrines were built in the yard, the size of the bog must correspond to the number of users latrine. Its walls must be coated with waterproof materials such as cement, stones or rammed clay, walls of the cabin should not have cracks, the door closes well ,vents to darning. To ensure biological self-cleaning of fecal waste pits recommended be arranged as septic tanks with two or three sections **(Fig. 4.2)**.

Desodoration of latrines (pits) is best achieved simply by using absorbent materials - coal dust, dry soil, ash. They reduce the rate of decay, retain gases, facilitate their mineralization.

For deodorisation and disinfection of latrines solutions of chlorinated lime (10-15%), lysol (3-5%), potassium permanganate (1-5%), and others.

For communal water nochanneled settlements with local water must be arranged with cesspools watertight. And here it is recommended cesspools to build a type of septic tanks with sections **(Fig. 4.2).**

Wastewater from septic tanks go almost clarified, reduced organic matter and can be discharged into nearby ponds or drainage system to be used in the backyard garden to increase soil moisture and fertilizer.

Hospital wastewater before discharge into sewers or waterways after septic pit, must be subjected to disinfection by chlorination with bleach - 60-100 mg active chlorine/l.

Solid waste from homes is collected in special containers with a volume of 15-20 l, covered with lids. Household waste must be removed once or twice a day in the street or yard waste containers. In modern cities most solid waste is collected and stored in plastic bags and containers that are transported daily from transport for disposal and recovery. This method creates an opportunity for presorting of kitchen waste, paper, glass, metal, plastics.

Waste removal. The second stage of assenisation is the waste removal. For liquid waste the most suitable pneumatic tankers, where using a pump and hose they withdraw from cesspools. Solid waste is also used special transport collect household plastic bags or empty (collect) containers.

Sites, where stored street and yard waste containers, must be cemented (asphalt), well fenced and if possible - covered.

Waste disposal. This involves the use of physical, chemical and biological methods. Through them largely achieves the destruction of pathogenic microorganisms, eggs bio- and geohelminthes and flies, and furthermore accelerates the digestion of organic matter.

1. Physical methods.

Assenisationic fields. The best method of disposal of liquid waste is soil by so called assenisationic fields. Assenisationic territory of the field is selected a distance of at least 1000 m from the settlement and water sources are divided into sections and is surrounded by earth mound and green plantations. Liquid waste subsequently flooded of sections on the field and then plow. As a result, self-cleaning organic matter is mineralized and the first two years after flooding the terrain can be used for planting industrial crops, and after the third year can be grown and other farm crops.

- *Incineration.*

Solid waste is disposed of by burning in incinerators or plants with the help of chemicals or biological methods.

The burning of solid waste has undeniable hygiene, epidemiological and economic advantages:

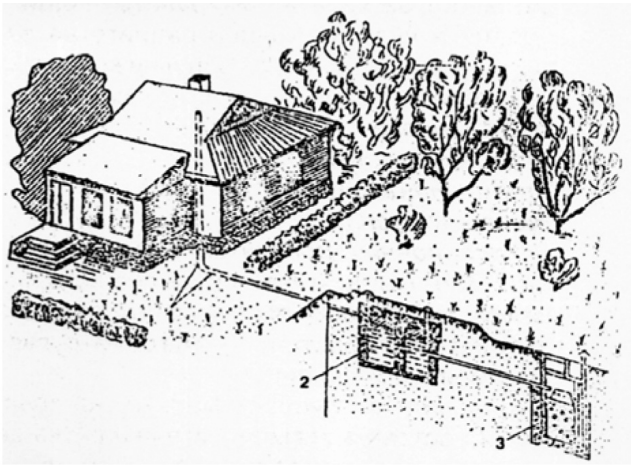


Fig. 4.2. Residential sewage wastewater septic tank and filter well (scheme):
1 - channel and vent; 2 - septic tank; 3 - filter absorb well.

- disposal proceeds radically and quickly;
- shortening transport, eliminating the need for disposal of garbage away from settlements;
- not necessary earthworks significant sections;
- slag produced during combustion, steam and heat can be used. Burning of solid waste can be registered under the following conditions:
- big cities with over 500,000 inhabitants, where it is difficult to set aside large areas for composting and landfill and where the transportation of garbage long distances;
- in resort areas where the border areas normally used for remedial purposes and the problem of waste disposal requires a temporary solution:
- in big hospitals, sanatoriums and veterinary offices where the waste most often are high epidemiological dangerous. The waste for incineration should be dry, with humidity not higher than 45-50% and an ash content of up to 45%, and the heat must not be lower than 700-800 kcal (2,929-3,347 kJ/kg). In this connection, communal household waste should not be mixed with street dust and slag from coal. In modern specialized incinerators for solid waste combustion temperature reaches 1000-1350° C. At this temperature even waste wards with high humidity completely burned without polluting the air.

In waste incineration in large factories, released heat can be used, for laundries, bathrooms, for obtaining electricity, etc.

In plasma waste treatment, chemical substances contained in them decay of atoms, ions and electrons. As a result of this process was a black colored vitreous melt. Plasma technology combustion proceeds at 4000-6000 ˚C, despite the high temperatures are separated, albeit in small quantities gas

- hydrogen chloride, nitrogen and sulfur oxides, dioxins, furans, solid particles **(Fig. 4.3.)**.

Of all the methods for high temperature treatment of disposal, plasma treatment is the fastest and most disruptive to protect human health and the environment clean.

The prevalence of the method is currently hindered by its high cost.

1. Chemical Methods. They are not suitable for the disposal of solid waste.

2. Biological methods. In practice largest use are natural and advanced biological methods, by simply using the so-called organized landfills, compost piles, various biotermical cameras.

Organized dumps most often selected barren terrain with deep groundwater located at least 1000 m away from the settlements. To prevent unauthorized persons and animals in them are enclosed landfill. In order to provide more rapid disposal, waste is laid out at a thickness of 30 cm and cover in daily with such a layer of soil. Under these conditions, the organic matter in the summer mineralized 2-3 months.



Fig. 4.3. System for plasma waste treatment.

Model for predicting health risks from landfills for municipal solid waste (MSW).

In conducting health-ecological studies on the possible impact of landfills for solid waste on the health of the population is necessary to identify opportunities for migration of chemical substances, eg. heavy metals into groundwater. By using a laboratory model for migration "soil-groundwater" for heavy metals by recreating the conditions of a landfill for MSW and implementing a dynamic statistical analysis is drawn pattern of migration of heavy metals from the soil surface in depth, depending on the time **(Fig . 4.4)**.

Composting of solid waste is a practical method at their disposal, which can be widely applied in rural settlements. Composting is carried out on a specially prepared for this purpose site on impervious terrain (cemented or rammed clay). On-site spread loose soil, leaves, straw or other porous material, thick about 10-15 cm, and on this layer daily spread separated household waste, as their thickness should not exceed 10-15 cm. Immediately after discharge, they were coated with a new layer of porous material until the stack reaches a width of 2-3 m and a height of 1-1,5 m. Because the pile easy going air, the decay of organic matter is aerobically thermophilic and quickly. After 10-20 days the temperature in the interior of the pile reaches 65-70°C., to estab-

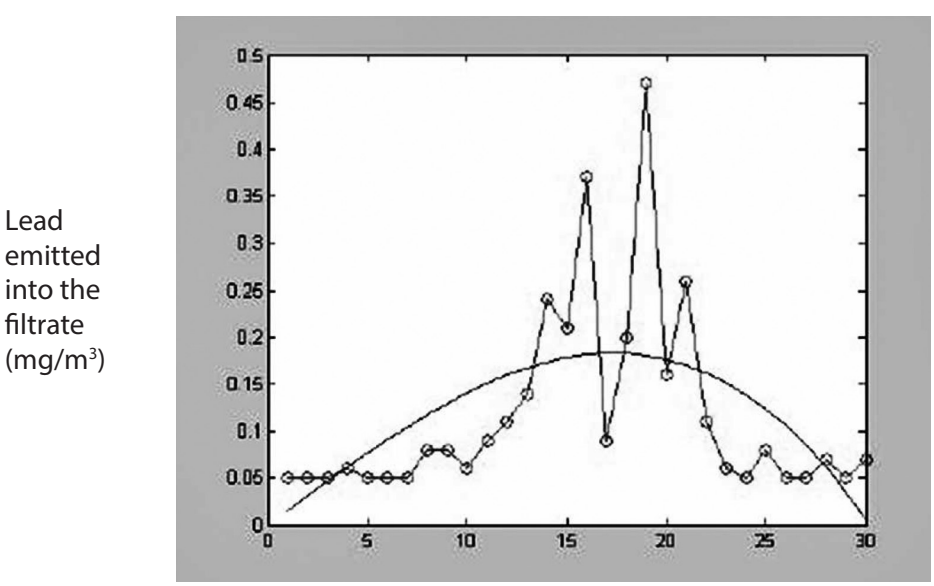


Fig. 4.4. Approaching curve regression model for the migration of lead from soil into groundwater. Initial concentration of lead in the pattern 2xTLV (160 mg/kg).

lish thermal destruction of pathogenic microorganisms and helminth eggs. Usually under these conditions decay ends for 4-5 months and defuse mass can be used as valuable fertilizer.

Biotermic method involves the use of large biotermic chambers, with a capacity of 50 to 300 m^3, the bottom of which is constructed with lattice apertures, through which the chambers are emptied. The method has a great advantage, since the decay is faster and thermophilic - the temperature rose to 72-75°C, and mineralization is completed in 35-65 days, depending on the type of waste and the temperature of the ambient air. The method is expensive and is rarely used.

Mechanical biological treatment (MBT) technical approaches to composting of mixed waste. Fractions such as plastic, paper, cardboard and textiles are first separated by sieving and manual sorting and rich with organic matter fraction and inert materials are sent for biological treatment, or composting or fermentation. After this treatment, the biological activity is reduced to 5% of that of the starting material and can be deposited without any nearly any further adverse effect. The advantages of MBT is the opportunity to apply for a not very large amounts of waste - from 30,000 to 50,000 t/yr., or areas with a population of around 150,000 inhabitants. This system is very flexible allowing for recovery of untreated waste fraction by recovery of materials (manual sorting) or energy recovery.

Combine the advantages of the incineration of waste, yielding energy recovery with the biodegradation of the constituents, having a low calorific value because of its high water content or are inert.

In such a combined approach of three different phases of the treatment can be implemented in different locations. It is possible mechanical treatment (splitting, sorting) to become close to the city where generated waste, and biological treatment in the vicinity of the landfill where waste will be received after being treated. Burning fraction with high calorific value can be done elsewhere, where the appropriate incineration.

Widely used in villages is called. primitive soil method. The waste is disposed of in pits at home and away from local sources of the plot and periodically covered with dust.

3.2. SEWAGE SYSTEM

It is used primarily to remove liquid waste from the settlements.

The sewage system has a great hygienic and epidemiological importance.

1. In all places where sanitation suits, the incidence of infectious diseases markedly decreased.

2. A prerequisite for spending larger amounts of water for personal and public hygiene.

3. Allows for quick disposal.

4. Once built, the sewage system is economical to maintain.

To the elements of the sewerage system concern:

- *Collection facilities - toilets, baths, sinks and more.*
- *Facilities for the removal of liquid waste - the net of sewage pipes.*

Methods of treatment and disposal of sewage. There are three types: mechanical, chemical, biological.

1. Mechanical methods. These include the methods by which the water is purified using gratings, screens, grit chambers, grease-, oil-, and petrol catchers, settling ponds and others.

Settling ponds are essential equipment for mechanical wastewater treatment. They are horizontal and vertical, also called Emshers wells. Primary settling tanks are designed for precipitation of water passed through the rough mechanical treatment of screens, sieves, sand catchers. In secondary precipitation is carried out of the water after artificial biological treatment, i.e. passed through biofilters and aeration tanks (aerotanks).

2. Chemical methods. The chemical method of sewage treatment applied rarely. Through it releases about 85% of the insoluble and about 25% of soluble substances in the effluent. The essence of the method consists in the introduction of coagulants, which enter into chemical reactions in the water substances and contribute to their separation and rapid sedimentation. After coagulation water stays around for 24 h in contact basin, then placed in the appropriate reservoir or used for irrigation. Are many diverse chemical methods for purifying industrial effluents (containing alkalis, acids, heavy metals, etc.).

3. Biological methods. Purification of effluents apply:

- *Primitive and improved soil methods* - assenisationic fields.
- *Biological filters.*
- *Setlements treatment plants.*
- *Small sewage.*

Biological filters are facilities which operate in the same way as natural soil, but therein the biological decomposition of organic matter is carried out for 8-10 h. They are constructed as concrete tanks equipped with a perforated double bottom, which is charged on the coarse filter mater (coal or cinder).

Treated wastewater from the biofilter are almost totally free of organic matter, pathogens and hel-

minth eggs. A major disadvantage is that it can be treated relatively small amounts of sewage.

Urban sewage treatment plants are expensive and complex equipment. They include facilities for mechanical, chemical and biological wastewater treatment.

Especially complicated biological treatment facilities, which include aerotanks, biofilters, aerofiltri.

Aerotanks (aeration tanks) are concrete channels 1-4 m deep, 1-2 m wide and long few tens of meters, in which the water flows at a rate providing a residence therein from 6 to 8 h. To accelerate the biodegradation takes place in aerotanks abundant aeration, by placing air upwards by means of pipes located on the bottom of the aerotank and adding the so-called active sludge of secondary settling tanks or other operating aerotank.

In small towns, where there is a central water supply and no common sewerage, the so-called small drainage suits **(Fig. 4.2)**.

It may dispose of liquid waste from individual houses, hospitals, schools or groups of public buildings or residential homes with a capacity of wastewater to 1 -3 m^3 per day. The distance between the filtration absorbs wells and housing should be about 10-20 m, and between them and wells for drinking water - from 30 to 100 m.

REFERENCES

1. **Bojinov, T.** Ecology and Management. Sofia, 1989. (in bul.)

2. **Chaniett, E.T.** Solid Wastes Management and Rodent Control. Maxcy-Rosenau. Preventive Medicine and Public Health ed.E. Sartwell, 1975, p. 1151-1160.

3. Council Directive 1999 (31) EC, 26.04.1999, on the Landfill of Waste, EU Official Journal 182, 16.07.1999, p.1-19.

4. **Grisham, J.W.** Health aspect of the Disposal of Waste Chemicals. Pergamon Press, 1986.

5. **Kaloyanova, F., K. Basmadjieva, M. Popov et al.** Ecology and Health. Sofia, "Med. and Phys.", 1985, by 67-78. (in bul.)

6. **Kupchik, G.J.** Solid Waste Management the Metropoliten View. Amer. J. Public. Health, 1986, 61, 359, 197.

7. **La Dou, J.** Occupational medicine. Environmental Health - Hazardous Waste Management, Lange. Norwalk, Connecticut, San Mateo, California, 1990, p. 526-533.

8. **Marzeev, A., C. Zhabotinskiy.** Communal hygiene. Moscow, "Medicine", 1979. (in russ.)

9. **Mikhailov W. L. Raikov, P. Petrov, V. Grozdanova.** Annual Status of the environment of the Republic of Bulgaria, 1989. Sofia, 1991. (in bul.)

10. **Pokrovsky V.A. Hygiene.** Hygiene of soil and assenisation of setlements, 124-155, Moscow, Medicine, III ed., 1980.495. (in russ.)

11. Regulation 3/2004 for the classification of waste, SG 44/2004 (in bul.)

12. Regulation 3/2008, of standards of acceptable content of harmful substances in the soil, SG 71/2008 (in bul.)

13. **Sidjimov M.A.** Hygiene study the impact of the landfill for municipal solid waste on the health of local residents, Dissertation, Sofia, 2005.160 p. (in bul.)

14. **Sidjimov M.** Methodology for Health - ecological Risk Assessment of a Municipal Landfill Sofia City, Bulgaria. Proced of VI Int. Symp. Of Env. Contam in Central and Eastern Europe, Prage, 2003, CDROM, Ind 095.

J. Staykova, Vl. Boyadzhiev, M. Lyapin

5 ENVIRONMENTAL POLLUTION IN INDUSTRIAL REGIONS IN BULGARIA

1. THE CHEMICAL INDUSTRY, CONSTRUCTION, ENERGETICS. Vl. Boyadzhiev, M. Lyapin

In major industrial region in northeastern Bulgaria, situated on an area of about 120,000 km^2 are concentrated enterprises of heavy chemical industry, cement production, construction and energetics. Water and road transport are additional sources of air pollution in the region.

1.1. ATMOSPHERIC POLLUTION

Degree of pollution depends not only on emission levels, but the nature of their dispersion in the atmosphere and the conditions for its self-purification. Important is the role of climatic and meteorological characteristics of the spread of pollutants.

1.1.1. CLIMATE

The climate in the region is considered moderate-continental. The region is lowland in direction west - east with a length of 20-25 km, with the surrounding slopes to 200-250 m, open only to the east of the Black Sea, which facilitates the penetration of maritime climatic influence. The topograph characteristics largely determined as weather conditions and the spread of pollutants. The influence of the Black Sea results in a mild climate (relatively mild winter, cool in summer, warm autumn), in a high relative humidity and the typical breeze circulation, particularly well expressed in the summer. Specific valley topography predisposes the occurrence of frequent inversions and fog due to the presence of polluting sources.

The amplitude of **air temperatures** in the annual allocation is 20,7° C, indicating softened continental climate. The highest temperature measured during the period of observation was 39° C, and the lowest - minus 11° C. There is evidence of the development of temperature inversions, which limits abrupt vertical exchange to the troposphere and the concentration of contaminants in the surface layer is greater.

The annual average **relative humidity** in the region is 77%, with a maximum of about 81% in winter and a minimum of about 70%. Sea provides opportunities for hydration of the pollutants with the formation of new toxic compounds.

The relatively high incidence of calm or low wind speed and the existence of large sources of air pollution in the region justify a relatively high average number of **foggy** days - about 37. Typical of the area phenomenon is the existence of photochemical smog.

The annual **rainfall** in the region are relatively small - the average annual rainfall is less than the national average, which hinders the natural air purification. Relatively more frequent droughts, especially in summer and autumn under weak winds create conditions for ground-level inversion and increasing the concentration of pollutants. The seasonal distribution of precipitation is with the autumn-winter maximum.

The average annual distribution of wind direction and incidence of quiet time (no wind) are shown in **Fig. 5.1.**

The biggest repeatability of wind from the north - northwest, and the smallest - from the south and southwest.

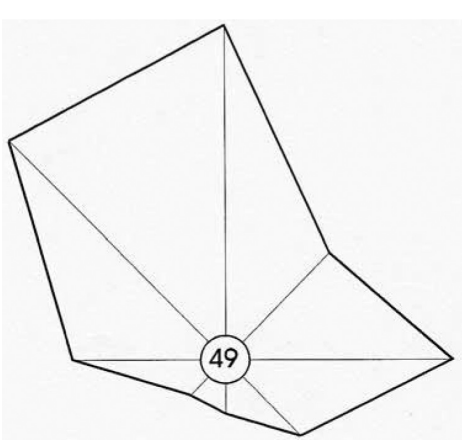


Fig. 5.1.

The breeze circulation phenomenon is typical for the region. Breeze helps repeated passage and accumulation of pollutants in the coastal region. In the days of breeze there was no characteristic for flat area lunch decreasing concentrations of pollutants in the surface layer of the atmosphere, and in the afternoon retain higher concentrations such as establishing and higher average daily concentrations.

The average annual incidence of quiet time (no wind) is relatively high 53.8%. So strong is the possibility of forming a "stagnant" areas and concentration of pollutants in the surface layer of air near their disposal.

The main climatic and meteorological factors favouring the accumulation of atmospheric pollutants and reduce the purifying capacity of the atmosphere in the area under consideration are:

- high frequency of days with calm weather or with weak winds;
- considerable number of foggy days;
- formation of ground temperature inversions;
- adverse seasonal distribution of rainfall during the cold and warm half (to the amount of rainfall during the cold season to warm this in less than 1.0).

Climatic and meteorological factors in the region are relatively nofavourable for self-purification of the atmosphere and scattering of atmospheric pollutants during the warm half-year and relatively favourable in the cold.

1.1.2. EMISSION AND SOURCES

Main part of the production facilities of industrial enterprises in the region have been built in the period 1974-1977 year. Given the increasing requirements for environmental protection and to ensure safe and healthy working conditions, significant investments are needed for renovation of technological capacities and improvement of technological processes.

Industrial enterprises in the region emit into the air following major air pollutants: organic and inorganic dust (ash, calcium oxide, calcium carbonate, slack, fertilizer, cement, etc.), soot, sulfur, nitrogen and carbon oxides, hydrogen sulfide, hydrogen fluoride, ammonia, chlorine, hydrogen chloride, volatile organic compounds, lead aerosols, aerosols of acids and bases, phosphogypsum and others. Moreover, the population of the region is exposed to the air pollutants (dust - coal and ash, soot, sulfur dioxide, nitrogen oxides and carbon monoxide), the source of which is located **outside the area**, but the impact on air quality.

Apart from large enterprises do air pollutants and intense road and rail from construction sites and insufficient urbanized residential areas, as well as communal and domestic heating. The reason for the high levels of dust is also a low level of public utilities, as well as uncleaned street network.

In the 70^s of the last century sources of air pollution unless major industrial enterprises were coal electric centrals (TPP), serving industrial complex. Due to the burning of low-grade (highsulfur) coal and to bad mode of operation of the outbreaks and smoke purging devices are a powerful source of contamination of ash, soot and sulfur dioxide. Were studied hygienic- ecological and economic aspects of various technical and technological measures to reduce emissions of harmful substances and in particular of sulfur dioxide into the air.

It is believed that a reduction of concentrations of sulfur dioxide in the air can be achieved by increasing the height of the chimneys of thermal power plants (TPP). Disposal of waste gases through tall chimneys allows the diffusion of sulfur dioxide in the upper atmosphere, but not conducive to the prevention of pollution at all, since the period of distraction for SO_2 is approximately five days. For this period it is absorbed by the Earth's surface, vegetation, dissolved in water, is oxidized in the atmosphere under the influence of ozone, oxygen and ultraviolet radiation and oxidation products of sulfur dioxide have more adverse health effects. Both chimney of central (TPP) serving the area under consideration are high 180 m. with an internal diameter of 5 m.

For the period 1974-1977, the extensive research conducted, generally not been established excessive levels of SO_2 in the region with the exception of the spring period in 1977, when it registered several times up to 17.5 times exceeded the norms in case of unfavourable weather conditions . Measured in this study the mean maximum concentration of SO_2 that are 0.433 mg/m^3 at work on all boilers at the rate of 0.5 mg/m^3. When operating the boiler gas, the mean maximum concentration is 0.153 mg/m^3. Increasing concentrations of ground is unlikely to be due to the work of heating due to the adjusted mode and that most of the boilers are working on gas. Suspected source of excess concentrations of SO_2 in the ground layer of air is sulfuric production at the plant for mineral fertilizers.

Main discussed approaches to limit SO_2 emissions were desulphurization of solid and liquid fuels and smoke gases desulphurisation. Desulphurisation discussed methods are divided into two main groups:

1. Methods in which the resulting end products are not used, but can contaminate soil if it is not stored

and handled properly - i.e. "throw-away" processes;

2. Methods in which is prepared a valuable final product, liquid SO_2, sulfuric acid or sulfur electrolytic - ie. "recovery" processes.

In a comparative analysis of the methods used, it is clear that the capital and operational costs are the methods of the group "throw-away". Regenerative methods require a lot of capital investment and operating costs are high. Moreover, utilization of the final product reduces these costs no more than 10-20%. When choosing a method for sulfur purging must take into account the specific natural, agricultural and economic circumstances of each country.

At the beginning of the XXI century in connection with the EU began implementing a program to achieve the emission limit values. For this purpose in recent years they have installed two new high effective electro filters. After repairs are carried settings fuel-air mode of steam generators to optimize the combustion process. In recent years, as the main fuel is coal, so burning natural gas steam generators are used only in cases of accidents with coal-fired steam generators. Fuel oil (mazut- high sulfur content) is used only in limited quantities as burning fuel.

1.1.3. MAJOR AIR POLLUTANTS

Powder

Major sources of dust pollution from point sources are: Central (38.5%), cement plant (35.1%, the powder here is characterized by a high dispersion), fertilizer plants (22.9%) and plant for sodas (emitted dust is mainly sodium carbonate and calcium oxide).

It is estimated that fugitive emissions are over six times more than the organized exhaust ones. Annual fugitive emissions of dust orientation can evaluate total of about 11 170 t/a, as 68.3% of them are emitted from the cement plant and the plant for sodas and fertilizer plant have almost equal share, respectively 14.8% and 13.4%.

TPP fugitive emissions from loading - unloading activities, transportation and storage of coal, as well as secondary emissions from contaminated with coal dust and ash sites. According to expert assessment of the annual fugitive emissions can now be estimated at around 380 t/a. When the activity of the soda plant fugitive dust sources are at loading and loading - unloading devices, for transport devices, for packaging, storage, and dispatch.

Nitrogen oxides

Biggest organized emissions of nitrogen oxides from cement factory and Central - more than 95% of the annual amount. In recent years, is not counted exceeded health standards. Fugitive emissions of nitrogen oxides are insignificant.

Ammonia

The main source of ammonia emissions into the air is the fertilizer plant (about 88.6%) and to a lesser extent - the plant for sodas. Overall, for both enterprises annual concentrations are well below health standards. Fugitive emissions at both plants are local, short and small in value. Only in the process of the offgassing of the installations which lasts 15-20 min, to give the release directly into the atmosphere. Ammonia emissions marked a sustained decline compared to previous periods and maintain values around and below TLV.

Carbon monoxide

Main emitters of carbon monoxide are factory for sodas (67.2%) and Central (25.2%). The emission concentrations of CO emissions from point sources, are within acceptable limits.

Sulphur oxides/Sulphur dioxide

Main sources of organized sulfur dioxide emissions are heating (68.2% of total) and cement plant - 30.4%. After 1999 the emissions are within acceptable limits.

Emissions of **chlorine and fluorine** compounds in small amounts discharged by a chemical plant and a fertilizer plant. In recent years, a tendency to reduce the emission concentrations of chlorine and hydrogen chloride, but there are still exceeding the standards. Data from the measurements indicate that the emission concentrations of fluorides (such as HF) were the norm. Fugitive release of hydrogen fluoride is negligible.

Total hydrocarbons

Main source is the chemical plant. Periodic measurements show constant high concentration issue. However, its variance is within the local area and ground concentration is much below the standards for the most toxic hydrocarbons.

1.2. WATER POLLUTION

Rivers are polluted by brine production of chlorides and oil products. Data from laboratory studies indicate exceeding the standards for dissolved solids for the third category water about 8 times. Fivefold higher the concentrations of nitrite nitrogen, 15 times elevated levels of chloride ions and chlorine, eight times - the total hardness. Elevated concentrations are ammonium nitrogen and sulfate ions.

In the channels in the region concentrations of ammonium nitrogen were over 49 times above the norm for the third category water, of dissolved substances - 33 times more than the norm, of chloride ions - 61 times above the norm.

The characteristics of the relief help to intensive infiltration of surface polluted waters. It is possible contamination of sources of drinking water.

1.3. SOIL POLLUTION

Natural soil cover is represented by black earth, sediments, luvisols, peat, gleevi, salty, anthropogenic soil types. There have been marshes that occur in intensive snowmelt and autumn rainfalls.

Mechanical soil disturbances associated with the construction of dumps, the accumulation of construction and industrial waste. As a result of the contaminants from the cement and soda plant is detected accumulation of calcium and magnesium in the surface layers of the soil, thereby increasing the pH value. Most actively affected lands to 1800 m away from the source of contamination. The liquid waste contain salts of the alkali and alkaline-earth metals. Solid waste (tailings, sludge, TPP ash, pyrite butts, phosphogypsum, pyrite and sulfur residues, etc.) containing silicon, iron, aluminum and heavy metals (lead, copper, zinc, mercury) and arsenic.

Observe and salinity and alkalinity of soils contaminated by industrial waste water. The total area of moderately and heavily eroded soils is 7% of the land.

It was found that soil located at a distance of 20 km from the plant are outside the scope of industrial emissions. At a distance of about 3 km from active sources of contamination observed accelerated development of degradation processes and the formation of soil profile with industrial genesis.

1.4. ADVERSE HEALTH EFFECTS OF EXPOSED POPULATION

When conducted in the 70^s of the last century study of the health effects of air pollution in the region focuses on the study of physical development and health status of students. By anthropometric indexes decrease from the norms of the country established for vital capacity, more pronounced in boys than 9 years old. Lag is in terms of height, and chest, but negligible in terms of weight, in puberty.

Current morbidity in students was increased for chronic rhinitis, hypertrophy of the tonsils and adenoids. Significantly higher is the frequency of dermatoses. No changes in hematology.

More recent data on the structure of morbidity of the population (2002 - 2003 year) show higher than the national average incidence of respiratory and musculoskeletal system. The structure of causes of death in the foreground are cardiovascular diseases (between 55 and 67% of all deaths) and malignant neoplasms (between 11.5 and 24%). Mortality due to injuries, poisoning and accidents in most years of period 1990 - 1999 was was higher than the national average.

The working environment is also a health risk to employees. The main risk factors are associated with adverse working conditions, air pollution with various chemicals, high levels of production dust, noise and vibration, overheating microclimate.

Necessary **preventive measures** primarily include reducing emissions from sources. As an example may indicate the measures taken to reduce emissions of dust and ammonia of a soda plant: significant investment in treatment facilities, modernization of technology and computerized management and control of technological processes, installation of dust collecting systems to packaging machines and vibro-sieves , process control and on the operation of purging facilities, building a system for environmental management and others.

This includes measures in sites and areas such as gasification of public buildings; replacement/rehabilitation of the public transport fleet; landscaping and development of vacant land and others.

2. METALLURGICAL INDUSTRY. J. STAYKOVA

Problems related to environmental pollution caused by anthropogenic activity of man, are especially significant in the world.

In international practice officially recognized term "disease associated with the environment" (environmental disease). It notes any disease arising direct or indirect, wholly or partially as a result of the impact of the environment on human. In an effort to define the problem, the World Health Organization (WHO) states: "Environment - Health" covers those aspects of human health, including quality of life, defined by physical, chemical, biological, social and psychosocial environmental factors . It also refers to the theory and practice of evaluation, adjustment, control and prevention of these factors in the environment that could potentially harm the health of present and future generations. " Modern study of the state of the environment includes research of its main components: air, water, soil and food, and the impact of pollutants on human health.

The industrial area is located in southern Bulgaria in the Eastern Rhodopes (Kardzali)) **(Fig. 5.2)**.

The climate is in continental-mediterranean climatic region mountain influence. Winter is moist and soft, and the summer is hot and dry. **Rainfall** (average annual amount for the 50-year period, 663 mm), mainly from rain are below the national aver-

age, with a maximum of 197 mm in winter and minimum in summer - 143 mm. Snow cover lasts about 24 days. Rainfall is a major statement of revenue in the balance of surface and groundwater. The region is characterized by poor northern, northwestern and southern winds. In most seasons prevailing north winds, and in the spring - south.

Geology of the terrain in the area is composed of paleogenic sediment, volcanodezimentic and volcanic rocks and sediments of Quaternary. The region is poor, agricultural, with a focus mainly on development of tobacco-growing.

The main sources of pollution in the region are: **Plant for the extraction and processing of lead-zinc and gold ore** underground. In the processing of lead-zinc ore tailings sand is formed. Besides its main ingredients, sand contains heavy metals - lead, zinc, cadmium, manganese.

Lead and Zinc Complex (LZC) is in operation zinc and sulfuric acid. Is later started production of lead, zinc sulfate, bismuth, lead varnish, lead minimum lead-antimony alloys, sodium bisulfite, and lead-tin solder.

Factory for processing of bentonite, perlite and zeolite.

The results of the study pollution of the 4 main components of the region's environment (air, water, soil, food) with heavy metals and specific for ambient air particulates, sulfur dioxide and sulfur acid aerosols to 16-year period (1990- 2006) have shown:

2.1. ATMOSPHERIC AIR

Prevalence of atmospheric pollution is determined by the prevailing winds in the area. Long-standing record shows that the main directions are mostly north-northwest, south and quiet time. Northwest and south winds are a prerequisite for the transfer of air pollution from the southern and eastern industrial areas.

The main sources of pollution and atmospheric monitoring stations are indicated in **Fig. 5.2**.

Sources of air pollution are energy, road transport, domestic and local sources.

According to the period 1995-2002 for **dust** emissions from the production of bentonite, perlite and zeolite are more than the emission limit value (TLV). Control measurements in Lead production and work shop "Sulphuric acid" of LZC show that emissions of dust in lead production over TLVs in 1997, 2000 and 2001. Emissions of **lead** are above the TLV in 2000 and 2001, and cadmium in lead production over TLVs in 1999, 2000 and 2001. The concentration of **sulfur dioxide** in lead production is above the TLV in 1995, 1996, 1998, 1999, 2001 and 2002, control measurements of emissions of sulfur dioxide in the workshop "Sulphuric acid" for the period 1994-2002 indicate that the values were above the TLV for the entire period.

Fig. 5.3 are presented the annual average concentrations of aerosol content of cadmium in ambient air for the period 1999-2006.

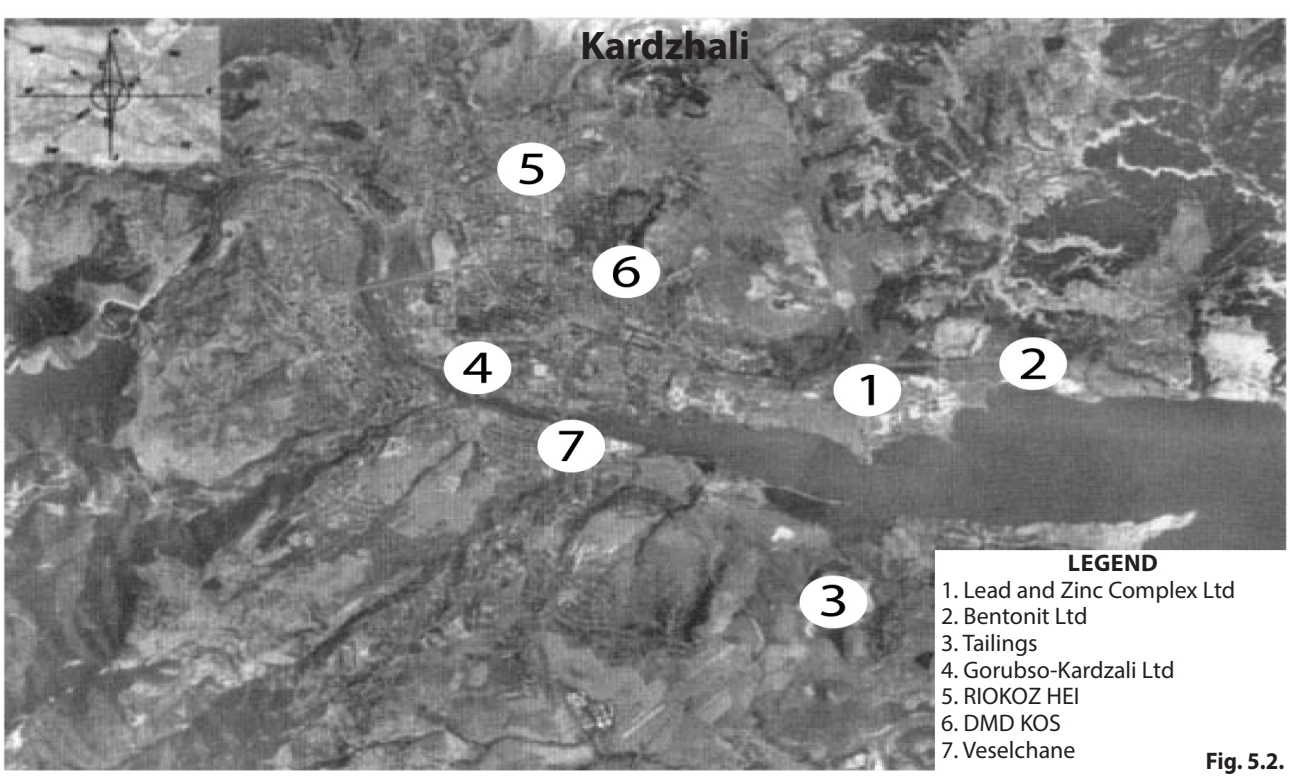


Fig. 5.2.

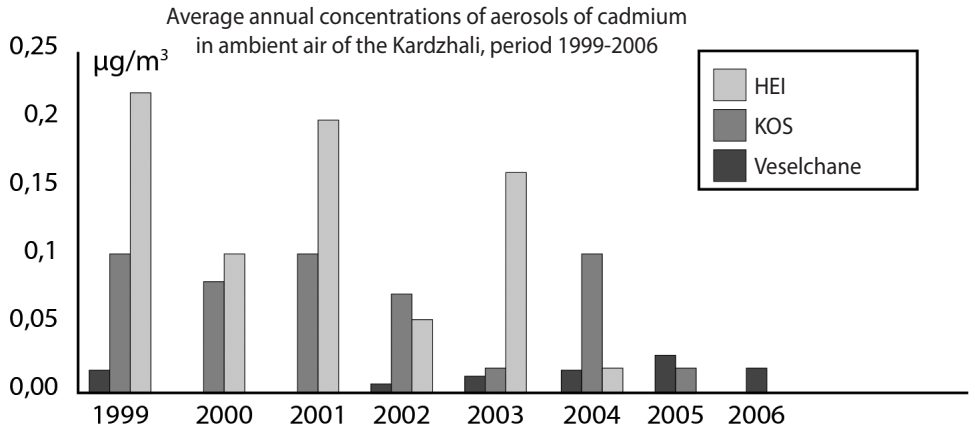


Fig. 5.3.

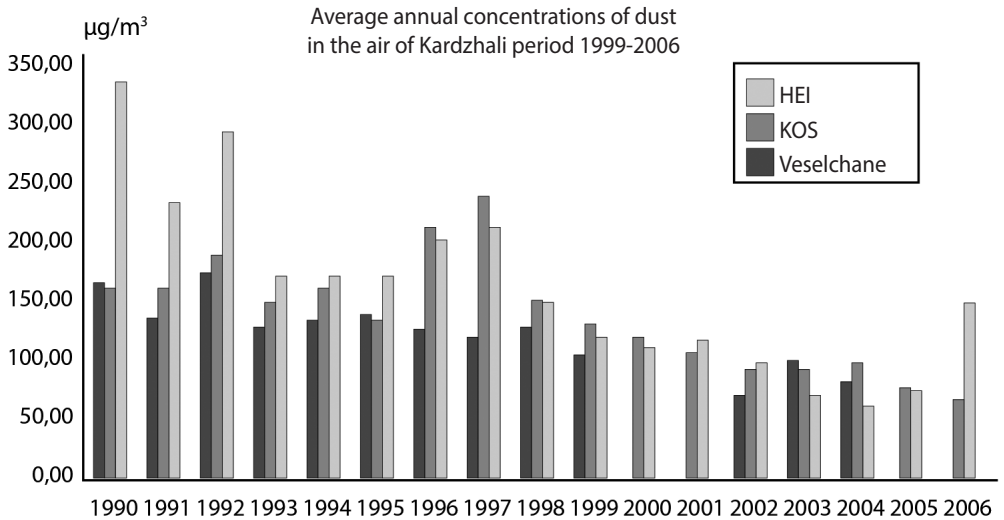


Fig. 5.4.

Average annual concentrations of dust in the atmosphere are presented in **Fig. 5.4.** Downward trend in the values of total dust probably due to the reduction of production of industrial enterprises in the region.

The average annual concentrations of dust, sulfur dioxide, lead aerosols and aerosols of sulfuric acid and cadmium reduced for the period 1990-2006, which is likely due to stop or reduce the production of industrial enterprises, as well as measures taken in the health and ecological aspect . However, the average annual concentrations of lead aerosols and aerosols of cadmium were above the allowable limits for the entire study period. The strong variation of the maximum values for sulfur dioxide, lead aerosols and aerosols in the atmosphere of cadmium is probably due to changes in the technological regime, overload capacity during certain months of the year, off and on the production of LZC.

2.2. WATER

The region main surface reservoir is **flowing river**. **Arda.** There are three dams. **Wastewater** in the city is formed by population, industry, budget organizations and the private sector. No built treatment effluent plant. The majority of industrial water (547,781 m^3/g) are discharged into urban, then with household water (230,379 m^3/g) is discharged untreated into the tail of the dam "Cold well". Above the town of Kardzhali, in the river flow wastewater from the towns of Smolyan, Rudozem, Madan and Ardino.

Before the city concentration of heavy metals and arsenic in r. Arda primarily responsible for the standards I category water. In a small part of the research, the river falls into the category II and III, and only in respect of lead, manganese, cadmium and iron. Low concentrations increase registered for arsenic and nickel. Out of city categorization preserve same tendency - prevalent quantities of metals I category. It was found, however, increase the content of zinc, manganese, lead, cadmium, iron and arsenic, and to them the river falls into the category II and III. For the entire period of observation and generalization of data points after Kardzhali, three times where

concentrations of cadmium and twice for lead to TLV for III category water. This increase is incidental and especially for lead is found in the years when r. Arda was very dirty in the upper stream.

Drinking water is characteristic of soft water with an active reaction to the lower limit of the permissible range, low values of total hardness determined of calcium and magnesium, whose values were respectively 0,6 mgEqv/l, 3,6 mg/l and 5 2 mg/l. The ion composition is characterized by insignificant content macroions typical of mountain water dam chlorides 5,0-5,2 mg/l, sulfates 18,0-20,0 mg/l. Phosphates not prove. Absent the presence of nitrite and ammonium ions. Established levels of nitrates in the range 0,7- 3,0 is negligible in health and hygienic aspect. The fluorine deficit is a serious hygienic problem for the state of dental status in the incidence of caries. Does not prove the presence of cyanide.

Drinking water is not involved with a significant share in the total daily intake and is not a significant route of exposure of the population with heavy metals and arsenic.

2.3. SOILS

For the potential impact of soil pollution with heavy metals on the health of the population, have important climatic and geographical characteristics and landscape of the study area.

The study found that the metals contained in two sub-regions - sub Kardzhali with 14 constituent territories and sub Gledka with 10 constituent territories.

It was found a statistically significant difference in average values for lead and cadmium. The same sets and average for copper. It is not a statistically significant difference in mean zinc. The average values of lead, cadmium and copper from nearby stations are significantly higher than those further removed.

In the urban zone around schools and kindergartens, the lead content exceeds 3 timesTLV. The cadmium content was also above the maximum admissible concentration for soil (since soil is a permanent depot of various environmental pollutants is possible their migration in plants and groundwater).

The obtained data shows that the levels of lead above TLV 2 to 12 times. Heavy lead pollution is near the railway station. The total average concentration of lead was 4.5 times TLV.

Cadmium is contained in soils research area of 0.8 to 3.5 times the TLV. Most high concentration of cadmium is also points to the railway station. The average value is 1.5 times the TLV. The copper content is below TLV and zinc ranges from 1 to 5.2 times the TLV. And this metal is most high concentration in the soil at the point of the railway station. The other metals - chromium, arsenic and nickel are in the TLV.

Comparing the data content of heavy metals (lead, copper and zinc) in the soil of the area of the city during both the study period - 1988-1990 and 2004-2006 is significantly higher their concentration in the last period, which confirms cumulative properties of the soil as a medium.

In areas around the sources of pollution and the main part of the town contents of lead and cadmium is much higher than TLV.

2.4. FOOD

Studies made in 1991 analysed the content of lead and cadmium in common feed used in raising livestock. The results show that there is no contamination of the products with heavy metals in excess of the permitted by Directive 32/2002 EC. Al though limited in size, the results suggest that feed near Kardzhali are not a major source of heavy metals to livestock and their products - milk and meat.

Studies of animal and plant foods continue in the 1995-2006 show the relatively higher values for lead in milk (0,018-0,050 mg/kg at the rate of 0,020 mg/kg). Not excluding the possibility of increased content of lead in animal feed, but it may be due to the migration of lead from vessels and apparatus.

Are analysed and meat of farm animals - beef, pork, lamb and sheep, and cow milk and freshwater fish. The concentration of heavy metals in the tested products under the levels stipulated by Regulation № 31/2004 (SG 88/2004).

The study was conducted and the content of lead and cadmium in plant foods such as vegetables are selected for which it is known that lead and cadmium can accumulate - leaves (lettuce), root vegetables (carrots and potatoes), some stalks - green onions and leeks, mushrooms, dried beans. Samples are tested and bread. The heavy metal content in root vegetables - carrots and potatoes, in 2003 and 2004 is below the permitted levels. The same can be noted for the content of lead and cadmium in the leaves and stalks vegetables (surveyed in 2005).

It can be concluded that no evidence of significant contamination of feed and food of animal and vegetable origin with lead and cadmium. Early studies in 1991 for a direct increase in the concentration of lead and cadmium in meat and organs of pigs in comparison with data of other countries, higher values in freshwater fish farmed in the area. Research into dynamic to 2006 showed the maintenance of a favourable trend - values for lead and cadmium are within the officially accepted in our country standards for maximum levels.

Preliminary assessment of the dietary intake of

lead and cadmium in children (boys) aged 10 to 14, showed that intake is significantly lower than the internationally accepted standards and is comparable with data of other countries of the European Union.

2.5. HEALTH STATUS AND BIOLOGICAL MONITORING OF LEAD AND CADMIUM

Compared with negative demographic changes in Bulgaria in the last decade, the demographics of the population in the region are better but traced in dynamics, they mark a clear negative trend. Against the background of an almost unchanged birth rate stands increased mortality and reduction of natural growth.

Priority diseases for the population of the city during the period - (1990- 2000 years) are:

- Diseases of the blood and hematopoietic organs
- Psychiatric disorders
- Diseases of the nervous system and sensory organs
- Diseases of the respiratory system
- Diseases of the digestive system
- Diseases genitourinary system
- Complications of pregnancy, childbirth and the postnatal period
- Diseases of the skin and subcutaneous tissue
- Diseases of the musculoskeletal system and connective tissue
- Congenital anomalies

Particular attention should be paid to ***diseases of the blood and hematopoietic organs***, covering anemia , incl. iron deficiency anemia, that are statistically and significantly higher in adults and in children compared to the national average. Other classes of diseases with higher values and in children and in the elderly include: ***diseases of the digestive system, of the musculoskeletal system and connective tissue***.

Biological monitoring for health risk assessment through eleven period (1991-2002) includes determination of lead and cadmium in blood, free porphyrins in erythrocytes and hematological studies of children aged 9 to 14 years from schools in the city (at biological control erythrocyte protoporphyrin (EPE) is applied as a biological marker for the detection of early effects in chronic lead exposure).

The level of lead in blood of children in the city is statistically significantly higher than children in a control city, due to the proximity of polluting industries and more intense traffic. Higher levels P-blood of boys compared to girls from the same city can be explained by their greater physical activity and spending more time playing outdoors. Establish average content of lead in the blood indicates that existing pollution entering the body lead does not reach levels that would be expected changes inerythrocytic protoporphyrin, respectively violations in the biosynthesis of hemoglobin.

Mean group and average values of cadmium in the blood of children (boys and girls) in the city were significantly higher than their respective levels in the control area, but this fact has no biological significance, because the results are within acceptable levels.

The levels of some disease groups exceeding several times the national average, and the results of biomonitoring determining about 30% of children surveyed a representative group of carriers of lead in the blood than recommended by the WHO minimum "safe" limit of 100 μg/l, gives us reason to assume that among the specific etiologic, socio-economic status and cultural-ethnic features, deteriorating environmental quality in the region is a potential risk to public health.

Low levels of lead in food and drinking water and its substantial content in the soil, but unlikely as facility, determine atmospheric lead pollution aerosols as a priority risk factor for exposure of the population of heavy metals.

REFERENCES

1. **Baykova D., M. Kurtisheva L., Mechkueva, T. Rizov.** Study of food and energy intake of children in the region ofLZC - Kardzhali. National Center for Hygiene and Medical Ecology, Sofia, 2003. (in bul.)

2. **Boer L. De.** Chemical Industry. Encyclopaedia of Occupational Health and Safety, ed. J.M.Stellman, 4th ed, V. III, ILO, Geneva, 1998, 77.2.

3. **Boyadzhiev Vl.** Hygiene and occupational diseases. Med. and phys.., Sofia, 1990, 90-99 (in bul.)

4. **Boyadzhiev Vl. Tsvetkov D., P. Boyadjieva** Hygiene foundations of a healthy lifestyle in terms of the NTS. Matt. conf. of physiopreventive and a healthy lifestyle, Sofia, 1987, p. 20-28 (in bul.)

5. **Calderon J, Ortiz-Perez D, Yanez L, Diaz-Barriga F.,** Human exposure to metals. Pathways of exposure, biomarkers of effect, and host factors. Ecotoxicol Environ Saf. 2003 Sep; 56 (1): 93-103.

6. Chemical-management policy: prioritizing children's health. Council on Environmental Health. Pediatrics. 2011 May; 127 (5): 983-90. Epub 2011 Apr 25. Review.

7. **Gichev J. P.** At problem estimates interrelation "Environment - personal health", in: Environment pollution and personal health, Novosibirsk, Moscow, 2002, 157-159. (in russ.)

8. **Graziano J.H., Slavkovich V, Liu X, et al.** A prospective study of prenatal and childhood lead exposure and erythropoietin production. J Occup Environ Med. 2004. 46: 924-929.

9. **Hamouda M.A., Anderson W.B, Huck P.M.** Decision support systems in water and wastewater treatment process selection and design: a review. Water Sci Technol. 2009; 60 (7): 1757-70.

10. **Hayakawa K.** Decomposition and treatment of environmental pollutants. Yakugaku Zasshi. 2009 Jan; 129 (1): 35-43. Review.

11. **Hunt A.J., Sin E.H, Marriott R, Clark J.H.** Generation, capture, and utilization of industrial carbon dioxide. Chem.Sus.Chem. 2010 Mar 22; 3 (3): 306-22. Review.

12. **Jarup L., Berglund M, Elinder C.G., Nordberg G., Vahter M.** Health effects of cadmium exposure a review of the literature and risk estimate. Scand J Work Environ Health. 1998, 24 (Suppl 1): 1-52.

13. **Kraus R.S.** Developing a Process Safety Management Programme. Encyclopaedia of Occupational Health and Safety, ed. J.M.Stellman, 4th ed, V. III, ILO, Geneva, 1998, 77.3-77.7.

14. **Lipton S.** Major Unit Operations and Process: An Overview. Encyclopaedia of Occupational Health and Safety, ed. J.M.Stellman, 4th ed, V. III, ILO, Geneva, 1998, 77.8.-77.17.

15. **Mark H. Hermanson I. and J. R. Brozowski.** History of Inuit Community Exposure to Lead, Cadmium, and Mercury in Sewage Lake Sediments. Environ Health Perspect. 2005 October; 113 (10): 1308-1312.

16. **NCHMEH, HEI-Kardzhali, Plovdiv-HEI.** Epidemiological study to assess the health risk and its management in ecologically threatened regions of the country: district KCM - Plovdiv and the region of LZC - Kardzhali, 2003 (in bul.)

17. **Nosko M. Pernov K., M. Spasovski** Vinyl chloride disease in Bulgaria. Hyg. and Pub. Health, 1977, 4, 34-40. (in bul.)

18. Program to reduce emissions and reaching the established standards for harmful substances in the air Varna Municipality. G. Georgiev, Varna, 2009 (in bul.)

19. Project Devnya municipality. Municipal development plan 2005-2013 (in bul.)

20. **Smith L.L., Brent RL, Cohen SM, Doerrer NG, Goodman JI, Greim H, Holsapple MP, Lightfoot RM** Predicting future human and environmental health challenges: the Health and Environmental Sciences Institute's scientific mapping exercise. Crit. Rev. Toxicol. 2008; 38 (10): 817-45.

21. **Spasov A. Ts. Balabanov** Hygiene study and impact on the environment and public health from the activities of an enterprise of ferrous metallurgy. Problems of hygiene, 2000, XXI, 1: 33-35. (in bul.)

22. **Staykova J.** Quality of environmental and health risks in the town of Kardzhali, "St. Kliment Ohridski", 2009, 62-70.

23. **Vasilev K., V. Kambourova, D. Gopina, Zl. Bratanova al.** Study of water contamination with heavy metals near KCM - Plovdiv. Problems of hygiene, XIV, 2003, 2, 21-25 (in bul.)

24. **Wilhelm M, Wittsiepe J, Schrey P, Budde U, Idel H.** Dietary intake of cadmium by children and adults from Germany using duplicate portion sampling. Sci Total Environ. 2002 Feb 21; 285 (1-3): 11-9.

D. Tsvetkov

6 URBANIZATION, HOUSING AND HEALTH

Hygiene of settlements is a major section of communal hygiene, dealing with hygiene problems of planning, construction and public works of settlements in order to create the most favourable conditions of life of the population. To realize this goal naturally is necessary to solve a wide range of issues with the participation of many non-medical professionals - architects, engineers, economists, geologists, hydrologists, meteorologists, road builders.

Major issues that require hygienic assessment are:

1. Choice of territory, functional layout and zoning of the settlement.

2. Planning and development of region, microregion, neighborhood.

3. The planning and construction of residential and public buildings.

4. Protection of ambient air in urban pollution.

5. Protecting water sources from pollution and water supply of the settlement.

6. Protection of soil contamination. Installation of drainage and purification of waste from the settlement.

7. Landscaping settlements.

8. Planning and lay-out street network.

9. Fighting noise in the settlement.

The growing importance of hygiene of settlements is now closely linked to the so-called urbanization of life.

Urbanization of life is a world historical process, confirmed in the fifties of the XX century related to scientific and technological revolution and new forms of social life (G. I. Rumyantsev). Urbanization is associated with profound structural changes in existing cities and towns due to the development of industry, transport, housing, penetration of "urban living" in small villages. Urbanization has a major influence on the development of society and the state, as is the fruit of civilization and progress.

One of the most significant signs of urbanization is the increase of large cities and increasing their essential role. Now talk about urban revolution, indicating that after 1950 the urban population has increased three times, has reached about 2 billion people in 1985. In industrialized countries for this period increase was double - from 477 to 838 mln., while for developing countries - quadrupled (from 286 mln. of 1.14 billion.). It points out that in developing countries (so far predominantly rural population) in 2000 to 75% of the population in Latin America, 42% - in Africa and 37% - in Asia live in cities (N. Sladik).

Especially characteristic trend in urbanization is the increasing number and population in large (over 100 thousand Inhabitants) and the million cities **(Table 6.1.)**.

Table 6.1. In cities with populations over 1 million. Inhabitants in the period from 1950 to 2015

Region	Population million			
	1950	1970	1990	2015
Africa	3	16	59	225
Latin America	17	57	118	225
Asia	58	168	359	903
Europe	73	116	141	156
North America	40	78	105	148

At the end of XIX century in the world there were 4 cities with populations over 1 million. In 1920 they were 25, in 1950 - 90 to 1980 -168. This process continues uninterrupted, as now in the 25 largest urban agglomerations in the world, with a population in 1995 of 7.5 to 26.8 million inhabitants, the rate of their increase during the period 1990-1995 was 40 -5.68 **(Fig. 6.1)**.

Urbanization has both favourable and unfavourable social, health and demographic effects on the population.

<u>*Beneficial effects of urbanization.*</u> Most important are:

- *high degree of comfort in everyday life, work, leisure, transport;*
- *comprehensive and modern development of the settlement;*
- *diverse and comprehensive education;*

THE 25 LARGEST CITIES IN THE WORLD IN 1980-2008

2005–2008 (in milion)

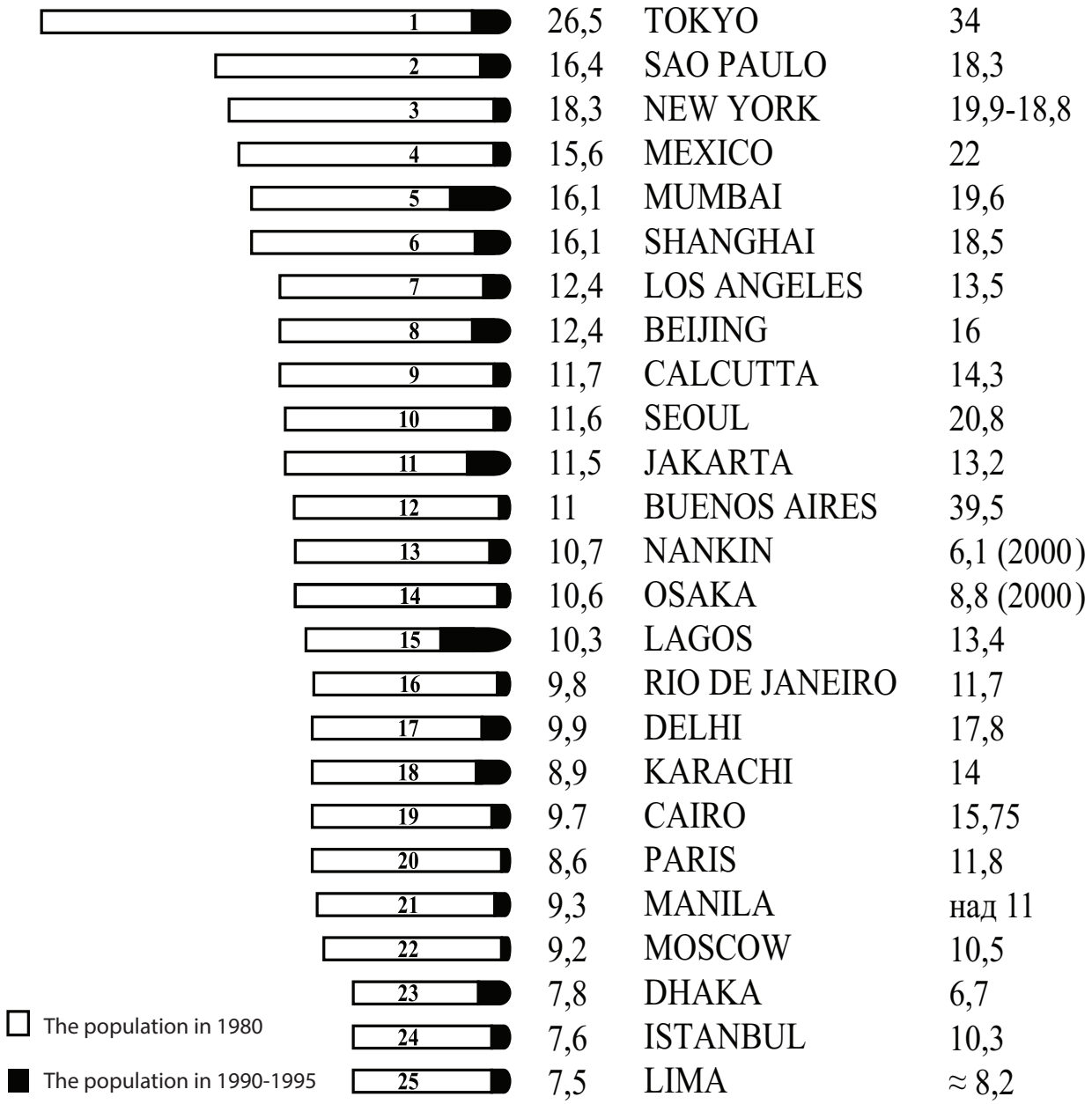


Fig. 6.1.

- *complete professional development and training;*
- *rich cultural and social life;*
- *comprehensive and prompt information;*
- *aesthetics of the environment and creative development of personality;*
- *highly skilled, medical care, etc.*

Adverse effects of a healthy lifestyle. They are:

- *significant pollution of air, water and soil. A huge volume of urban solid and liquid wastes;*
- *changes in the local climate. Reduce insolation and "ultraviolet hunger";*
- *noise 'pollution' of the environment and low frequency vibration;*
- *increased intensity of electromagnetic radiation in the radio frequency range,*
- *detachment from natural factors, inadequate landscaping;*

- *significant neuro-sensory and mental stress, fast pace of life;*
- *hypokinesia and hypodynamia;*
- *psycho-emotional coldness and aloofness;*
- *difficult transport due to large distances.*

Based on the average estimates indicate approximately that, for example a milion cities consumes daily about 625 thousand tons of water, 2000 tons of food and 9,500 tons of fuel, while paid 500 thousand t. sewage, 2000 tonnes of solid waste and 9500 tons atmospheric pollutants (of course in individual cities these figures adduced for greater comparability of per capita show very big differences - eg. a resident of New York paid 3 times more solid waste than a resident of Calcutta).

Demographic and health impacts associated with urban life:

- reduced fertility;
- reduced child and total mortality;
- increased life expectancy - "aging" of the population;
- increased frequency of disease-3-5-fold higher incidence of bronchitis; 2-3 times of pneumonia and pleurisy;
- amended structure of general morbidity, increased incidence of so-called. "Diseases of civilization", such as cardiovascular diseases as the cause of more than 50% mortality; malignant neoplasms;
- respiratory diseases;
- transport accidents and injuries;
- allergic diseases;
- neuro-psychiatric diseases;
- overweight at 30-40% of the population;
- diseases and conditions associated with current non-production buildings (housing, offices, offices).

1. ZONING. URBAN AREAS - CITIES AND SETTLEMENTS

Under current laws - Law on territory Planning (LTP) - 2001, and Ordinance 7/SG. No.3/2004, its purpose territories in Bulgaria are divided into a total of 19 groups - for residential purposes; production and storage; recreation; landscaped areas; sports and entertainment; cultural-historical heritage; public and business services; traffic and transportation; communal services; agricultural activity; forests and water areas; recovery and rehabilitation, etc.

In urban areas - cities and settlements, are defined planning zones (areas) - **housing; production and storage; recreation and mixed.**

In mainland - housing, including residential areas, areas for public and service buildings; for streets and parking lots; greenery public areas. Gross area required for this area varies from 35 to 350 m^2/inhabitant, according to the size of the settlement **(Table 6.2.)**. *.

Accordingly, the character of building settlements refer to: prevailing construction of low height (10 m); medium height (up to 15 m); with greater height (over 15 m); a complex building. Depending on the height of the building of individual areas, the density of construction (built-up area to the total area of the territory) is 20 to 80%. Public green areas should occupy at least 15% of the total area of the residential complex. One third of the required landscaped area should be with trees.

Table 6.2.

Types of settlements	Area of the residential area (gross) m²/inhabitant
Major cities	35-50
Medium-sized cities	45-60
Towns	55-100
Many small towns	100-200
Many large villages	170-270
Large villages	220-320
Average villages	250-350
Small villages	300-370
Many small villages	Over 350

The high-building and density of construction, insufficient landscaping worsen living conditions in urban areas.

2. AIR POLLUTION ENVIRONMENT AND TRANSPORT. PRODUCTION AND STORAGE ZONE IN THE VILLAGE

◆ Air environment and transport

One of the main sources of air pollution in urban areas is road transport.

The exhaust gases contain over 200 chemical compounds. Moving in 1978 about 400 million cars were removed annually 7.5 billion tons of exhaust gases. They contain hydrocarbons - completely or incompletely burned. Release carbon monoxide, aldehydes, acrolein, formaldehyde, and nitrogen oxides, sulfur gases. Due to incomplete combustion remove soot containing resinous substances, incl. and 3-4 benzpyrene.

The type and amount of pollutants emitted by cars depends on the engine type. In diesel engines emit less carbon monoxide and nitrogen oxides, and more fine soot, and petrol - lead compounds (gas-

* Major cities are more 200 thous. inhabilitants; many small villages - to 250 inhibitants (Ordinance 7/2004)

Table 6.3. Road transport - pollutants

1973 -150 million cars -> 600 thousand tons CO_2/h. ***1977*** - 400 million cars -> 7.5 billion tons exhaust gas/ year. ***2000*** - 600 million cars. ***4,5 m³ burning gasoline (without liquid ethyl)*** -> 131 t carbon monoxide; 1,31 t hydrocarbons; 450 kg of nitrogen oxides; 45 kg sulfur gases; 9 kg organic acids; 9 kg ammonia; 1,5 kg metal oxides - zinc, lead and the like. ***Ethylic gasoline*** -> ..... exhaust gases in medium and 1 mg/m³ lead.

oline with ethyl fluid), chlorine, bromine and phosphorus compounds. Both engines produce large amounts of carbon dioxide **(Tab. 6.3)**.

The amount of pollutants depends on the construction of engine, power, modes of work, wear, degree of maintenance **(Table. 6.4 and 6.5)**.

New vehicles equipped with fuel injection mixture in computer assessment its quantification and composition, with the use of catalysts for exhaust gases, etc., have significantly reduced the amount of incomplete combustion products and the total quantity of pollutants emitted. The latter is related to the sharp improvement in energy efficiency (fuel economy) of cars. They appeared in series production vehicles with fuel petrol 2,4-3,5 l per 100 km, which is important to reduce the energy (and pollution), associated with oil and petrol extraction as well as the consumption of atmospheric oxygen.

Table 6.4. Average composition, maximum and minimum values of the components of exhaust gases

Composition of exhaust gases%	Gasoline engine			Diesel engine		
	maximum	minimum	average	maximum	minimum	average
1	2	3	4	5	6	7
Carbon dioxide	15,0	2,6	9,0	13,8	0,7	9,0
Carbon monoxide	13,5	0	4,0	7,6	–	0,1
Oxygen	17,4	0	4,0	20,0	0.5	9,0
Hydrogen	5,8	0	2,0	2,5	0	0,03
Hydrocarbons	4,0	0	0,5	0,5	0	0,02
Aldehydes	0,03	0	0,004	0,004	0	0.002
Nitrogen oxides	0,2	0	0,06	0,15	0	0,04
Sulphur dioxide	0,008	0	0,006	0,3	0,01	0,04
Note: When the diesel engine is emitted, and carbon black, the amount of which is up to 1% of the mass of fuel.						

Table 6.5. Composition of exhaust gases in various modes of work

Pollutants	Gasoline engine				Diesel engine			
	slow engine	accelerated the engine	optimal engine	Worst of engine	slow engine	accelerated the engine	optimal engine	Worst of engine
1	2	3	4	5	6	7	8	9
Carbon monoxide, %	13,8	2,8	5.1	4,8	0,1	0,1	0,1	0,1
Hydrocarbons, %	0,98	0,2	0,05	2,64	0,047	0,018	0,013	0,061
Nitrogen oxides, cm^3/m^3	45	1430	314	12	60	827	310	40
Formaldehyde, cm^3/m^3	72	28	1	2214	4	7	4	7

The exhaust gases, combined with the intensive ultraviolet radiation under conditions of no wind and high humidity, lead to the formation of so-called photochemical smog. This is the famous Los Angeles smog, wherein the forming and the large number of new (secondary) toxic oxidizers - so-called photooxidation **(Fig. 6.2)**.

Photooxidants have a strong irritation of skin and mucous membranes, causing the development of allergic and photosensitizing damage to eyes, respiratory system and skin **(Table 6.6.)**.

The way the vehicle is moving, the organization of traffic, the layout of the settlement, road network and landscaping determine the level of air pollution in different regions of settlement. The low speed of vehicles, frequent stops and starts increasing the amount of emitted harmful. Also increase them and very high speed and high density of traffic flow. High levels of contamination have with many narrow streets, areas with high-rise buildings and high-density construction (over 30%), in the underground movement (in tunnels, passageways below the surrounding terrain), in underground and surface parking lots, less or missing landscaping of streets, habitant regions and micro areas, etc.

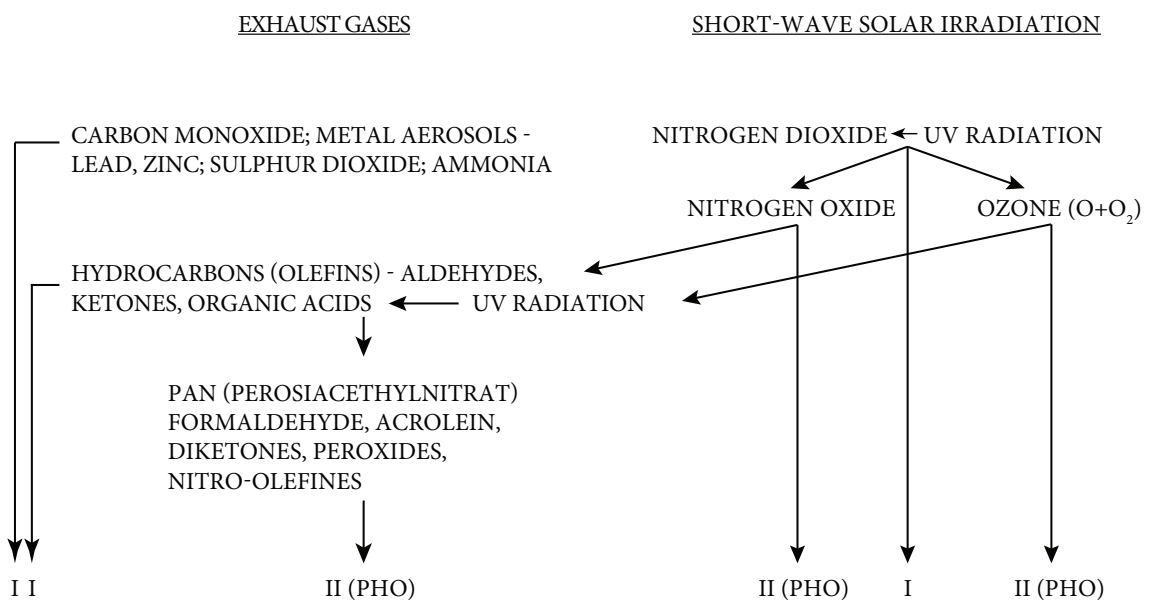
Automobile transport, depending on the quality and cleanliness of pavements of the street network, is the reason for the high dusty air of the settlements.

High dusty air is the reason for increasing the frequency of damage to the respiratory system - bronchitis, bronchopneumonia, light communality pneumosclerosis in children; Ocular lesions - conjunctivitis, keratitis, Same and rhinitis and pharyngitis.

Summary data on the impact of air pollution with sulfur dioxide and dust on the health and environment of the settlements are presented in **Table. 6.7** and **6.8.**

Table 6.6. Impacts caused by air pollution by ozone and photochemical oxidants (Work K., S. Warner, 1980).

Concentration ($\mu g. m^{-3}$)	Exposure	Effect
Ozone		
40	1 h	cracking rubber
60	8 h	damage to vegetation
200	1 h	spasm of the respiratory tract
590	constantly during the workday	irritation of the nasopharynx, chest spasms
3900	2h	cough
Photochemical oxidants		
100	4 h	damage to vegetation
200		eye irritation
250	maximum daily concentration	exacerbation of respiratory diseases
60-600	1 h	deterioration of sports performance
160	maximum hourly concentration	norm for air quality in the USA



I – primary pollutants
II (PHO) – secondary is formed photooxidants

Fig. 6.2. Smog in Los Angeles

Polycyclic aromatic hydrocarbons (PAHs) and primarily 3,4-benzpyrene, issued by motor vehicles are considered to be causative factor for lung carcinogenesis. Particularly high risk in male smokers living and working in large industrial centres **(Table. 6.9)**.

Indicate that smoked 40 cigarettes a person receives about 150 μg 3,4-benzpyrene and breathing the polluted air of motor vehicles in the city - about 400-600 μg; that living near a highway death rate from lung cancer was nearly 9 times higher compared with that of residents in a remote area of the highway; that all air samples in larger cities are present 3,4-benzpyrene in an amount proportional to the population; that for 70 years inhabitant of the big city inhaled 16 mg 3,4-benzpyrene - dose hundredfold higher than that causing skin cancer in mice, and so on. But there are other studies that show that it is not proven link between the level of air pollution with 3,4-benzpyren and incidence of lung cancer, i.e. no relation dose/effect. It is also much larger role and proven link the rate of smoking (number of cigarettes years) and lung cancer. Also in tobacco smoke contains over 3,500 substances and also 3,4-benzpyrene there are many other ingredients expressed carcinogenic effect in humans - nitrosamines, heavy metals (arsenic, chromium, nickel, cadmium, cobalt), radioactive substances (^{210}Po, ^{223}Ra, ^{90}Sr, etc.).

Table 6.9. Factors contributing to the development of lung cancer (urbanization and smoking)

Type of population	Population	Deaths per 100 000	Mortality
Citizens smokers	5 187 000	79,0	4097
Citizens smoking	2 756 000	11, 2	308
Villagers smokers	2 572 000	65,2	1677
Villagers smoking	1 645 000	1, 0	16
			6098

Table 6.7. Impact of air pollution with dust on the human and environment (Work K., S. Warner, 1980)

Concentration (μg.m^3)	Terms impact	Resulting from the impact
60-180	The average annual mean geometric concentration in the presence of sulfur dioxide and moisture	Increase corrosion of steel and zinc surfaces
75	Average annual mean geometric concentration	Target air quality in the US
150	Daily average concentration	Target air quality - average anmual TLV
150	At a relative humidity below 70%	Reducing visibility to 8 km
100-150		Fold reduction of direct solar radiation
80-100	Simultaneously with precipitated sulphates amount 30 μg.m^{-3}	It can be observed increase in mortality by 50%
100-130	At a concentration of sulfur dioxide 120 μg.m^{-3}	It is possible to increase the number of respiratory diseases in children
200	Daily average concentration in the simultaneous presence of sulfur dioxide over 250 μg.m^{-3}	Increasing absence of work of industrial workers
260	Maximum daily concentrations	Target air quality in the US
300	Maximum concentrations for 24 h in the simultaneous presence of sulfur dioxide above 600 μg.m^{-3}	Sharp exacerbation of symptoms in patients with chronic bronchitis
500	Maximum - single concentration	Target air quality - maximum - single time TLV
750	Daily average concentration in the simultaneous presence of sulfur dioxide over 715 μg.m^{-3}	Can significantly increase morbidity and mortality

Table 6.8. Impact of air pollution with sulfur dioxide on the environment and human (Work K., S. Warner, 1980)

Concentration (μg.m^3)	Terms impact	Resulting from the impact
80	Average concentration	Norm air quality in the United States; chronic damage to vegetation
125	Daily average concentration	Norm air quality in Bulgaria
100-240	Average concentration	The presence and concentration of powder in 185 μg.m^3 leads to increased incidence of respiratory complaints and may cause diseases of the lungs
287-500	Daily average concentration	At low concentrations of suspended dust can lead to frequent hospitalization of older people with respiratory diseases; accelerates the corrosion of the metals
350	Hourly average concentration	Norm air quality in Bulgaria
500	Daily average concentration	At low concentrations of suspended dust can lead to increased mortality
650	Daily average concentration	In the presence of the powder at a concentration of 750 μg.m^3 may lead to an increase in deaths: a sharp increase in the number of patients
800	Average concentration for 8 h	Visible damage to some trees
1350	Daily average concentration	In the presence of suspended particulates can lead to fatalities

Many surveys have found that air pollution by asbestos (asbestos emitted from materials previously used in brake and clutch car) is associated with an increased incidence of mesothelioma of the lungs.

◆ **Production and storage area**

Territory of industrial-warehouse zone occupies about 20-30% of the total territory of the city.

Industrial adversely affect the environment and the population through pollution of air, water and soil settlement. They are a source of noise, and also often are fire and explosion dangerous. They therefore have more unfavourable and barren terrain of the locality in the leeward part, respectively grouped and located on the lower reaches of rivers towards settlement (separate wastewater).

Industrial areas can be:

- *Only production*
- *Mainly production*
- *High-tech - production (technology park).*

In the first territory is built up only production, storage and servicing buildings and facilities - health centres, shops and catering for workers there, administrative buildings, gardens, housing security.

In the mainly production area are not allowed polluting industries of chemical and rubber industry, asphalt plants, enterprises of ferrous and non-ferrous metallurgy. However, allowed construction of residential buildings for staff, shops and catering establishments, hotels, hospitals, vocational-technical schools, scientific- experimental bases to enterprises.

In the technology park are built with high-tech enterprises, also housing for researchers, lecturers and workers, hotels, hospitals, sports and show entertainments, exhibition halls.

The density of construction of these areas is 40 to 80%.

Greenspaces should be from 20 to 40% within 1/3 of it is with trees.

To protect the living area separated from the enterprises injuries - dust, gases, vapors, noise, provides at least allowable distance between its territory and enterprises - ie. hygienic protective zones (HPZ). Depending on the type of production are determined seven groups enterprises with HPZ of 50-3000 m. The aim is in closest to the plant buildings of the residential area, emitted by the enterprise hazards (chemical and particulate pollutants, noise)

to be within the communal norms. Enterprises that do not emit harmful substances may be in the residential area - eg., precision engineering, electronics, clothing enterprises and others.

HPZ is planting an extensive - 40-60% of the surface with a durable and harms trees - Canadian poplar, American maple (unstable are birch, acacia, lime). Recommended mixed planting resistant deciduous or coniferous trees.

3. NOISE IN THE CITIES

In modern city no less importance than the chemical and particulate pollution of the air environment has "noise pollution". From the hygienic point of view noise is any sound (including tone), which acts negatively on health, violates recreation, disturbs human contact with the environment - distort the hearing and speech connections.

In terms of urban life continuously growing intensity, the number and diversity of the various noise sources. It is noted that in the last few decades in cities increases the intensity of the noise averaged 1 db/A per year combined with steadily increase the size of the territories in which the noise impact.

Noise in urban areas is by nature mostly broad (wide frequency range), more often intermittent rather than continuous. He has a different intensity during time (day, season) and in different areas of the settlement.

◆ **The main sources of noise**

In the locality and premises (residential and various other communal institutions - hospitals, schools, restaurants, offices and so on.), they can be grouped as follows:

1. Transport noise - car (cars, motorcycles, trucks), rail and non-rail public transport, railway transport, aviation.

2. Industrial enterprises, workshops and warehouses.

3. Neighborhood noise - schools, kindergartens, shops, garages, discotheques, restaurants, clubs and so on.

4. In building noise - from located in the building sources - elevators, transformers, hidroforic pumps, shops, workshops, garbage carry out, ventilation equipment etc.

The main source of noise - such as intensity, comprehensiveness, difficulty for effective preventive measures is the road transport.

It indicates that the movement of motor vehicles (MV) generate noise intensity:

- cars - 72-90 dB/A;
- trucks (gasoline) - 74-106 dB/A;
- trucks (diesel) - 90-108 dB/A;
- buses - 83-95 dB/A;
- bikes - 81-90 dB/A;
- trams - 79-96 dB/A.

The values are quite different and depend on the specific design of the engine driving modes, the technical condition and proper operation. Scientific and technical progress, the requirements for comfort and ecological requirements necessitate continuous noise reduction in motor vehicle, on the other hand constantly increasing their number (the density of traffic flow) results above now a steady increase in noise in the settlements. An important factor in this is the street network - "machine for movement" called by Le Corbusier. The qualities of its surface, width, planting, spacing of buildings, and its main function to penetrate and connect all areas of the settlement, determine its importance to the degree of intensity and noise propagation in the settlement. Indicates that currently in major cities daytime street noise intensity is 65-85 dB/A (in the cities in our country - 65-75 dB/A), but the peak (of busy intersections during peak hours, passing of heavy transport, buses and trams) reach 90-95 dB/A. These high levels of street noise cause intensity of noise penetrating into the living quarters of 64-65 dB/A opened windows and 47-51 dB/A closed. *

In surveys in London from 1400 respondents 82% indicated street noise as the main source of noise with irritant action, 16% were identified as a major source noise from neighbors, 1% - of their own noise in the house and only 1% did not consider that the noise factor is an irritant. In other studies with street noise measured with an equivalent level of 70-75 dB/A, 50% of respondents indicated that the penetration in their home noise is irritating during the day and at night violates their sleep.

Besides the noise source, transport - especially heavy vehicles and the metro is a source of vibrations in the subsonic range (3-10 Hz) in buildings that also can cause irritability, rapid fatigue, disturb sleep.

* For comparing (evalution) of these intensities: "forest noise"(wind lessness) - 20 dB/A; silent talk - 40 dB/A; lively conversation - 60 dB/A; weaving workshop - 90-96 dB/A; compressor - 100 dB/A. At 85-90 dB/A speach is no undersandable and hearing harm irreversibly; 120 dB/A perceive as pressure and pain in ears.

◆ **Impact of communal noise on the human body**

Noise in the settlements is a stress factor for the body. Depending on the intensity, spectral composition, exposure time it causes temporary or permanent changes to the diverse and complex nature, i.e. it affects all the body in overall prevalence of one or other symptoms.

Summary action of communal noise occurs as:

1. Mental effects - loss of work capacity, impaired speech communications, irritation.

2. Physiological effects:

- *On hearing* - temporary and permanent increase in hearing threshold.
- *On the metabolic processes and functions of various organs and systems* (cardiovascular, endocrine, vestibular, respiratory, etc.).
- *On the higher nervous activity and neurovegetative reactivity, i.e. on the body as a whole.*

3. Impact on sleep.

Unlike the permanent and high intensities (above 85 dB/A) production noise, here is not observed at the specific effect of noise - reduced auditory sensation. It is believed that the decrease in auditory sensitivity in urban dweller is primarily due to presbycusis (age increase in hearing threshold), combined with the effect of intense noise in production, household, some sporting activities (clubs, motor sports, shooting and so on.).

Impact of urban noise on the body of the individual systems. It manifests as:

1. Effect on the central nervous system - changes in EEG, mental instability, memory impairment, irritability, nervous exhaustion.

2. Impact on the autonomic nervous system - enhanced vascular tone, heart rhythm disturbances, increased blood pressure.

3. Impact on the digestive system - a violation of gastric secretion - low volume and acidity, delayed passage of food, poor absorption of nutrients.

4. Effects on the respiratory system - changes in the frequency of respiratory movements and increased breathing minute volume.

5. Effects on the endocrine system - increases basic metabolism, increased release of catecholamines (adrenaline and noradrenaline), ACTH, triiodothyronine and thyroxine (T4 and T3), thyroid stimulating hormone (TSH) and so on.

All these negative effects of noise lead to increase general morbidity resulting in decreased overall immunological reactivity of the organism, increase in the incidence of neurosis, peptic ulcer disease, hypertension, chronic ischemic heart disease, reducing the capacity (rapid fatigue), develops overstrain due to disturbances relaxation and sleep.

It indicates that the epidemiological study in 1000 in Sofia was established about 15 times higher incidence of hypertension in persons living in noisy areas. It found and reliably lower age at onset of the disease compared to those living in quieter areas. It found also a statistically significant higher levels of systolic and pulse pressure in hypertensive patients (men and women) in noisy areas.

◆ **Reducing noise in the settlements**

Fighting noise is kept complex, using a variety of architectural and urban planning, hygienic, technical, organizational and road construction, forest protection and other resources **(Table 6.9.)**.

1. Noise sources are used:

- *Reducing the noise of the engines of motor vehicles and improve their construction, control for technical state.*
- *Appropriate smooth street surfaces and low incline of the street* (not to speed up the engines).
- *Appropriate organization of the movement:* limited and banned for vehicles streets and areas; ban revving engines; ban on the movement of motor bikes and heavy trucks in certain areas and hours and so on.

2. To limit the spread of noise in the residential area:

- *Proper zoning settlement* without admitting street network of transit traffic in micro areas.
- *Sufficient distance of the buildings from the streets.*
- *Shielding and absorbing traffic noise.*
- *Inserting transport underground or below the residential area.*
- *Building up of serving the settlement buildings along the street* (on their premises can be used in high noise level.
- *When planning residential buildings, located on the streets to them to face their service premises, etc.*

3. Valuation and control noise. The adopted country norms of the maximum-permitted levels of noise are:

- *Residential areas* - up to 50-60 dB/A, depending on whether they are new or old areas (near urban highways, central areas).
- *Areas for recreation (parks), for hospitals, areas of scientific and educational activities* - up to 45 dB/A (at night - after 22 h, and in both cases the standards are lower by 10 dB).

Table 6.9. Expected efficiency in some architectural, town-planning and organizational noise abatement measures.

Architectural and urban planning	Indicative effect
1. Removing the object from the noise source.	at 4-5 dB / A double the distance
2. Building a screening barrier from buildings.	7-2 dB/A
3. Using the natural terrain as a barrier.	7-2 dB/A
4. Create a barrier of dense green plantations.	around 5 dB/A
5. Creating additional shield elements on the transverse road profile (shielding walls, etc.)	5-30 dB/A
6. Placing the roadway in the excavation, embankment, the stack.	to 20 dB/A
7. Decrease in traffic intensity.	to 40 dB/A
8. Speed reduction.	2-3 dB / A every 10 km
9. Reduce the number of heavy-duty machines in the total flow of traffic.	1 dB/A every 10%
10. Additional enhancement of the sound insulation of the building windows.	to 20 dB/A
11. Orientation of all buildings in need of silence to the opposite side of the noise source (street) side	10-30 dB/A

- *Industrial zone* - 70 dB/A (day and night).
- *Residential rooms* - up to 35 dB/A (30 dB/A - night).
- *Classrooms, reading rooms* - up to 40 dB/A, etc.

All developed countries there is a system to control noise in the settlements. In our country it is built on the bodies of the Ministry of Health and Ministry of Ecology and Water and consists of the control of the noise factor, and control of inhabitants health and morbidity, analysis and assessment of the role of noise and the effectiveness of preventive measures.

4. STREET NETWORK

Communications network placed besides architectural and road building problems also hygienic problems. By properly constructed road network, structure correctly and settlement - territories, zones, regions, micro-regions, districts. The device of the street network depends on good aeration and insolation. Vehicles moving on the streets, are a source of noise, vibration, gases, dust. Correctly structures the streets significantly reduce these harmful emissions.

The street network in urban areas and settlements in Bulgaria are divided into:

- Main street network: I class - urban high-speed ways; class II - urban highways; class III - regional arteries; IV class - main streets.
- Secondary street network: V class - gathering streets; Class VI - serving streets.

The street network takes an average of 17-22% of the residential area.

Adverse factors in the street network are related to:

1. The orientation and width of streets, which is associated with insolation and natural illumination of buildings and premises. Narrow streets with distance between opposite buildings less than two times their height worsen strong insolation and lighting of the home. In our country there is no accepted norms during insolation of buildings and territories (Russia, France, Germany, England, Belgium, it is minimally 2-3 h per day for a certain period during the year).

2. The direction and width of the streets is associated with aeration of the settlement, an important factor in maintaining good local climate and air purification. The direction of the street is the retention factor for the strong prevailing winds. Improperly planned street network back - creates conditions for the worsening physical, chemical of dust, and biological properties in the air.

3. The main disadvantages for the streets are connected with their main function - assuming pedestrian and motor traffic. Here it must note the fact that the function of streets for simultaneous movement in her pedestrians and vehicles puts in conflict the two participants in the movement. This raises a number of psycho-hygienic problems. To solve their need: the separation of pedestrian movement from the motor, introducing the motor transport underground, build bike lanes, pedestrian zones determi-

nation of prohibited vehicles, use of underground transport (metro), etc.

So-called free street network is one of the new type of zoning settlement. In it (unlike classical radial-circular and the more advanced rectangular grid) is reported as the main requirement of communication - speed, and also grading of various types of streets, with a view to structuring the residential and production-storage area and protection from the adverse factors related to road transport. Under this system creates more diversity, which is an important factor of psycho-hygienic significance. With free street network is an important choice for the direction of the street. It must comply with both the needs of communication and the need to better aeration - eg. in warmer areas by wide straight streets is pumped cool air of the green urban periphery to the center or back - to hold strong, constant winds blowing buildings are arranged transverse to the wind direction.

Important and appropriate pavement. Pavement surfaces are not good due to difficult cleaning, removal of dust in the air, are also a source of noise when driving the vehicle. Better in this respect are of asphalt, concrete and asphalt-concrete pavements. In the summer, however, they are strongly heated, separated and vapor hydrocarbons.

5. PLANTING OF POPULATED PLACES

Green areas in the settlement represent a single system of those in urban and in out of town territory, linking, the settlement with the surrounding nature. Already in the planning, construction or reconstruction of the settlements have maximum benefit and preserve existing green arrays.

Depending on their functional purpose green areas in the settlement are divided into:

1. For a broad public use - of all the town areas, regions and wide microregions, parks and gardens, green plantations of streets and boulevards, parks, recreation and landscaping arrays in the surrounding city area.

2. Limited public use - green kindergartens, schools, hospitals, businesses, neighborhood plots.

3. With a specific purpose - HPZ, sports fields, botanical and zoological gardens, dendrariums.

Total settlement for all groups of green plantations should occupy about 50 percent of its area.

Per capita, according to the size of the settlement in Bulgaria indicate values: 8 m^2 for many small towns; 4 m^2 of villages; to 20 m^2 of big cities.

Known is the thought expressed by world-renowned french architect and urbanist Le Corbusier (Charles Eduard Jeanneret-Gris - 1887-1965) - "The materials for development of cities are: sun, space, vegetation, steel, concrete. Their meaning corresponds exactly to the order in which they are listed." This highlights the importance of vegetation as one of the five basic architectural-urban planings elements.

Plantings have great hygienic importance as a factor for recovery and optimize the urban environment in many ways. One of the main effects of landscaping is the local climate on the settlement.

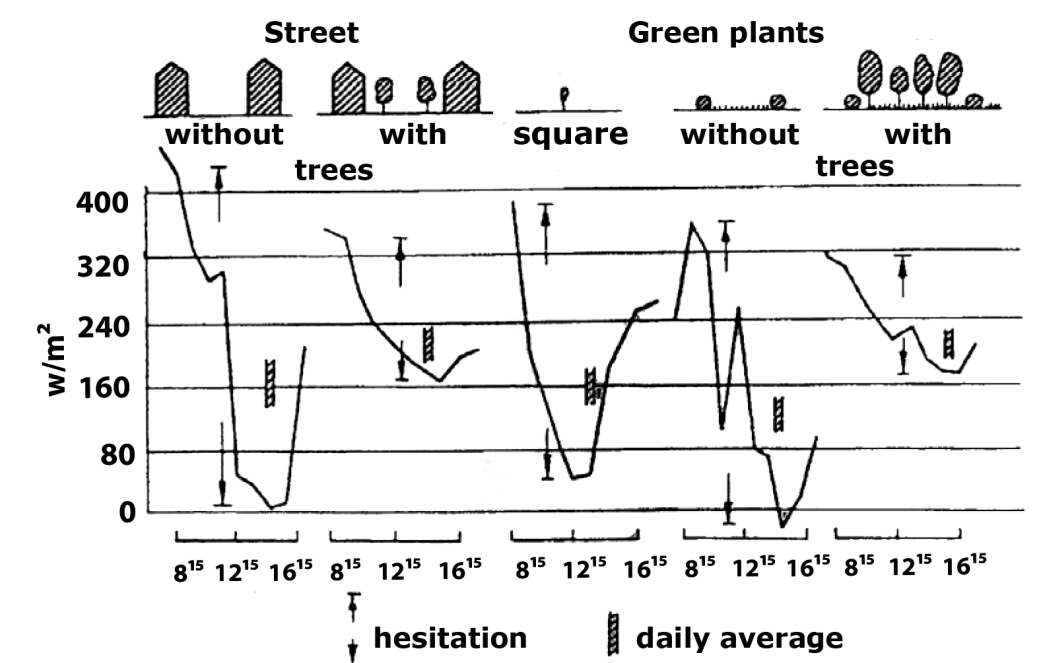


Fig. 6.3. Daily underway and average cooling effect of air and its hesitation in the summer at various locations in the city

Larger cities have their own "urban" climate. The intensity of solar radiation is 10-20% lower than that in the surrounding areas, as a result of air pollution. This is particularly pronounced with respect to ultraviolet radiation and the lower limit of its range.

The average temperature of the air is 1,5-2° C higher than that of the neighboring areas. This is due to the heat generated by energy consumption in industry, transport and heating of buildings. Eg., only district heating pipelines to be paid 15-20% of the heat of the heat-carrier, and the heat intended for buildings, eventually also released into the surrounding area. It also indicates that the simultaneous movement of 100 thousand cars release heat as this contained in 1 million liters of hot water. In the summer significantly warmed the walls of buildings, rooftops, streets, nogreenery soil (temperatures to 40-60° C), which emit radiant heat and heat the surface layer air.

Consequently, the higher the air temperature, the relative humidity is reduced by 5-10%. Due to highly air pollution, however, the number of foggy days is increased. Indicate eg., In Prague for the past 80, the frequency of foggy days has increased two times, and in Los Angeles the fog is characteristic of the urban climate.

The higher temperature and air pollution by dust and aerosols increase the number of cloudy days and precipitation with 10% - eg. Moscow for 10 years rainfall in the city were on average 668 mm per year, and in the vicinity - 572 mm.

The heat (ie. "heat island") in cities is a reason for the lower atmospheric pressure and the occurrence of typical "urban" wind at night, with direction from the periphery to the center.

Green plants have a favourable effect on temperature radiation mode in the cities as follows: reduce the direct effect of the sun (shaded surfaces), evaporate water separated from them, and they themselves are heated less by the sun's radiation. Eg., the temperature of the lawn is 5-10° C lower than that of the asphalt during the summer. The temperature of the air in areas close to large green arrays - a distance of 100 m of which is 1-1,5° C lower than that of the other areas **(Fig. 6.3).**

In cold seasons green areas have mitigating effect in this respect compared to fully open spaces due to lower radiation emit of the surfaces.

Plantings in the summer increased by up to 18-25% humidity than that of open places or dense built-up areas. For measurements made in Sofia is found in the park in the summer humidity is 8-10%

Fig. 6.4. Dust in the air of green and a built-up areas

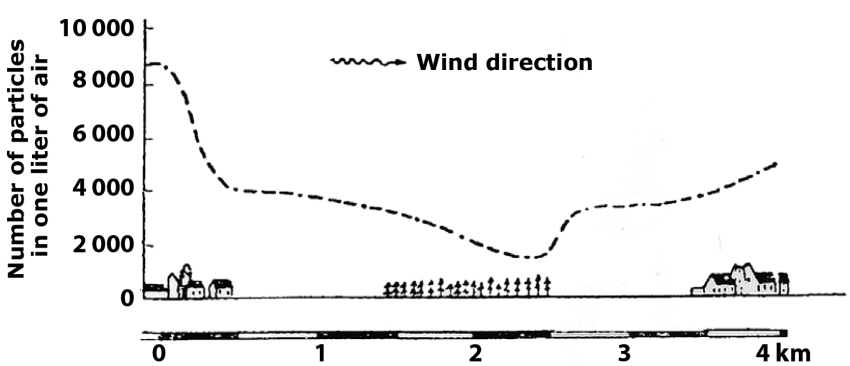


Table 6:10. Physiological state of leisure persons

Place of monitoring	Comfort assessment %	Difference in skin temperature, °C	Loss of moisture from the body g/h
On the sun between buildings in nogreenery subregion, asphalt	10	1,5	488
On the sun at an irrigation channel in micro- region, dry soil	30	1,1	301
On the sun on the square, green stripe	70	2,1	288
In the shadow of the alley in the subregion with low crowns, soil	96	1,8	179
In the penumbra of shrubs of open space, green stripe	100	2,6	143
In the shade of the trees with high crowns in micro- region, soil	100	3,1	103

higher than in a residential neighborhood. Higher humidity measured in land planted with chestnuts - 49%, and lower in those with limes - 46%, and poplars - 44%. Particularly beneficial in this direction is the combination of green areas and open waters.

It is known that green plants reduce the wind speed. Depending on the density and structure of the planting and the type of trees, the wind speed decreases from 30-40% to a complete calm inwardly in parks.

Plants influence of air ionization. It was found that the number of light ions in the air in the neighborhood with landscaped area was 141% compared to the control region, in the park - 159%, also in the park, but near the fountain - 259%, and in the residential district nogreenery - 65%. In the parks was reduced coefficient of unipolarity (prevailing light negative ions) and especially reducing heavy ions.

Plantings keep dust aerosols by filtering them and by reducing wind speed, favouring more rapid sedimentation. Dust in the air in areas with green plantations is 2-3 times fewer **(Fig. 6.4).**

It depends on the layout and the type of plants. Lawns also reduce the concentration of dust in the air as prevent dust formation from the soil, and also if the torch of dust from enterprises is low over the ground.

Green plants also influence the chemical composition of air. In the absence of vegetation nitrogen oxides from enterprise a distance of 1 km from it are 0,7 mg/m^3, and in the case of green area - 0,13 mg/m^3. Established fact is lower to 1.5-2 times the concentration of carbon monoxide and organic substance in air for green areas. The gases are reduced by green areas by their uniform dispersion and absorption through the leaves with subsequent absorption and metabolism.

Plants reduce air microflora. This is due to the reduced amount of dust aerosols and to separate from the plant substances - salts, aldehydes, ketones, phenols (i.e. phytoncides), with a strong antibacterial effect. The strongest such effect was observed in coniferous (pine) trees, followed by beech, willow.

Plantings of medium density and height of 7-8 m lower the noise of 10-13 dB/A. In other studies, in larger plantings found to decrease 23 dB/A. Districts small gardens have less soundproofing effect, depending on the layout and type of green plantations (up to 4-7 dB/A). The combination of many factors related to green areas has complex positive influence on the thermoregulation, functions of the respiratory and cardiovascular system, metabolism, neuro-hormonal regulation, recovery, etc. A number of studies have shown that on standing people in areas with green plantations in summer pulse falls, skin temperature and perspiration is reduced, and decreases the secretion of adrenaline in the urine **(Table. 6.10)**.

This is explained by the effect of the new local climate, and by soothing and psychotonic action of green plants. They help balancing the nerve processes and improved neuro-psychical state, through a complex set of factors - quiet, green color, specific aroma, specific noises, shadows, and so on. i.e. they associate the modern inhabitant with absent in urban areas nature.

6. CONDITIONS OF LIFE AND RELATED DISEASES WITH RESIDENTIAL AND PUBLIC BUILDINGS

Housing is a fundamental protection for people in all stages of its historical development and for all age groups (from birth to old age). Give details of cities in developed countries that people there spend only 10-20% of the day outside the premises - residential and business.

Currently living environment poses a number of hygienic problems regarding microclimate, insolation, lighting, ventilation and heating flocks, the composition of air, noise and related various architectural factors-terrain, floor plan, exposure, planning, building materials and construction elements, furniture.

Factors of residential environment (with similar parameters) can have a pronounced adverse effect in humans in comparison with those of the working environment and the environment outside the home, because of psychophysiological demobilization of the body during recreation (sleep), decreased general immunological reactivity in children, the elderly, reassigned, spend more of day lenght in residential environment.

Terrain exposure. Residential and commercial buildings are being built in well laid areas of the territory of the residential area of the settlements. The exhibition of housing in the house, for optimal insolation and natural lighting for the middle latitudes of the northern hemisphere is south, southeast.

Legislation in Bulgaria requires at least one of the living rooms to be optimal exposure (this includes and west), high green plants should not be closer than 6 m to buildings.

Floors. Problems associated with the number of storeys of buildings, stand differently according to size, type and structure of the settlement. More favourable from a hygienic point of view are one, two-storey, single-family homes, because of the connection of man and nature, better contacts with others and family ties, greater opportunities for "pri-

vate time." Conversely, excessively high-rise buildings and in big cities, realized at a very high density of the residential land (60-80%, recommended at 30%), leading to a very high density of habitation (reaching over 2,000 inhabitants per hectare, recommended 480). This determines the adverse effects of a healthy lifestyle in urban cities. Tall buildings themselves also pose hygienic problems associated primarily with the separation of man from nature and its replacement with an artificial environment. The higher the building, the lower the children and higher age are elderly, the greater the risk to their physical and mental health.

Layout and size of the dwelling. They should provide opportunities for:

- good ventilation;
- insolation;
- lighting;
- protection from noise and air pollution;
- comfortable microclimate;
- recreation;
- carry out creative activity;
- childcare.

To ensure that the necessary rational disposition of the rooms to each other and to those of neighboring homes, functional links between them, suitable orientation, to be sized according to the hygienic, aesthetic and professional requirements.

The living spaces (bedrooms, living room, office) should be separated (most often through the hall, entrance hall) of the kitchen block and sanitary facilities (bathrooms, toilets). Do not allow the deployment of bedrooms next to the elevator shafts, garbage carry-outs and other rooms and spaces with sources of noise and vibration over hygienic standards. Bathrooms over living space, kitchen, larder are allowed only home they serve. Possible direct links bedroom/bathroom-toilet with good insulation but not their spatial connection. So-called "light height" (clear height) of the premises shall not be less than 2,6 m.

Microclimate in the premises. It should be 20-22°C air temperature, 30-60% rel. humidity, up to 0,2-0,4 m/s velocity of the air, horizontal and vertical temperature gradient - 2-3° C, uniformity of air temperature during the day - up to 3° C deviation at central heating. These parameters must be provided by the heating equipment during the cold seasons, thermal insulation properties of the building, ventilation and air conditioning systems. The ratio of natural light (RNL) of housing should be above 0.5% (for the middle of the room, height of 0,5 m above the floor). To assess the quality of the air environment in the premises using hygiene standards for dust and chemical composition of air in the settlements.

Hygienic requirements for construction materials and structures, flooring, color and lining the walls are associated with their ability to provide thermal and noise comfort and chemical factors clean air environment. Plastic materials for flooring and wall coverings are charged with static electricity with a voltage of up to 600-2000 V/cm (allowed up to 300 V/cm).

Influence of habitation it on health status of the population. Antisanitary dwelling in the past and now for a large part of the population in developing countries and for certain groups of the population in developed countries, has been and is a factor directly and strongly influencing the health, physical development and mortality. Increased incidence of infectious diseases, rheumatism, rickets, skin diseases, allergies, neuroses are described in living in small-sized, moist, with poor insolation, noisy and so on.. housing. In the past, tuberculosis was called "residential disease", tuberculosis mortality was 3.5% with an average of 1.1 occupants per room and 5.2% - in 2.4 occupants per room (G. V. Hlopin).

Currently living and working in non-industrial purpose buildings (offices, office building and so on) of urban settlements have other health problems.

Back in the 60s of XX century describes the states of weakness, fatigue with such persons related to the specifics of the building.

In the 70 years increases the frequency of these complaints after reconstruction of buildings connected with the improvement of the thermo isolation or the introduction of conditioning devices and no opened windows.

In 1983, the WHO expert group has proposed the concept of *Syndrome of Unhealthy Shelter*, and later introduced the term "disease associated with buildings (Building - Associated Illness)". According to WHO, an average of 30% of non-industrial buildings intended to show such diseases.

When working and living in these unhealthy buildings describe symptoms like headache, dizziness, tiredness, fatigue, irritability, nausea, discomfort, irritation of the mucous membranes of the eyes, nose, upper respiratory tract. Often these events are amplified, increases body temperature, develop asthma attacks.

In these buildings, unless forced ventilation with air recirculation are used and many plastics (such as construction materials, synthetic textiles), the microclimate is isothermal (static). In the air space can contain up to 800 organic compounds - in hygiene standards for production facilities and close to those of the communal environment **(Table. 6.11.)**.

The emergence of the syndrome of unhealthy premise is associated with smoking (active and pas-

sive), presence of allergic diseases, migraine attacks, psychosocial factors (job satisfaction, commitment, skills, stress at work, relationship between individuals, tolerance) and others.

NIOSH studies in 1986 showed 444 buildings at 52% problems in ventilation systems, insufficient flow of fresh air, mixing easily with re-circulated air. 17% were found contaminants from own sources - copiers, used insecticides, detergents, tobacco smoke, exhaust gases (of coffee machines). At 11% - contamination from external sources - exhaust gases from the garages, of asphalt, from heating systems. At 5% were found increased content of air microflora and pathogenic micro-organisms (of the contaminated water to the conditioning systems). At 3% building materials were responsible for pollution (phenol, formaldehyde). 12% of the studies non established risk factor (s) for the occurrence of this syndrome (disease).

Table 6.11. Concentration of the components of the air environment in rooms with non-industrial purpose (WHO, 1984)

Pollutant	Concentration mg/m^3			Remark
	Measured	Unforced alert	A worrying	
Passive smoking	0,05-0,07 respirables particles	< 0,1	> 0,15	Japanese standard 0,15 mg/mi[1]
Carbon monoxide	1-1,5	< 2	> 5	Indicator - eye irritation (only from passive smoking)
Nitrosodimethylamin	(1-50). 10^6	–	–	Mutagen carcinogenicity study
Nitrogen dioxide	0,05-1	< 0,19	>0,32	
Carbon monoxide	1-100	< 11 (2%COHb)	> 30 (3%COHb)*	
Radon (daughter products)	4-8000 Bq/m^3	0	70 Bq/m^3	Swedish standards for new homes
Formaldehyde	0,05-2	< 0,06	> 0,012	Long and short term impact
Sulphur dioxide	0,02-1	< 0,5	> 1,35	
Carbon dioxide	600-9000	< 4800	> 12000	Japanese standard 1880 mg/m^3
Ozone	0,04-0,4	0,05	0,08	
Asbestos	< 10^6 fiber/m^3	= 0	10^5 fiber/m^3	Prolonged exposure
Mineral fibers	10 fiber/m^3	–	–	
Organic substances				
Methylchloride	0,005-1	–	350	TLV
Trichloroethane	0,0001-0,02	–	270	NIOSH
Tetrachlorethylene	0,002-0,05	–	335	TLV
1,4 Dichlorobenzene	0,005-0,01	–	450	TLV
Benzene	0,01-0,04	Carcinogen	Carcinogen	
Toluene	0,015-0,07	–	375	TLV
Xylene	0,01-0,05	–	435	TLV

* Inconformity of standard for ecological healing (WHO-Geneva, 1977, No.4)

The main reason for the occurrence of these diseases emphasizes smoking, primarily due contained numerous factors (gases, particles, radioactive substances) in cigarette smoke with diverse - early and late harmful effects, but it may be challenged when not apply to active smoking and stay in areas with high air pollution (eg. when aggregating many people in cafes and so on). However, it established a clear linear relationship dose-response between exposure to cigarette smoke in the rooms and the metabolite of nicotine - cotinine in the blood and urine.

When no smokings, staying in rooms without smoking bans in daily exposure of 143 μg nicotine, cotinine concentrations (blood/urine) were respectively 1,0 ng/ml and 6,2 ng/ml, and at the most exposed no smokings all these values were 10 times higher.

It has found that smokers indicate a reduction in their working capacity, as well as irritation of cigarette smoke when wearing contact lenses and for people with allergic hypersensitivity. Indicate two disease groups - with short and long latency period.

The first group includes:

1. Syndrome of closed room space. Appears quickly, most often in individuals with allergic rhinitis and asthma, a family hypersensitivity. Clinical symptoms - eye inflammation, rhinitis, sinusitis, breathlessness, headache, tiredness, dizziness. Not identified the exact chemical contaminants causing this syndrome - believed that this is due to the presence of many pollutants from different backgrounds with low concentrations. Treatment is symptomatic. Good condition of ventilation, stay outdoors during the day and the weekly leisure improve the state.

2. Mass psychogenic illness. Meeting together with the syndrome of closed room space, but occurs in groups of people, often women's groups. Transmitted from person to person (i.e. a model of an infectious disease), but is transmitted concern, not an infectious agent. Usually these people are badly paid work, monotony, with mental stress, easily responding auditory and visual and with physical stressors - noise, poor lighting. Predominant symptoms of headache, dizziness, fatigue, stiffness, confusion, drowsiness, dry mouth, but it can and symptoms associated with irritation and inflammation of the mucous membranes. No objective changes - laboratory, physical. Improve the environment (removal of pollutants, noise, lighting) and stay in the nature improve the condition.

3. Hypersensitivity pneumonitis. Immune interstitial lung disease due to inhalation of organic dust (antigens). Here, these antigens are mostly thermophilic actinomycetes (Termoactinomyces vulgaris, Micropolyspora faeni), fungi (Aspergillus, Penicillium, Alternaria) sometimes amoebae (Naegleria, Acanthamoeba), emerging in the hot water of the air conditioning systems with air recirculation and humectants, but may damp flooring, carpeting, tiling with textile materials, furniture. Clinical symptoms are characterized - cough, dyspnea, fever, headache, myalgia (weight loss, worsening breathlessness - in chronic forms). Symptoms appear 4-6 h after exposure, physical examination showed dyspnea, tachypnea, crackles at the base of the lung. Leukocytosis also boosted pulmonary pattern, impaired breathing from external restrictive type - reduced vital capacity and forced expiration (FEV and FVC). Not always establish specific antibodies in serum, and back - detect specific antibodies in the absence of clinical symptoms. Short course of treatment with corticosteroids and above all the removal of houses normalize the condition. It is necessary to improve ventilation.

Other diseases with short latency period are legionnelosis (Legionella pneumophila) - due to the development of these microorganisms in low warm water ventilation systems. Possible intoxications with carbon monoxide, formaldehyde and other contaminants, leaking from gas heaters, plastic surfaces, adhesives and more.

It is estimated that air pollution in rooms with cigarette smoke, asbestos, radon, nitrogen oxides, organochlorine insecticides, polycyclic aromatic hydrocarbons can be a causative factor for the development of diseases with long latency period - lung cancer and chronic non-malignant lung diseases (in effect nitrogen oxides). Because of the long latency period, small concentrations and multifactorial etiology of lung cancer, independent role in the unhealthy air space for the development of lung cancer can not be confirmed safe.

With regard to "passive smoking" models have been developed, indicating that the so-called. "Acceptable risk" for lung cancer from 1.10^{-6} case, the concentration of nicotine in the air at the workplace must not exceed 7,5 ng/m^3, at 8 h daily exposure for 40 years.

REFERENCES:

1. **Beryushev, C.G.** Hygiene planning settlements. In: Guide for communal hygiene V.1, ed. V.A. Ryazanov, 1961 Medgiz, 465-613. (in russ.)

2. **Fischman. M. L.** Building - Associated Illness. In: Occupational Medicine ed. J. La Dou, Appleton/Lange, Norwalk, 1990, 453-458.

3. **Frumkin H., Frank L., Jackson R.** Urban Spraul and Public Health, Island Press, Washington, London, 2004, p. 338.

4. Hygiene of settlements ed. **G. Stefanov** 1985, II ed., Med. and phys., 321p. (in bul.)

5. **Kreiss, K., M. Hodgson.** Building - Associated epidemics. In: Indoor Air Quality, ed. Walsh P., J., Dudney CS, Copenhaver ED, CRC press, 1984, 230-238.

6. Law on Territory Planning, SG. 1, 2001. (in bul.)

7. **Marzeev, A. N., V. M. Zhabotinskiy.** Communal hygiene. Med. M. 1979, 573. (in russ.)

8. **Mirchev V., D. Minkov.** Air pollution and means to protect its purity. Technique, 1974, S. 305. (in bul.)

9. Physical factors of the environment, ed. **Em. Efremov.** 1988 Med. and Phys., 277 p. (in bul.)

10. Regulation 6 for indicators of environmental noise, taking into account the degree of discomfort; limits, the assessment methods. Off. Bull. of the Ministry of Health, issue. 11, 2006 (in bul.)

11. Regulation 7, SG. 3/2004 (amend. 2005) for rules and regulations for the development of the different types of territories and zones. (in bul.)

12. Regulation 14, SG. 79/1987 (am. 1992-2004) to the resort areas and resorts. (in bul.)

13. **Rumyantsev, G., P. Vishnevskaya E., T. A. Kozlova.** Hygiene. Med. M. 1985, 431 p. (in russ.)

14. **Shafir, A.I.** Hygiene planning, arrangement and set up buildings in: Guide for communal hygiene, V. Ill, ed. I.S. Goromosov and A.I. Shafir. Medgiz, 1963, 27-97 (in russ.)

15. **Repace, J.L., A.H. Lowrey.** An enforceable indoor air quality standard for environmental tobacco smoke in the workplace. Risk Anal. 1993, Aug., 13 (4). 463-475.

16. The World Resources Institute. World Resources 1996-97, Oxford Universiti Press, NY 1996,365.

17. **Veselovskaya, K. A., I. V. Panfilova, E. Yu Orlovskaya.** Syndrome "unhealthy" premises how hygienic problem (overview). Gig. labour. 1991, 5, 33-35. (in russ.)

D. Tsvetkov, J. Staykova

7 HOSPITAL HYGIENE

Hospitals have a long historical development of BC to the modern state. There are also clinics in the temples of ancient Egypt. In ancient Greece created called. "Hosts" (lat. Hospes) for poor pilgrims and the sick; there exist yatres (gr. latros - healer) in the so called nozokomeoes (gr. nosokomeone; nosos - disease, komeo - care); clinics and to build temples to the god Asclepius (asclepiones). In ancient Rome that are called valetudinares (lat. valetudo - health). In the Middle Ages in Europe appear "host-shelters" (lat. Hospitalis - hospitality) for healthy and sick strangers and pilgrims; xenodohes (lat. xenodochium) - shelters for the poor and strangers; infirmaries (shelters of St. Lazarus) for leprosy patients; Maison Dieu (France) - for the disabled and the terminally ill.

Later in Europe create major church hospitals in the so-called housing (barracks) type - Hotel Dieu (651, Paris), Albani Hospital (794, London), San Spirito (1204, Rome). Follow them hospitals pavilion type Laribuaseur, Montpellier (France); John Hopkins (Baltimor, USA); Virchow (Berlin) and those of the so-called mixed (block) type with separate compartments (buildings) for different age contingents ,infectious and non infectious patients, etc., as are most modern hospitals.

First discovered by Joseph Lister (1827-1912) in the 70 years of the nineteenth century important and compulsory application of chemical disinfectants (carbolic acide) a sharp reduction in mortality from postoperative infections; the use of dry heat sterilization and ethylene oxide (1940), set as main directions of modern hospital hygiene problems of disinfection, sterilization, fighting nosocomial infections (NI).

Main tasks of this branch of hygiene are:

1. Optimizing patient person surrounding environment (planning, furnishings, equipment sanitary-technical equipments, fighting nosocomial infections, medical-protective mode).

2. Creation of favourable working conditions for medical staff.

Nomenclature surge for health care institutions in our country is diverse:

- *Hospitals with different capacities; serviced contingent and specialization.*
- *Specialized dispensary (skin-venereal, oncologic etc.).*
- *Outpatient-polyclinic institutions (diagnostic-consultative centres, urban, municipal, dental, labour, health centres and services).*
- *Institutions for security of maternity and childhood (maternity homes, creches, nurseries, kindergarten, etc.).*
- *Sanitation health (rehabilitation) facilities.*
- *Hospitals emergency.*

Modern hospitals in the current state of environmental pollution (polluted environment, urban settlements) and the development of medical science and technology put to resolve some new hygiene problems such as: maximize the positive qualities of the environment and protection from dust pollution, toxic emissions, noise and other communal hazards; hygienic assessment of new tools and methods used for diagnosis, treatment, disinfection and sterilization.

New vision of the role of prevention in modern hospitals was established in 1993 under the auspices of the WHO - a worldwide network of hospitals for health promotion (Health Promoting Hospitals - HPH). Started as separate projects for some hospitals in the US and Canada (from the early 80s), the network currently includes 30 countries. Including and Bulgaria.

In the main documents defining the requirements for these hospitals - the Ottawa Charter (1986) and the Declaration of Budapest (1992), states that HPH should:

1. Draws attention to the impact of hospital environment on patients, staff and the public. It must maintain, strengthen and improve the healing process.

2. To create the necessary conditions for health personnel and strive to become a model for a health service jobs.

3. To maintain and enhance cooperation with local communities and local governments through initiatives for health promotion.

4. To ensure the access of patients and their relatives to the necessary health information, educational programs, training activities by encouraging active collabouration for health promotion, etc., ie modern hospitals have actively participated in health-preventive activity of the country.

1. LOCATION, ZONING AND CONSTRUCTION OF HOSPITALS. HOSPITAL BUILDING SYSTEMS

Hospitals are built in residential areas of the settlements (residential to recreational activities and public service areas, under LTP in Bulgaria, 2001) and in non settlement territory. Health facilities are built in industrial areas for service employees.

In the residential area being built hospitals of general type, combined with outpatient clinics, and independent diagnostic and consultative centres. For the first is required section - 3-16 ha, they are city and regional (over city) matter and within the periphery of the residential area. In larger cities, where they are more are available within the bounds of serviced urban areas. In the periphery of the residential area of the settlement revealed independent infectious hospitals and in the surrounding area and beyond - independent tuberculosis and psychiatric hospitals (they may be in the residential area of the settlement, if included in the composition of health care complex).

The terrain of the hospital must be located in an area away from sources of noise and pollution of air, water and soil - airports, railways, roads and busy streets, urban wastelands, large sports and cultural sites. Account the possibilities for the use of urban public transport and public works facilities (water supply, sewerage, etc.). The size of the field is determined according to the number of beds, type, and kind of hospital, the number of population served by private ambulatory-polyclinic institutions (norms area of the terrain are usually 80-100 m^2 of bed depending on the number of beds).

It is desirable that the area be a rectangular shape (aspect ratio 1:2 or 2:3), whereby greatly facilitates its planning.

At the hospital of general type is required for functional zoning:

- *Outpatients.*
- *Hospital for non-infectious patients.*
- *Hospital for infectious patients.*
- *Hospital for sick children.*
- *Obstetrician sector.*
- *Business-bit sector.*
- *Hospital Park.*

Hospital buildings must be located in the best part of the plot - a higher positioned, windward (compared to the business sector), green, quiet, at the same time they and others auxiliary buildings not overshadow the hospital park (to be in the northern part). Infections ward, if it is in a separate building, is located in the depth of the section, but not closer than 30-40 m from the hospital.

Area businesses when it is in a separate building to be distant 30 m away from the building of the hospital.

Landscaping of the site must be at least 40 to 60 percent of its area. On the periphery of the territory to have protected "green" zone.

Plantings are formed in a park to walk the sick. They affect the temperature and humidity conditions of the area, protected from noise, purify air from gas and particulate pollutants, release phytoncides and reduce air microflora, have a beneficial psychological effect.

The noise around the hospital area should not exceed 45 dB/A during the day and 35 dB/A at night.

In hospital construction using three basic systems of planning: decentralized (pavilion), centralized (building), mixed (block).

◆ ***Pavilion system***

Historically, the emergence of this system is associated with the doctrine of the miasma - the presence in the air of volatile substances evaporating from soil, marshes, waste and leaking of patients causes of infectious diseases - "genius epidemicus". Hence the understanding then the damage at the gathering of many patients in large, enclosed, non-ventilated rooms of large hospitals. Later doctrine of contagion - Fracastor and foremost discoveries of L. Pasteur and R. Koch, rejected the doctrine of the miasma and set the theoretical justification for the existence of this system and now best for prevention of NI. It includes small buildings with a height of 1-3 floors, each of them specialized - for example administrative-farm building hospitals for various diseases. This system is not used in large integrated hospitals, but to specialized hospitals - infectious, tuberculosis, children's, psychiatric. It allows for better insulation, ventilation, landscaping, but requires a lot of duplication of services, difficult connections between buildings, require large areas for a relatively small number of beds.

◆ ***Centralized (building) system***

It is used in large general hospitals built in urban areas with high density of liaison. This system of construction is economical, allows for quick and easy communication between different compartments,

for quick consultation of specialists, use of common auxiliary rooms of several departments - eg. common laboratory for clinical studies. In it, however, it is the accumulation of many people, building a qualified and costly maintenance, noise comfort has deteriorated, increasing the risk of nosocomial infections.

◆ ***Mixed (block) system***

Upon her in a common housing are wards that do not require isolation (internal, surgical, eye, etc.). In other wings, connected to the central building or in separate buildings are children, infectious and maternity ward, ambulance, administrative and economic unit, radiology department and pathologists. This type of architectural style is most acceptable combination of sanitary-epidemiological and economic requirements. Modern hospital building is done almost exclusively through centralized and mixed system **(Fig. 7.1)**.

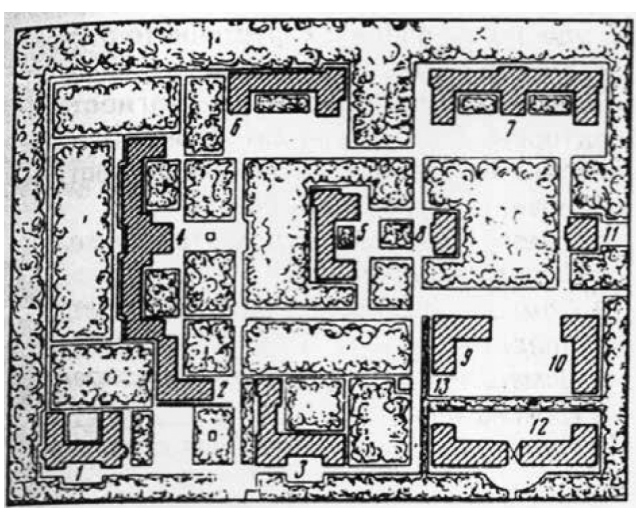


Fig. 7.1. Sample master plan of hospital (mixed system)
1 - ambulatory; 2 - reception ward and administrative and business sector; 3 - AG hospital; 4 - central building; 5 - pediatric hospital; 6 - pulmonary clinic; 7 - hospital for infectious sick; 8 - kitchen; 9 - garage; 10 - laundry; 11 - pathological sector; 12 - workshops and storage; 13 - transformer station.

2. HYGIENIC REQUIREMENTS FOR HOSPITAL BUILDINGS AND PREMISES

Input-output and communication elements of the hospital building - entrances, staircases and elevators, must to allow easy transfer of patients with litter, food, materials and equipment; to prevent the penetration of cold outside air; to protect against noise and provide faster movement of personnel. The main entrance for patients, visitors and staff is arranged as an airlock. They shall be separate entrances for business premises, pathoanatomy block, for ambulatory (division of the sectors for sick children, child consultation and adults), etc. They shall be separate staircases for patients, staff and economic service. Recommended placement of individual and small elevator for food, directly connecting offices with kitchen food block, if one is designed.

◆ ***Stationary***

Hospital ward (with total staff, consisting of one or two clinical sections) is the basic functional unit of the hospital. Any clinical section includes an average 25-32 beds (therapeutic wards for chronically ill can be a larger number of beds - 30-40, while children's infectious, skin-venereal, psychiatric wards are smaller - 15-20). In clinical sections of the total number of beds 7% should be in rooms with one bed and a private bathroom. Other rooms have 2-4 beds, also with its own bathroom.

Hospital room

1. Dimensions, exposure. It has a minimum area of 4-12 m^2 per bed, depending on the number of beds for adults or children. The minimum clear height shall be 2,5 m.

The exposure of the hospital room is recommended to be south or southeast. For rooms facing west to provide sun protection devices.

Next to hospital rooms do not allow deployment of operating, birthing rooms, mechanical rooms, workshops, X-ray and radionuclide offices and others sources of harmful or disturbing stay sick.

2. Internal arrangement. The beds in the hospital room must be no more than four. The walls are painted with bright and soothing cool colors (not just white - those areas not well perceived) best light green or light blue. In northern rooms color is too bright, but warm colors - pale yellow, yellow-orange. The ceiling is smooth, white, and blue may. The floor is covered with linoleum. The walls are with latex paint, beds and lockers to be light-colored, smooth and easily cleanable. All surfaces in the hospital room must be smooth and covered with materials (plastics, latex paint, no embossed) to allow easy wet cleaning and disinfection.

3. Ventilation. Hospital room ventilation must provide air exchange of 80 m^3 per bed. Suits are natural, forced-aspiration ventilation (aeration) best of descending type. Ventilation is a major factor in air quality. Air pollutants here are: products of the metabolism of patients (spend over 70 ingredients, of which the main ones are carbon dioxide, ammonia, hydrogen sulfide, indole etc.) Ingredients separated from polymeric materials (primarily flooring - vinyl chloride, phenol, ammonia, styrene, formaldehyde, etc.)., disinfectants, medicines, volatile feed used.

With exhaled air is released only about 2% of these pollutants (mainly carbon dioxide), which is why the content of CO_2 in the air is not sufficient as a criterion for its purity. Air microflora of hospital rooms is also a key indicator of purity and the risk of nosocomial infections. The air is considered clean when content in the summer under 3500 microorganismes/m^3; under 24 hemolytic staphylococci/m^3; under 16 α- and β-hemolytic streptococci/m^3. For the winter period values are: <5000; <52; <36.

4. Heating. It should be central, water, a surface temperature of the radiators to 75° C or radiation - the heating temperature of the walls and panels - 45° C, heated floor - 25° C (which may be an air conditioning). Radiation heating allows for more frequent airing of the room during the cold season, without risk of lowering the air temperature (very quickly recovers). Heating and ventilation should provide a microclimate with an air temperature 20-22° C with humidity - 40-60% and air velocity to 0,2 m/s.

Higher or lower air temperatures are necessary in certain diseases and conditions: 15-16°C in patients with thyrotoxicosis; 24-25°C in patients with hypothyroidism, premature infants, neonates.

5. Lighting. Natural lighting should be a light ratio 1:4 - 1:5 (no more than 1:3, to avoid overheating or cooling the room and the feeling of insufficient protection in sick). RNL be not less than 1.5%. In each patient to have a local lamp for artificial lighting. General lighting is not very hard, to be indirect - with milk or opaque light globes and provide illumination of 0,8 m from the floor of 100 Lx.

Hospital corridors.

Since corridors have functions of "air tanks" for clean air, are best one-corridors clinical sections - with windows on one side, or built with rooms on both sides of the corridor, but with interruptions. Modern construction requires two-corridors systems at major hospitals, but it is much worse natural lighting and ventilation of premises in the central part between the two corridors (there have storage rooms, elevator shafts, dining rooms with office, which must be efficient artificial lighting and ventilation).

Room for daily stay of patients. It relies area 1,5 m^2 per bed, but not total less than 15 m^2. Daily room stay (room alone) can be used as a dining room.

Dining room and kitchen office. They must be separate in each ward, and not be deployed in the enlarged corridor. The offices are stacked on the floors to be able to use any small elevator. The office is handing out food and utensils stored (each unit has its own utensils). In the next room or blocked part of the office (barrier height 1,8 m and stop) to wash dishes in the dishwasher or in two separate trays and dried. Dining room (if not a living room) and the office could be facing north or without natural lighting at two-corridors system.

Other spaces to a stationary.

- *Doctor's offices and room for nurses (related to the manipulation room).*
- *Cleaners.*
- *Warehouses for clean and dirty underwear and inventory.*
- *Bathroom and toilets for patients and staff.*
- *At the hospital ward and provides head ward office, office for the physician on duty, room head nurse.*

Balconies, terraces and porches. They are necessary for climate healing - air and solar procedures. Must be facing south or southeast and should not hamper the natural lighting on the lower floors.

◆ ***Operational block***

Operational units can be located centrally on one floor (not in the basement) of the hospital building or centralized vertically one above the other on different floors. They should be conveniently associated with the surgical unit; with compartment for anesthesia, intensive care and resuscitation; with functional diagnostic laboratories. Operational block includes two private sector - aseptic and septic.

The main areas are:

1. Operating rooms and premises for preparation of the team.
2. Sterilization.
3. Room for preparation of patients.
4. Hardware.
5. Room to wake operated.
6. Shock hall.
7. Plasters room with room for preparing gypsum.
8. Room for storage of blood and blood substitutes.
9. Laboratory for urgent analysis.
10. Premises for mobile X-ray equipment.
11. Sanitary service for staff.

Operating room. There is only one operating table (operating room serves 30 beds). Its area is 30 m^2, and height - 3,5 m. It must be directly linked to the sterilization and premises for preparation of the team and the sick.

Operating room is oriented to the north (also rooms for intensive care and resuscitation). It should be a natural lighting with RNL 2.5% (but can be only with artificial lighting). General artificial lighting in

operating should be 1000 Lx (of 0,8 m above the floor) and the operational field - 10-100000 Lx. Light sources for general lighting must be fluorescent. Special surgical lamps are shadowless and should ensure that high illumination field with a diameter of more than 0,2 m without being heated above 30° C. It is obligatory placement emergency generator for power supply with automatic switch (switching to 15 s after power failure). Operating walls should be lined to the ceiling with bright tiles - pale blue or pale green. Operational linen and clothing be green - the contrast of the surgical wound. Flooring (linoleum, and others) to be antistatic.

The microclimate in the surgery must be temperature - 22-26°C, humidity - 50-60%, air velocity - 0.2-0.3 m/s. Microorganisms (total number) are allowed to 1000/m^3 air, pathogenic staphylococci (S. aureus) there should'nt be in 250 l air. The operation must be equipped with air conditioning **(Table 7.1.)**.

The type of ventilation, realized it must be descending, the air is sucked from the upper and lower area of the hall, the flow prevails (with multiplicity + 0.5). The ventilation rate should be high - over 8-10. It has been found that, when a multiplicity 10, purulent post-operative complications have been about 8% of all operated; Multiplicity at 30 - 2-3%, and in the absence of ventilation - 20-30%. In the air induction pipe to suit the double filters for coarse and fine cleaning of dust and microorganisms and mounted UV bactericidal lamps. In operating also mounted such lamps with a specific power in direct radiation 6 W/m^2, which includes constant at night or 1-2 h to starting work.

◆ ***Physiotherapy and rehabilitation***

It is located on the first floor - to ambulatory and hospital, for general service (without contact) outpatient and hospital patients. The department covers the following sectors: electro-light healing and inhalation, physiotherapy, water treatment, spa, paraffin-healing, mud, etc., according to the capacity of the hospital. There are 1-2 floors directly connected one above the other, as hydrotherapy and mud can be in the basement. In the unit require a high ventilation rate with feeding and extracting the air in the upper space. Have to separate dry from wet areas. The air temperature in the procedural premises of water treatment sector is 24-25°C at a relative humidity to 75%.

◆ ***X-ray diagnostic department and radionuclide diagnostics***

Latter revealed only at major hospitals.

◆ ***Clinical Laboratory***

It can be central, serving inpatient and outpatient, but some specialized tests may be carried out in decentralized laboratories. Premises for the laboratory (clinicochemical, tsitomorfologichni, immunological, etc.) with a height 3 m, north orientation, RNL - 1.5%, combined artificial lighting with illumination of 500 Lx of the work surface (general lighting).

◆ ***Pathoanatomy compartment***

Table 7.1. Comparative table for microclimatic norms in operating rooms

Country Norms	Air recirculation	Microclimate parameters			Noise dB(A)
		Temperature °C	Relative humidity, %	Air Flow m/s	
Austria ONORMM7620	allowed	min 19 max 24	45-65	0,2 0,25	–
Switzerland Norms	allowed	min 19 max 24	45-60 45-55	0,25 (0,45)	45
Germany DIN 1946 part 4	allowed	min 22 max 26	40-60	0,2 0,25	40
England DHHS	not allowed	min 18 max 21	40-60	0,25	50
USA ASHRAE	allowed	min 22 max 25	40-60	–	40
Healthcare Bulgaria Norms	not allowed	winter 22 summer 26	50-60	0,2 0,3	30

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Rapid results to avoid delays in production (1min)

Easy data read out, easy data transfer via USB, integrated printer.

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It is designed in a separate building, surrounded by green plantations or in the basement with a separate entrance.

The department should have the following premises:

1. Storage of corpses (with freezer boxes).

2. Sectional hall (16-24 m² for a table).

3. Room for preparation and submission of corpses (storage and sectional separate rooms for infectious and non-infectious corpses).

4. Laboratories (formalin, paraffin, biopsy, histology).

5. Offices.

6. Sanitary service for staff like.

Autopsy rooms face north, RNL - 2%, combined artificial lighting of 5000 lx on the sectional table (500 lx general lighting). Freezer boxes, storage, sanitary services, photo labs may be without natural lighting. The floor in the section, store and preparatory bodies should be mosaic and the walls are faience tiles to the ceiling. In these areas of the ward and in laboratories only exhaust is arranged or forced-air exhaust (with significant prevalence of aspiration) ventilation. Working furniture should have a smooth surface, sectional tables are covered with mosaic or stainless steel.

The sanitary arrangements of blocks include: wash thoroughly with cool and hot water to the sectional mass and tools after each section; in carcasses of infectious sick washing followed by treatment with 2.5-3% solution of chloramine, chlorinated lime or other disinfectant. During the autopsy, staff must use additional special clothing. Gloves, rubber overalls are washed and disinfected.

◆ ***Reception ward***

It provides direct access to the road transport, so has to be the first floor. Sick children, skin-venereal, psychiatric, tuberculosis and obstetric ward shall be adopted in separate, while the remaining units - in common reception. In smaller hospitals (under 600 beds) will be only one ward, but with separation of children, mothers and infectious patients.

◆ ***Pharmacy***

Hospital pharmacies are closed type - serve only the needs of the hospital (can serve and outpatients, but their full separate). They include the following premises: assistant room; reception-prescription room; laboratory - with washing, sterilization, distillation and koktorium; aseptic room, cabinet for pharmacy head; stores; unpacking room; sanitary service (can be used on any other sectors).

◆ ***Clinical diagnostic centres***

They are designed in separate buildings with distance from neighboring buildings. Have in the central part of the service area, with convenient public transport, but not on streets with heavy traffic. Arranged in three main sectors - for adults, sick and healthy children. Separated and dental, medical diagnostic, administrative and economic sector. In the children's sector to suit filter entrance manned by a nurse. Children with suspected infectious disease are isolated for medical examination in the box to filter.

Due to the high epidemiological risk is necessary to ensure good flowability and functional links from the entrance, to the registry offices, to the departments of diagnostic and treatment (without crossing the separate streams). Waiting rooms for offices are the most common corridors or hallways extensions (minimum width of 2,2 m). Skin - venereal and OG have separate offices, separate waiting rooms.

Doctor offices should have good natural light - facing south, RNL - 1.5-2.0%. Their area is minimum 12 m2. Combined artificial lighting should provide general illumination of 500 lx and 1000 lx for examinations and treatment. The walls are stained light blue, light green or light gray for good illumination for better view of the coloration of the skin and mucous membranes and soothing effect. Noise in doctors' offices must not exceed 40 dB/A.

◆ ***Economic Sector***

<u>*Food supply (hospital kitchen).*</u> Hospital kitchen is generally designed as a centralized food unit that receives and stores the food prepared and cooked food supplies in hospital wards. Used common containers (water bottles cisterns), of which in the office of the hospital ward food spills in table utensils compartment. Food unit must be in a separate building block or in the basement of the hospital building.

Decentralised system here is possible in some departments of the hospital, requiring a special diet (eg. In children up to 2 years), but it can reveal sector and children's dietary cuisine to the food supply.

The device of the food block in hospitals must be in compliance with all requirements for the structure of catering. Feature here is the additional disclosure of premises for storage, cleaning, disinfection and drying pads containers and food. The management of the food supply is provided by a physician-nutritionist.

Upon subscription delivery of food, providing room for the reception and distribution of food to the provision of cold storage and for conditions sampling and examination of its quality.

<u>*Washing and disinfection unit.*</u> These two units are

merged functional, as in infectious, skin-venereal and tuberculosis hospitals and wards all linens are disinfected before washing, but in other hospitals and wards 30% of the underwear is subject to prior disinfection.

Washing and disinfecting unit must be in a separate building (maybe in total farm building). Disinfecting compartment consists of two parts - the "dirty" and "clean", separated from the disinfection devices. The clean part is connected directly to the laundry room, where linen is washable at 95 ° C (Disinfection of blankets, mattresses, clothes, etc. Is carried out in the disinfection chamber without washing). Disinfection of linen is carried out at the hospital ward, by spray with disinfectants and in disinfection unit in containers with disinfectant solutions.

3. WATER, SEWAGE, REMOVAL AND DISPOSAL OF SOLID WASTE.

◆ ***Water supply***

Hospitals must be connected to the central water supply of the settlement. The required amounts of water depend on 250-350 l of the bed for 24 h. For outpatient needed 15 l/24 h. There must be a hot water and household use, with a temperature up to 42° C.

◆ ***Sewerage***

Hospital sewage is associated with the overall sanitation of the settlement. Pre-decontamination of hospital waste water treatment (chlorination) should be performed in specialized infectious and tuberculosis hospitals.

◆ ***Removal and disposal of solid waste***

Hospital waste is divided into three streams:

1. Incineration in special furnaces (incinerators). These are materials with large epidemiological risk, waste of infectious and tuberculosis ward, biological material from the post-mortem compartment, dressing materials and inflammable waste. Installations for multilevel burning of this waste, with washing (purification) of flue gases and heat recovery, i.e. with very good environmental and economic effects, are being developed by many companies (eg. the installation "Hoval-Multizon" with pyrolysis chamber of company Hoval-Austria).

2. Waste of small epidemiological risk for disposal to landfills.

3. Secondary raw materials (recycling) - glass packaging, paper, plastics, metals.

4. SANITARY MODE. HEALTH CONTROL OF STAFF. PERSONAL HYGIENE OF SICK

◆ ***Cleaning***

Daily after the morning toilet of patients, performed cleaning of all areas of the hospital ward: wet or hoods. During the day cleaning of hospital rooms is done when necessary. Canteen and offices are cleaned after every meal. Once a week cleaning is done on the premises. Toilets are cleaned with water and disinfected. The bathrooms are cleaned with hot water and detergent and disinfected.

◆ ***Control of health***

Workers in the food block on recruitment subject to clinical examination and control for germ carrier. Medical personnel serving infants, is subjected to control for the presence of pathogenic staphylococci and streptococci in the nasopharynx. For staff and workers in the food suits block course in sanitary minimum.

Of bedridden patients are helped to carry out morning and evening dress. Provides bathe, clean and household linen.

Held disinfection, disinsection and deratisation and exterminating the premises.

5. MEDICAL-SAFETY BEHAVIOUR

Therapeutic - safety mode supports the healing process by creating an optimal environment, mode of stay in hospital, high professionality and culture of service to the sick. He has a great health enlightenment and educational impact of the patient.

These include:

1. Removal of the negative factors of the hospital environment: noise as a factor obstructing recreation; hospital odors; adverse lighting (very strong or weak, high brightness); unaesthetic, not meeting the requirements of the medical environment arranging the hospital premises; poor sanitary maintenance of the premises; poor personal hygiene of the patient, etc.

2. Tackling pain. When the patient's bed should not be made (if possible) therapeutic manipulation. Reducing or eliminating fears experiences.

3. Fighting iatrogeny, and back, informed consent and instilling confidence of the patient in the correctness and the successful completion of the prescribed and ongoing treatment, creating an active, positive attitude towards the healing process.

4. Ensuring proper daily regimen of the patient, with the possibility of relaxation and sleep. To allow

the sick walking in the hospital park, occupational therapy and hardening procedures (appointment of the physician), cultural entertainment, information. From 22 h to 6,30 h sufferers sleep, ensuring peace and preliminary-hospital rooms ventilated. From 14.30 to 16 h should provide opportunities for an afternoon sleep or quiet relaxation. Identify and observe precise time, location and means of visiting the sick, obtain information on their condition, receiving food and belongings, the order of work in the ward - visits, operating days, carrying out tests etc. When dietary the patients should be monitored about the food is more varied, with appropriate temperature, to be served in a clean and friendly environment, in aesthetic dinner sets, to be served at a certain time, etc., i.e. to take into account all the things that inspire tranquility and confidence in the ability of the hospital, the professionalism of staff and improve the stay of patients.

Color interior design of the hospital. By rational color schemes are used the colors for:

• Psycho-physiological impact on staff and patients. For example, warm colors (yellow, pink, orange) act toning and cool (green, blue) - soothing.

• Better illumination of premises using pale (unsaturated) colors.

• The color as a danger signal (red, orange). • Creation of a subjective feeling of heat or cold (warm and cool colors respectively).

• Aesthetic satisfaction

6. PREVENTION OF NOSOCOMIAL INFECTIONS

To bacteriological era in hospitals of antiquity and the Middle Ages nosocomial outbreaks of dysentery, tetanus, gazgangrene, staphylococcus septicemia, etc., they were constant phenomenon. In 1646 described nosocomial outbreak in Hotel Dieu (Paris) in the form of puerperal fever, immediately caused death in 20% of mothers. The reason for this was lack of both scientific knowledge and antisanitary conditions - appointed in 1785 by Louis XVI committee found that in this hospital "bed ... of 1219 are 3418 sick ..." and that " ... in one hospital pavilion are from 558 to 818 patients with fever ... ".

Discoveries of L. Pasteur, R. Koch, J. Lister, I. Zemelweis, of sulphonamides and antibiotics, the widespread introduction of immunization, dramatically lower the incidence of infectious diseases and epidemics of NI.

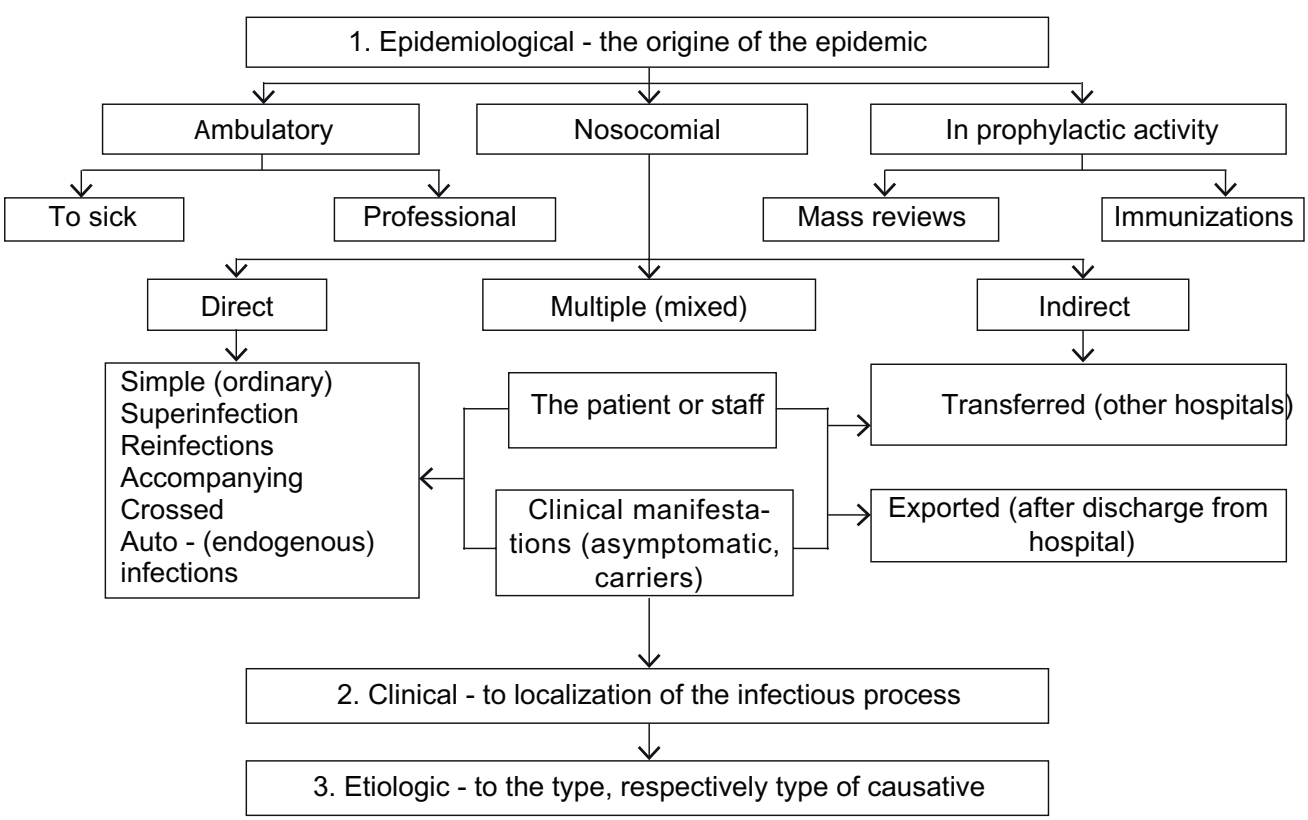


Fig. 7.2. Classification of hospital (nosocomial) infections (by D. Loshontsi).

But now, on a background of greatly reduced infectious morbidity continuing, widespread nosocomial infections and the relatively high lethality of them in developed countries (including our country) represents an important epidemiological and hygienic problem. The current estimate is that 50% of infectious diseases are hospital-acquired infections, and data for the US and Germany present that 5-10% of received patients, fall ill of them. It indicates that the US NI are over 1.5 million cases per year; Hungary - 100 thousand per year. In our in monitoring a most-risk groups - wards for premature infants, found that over 80% of morbidity and in fourth place as a cause of death were NI.

NI are diseases with infectious etiology occurring in the units of the health system (mostly hospitals) directly or indirectly associated with the medical care of patients (for this called nosocomial infections - greek Nosokomeone - hospital). They occur mainly in the hospital, but also in outpatient facilities, and preventive action - mass examinations, immunizations. Localization of the infectious process is varied - infections of the respiratory, digestive, genitourinary, bone-joint, cardiovascular and central nervous system, skin and subcutaneous tissue, of the female genitalia. Diverse are the infectious agents. Source of infection are sick or infection carriers **(Fig. 7.2)**.

A new feature of the NI is so called nosocomial colonization - creating conditions for a strong growth of conditionally pathogenic microflora (eg. disbacteriosis of prolonged treatment with antibiotics), which is the reason for the auto- or transmitted infection to others.

Ways of infection at NI are the same as with any infection, but manifested in the concrete conditions of the hospital environment - eg., various medical instruments or introduced liquids, bringing microorganisms in the patient **(Table 7.2.)**.

In Bulgaria states that NI to clinical location are those of:

1. The respiratory system (50% of all NI).

2. Yeast infections - surgical wound, pyoderma and mastitis (25%).

3. Uro- and intestinal infections (10%).

The most frequent causes are staphylococci and coliform and reduce NI caused by Shigella and salmonellosis.

Data for England showed that 3/4 of the NI include:

- *Urinary tract infection.*
- *Surgical wound infections.*
- *Infections of the lower respiratory tract.*

Table 7.2. Characteristics of 53 nosocomial outbreaks, associated with medical treatment (W. Stamm).

Type of NI	Number of outbreaks	Appliance - manipulation (number)	Isolated microorganisms (number)
Urinary tract infection	14	urinary catheters (11) urinary catheters + contaminated disinfectant (2) cystoscope (1)	Serratia (1), Klebsiella (4), Proteus rettgeri (2) Pseudomonas cepacia (2)
Bacteraemia	13	intravenous fluid (4) venous catheter (4) blood product (2) blood pump (2) haemodialysis (1)	Enterobacter (3) Pseudomonas sp. (3) Klebsiella (1) E. coli (1) Serratia (1), Citrobacter (2), Salmonella (1), Flavobacter (1), Pseudomonas aeruginosa (1)
Hepatitis	10	hemodialysis (8) plasmapheresis (1) blood product (1)	Hepatitis B virus (9) Non-A, Non-B virus (1)
Pneumonia	6	contained breathing apparatus (5) anesthesiology equipment (1)	Pseudomonas aeruginosa (5) Herella (1)
Sepsis	5	blood (2) plasmapheresis (1) monitor artery pressure (1) hemodialysis (1)	Plasmodium (2) missing pathogenic agent (1) Epstein-Barr virus (1) missing pathogenic agent (1)
Gastroenteritis	2	aspirater breast milk (1) infected breast milk (1)	Salmonella (2)
Conjunctivitis	2	a humidifier (2)	Pseudomonas aeruginosa (2)
Shunt infection	1	arterio-venous shunt (1)	S. aureus (1)

Depending on the type of hospital is different and the incidence of clinical localization of NI **(Tab. 7.3)**.

Predisposing risk factors are: age (neonatal and elderly), prematurity, neoplasm, burns, diabetes, malnutrition, obezitas, hemodialysis, catheterisasion, abuse of antibiotics, organ transplants.

Observe and distribution (prevalence) of microorganisms causing NI in connection with specific characteristics in different hospital wards and certain diseases (in Sl. Neychev):

1. Abdominal Surgery - bakteroidi, staphylococci, streptococci, coliform, Klebsiella, seracs, Proteus.

2. Heart surgery - staphylococci, Klebsiella, Candida, anaerobic streptococci.

3. Urology - Pseudomonas, Proteus, Klebsiella, seracs, staphylococci, Candida.

4. Burns - Pseudomonas, Proteus, seracs, Klebsiella, Staphylococcus.

5. Diabetes - Gram-negative bacteria of the intestinal group, staphylococci, Candida.

6. Blood diseases - pseudomonas, fungi, molds.

7. Renal transplantation - Pseudomonas proteus, mold.

8. In maternity hospitals (data from the US study) NI developed 2.2% of mothers and 1.2% of newborns. Most were skin infections, pneumonia and bacteriemia in infants; surgical wound infections and urinary tract infections - in maternal.

To combat NI our country was founded on the basis of norm and relevant organization - the Central Commission for NI the Ministry of Health; National headquarters at the National Centre of Infectious and Parasitic Diseases; units in regional health inspections; hospital committees to combat NI (to any medical facility with inpatients).

Degree of efficiency measures that are recommended to combat IVI (in Th. Eickoff).

1. Proven eficiency:

- *Sterilization.*
- *Wash your hands.*
- *A closed system of urinary drainage.*
- *Compliance with the rules of proper conduct intravenous catheterization.*
- *Compliance with operational aseptic.*
- *Preoperative chemoprophylaxis - selective in contaminated wounds.*
- *Compliance with the rules to use respiratory equipment.*

2. Adopted by trying efficiency:

- *Isolation measures.*
- *Training with educational activity.*

3. With questionable or unknown effectiveness:

- *Disinfection of floors, walls, sinks, etc.*
- *UV radiation of the premises.*
- *Aerosolization (the disinfection of the air)*

Table 7.3. Clinical localization of NI according to the type of hospital wards - morbidity per 1,000 discharges (W. Stamm, J. Bennett) *

Localization	Surgical	Gyneco-logical	Internal	Obstetric	Pediatric	Nursing	Everyone else
Respiratory system	8	2	7	–	2	1	5
Genito-urinary tract	17	24	16	6	2	1	13
Gynecological infections	–	3	–	4		–	1
Surgical wounds	16	12	2	2	1	–	8
Gastrointestinal tract	1	1	–	–	1	1	1
Skin	2	–	1	–	1	3	1
Blood	2	–	2	–	1	1	1
Others	1	2	2	1	4	2	2
Total	47	44	30	13	12	9	32

* Note. Less than one disease in 1000 discharges (-)

- *laminar-air flow (directed air filtration).*
- *Preoperative prophylaxis - to clean wounds.*
- *System (planned) survey the external environment.*
- *Extreme intravenous filters.*

Sterilization/aseptic/antiseptic/disinfection.

Sterilization subject: medical and dental instruments; special medical equipment and supplies; laboratory equipment and glassware; operational linen; lingerie of departments for transplant, thermal trauma, centres of resuscitation, intensive care, anesthesia. Sterilized materials must first be thoroughly cleaned and disinfected.

The methods used for sterilization:

1. Heat Sterilization

Sterilization with steam under pressure - 121° C and 134° C temperatures, pressure 1,15 and 1,26 bar, exhibition 10-30 min. For medical instruments, laboratory glassware, hospital and operating textiles and others. The most commonly used, secure and environmentally sound method.

"Dry" sterilization with hot air - temperatures 160-180°C and exposures from 2 h to 30 min. It applies when it can not be used "wet" heat. Time for use - 3-7 days, under proper storage containers.

2. Gas sterilization

Gas sterilization with ethylene oxide - in the programmed automated cameras at 37-55°S, time of action 1-2 h. Decontamination of heat-sensitive materials - plastics; rubber; electric instruments; optics. Is needed degassing premises - control the concentration of ethylene oxide - up to 1 ppm.

Sterilization with formaldehyde in the gas sterilizer - a mixture of formaldehyde and water vapor, temperature 60-70°C, 1-2 h exposure, for heat-sensitive materials.

Sterilization with paraformaldehyde tablets - small heat-sensitive objects, placed in sterile hermetically sealed plate, exposure for 18 h.

Sterilization with plasma of hydrogen peroxide in the vacuum chamber (300 mmHg), at room temperature, 75 min exposure.

3. Sterilization ionizing radiation - heat-sensitive materials for a single time use (syringes, needles, catheters). It applies only in industrial conditions.

4. Cold chemical sterilization - for thermolabile materials, by applying the solutions of the chemicals with strongly sporocidal effect (aldehydes, oxidizing agents) at room temperature and pre-disinfected and dried materials. Time for use - 24 h, in sterile containers.

To demonstrate the effectiveness of the **antiseptics (chemical disinfectants)** are required standardized methods for determining the microbicidal activity. In previous periods are used: DGHM - Germany, methods; AOAC - US standards; AFNOR -France, standards. In the European Union use approved by the European Committee for Standardization (CEN) various European norms (EN) in the case CENTC 216 "antiseptics and chemical disinfectants" and adopted in Bulgarian State Standard (BSS).

In the medical field (medical devices) acting now standard tests:

Bactericidal: EN 14561 and EN 14 563 - tools;

Fungicidal: EN 14562 - tools;

Virucidal: EN 1499 - hygienic washing of hands; EN1500 - hygienic hand disinfection; EN12791 - surgical hand disinfection **(Table. 7.4)**.

Fighting NI is complex. It includes a variety of anti-epidemic measures: on the source of infection - epidemiological study, diagnosis, treatment, isolation; to susceptible- specific prophylaxis; to environment - disinfection, sterilization, aseptic, and hygienic and organizational events. Those hygiene measures, such as proper planning decision of health units, sanitary regime, effective ventilation, work organization, personal protective equipment, monitoring of health status and bacillicarriers, isolation of infectious patients and many others, also have an important bearing on the prevention of NI.

7. HYGIENE REQUIREMENTS FOR SPECIALIZED HOSPITAL WARDS

◆ ***Infectious wards***

Main feature of infectious units is the great danger of nosocomial infections and removal of the infection. This requires careful sanitary and disinfecting regime, strict organization of work, a special layout of the premises.

Infectious ward within the hospital of general type must be in a separate block, providing self-acceptance and a separate discharge of the patients, own therapeutic and diagnostic surgeries, x-ray room and more. Allowed exceptionally disclosure in general building, but in complete isolation of any premises, people, activities of other departments in the hospital.

The area of the section of infectious specialized hospitals should be well fenced and strictly isolated (guarded) the possible contact with the general population. Best system of hospital construction here pavilion system (separate pavilions for various infectious diseases). In cenralized construction (building) system is required strict isolation between

Table 7.4. DISINFECTANTS - EXTRACT (AUTHORIZED BY THE MINISTRY OF HEALTH - 1994)

Preparation	Active substances	Working concentrations and exposure	Company manufacturer
1	2	3	4
Hygienic hand disinfection			
Ethyl alcohol with glycerin	70% ethyl alcohol 5% glycerol	3-5 ml of concentrate (2 min)	Bulgaria
Hospisent	75% ethyl alcohol	3-5 ml of concentrate (30 s.)	"Lizoform" Switzerland
Dekosept	45% isopropanol 22% n-propanol	3 ml of concentrate (30 s.)	"Borer-Hemi" Switzerland
Promanum N	73,4% ethanol 10% 2-propanol	3 ml of concentrate (30 s.)	"B. Brown ", Germany
Softa-Man	45% ethyl alcohol 18% 1-propanol	3 ml of concentrate (30 s.)	"B. Brown ", Germany
C 10	30-70% isopropyl alcohol 10-30% n-propyl alcohol	3 ml of concentrate (30 s.)	"Oro-Chemie", Germany
Etaproben	ethanol isopropyl alcohol benzyl alcohol glycerol	concentrate - to complete wetting (2 min)	"Septoma" Poland
Sterilium	45% 2-propanol 30% 1-propanol	3 ml of concentrate (30 s.)	"Bode Chemie", Germany
Rapidosept	0.3 dihlorbenzinalkohol 15 g of isopropyl alcohol 30 g butilglikol	3-5 ml of concentrate (1 min)	"Bayer", Germany
Dezinfekt B	1.6 active iodine	4% 10 ml (1 min)	"Iodine", Bulgaria
Oxisept	7.5% povidone iodine	7.5% concentrate 10 ml (30 s.)	"Ladies", Greece
Ido-vari 5	5% active iodine	0.4% aqueous solution or alcohol (70% ethyl alk.) - 10 ml (2 min)	"Feros" Denmark
A combination of hydrogen peroxide with formic acid	performic acid according to formula, - 8,1 ml formic acid (85%) and 17,1 ml hydrogen peroxide (29-32%)	10 ml of concentrate (1 min)	Russia
Setridin-Forte	15% Setrimid 1.5% chlorhexidine diglkzkonat	3% alcohol (70% fl. Alcohol) 5 ml (30 s.)	"Feros" Denmark
Ayahs	9.5% TIME	1% 10 ml (2 min)	"Slovakofarma's" Slovakia
Hospisept	75% ethyl alcohol	Concentrate twice 5 ml for 5 min (2,5 + 2,5)	"Lizoform" Switzerland
Promanum N	73.4% ethanol 10% 2-propanol	Concentrate twice 5 ml for 2 min	"B. Braun", Germany
Softa-Man	45% ethyl alcohol 18% 1-propanol isopropyl alcohol	Concentrate twice 5 ml for 2 min	"B. Braun", Germany
10	30-70% isopropyl alcohol 10-30% n-propyl alcohol	Concentrate twice 5 ml for 5 min (2 + 3)	"Oro-Chemie", Germany
Dekosept	45% isopropanol 22% n-propanol	Concentrate twice 5 ml for 3 min (1 + 2)	"Borer-Hemi" Switzerland

Preparation	Active substances	Working concentrations and exposure	Company manufacturer
1	2	3	4
Hygienic hand disinfection			
Rapidosept	0,3 g dichlorobenzyl alcohol 15 g isopropyl alcohol 30 g butilglikol	Concentrate twice 5 ml for 5 min (1 + 3)	"Bayer", Germany
Sterilium	45% 2-propanol 30% 1-propanol	Concentrate twice in 5 ml (5 min)	"Bode Chemie", Germany
Hibiscrub	4% chlorhexidine gluconate salt	Concentrate twice 5 ml for 3 min (2 + 2)	"ICI", England
Hibitane gluconate	20% chlorhexidine gluconate salt	Hibitane 1:40 in 70% ethyl alcohol for 2 min	"ICI", England
Idoskrab soap	5% isopropanol 4% chlorhexidine	Concentrate twice 5 ml for 3 min (1 + 2)	"Ferosan" Denmark
A combination of hydrogen peroxide with formic acid	performic acid according to formula, - 8,1 ml formic acid (85%) and 17,1 ml hydrogen peroxide (29-32%)	Concentrate 20-25 ml (1min)	Russia
Manu scrub	4% chlorhexidine	Concentrate twice 5 ml for 3 min (1 + 2)	"Bode Chemie", Germany
Hospital clothing and work clothing			
Chloramine	active chlorine (25-30%)	1%-2% (2 h) 3% (30 min)	
Lidol	cresol and potassium soap	3% (2 h)	Bulgaria
Idosept	8% glt. aldehyde 3,8% formaldehyde	3% (12 h)	"Ferosan" Denmark
Melset	4,2% formaldehyde 3% glt. aldehyde	1% (12 h) 2% (4 h)	"B. Braun", Germany
With 0.5% hydrogen peroxide liquid degenerate	30% hydrogen peroxide	3% (2 h)	
Surfaces			
Chlorinated lime	25-30% active chlorine	1% clarified solution (60 min)	Bulgaria
Chloramine	25-30% active chlorine	1-2% (60 min)	
Bleach	sodium hypochlorite – 2,5% active chlorine	5-10% (60 min)	Bulgaria
Tref	5-15% chloramine T (4% active chlorine)	1% (30 min) 2 and 4% (4 min)	"Henkel" Denmark
Trihlorol	80% chloramine T	0,5% (60 min) 0,75% (15 min) against fungi – 3% (4 h)	"Lizoform" Switzerland
Klorina	100% chloramine T	0,5% (60 min) against fungi – 3% (4 h)	"Lizoform" Switzerland
Idofor	5% active iodine	1% (60 min)	"Ferosan" Denmark
Kliarsol	40% xylenols	1% (60 min)	"Coventry Chemicals" England
Derin A	2% formaldehyde	10% (60 min)	SD "Broneks", Bulgaria

Preparation	Active substances	Working concentrations and exposure	Company manufacturer
1	2	3	4
Surfaces			
Aldevir	4% Glutaryl. aldehyde	5% (15 min) contamination with organic matter – 10% (15 min)	"Septoma" Poland
Ido-sept	8% Glutaryl. aldehyde 3,8% Formaldehyde	1-3% (60 min)	"Feros" Denmark
Melsit	4,2% Formaldehyde 3% Glutaryl. aldehyde	0,5% (60 min)	"B. Brown ", Germany
Dezin B	2% Formaldehyde 0,25%	10% (60 min)	SD "Broneks" Bulgaria
Deconex 50 FF	12% ethanediyl 0,5% Glutaryl. aldehyde 7	0,5% (30-60 min)	"Borer-Hemi" Switzerland
B 10	1-5% Glutaryl. aldehyde 1-5% Formaldehyde 1-5% ethanediyl	1% (60 min) in case of spores– 10% (4 h)	"Oro-Chemie", Germany
Rinovit	ethanolamine – Formaldehyde < 5%	1-2% (60 min)	"Henkel" Denmark
Vircon	10% active oxygen	1% (10 min)	"Krka", Slovenia
Hydrogen peroxide with 0.5% liquid detergent	30% hydrogen peroxide	3% (60 min) in case of spores– 6% (60 min)	
Deconex Solarsept	0,5% Alkylamine 20% 1-propanol 40% 2-propanol	concentrate (10-30 min) usage -20-25ml/m^2	"Borer-Hemi" Switzerland
Deconex 51 DR	0,5%	2%, 3%, 4% (60 min)	"Borer-Hemi" Switzerland
Ayatin	9,5%-10,5%	2% (30 min) (20 ml of concentrate in 100 ml water)	"Slovakofarma's" Slovakia
Siraphan M	1-5% hour	1,5% (30 min)	"Henkel" Denmark
Kvatoheks	biguanides	0,5% (60 min)	"B. Brown ", Germany
D&N Pain dezinfecta	4% Glutaryl. aldehyde 3,15% Formaldehyde 3,2% glyoxal	1,5% (60 min)	Greece
Fenodin	6% Formaldehyde 1,8% Glutaryl. aldehyde	1,5% (60 min)	Greece
Laboratory glassware			
Idofor 5	5% active iodine	2% (60 min)	"Ferosan" Denmark
Helipur	8,5% steam chlorine cresol 4% phenylphenol 4,8% paradihlorbenzol	1,5% (60 min) 5% (15 min)	"B. Brown ", Germany
Aldevir	4% Glutaryl. aldehyde	10% (15 min)	"Septoma" Poland
Hydrogen peroxide with 0.5% liquid detergent	30% hydrogen peroxide	3% (60 min) in case of spores – 6% (60 min)	
Vircon	10% active oxygen	1% (30 min)	"Krka", Slovenia

Preparation	Active substances	Working concentrations and exposure	Company manufacturer
1	2	3	4
Medical tools			
B 40	30-70% n-propanol 10-30% etanol	concentrate 15 min	"Oro-Chemie", Germany
Idofor 5	5% active iodine	1% (10 min)	"Ferosan" Denmark
Helipur	8,5% steam chlorine cresol 4,8% paradihlorbenzol-benzol 4% orthophenylphenol	1,5% (1 h) 5% (15 min)	"B. Brown ", Germany
Korsolin ID	7% glutaraldehyde	2,5% (60 min) 4% (120 min) 10% (60 min)	"Bode Chemie", Germany
Izofor	5,4%-6,6% formaldehyde	5% (1 h)	"Medica" AD, Bulgaria
Paraformalinovi tablets	95% paraformaldehyde (1 tabl.)	1 tabl. Petri dish (6 h) – small dental tool 10 tabl./1 ml^3 (6 h) – surgical instrument	"Merck", Germany
Ido-Scope (with a pH indicator)	2% glutaraldehyde	concentrate after activation (10, 30 and 60 min), in case of spores – 120 min	"Ferosan" Denmark
Totacid 28	2% glutaraldehyde	concentrate after activation (10, 30 and 60 min), in case of spores – 3 h	"Coventry Chemicals" England
Aldevir	3,9%-4,4% glutaraldehyde	10% (15 min)	"Septoma" Poland
Ido-sept	8% glutaraldehyde 3,8% formaldehyde	1% (60 min) 3% (20 min)	"Ferosan" Denmark
Helipur H+	11% glyoxal 14% glutaraldehyde	1,5% (60 min); 2,5% (15 min), in case of spores – 5% (24 h), 10% (8 h)	"B. Brown ", Germany
Prontocid	4,5% formaldehyde 3,5% glutaraldehyde 2,8% glyoxal	1,5% (60 min); 2% (30 min); in case of spores – 5% (24 h), 10% (8 h)	"B. Brown ", Germany
A 10	1-5% etandyal 5-10% formaldehyde 1-5% glutaraldehyde 1-5% benzalkonium chloride	2% (1 h) in case of spores – 10% (4 h)	"Oro-Chemie", Germany
Dezoform	20% dimethyl carbamide 22% glutaratsetal	2% (60 min) hepatitis B – 4% (60 min)	"Lizoform" Switzerland
Aldozan 2000	dimethyl carbamide glutaratsetal	2% (2 h); 3% (60 min) 4% (30 min)	"Lizoform" Switzerland
Deconex 50 FF	12% ethanediyl 0,5% glutaraldehyde	1% (30-60 min)	"Borer-Hemi" Switzerland
Vircon	10% active oxygen	1% (30 min)	"Krka", Slovenia
B 40	30-70% n-propanol 10-30% etanol	concentrate (15 min)	"Oro-Chemie", Germany
Deconex Dental BB	0.25%	concentrate (30 min) – dental tool	"Borer-Hemi" Switzerland
Hibitan-gluconate	20% chlorhexidine gluconate salt	aqueous solution 1:1000 (30 min)	„ICI", England
Setridin-forte	15% cetrimide 1,5% chlorhexidine digluconate	3,5% (60 min)	"Ferosan" Denmark



Vibration meters - for machine vibration and "human vibration"

Sensors - for vibration, acoustics, pressure





Vibration meters - for machine vibration and "human vibration"

Class 1 sound meters, octave filters



Brüel & Kjær

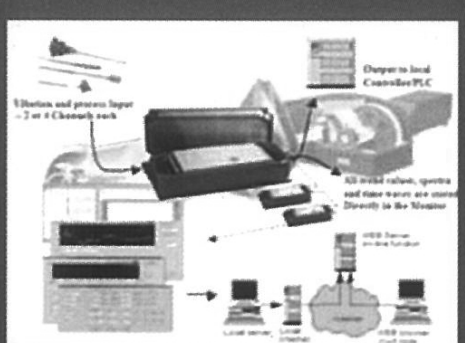
www.spectri.net



Balancing machines

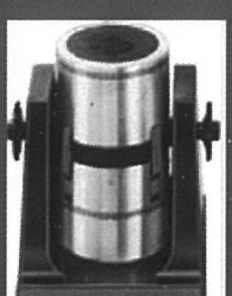
Diagnostic kits - for vibration, acoustics, process, parameters





Vibration monitoring systems and components

Vibration test stands and systems



different wards (passes through them only healing personnel after, appropriate treatment and change of clothing).

Admission of patients is done through individual boxes with entrance from the street and exit to the hospital corridor of infections ward (if the reception area lacks a bathroom, sanitary treatment of the patient is carried out in sanitary service of the relevant section). After each patient box is cleaned and disinfected.

Infectious diseases hospital (department) consists of separate clinical sections (for various infectious diseases) with a reduced number of beds - to 20. Each section must be a gateway to treatment staff - there are places apron, hat, gauze mask, washed and disinfected hands. Hospital rooms is desirable to plan for less beds - 2-3, as they must have bathroom and gateway. In the clinical section number of rooms with one bed is increased (20% of the total number of beds), the room is arranged as a complete box or half-box. The full box is best to have its own outside entrance (so it becomes a reception area). Box has a bathroom (with shower or bath) and toilet lock-before-box, with entrance to the corridor of the ward (used by staff). Half-box is similar, with the difference that the entry of the patient going through the corridor of the hospital ward and can have a shared bathroom with another room (bigger risk for nosocomial infections). In childhood infectious wards to fight infections using so called semi-boxing rooms, where individual beds separated by glass partitions with a height of 1,8-2 m. Best as planning decision is, when all the infectious ward consists only of full boxes or half-boxes. There must be separate reception compartments for receiving patients with droplet infections, intestinal and transmissible infections and rooms-isolators to them.

The office is divided into "dirty" and "clean" sector related to counter. Dishes and cutlery of patients are cleaned mechanically from leftover food, wash, is decontaminated (boiling or chemical disinfectants) in "dirty" sectors and then enter the "clean" where are rinsed with hot water and dried. This can be realized with a dishwasher, placed between the two sectors. Obtaining food from the hospital kitchen in a separate room-filter where food is transferred in its own compartment vessels. They go into the office for dispensing food at the table vessels. Following the adoption of the patient his personal clothing is disinfected and returned to his relatives. Dirty laundry before washing, also disinfects (disinfection starts in the room to store dirty laundry of section).

After discharge of patients disinfect blankets, mattresses, pillows, bathrobes. The sanitary arrangements of the premises in the wards is performed with marked individual premises equipment (should not use the same equipment for hospital rooms, for manipulation, for doctors' offices), then it is disinfected (with hot water or disinfecting solutions). After each procedure, the patients consumed disinfect utensils and equipment.

Personnel must be arranged sanitary service (to be used after the end of the working day), also a separate dining room with separate utensils. In each office and manipulation should have disinfectants for hands.

The staff when entering another clinical section of the compartment, in the offices of examinations, in the reception area and in other boxes need to put a second overall, to put a hat and a mask, wash hands and to deal with disinfectant solution, to wipe shoes on mats soaked with disinfectant solution also. When exiting, staff must repeat the above procedures, leaving for disinfection second overall and hat.

Staff are prohibited:

- *Sitting on the bed of the patient.*
- *Do not wear special clothing or hanging out with him outside the ward.*
- *To accept food in the corridors, rooms for patients, laboratories and manipulation.*

Visiting the sick is not allowed, unless specifically established video telephones.

For removal of solid waste is used and special transport containers, which were then disinfected. All solid waste from sick burn. It provides wastewater treatment.

◆ ***Wards for treatment of tuberculosis***

With high epidemiological risk are similar and hygiene requirements for antituberculosis dispensaries (for the treatment of acute forms) and specialized sanatoriums for chronically ill from tuberculosis. Here are necessary relevant planning and organizational solutions for a reduced number of beds in hospital rooms; increased number of rooms with one bed and semi-boxing rooms; separation of sick adults and children, serious and slightly ill patients, with different localization of the disease. Similar are the requirements for offices, sanitary arrangements, personnel hygiene, removal and disposal of solid and liquid waste.

Sanatoriums for chronically ill from tuberculosis, with a view to the favourable impact of climatic factors are developed in areas with altitudes 500-800 m. Landscaping must be rich, in high enough green plantations - especially conifers, leaking air phytoncides and increasing the number of negative light ions. In the hospital park should be divided helio- and aerotherapy areas, sites for remedial gymnastics, occupational therapy and cultural entertain-

ment. Sanatoriums recommended to be built in the pavilion system.

Hospital rooms are just south and south east facing, with increased area of glazing and solar protection facilities. Each hospital room have terraces facing south and equipment for wind protection (open solariums). Rooms to be ventilated not less than 3 times a day during the cold seasons.

To provide educational facilities for sick students, rooms for medical gymnastics, for diagnostic radiology, occupational therapy and physiotherapy. In the corridors, study halls and the dining room have installed UV bactericidal lamps.

◆ ***Children's wards***

They are designed as stand-alone pediatric hospitals (in particular assignment) or as a children's wards in the hospital of general type.

Peculiarities are related to different age groups (nursing to 14 years) and easy susceptibility of children to infectious diseases.

Reception unit is self for the children and is divided for different age groups (up to 1 year, the 1-3, 4-14 years). Best reception unit for each age group to be developed as a full box. Mothers-attendants are accepted in a separate ward.

Hospital ward includes separate clinical sections (for different age groups) with a reduced number of beds - up to 25. Rooms in clinical units are designed with extra segregation of children in clinical diagnoses and age groups. The area of the room is reduced - 4-5 m^2 per bed, depending on the age (to 3 and over 3 years) and number of beds. Each section must have at least one box quarantine isolator. Children under 2 years are placed in half-boxes with 2 beds. Older children are placed in rooms by 4 beds, as against airborne infections is well they are semi-boxing. In clinical sections are formed units for the treatment of children up to 2 years of age with and without enterocolitis as a primary or underlying disease. Mothers-attendants are in separate rooms, but if the child is in boxing-isolator (all children up to 2 years after the adoption necessarily 1-2 days in boxing), they must also be in the pits in second bed. Monitoring children is appropriate part of the partitions between hospital rooms and corridors to be glazed. Hospital rooms must be designed with balconies and rooms for infants - with balconies, awnings, wind protective equipment.

The office is also divided on "clean" and "dirty" sector (as in the infectious ward). Envisaged and office-kitchen milk for infants.

The dining room can be used as study-hall (planning to serve simultaneously 50% of children), but it is better to perform group isolation, having arranged separate play-areas (for children 1-3 years) and study-areas (for children over 3 years). In children's hospitals (and in large compartments - more than 50 beds) to provide classrooms for chronically ill students.

Staff provides sanitary service in the ward for sick nursing, premature and hypotrophic children (to be used before starting work).

◆ ***Psychiatric wards***

They also arranged as individual hospitals or wards in the hospital (but they can be isolated from other hospital wards).

Peculiarities of these hospitals are related to:

- *Opportunities for personal injury of patients, injury to other people and self-harm (suicide).*
- *Attempts to escape.*
- *Simultaneous residence agitated and calm ill (melancholic).*
- *Mental patients suffering from other diseases.*
- *Different age groups (incl. and sick children).*
- *Need thorough isolation and protection of the hospital from uncontrolled intrusion of outsiders.*
- *Continuous control over the behaviour of patients.*

Within the hospital area should be fenced, guarded and lighted at night. It must be certain sections of walk for the excitement and quietly sick. The sections must be separated by fences smooth, height 3,5 m and 2 m (respectively agitated and ill at ease). It is also necessary to cut the lower branches of trees, the area is thoroughly cleansed of any objects, stones, etc.

Reception unit is organized as sanitary service. Admission of patients is carried out in the presence of three people - a doctor, nurse and paramedic.

Depending on the size of the hospital in her revealing separate compartments (or single rooms) for: calm and agitated patients; patients suffering from internal diseases, tuberculosis, infectious diseases; sick children.

Hospital rooms should be located on one side of the corridor for easier tracking of duty nurse. Hospital rooms and all other areas must be designed and equipped so that there is no danger for patients and staff from injuries.

In compartments for agitated patients in hospital rooms the beds, tables and benches in the dining room can not be raised by patients. Food to be fed through a narrow counter. Table vessels to be lightweight, unbreakable material. In other patients such equipment requirements not be claimed.

In all areas where patients reside, the walls should be smooth (without any projections and protruding sharp objects). The windows are of thick safety glass and can not be opened by the patients. The doors also can not be opened or locked by the patients.

The lavatories taps to be metal, unbreakable and tightly wrapped. In the toilets there should be no protruding parts of pipes. The use of washrooms and toilets in agitated patients is carried out under the supervision of paramedics.

In the relaxation room (calm patients) radios, televisions and more must be installed in special glass cabinets and have no open wires. The heating must be central with hidden heating panels and tubes. The lighting must be switched out of hospital rooms, to be hidden wires, lighting fixtures to be unbreakable ceilings. Plumbing and sewer pipes also will be closed.

Premises residing agitated patients to be dyed in bright, soothing (cool colors). Conversely, in patients in a depressive state - in rejuvenating (hot), saturated colors.

◆ ***Obstetrics and gynecological wards***

Gynecological wards are part of the hospital to the hospital of general type. Can detect and separate specialized gynecological hospitals. General hygiene problems are related to:

- *Isolation of obstetrics-gynecology departments from other departments.*
- *Isolation obstetric of gynecological clinical sections; isolating the sick from the healthy mothers.*
- *Need flowability and continuity.*
- *Significant risk of easily damage the health of newborns.*

In the adoption of obstetric unit women are divided into three main, well isolated from one another flow:

1. *Healthy mothers with normal and abnormal pregnancy.*
2. *Sick mothers.*
3. *Gynecology sick.*

Accordingly differentiated obstetric and gynecology department.

After sanitary service maternal prenatal enter the room, and at more frequent contractions - in the prenatal room. Prenatal rooms are arranged according to the general requirements for hospital rooms. Delivery room is arranged with one or two maternity beds (with a total area of respectively 24 m^2 and 36 m^2). Prenatal rooms need to have room for obstetric post and to the delivery room - isolated (including noise) delivery room for sick mothers. We are here and a separate room for the toilet for the infant room resuscitation of newborns and mothers, small obstetric operating room, sterilization.

In the postnatal ward rooms for mothers and the newborns are separate. The mother are as common hospital rooms and newborns are in boxes, set up in a centralized or decentralized system. In the first newborn are in a separate compartment in the sector of room-boxes for 6-12 children (to provide separate, isolated boxes for sick and premature infants). In decentralized system newborns are in boxes next to the mothers room. This system is better because it reduces the risk of nosocomial infections in newborns. Modern trend is newborns and mothers with shared rooms, but the rooms are for 1-2 mothers. In the boxes for normal infants air temperature must be 23° C, and in prematures - 25° C. High requirements for microbial purity of the air - in maternity halls are allowed up to 2,000 microorganisms/m^3 air (total) and up to 24 hemolytic streptococci or staphylococci; in the halls for newborns - to 2,000/m^3 and to 44/m^3.

To protect infants from nosocomial infections, the most common skin - purulent and respiratory system is necessary:

- *Especially carefully conducting sanitary regime of the premises.*
- *High personal hygiene of staff and mothers.*
- *High degree of purity of the used diapers of infants.*
- *Non conditions for contamination of food with artificial feeding.*
- *Bactericidal UV lamps in the delivery room, corridors, dining-room.*
- *Controlling health and bacilli-carriers of personnel.*

Gynecological wards arranged as surgical. They should have a separate operational unit or (if small) to use a separate operating unit to the birth ward or to the operational unit of the surgical ward.

8. THE WORKING CONDITIONS OF DOCTORS

In the concept of medical staff include:

- *Numerous wide and narrow specialties, requiring different skills and responsibility.*
- *Different volume and nature of medico- diagnostics and others activities (organizational, research, teaching).*
- *Various are working conditions in different types of health institutions.*

The work of senior medical staff is mostly mental work with discovery (heuristic) character and high neuro-psychological tension, resulting high responsibility for the health and life of the patient, the need for fast information processing, accurate diagnosis and urgent decisions, public responsibility also to the patient and his relatives. This poses a great challenge and personal qualities of the physician, requires a high level of qualification and responsibility. Such is the nature and work of the medical staff

with secondary and college education, which is also mental work, but with organizational - executive character with more and motive activity.

The main problems of the physiology of labour here are related to: the degree of burden and stress of work and his character in different groups of medical personnel; night and shifts labour; ergonomic aspects of work.

◆ ***Unfavourable factors in the labour***

Frequently meets are:

- *Norational work posture* (straight posture, with forced inclination of the body - for example, surgeons and pathologists; posture straight with torsion and tilt forward - in dentists).
- *Irrational regime of work and leisure* (duration of operational time when surgeons; non-use of regulated and shorter lunch breaks, not including in them active motor activity, weekly and annual holiday with non-inclusion in active motor activity and quenching procedures).
- *Non-ergonomic arranged workplace and work chair, norational work movements.*

Upon characterization of the burden of labour has to be underlined that the medical staff are different forms of loading.

1. Physical loading:

- *A considerable number of power consumption when in manual processes.*
- *Often carrying cargo, use of heavy trucks.*
- *Static efforts in performing various manipulations by doctors and nurses.*
- *Inconvenient posture - prolonged standing, bending.*

2. Psycho-emotional load. The main reasons that determine neuro-psychological and emotional stress include:

- *Making decisions in a short time.*
- *Need for long-term memory (knowledge and experience).*
- *Constant high attention.*
- *Responsibility for the life of the people.*
- *High emotional tension and therefore humane and ethical reasons.*

Night and shifts work are also factors affecting the performance and health. For the best adaptation of the medical staff to night and shift work are needed:

- *Flexibility habits regarding bedtime.*
- *Ability to overcome sleepiness.*
- *Adaptation of family and social obligations.*
- *Suitable regime of work and rest - duration of working time, overtime, regulated rests and holidays.*

Here is a particularly important issue for breaks between shifts and duration of night shifts.

3. Ergonomic problems in healthcare workers. They include the following main aspects:

- *Ergonomic requirements for workplace and furniture.*
- *Requirements for ergonomic solution to the various apparatus and instruments*, with regard to the requirements of both-working with them and the patients.
- *Ergonomic requirements for various devices* (display, screens), requiring significant visual tension.

An important factor associated with the working conditions is and work organization. The work of senior medical staff can be divided into: work related to the patient - preparatory, medical diagnostics, shaping the medical documents; work unrelated directly to the patient - meetings, solve organizational-methodical questions, health educational work, unregulated rest and more. Studies have shown that the latter activity being spent 20-40% of their working time. This leads to the accumulation of patients, with extrinsic work overload, rapid onset of fatigue, difficult recovery.

◆ ***Unfavourable factors in the workplace***

Labour in health facilities is often associated with a number of adverse factors in the workplace.

1. Heating. The microclimate in the washing, sterilization, physiotherapy, water-procedures sections and others, it characterized mostly by overheating, especially during the warmer seasons. Conversely, during the colder seasons in different rooms, due to deficiencies in the heating, furniture, ventilation, etc., often microclimate is cooling. In some units the nature of the work involves the maintenance of a cooling microclimate (sectional halls).

2. Noise. The noise, penetrating or generated from own resources, is a reason for reducing the quality and efficiency of labour, especially at the senior medical staff. In studies in Bulgaria are measured noise levels in dental surgeries and dental workshops most often in the range of 72-85 dB/A (but sometimes up to 98 dB/A); in clinical and pathomorphological laboratories- 67-75 dB/A.

3. Vibration factor. It is relatively less pronounced risk factor, but dentists and dental technicians using constant in their work turbine, dental engine with micromotor, filing and metal cutting equipment, local vibrations adversely affect sensation in the hands and hence the efficiency of labour.

4. Other physical factors in the work environment. Of those expressed as risk factors for health staff should be noted:

- *Sources of ionizing radiation* - the main hazard in the work of the personnel using them

permanently for the purpose of diagnosis and therapy.

- *Radio frequency electromagnetic fields* - especially intensive in physical therapy and rehabilitation, which uses ultrashort wave generators - ultraterm, diathermy, and ultrahigh frequencies - radar. Measurements carried out in such sites indicates that the tension of the electric field and density of power flow 0,5 m from the apparatus exceed hygiene standards up to three times.
- *Static electricity is both a health hazard and risk for occupational safety (fire hazard)*. Voltage electric field at surgeons, not using antistatic shoes up to 2000 V/cm.
- *Coherent electromagnetic radiation - lasers.* When working with them are required stringent safety measures of labour primarily for the protection of the eyes, and to prevent of other possible side effects - noise, reflected radiation, vapor and aerosols from the treated tissues and materials, radio-frequency electromagnetic radiation.
- *Ultraviolet radiation in the bactericidal range* necessarily means used to combat microbial contamination in many healthcare departments and laboratories. Failure to comply with strict and non-use of protective equipment when working with UV lamps, poses a health risk to staff.
- *The air ionization* in some healthcare departments reaches very high values tens and hundreds of thousands of ions/cm^3 in air of X-ray cabinets and radioisotope divisions; thousands and tens of thousands/cm^3 - in physiotherapy departments in handling sunlamps. This high ionization exceeds 1000 times or more natural air ionization.

5. Chemical factors. Characteristic of modern diagnostic and treatment process is its use of chemicals, which creates a risk for professional medical personnel. First there must indicate operating surgical teams using inhalation anesthesia. The latter creates a real risk of chronic intoxication by anesthetic gases - nitrous oxide ("laughing gas"), halothane, ftorotan, methoxyflurane, enflurane, isoflurane. The personnel in operating rooms and is exposed to ozone and nitrogen dioxide, formed by bactericidal lamps, and formaldehyde, hexachlorophene, ethylene oxide and others. disinfectants. In many of these are described in animal experiments, mutagenic and carcinogenic effects.

Do not lower the risk of chronic occupational poisoning in clinical laboratory workers, histo- and pathomorphological, biochemical, hormonal, phytochemical, a chemical analysis of the working environment, etc. laboratories.

Indicate that laboratory personnel in such laboratories is exposed to inorganic over 20 and over 60 organic toxic substances. In HSDB (Hazardous Substances Data base) of the US National Library of Medicine are given over four thousand chemical solids in medical practice with possible toxic effect - disinfectants, antiseptics, sterilizants, laboratory reagents.

The specificity of the medical work is related to the wide use, preparation and storage of various medicaments. The constant contact with them leads to a pronounced professional risk of developing drug allergy to one or more allergens. The most common occupational allergens suggest antibiotics, sulfonamides, anesthetics, quinine preparations, neuroleptics, some antituberculosis drugs, the dust from medicinal plants.

Professional risk of allergic reactions (contact dermatitis, eczema, etc.) are widely used in infectious, tuberculosis, pathology and others wards, disinfectants - formalin, hexachlorophene, chlorhexidine and others.

6. Biological factors. Biological factors pose risks to medical staff in infectious, tuberculosis and pathoanatomicals wards, microbiological and virological laboratories, dental offices, all the diagnostic - auxuliary units serving infectious and parasitic patient and where work with biological materials.

The incidence of viral hepatitis type B (HBV) in healthcare workers is 2-6 times higher than that of the rest of the population. A high frequency of professional candidiasis of different organ localization in nurses of constant contact with antibiotics. The medical staff is risk group for infection with the virus that causes AIDS (especially surgeons, nurses, pathologists, laboratory technicians).

Often unfavourable working conditions created by unefficiently settled sanitary technical equipment - ventilation, heating, lighting, also by the furnishing of health departments.

◆ ***Morbidity health workers***

Compared with other professional groups, healthcare workers are relatively higher frequency and severity of diseases with temporary disability (MTD). Prevalent respiratory diseases, followed by cardiovascular, nervous and digestive system.

Risk factors associated with the work of medical personnel and cause occupational diseases, such as skin cancers in radiologists; acute and chronic radiation sickness when working with ionizing radiation; bronchial asthma and other allergic disabilities in working in clinical laboratories, pharmaceutical establishments, dentists; infectious and parasitic dis-

eases in working with those with sick or infected material; psychoneuroses when working in psychiatric establishments; eye injuries when working with lasers.

Studies in pharmacy workers (T.S. Alferova) have established a very high percentage of persons (over 50%) suffering from one or more allergic diseases. The incidence of allergic diseases was 6 times higher than that of the population, and a drug allergy - 10 times higher.

It is noted that in the field of dentistry have been used more than 500 substances can cause allergic reactions and that 15% of dentists have had allergic damage from drugs and materials (Kleine - N. E. Natrop).

Preventive measures to optimize the work of medical staff. They are diverse, requiring their comprehensive and targeted implementation. Such events are:

- *Various measures related to the sanitation of the environment and the situation in health departments - microclimate, noise comfort, gas and dust present in the air, heating, lighting, etc.*
- *Optimisation of work organization.*
- *Rational organization and ergonomic device in the workplace.*
- *Ergonomically arranged work area and chair, tailored to the specificities of different types of medical work.*
- *Implementation of rational regimes of work and recreation.*
- *Good psycho-social climate and aesthetics of the working environment.*
- *Healthy nutrition.*
- *Annealing procedures, tourism, physical activity and sport.*
- *Continuous monitoring of health status.*

REFERENCES

1. Antiseptics and chemical disinfectants in Europe - development of competentive and legislative context NCIPD, journal issue. 3, 23-37, 2011 (in bul.)

2. **Ashbel C. I., 3. C. Sharonova.** Hygiene of labour and prof. pathology of medical staff. Gig. of labour, 1981, 6, 6-9. (in russ.)

3. **Baur M.** L 'hopital, 211-243. Sante Publique, dir. G. Brucker et D. Fassin, Edition Marcketing, Paris, 1989, p. 848. (in fren.)

4. **Boyadzhiev Vl., N. Tsaneva, D. Tsvetkov and oth.** Problems of hygiene of labour among health professionals in Bulgaria, Coll. mat. IV National Congress of Hygiene. S., 1982, 61-64 (in bul.)

5. **Christiansen B, Bitter-Suermann D.** Joint recomemendations of the Association of German Faculties (MFT) and the Commission for Hospital Hygiene and Infection Prevention (KRINKO) at the Robert Koch Institute for the education of hospital hygiene at German universities. Bundesgesundheitsblatt Gesundheitsforchung Gesundheitsschutz. 2011 Dec; 54 (12): 1351-4.

6. Disinfection, Deratisation and Disinsection. Inf. Bull., issue. 1.1994. (in bul.)

7. Higiene hospitallere pratique - coord. **A. Dauphin, J. C. Darbord.** Ed. Medicales internationales, 2ed. 1990, p. 716. (in fren.)

8. Hospital hygiene. ed. **B. Voyfen, Oberdester F. and A. Kramer** (trans. rus.). Minsk, 1985, p. 464.

9. Hospitals for health promotion. Inf. Bull. NCHP. No. 6, 1993 (in bul.)

10. Hygiene standards and requirements for conducting sterilization in medical practice. Inf. Bull. Ministry of Health, № 1, 2001 (in bul.)

11. **Murer I.M.**, Hospital Higiene, ed. E.Arnold Ltd, IIled, 1986, p.152. (in fren.)

12. Nosocomial infections ed. **P. Andonov.** Med. and Phys., S. 1986 p. 266 (in bul.)

13. Order № RD09-325 of MH/2000 Hygiene requirements to the premises of the medical and dental outpatient centres (DCC). (in bul.)

14. Ordinance № 2/SG. 8, 2005 on the organization of the prevention and control of nosocomial infections. (in bul.)

15. Ordinance № 29/SG. 55, 2008 basic requirements to medical establishments for hospital care, dispensaries and homes for medico-social care. (in bul.)

16. **Rumyantsev G. I., E. P. Vishnevskaya, T. A. Kozlova.** General hygiene, p. XII Hygiene of health-preventive departments 230-330, Moscow, Medicine, 1986, 432 p. (in russ.)

17. **Tasseau F., D. Baron.** Infection nosocomiales. Sante Publique, Elition Marcketing, Paris, 1989, p. 848. (in fren.)

18. **Yassi A** (ed) .Health Care Facilities and Services, in. Encyclopedia of Occup. Health and Safety. ed. J. M. Stellman, V.III. 4-th ed., 97.2-97.64, 1998.

D. Tsvetkov

8 RADIATION HYGIENE

Radiation hygiene is a relatively new section of sanitary science - is formed in 30-40 years of XX century, with the primary aim of developing preventive measures to prevent the harmful effects of ionizing radiation on the human body.

All organisms on earth are constantly subjected to the action of ionizing radiation from natural sources (natural background radiation). They have adapted to it in the process of evolutionary development and therefore relatively constant intensity and character have not created specific receptors. Irradiation, however, of biological objects by ionizing radiation with intensity exceeding that of natural background radiation is a risk of damage.

Issues relating to the protection of the body from ionizing radiation, arise and are closely connected with the discovery of X-rays and radioactive decay, and their widespread use in medicine, research and business, energy, transport, military.

In 1895 Wilhelm Conrad Roentgen discovered unknown penetrating rays, he called X-rays. Over the next year Henri Becquerel discovered the phenomenon of radioactivity of uranium (which he associated with photoluminescence). Several years later, Maria Sklodowska-Curie (twice Nobel laureate) and Pierre Curie discovered that this phenomenon is observed in thorium (1898). They discovered new radioactive elements - polonium and radium ("radiant"). The name of the latter is associated with this new feature of the substance - radioactivity, and chemical elements emitting penetrating invisible rays - radioactive. The outstanding English physicist Ernest Rutherford discovered that emissions of radioactive substances have a different character and introduces the concept of alpha- and beta rays (1899). It proves that the rays emitted by radium are helium nuclei - alpha rays. Together with P. Sodi, Rutherford created the theory of radioactive decay (1911).

In 1934 Irene Curie and Frederic Jolio Curie receive artificial radioactive isotopes - radioactive phosphorus by irradiation of aluminum with alpha particles. In the same year Enrico Fermi reaches the same conclusion in a theoretical way and found that the process is very hurried by bombardment of nuclei with neutron.

During the period 1939-1940, the german radiochemists Otto Hahn and F. Strassmann, and E. Fermi, F. Joliot-Curie, O. Frisch and others. discovering the chain reaction. For the first time in 1942 in the US there emigrate E. Fermi carried out nuclear chain reaction in created by him the first atomic reactor. The latter is given an opportunity to make the first atomic bomb tested in august 1945 in Hiroshima and Nagasaki.

Almost immediately after the discovery of X-rays and the natural radioactivity they are applied in medicine **(Fig. 8.1)** and was found to possess pronounced biological activity (in 1896 physicist prof. V. Roentgen afford the title "Ph.D. Medicine "at the Medical Faculty in Würzburg).

Back in 1896 it reported hand dermatitis, hair loss, decreased skin sensitivity in patients who are taking



Fig. 8.1. First "arteriogram" - 1896 E. Haschek, O. Lindenthal

X-rays and doctors working with X-ray machines. Later Pierre Curie describes in detail the effects of radiation on the skin (he and Marie Curie were held radium often with bare hands) - redness and long non-healing wounds, decreased sensation and pain in the fingers, hyperkeratosis.

During the period 1900-1920, discloses a variety of changes in the body of action of ionizing radiation: the development of skin cancer after initial chronic skin ulcers - 1902; blood dyscrasias - 1904; deaths from aplastic anemia radiologists - 1911; case of osteosarcoma in reach of radium in the body of the watchmaker factory workers in the US, which have caused manually luminous paint containing radium on dials and mouth are sharpening brushes - 1916-1920.

The use of ionizing radiation for treatment of malignant tumors and other bone- joint and skin diseases (started in 1901 in France) then brought them often severe radiation damage.

This necessitated biology and medicine to study the issues of the effects of ionizing radiation on living organisms, opportunities and conditions of use for the purposes of diagnosis and treatment, and above all to protect them from harmful action.

Radiation hygiene is a complex discipline closely related with radiobiology and nuclear physics, and other medico-biological, physical, engineering sciences, with other hygiene disciplines - labour, communal, military hygiene, with aerospace and aviation medicine.

Radiation hygiene study and appraise:

- *Different sources of ionizing radiation and the conditions of their application in communal and labour environment.*
- *Studied, alone and combined with other factors, effects of ionizing radiation on the human body.*
- *Develop a variety of means - regulations, methods and rules, etc. - for protection against radiation.*

1. RADIOACTIVITY, IONIZING RADIATION - CHARACTERISTICS, INTERACTIONS WITH SUBSTANCES

◆ Ionizing radiation

Ionizing radiation is any radiation which may interact with the substance (organic or inorganic matter) lead to the formation of electrical loads with different charges - ionize the substance. They are:

1. The corpuscular - stream of elementary particles with different mass, with and without electrical charge (alpha-beta particles, neutrons).

2. Electromagnetic (photon) radiation - gamma and X-ray.

Can be classified in: velocity of propagation; run in substance; density and type of ionization. ***X-ray*** radiation occurs in change (delay) the speed of electric charged particles (mostly electrons). This happens in artificial sources - Coolidge X-ray tubes or linear accelerators of electrons and betatrons.

Their energy is several tens of keV (X-ray tubes) to hundreds of MeV (betatrons). The spectrum of radiation include braking and characteristic radiation. The first is relevant to medical diagnostics and fault detection and the overall intensity dependent on the size and voltage of the current, the atomic number of the target, the structure of the tube. Characteristic radiation depends on the chemical element and the target is important in X-ray analysis. Penetrating ability is high and the air reaches hundreds of meters. The linear density of ionization is low. Upon reaction with the substance occurred three main processes: photoelectric effect, kompton's effect and form a pair of electron-positron. In these processes the primary ionize the atoms and also to receive and secondary ionization of the precipitated charged particles (electrons and positrons) and γ-radiation from the excitation of the nuclei of atoms.

◆ Radioactivity

Radioactivity is the spontaneous disintegration of atomic nuclei of elements with changes in their chemical and physical properties and emission of ionizing radiation. Such elements are called radioactives - natural and artificial radionuclides (currently about 70 known natural and artificial radionuclides around 2000). Each of them has a constant half-life - T, which ranges from fractions of a second to millions of years. This is determined by the law of radioactive decay, which indicates that their number decaying nuclei (d N) to the total number of nuclei (N) of a radionuclide per unit time (t) is constant (λ) or

$$\frac{dN}{dt} = \lambda N$$

Radioactivity (radioactive transformations) has several types:

- *Alpha-decay* - primarily in natural radionuclides with high atomic number (^{226}Ra, ^{235}U, ^{239}Pu, ^{214}Bi, ^{232}Th, etc.). Set off from the nuclei α-particle and photon γ-radiation.
- *Electronic beta decay* - in the majority of natural and artificial radionuclides with different atomic number (^{3}H, ^{14}C, ^{58}Co, ^{90}Sr, ^{228}Ra, etc.). In nuclei neutron converting it into a proton, thereby emit rays elektrons-beta rays (-) and γ-rays from the excited nuclei.
- *Positron beta decay* – some artificial radionuclides (^{15}O, ^{11}C, ^{13}N). In the nuclei, on the

contrary, a proton is converted to a neutron, thereby emit positrons - beta-rays (+).

- *Electronic capture (K-grip)* - in which similar to the above proton becomes a neutron in the nucleus, but by the capture of an electron from the K-layer nuclear envelope. The core is excited and becomes a source of γ-rays and characteristic X-ray radiation. In artificial radionuclides, positron β-decay has electronic capture (^{23}Na, ^{58}Co).
- *Spontaneous division of nuclei* - in radioactive elements with high atomic number (^{235}U, ^{239}Pu), snatching slow neutrons, thereby release energy and neutrons (may arise chain reaction and explosion). The excited nuclei emit γ-rays. They can under go also α- or β-decay.

(Artificial our planet is thermonuclear synthesis made so far in hydrogen bombs.)

1. Alpha particles **(Table 8.1.)** They ionize atoms and excite the nucleous, which becomes a source of secondary γ-radiation.

The linear density of ionization of the substance is very high, but with little penetrating power, α-radiation with energy 4 MeV there is run in the air around 3 cm, and in the human body 30 μm. Particularly dangerous are sources of this radiation such as internal sources. These are natural radionuclides with high atomic number.

2. Beta-particles. Have about 1000 times less dense ionization of α-rays with the same energy. Act on the substance as α-particles, but at high energies cause and secondary (braking) X-ray radiation. At 4 MeV energy run in air - 18 m, in water - 2,6 mm. Hazardous are sources of beta-rays at high energy and as external sources of radiation.

3. Gamma radiation. This is a photon radiation having wavelengths less by X-rays.

Is reacted with a substance in the same manner as the X-ray radiation, and is similar to it penetrating power and ionization density. Intensive sources of γ-rays are ^{60}Co, ^{137}Cs, ^{24}Na, ^{226}Ra. Almost all the radionuclides with α- or β-decay are sources of γ-radiation.

Table 8.1. Types and properties of ionizing radiation.

Radiation symbol/ mass	Nature	Speed	Energy	Density of ionization	QR	Run	Interaction with substance	Irradiation	Protection
Alpha Particles α / 4	$^{4}_{2}$He	15-20 000 km.h^{-1}	2-9 MeV	2 MeV air 5000 ion pairs	20	2-11 cm air, 30-40 μm tissues	Ionization atoms and excitation - secondary gamma radiation	Internally	Distance
Beta-Particles β / 1/2000	Electrons and positrons	Close to light	0,01-10 MeV	2 MeV air 6 pairs ions	1	to 18 m air; to 1 cm body	Ionization atoms, excitation and braking radiation - secondary gamma, X-ray radiation	Internal and Externally	Distance and Screens
Gamma rays γ / 0	Electro-magnetic 10-10^{-4} A *	Light c = 3.10^{8} m.s^{-1}	0,01-10 MeV	2 MeV air 0,1 pairs ions	1	hundreds m air; passed in the body	Ionization atoms and excitation - secondary gamma and beta radiation	Externally	Screens and distance
X rays χ / 0	Electro-magnetic 10-10^{-4} A *	Light c =3.10^{8} m.s^{-1}	0,1 – hundreds MeV	2 MeV air 0,1 iopairs ions	1	hundreds m air; paseed in the body	Ionization of atoms and excitation - secondary gamma and beta radiation	Externally	Screens and distance
neutrons n / 1	Slow resonant intermediate fast very fast ultrafast	Dependent of the energy	to 1 meV 1 eV-0,5 KeV 0,5KeV-0,5 MeV 0,5-20 MeV 20-300 MeV up 300 MeV	close to photonic radiation	3-10,5	close to photonic radiation	Interaction with nucleous, indirect ionization from secondary corpuscular and photon radiation	Externally	Three layer screens distance
* Remark. 1 E = 10^{-10} m (10 nm)									

4. Neutrons. Neutrons have a large mass and a large energetic range (below 0,025 MeV to 300 MeV), according to which are divided into slow, resonant, intermediate, fast, very fast and ultrafast. Have a great penetrating power. Ionizing the substance through indirect action by interacting with the nucleus of the atom, to yield the division of heavy nuclei, leakage of nuclear reactions with separation α- and β-particles and γ-radiation (often high-energy), very nuclei may exit bounce to ionize and excite the neighboring atoms. Except in the spontaneous division of heavy nuclei (^{225}U, ^{239}Pu) neutrons are produced by irradiation with α-particles (or γ-rays) of ^{8}Be, ^{11}B, ^{24}Na. Human exposure to neutrons as possible from external sources.

The activity of radionuclides is determined by the number of decay in seconds. In the SI unit for radioactivity is Becquerel (Bq) - one decay. s^{-1}. Off SI unit, but widespread is curie (Ci). One gram of radium has activity 1 Ci **(Table. 8.2)**. Absorbed dose (or only dose) is the transmitted energy of radiation per unit mass of irradiated material. The unit of absorbed dose by SI is gray (Gy) - one joule (J) kg. Off SI unit widely used of absorbed dose is rad (radiation absorbed dose).

To measure the dose penetrating photon radiation used exposure doses (or only exposure). According to SI unit of exposure is the coulomb per kilogram ($C.kg^{-1}$) and widely used off SI unit is roentgen (R). To determine the power of the photon radiation is used the term dose power, which is expressed in $C.kg^{-1}.s^{-1}$ ($R.s^{-1}$). Exposure and the dose absorbed by the soft tissues of living organisms under photon radiation are approximately equal. The use of the absorbed or equivalent dose for this radiation, not the exposure, that has limited application ($C.kg^{-1}$ is a very large unit).

The biological effect of the absorbed dose depend on the type of radiation. As a major magnitude, characterized the degree of influence of various ionizing radiation on the body, using an **equivalent dose (Deq)**. It is equal to the absorbed dose multiplied by a so-called **quality ratio** -QR. QR for gamma, beta- and X-ray radiation is 1; alpha radiation - 20; neutrons - 3 to 10.5; for heavy nuclei - 20. Equivalently term of QR is RBE - relative biological effect of radiation (ICRP recommends the use of QR, and RBE - only for research in radiobiology). Unit dose equivalent by SI is Sievert (Sv) - 1 gray γ-radiation. Off SI unit is used ber (biological equivalent of rad) or rem (rad equivalent man).

Assessment of collective risk (expected collective loss) of ionizing radiation in relation to the so-called. stochastic (non-threshold) biological effects, using **collective equivalent dose**. It is equal to Deq in individuals, multiplied by the number (n). Expressed in "mansivert (ber/rem)".

◆ ***Sources of radiation are considered:***

1. Closed, excluding the possibility under normal (non-emergency) conditions fall radioactive substances into the environment.

2. Open - where this possibility is real.

Eg., Closed sources are radioactive substances placed in closed glass ampoules and open - solutions or powder of radioactive substances. External radiation is one in which the source of ionizing radiation is irradiated outside the body. In internal radiation radioactive material is inside the body. Irradiation may be combined.

2. BIOLOGICAL ACTION OF IONIZING RADIATION

Biological effects of ionizing radiation depends on:

- **The total absorbed dose.**
- **The power of the dose.**
- **The type of radiation.**
- **The size of the irradiated surface.**

Table 8.2. Units used for ionizing radiation.

Magnitude symbol	Unit symbol	Definition	Recalculation
Activity, A	Curie, Ci *Becquerel, Bq	$3,7.10^{10}$ decomposition$.s^{-1}$ 1 decomposition$.s^{-1}$	1 Ci = $3,7.10^{10}$ Bq
Exposure, D_{ex}	Roentgen, R *Coulomb. kg^{-1}, $C.kg^{-1}$	in air $2,08.10^{9}$ couples ions/cm^3 = 0,114 erg. cm^3	1R = $2,58.10^{-4}$ C.kg-1 $C.kg^{-1}$ =$3,88.10^{3}$ R
Absorbed dose, D	rad, rad *Gray, Gy	100 erg.g^{-1} 1 J.kg^{-1}	1 rad = 10^{-2} Gy
Equivalent dose, Deq	BER/REM * Sivert, Sv	1 rad.QR 1 Gy.QR	 1 Sv= 100 BER(REM)

* Units SI

- **The timing and nature of exposure.**
- **The accumulation of the substance in an organ or tissue.**
- **• Specific and individual susceptibility.**

Significant impact on radiosensitivity have nutrition, alcohol consumption, smoking, the impact of other physical, chemical and biological environmental factors.

The primary processes underlying the biological effects of ionizing radiation, can be explained by the ionization of the atoms and molecules within the cell and cellular structures. It is believed that about 50% of the absorbed dose of an "average" cell is contained therein water, and the rest - of cellular organelles and organic macromolecules. Ionization of water in the cell is recognized as an indirect way of biological effect and ionization of cell structures and organic macromolecules - as a direct action. So far it is believed that the main primary effect of ionizing radiation is indirect - ionization and radiolysis of the molecule of water, forming highly radicals - H +, OH, H_2O_2 and HO_2 (hydroperoxide), having high oxidative capacity. They interact with the molecules of different substances dissolved in the cell, thus forming the active secondary radicals. In the direct effect of ionizing radiation is obtained the ionization and excitation of biomolecules of lipids, nucleoproteins, nucleic acids, carbohydrates, also with the occurrence of complex active secondary radicals.

The above primary radiation damage processes - ie. physical (ionization), physico-chemical (radiolysis), chemical stages are only the beginning of radiation cell damage. They run too short - respectively for 10^{-13}s, 10^{-10}s and 10^{-6}s, but are essential for subsequent biochemical and biological changes. The damage of the cells due to the interlinked and reinforcing the physical, chemical and biochemical processes and stages - A. M. Kuzin, leading to a variety of functional and structural changes, while at high doses - and to the death of the cell **(Fig. 8.2)**.

Irradiation in vitro or in vivo (in the latter case, the amendments are stronger) on protein structures leads to configurational modifications, cleavage of the peptide bonds or carbon (at high doses). Upon irradiation of the experimental animals once at a dose of 500 R, and 650 R, the cells of the organism is modified free amino acids - decrease of methionine and tryptophan (respectively 75% and 25%) and stronger and earlier are reduced sulfhydryl groups (over 50% reduction a fifth day after irradiation). Change your activity of a different nature and extent enzyme systems. Particularly important is the increased activity of deoxynucleoproteases causing (along with other processes) destruction of DNA proteids complexes and accumulation of free nucleic acids in the cytoplasm. To the most radiosensitives metabolic processes to decline and oxidative phosphorylation - in a single exposure to a dose of 100 R in the first 30 min ATP greatly reduced. Irradiation of lipids leads to the formation of peroxides (direct effect or consequence a decrease in antioxidants), which is important for radiation damage due to the role of lipoproteid complexes for structure and functions of cell membranes. Irradiation of carbohydrates (in vitro and in vivo) showed their decay products (glycosacharides, organic acids) decrease the level of glycogen in muscle and liver cells, offense, anaerobic glycolysis. From the organelles in the cell especially sensitive to radiation are the nucleus and mitochondria.

Ionizing radiation can cause all kinds of mutations in the genetic apparatus of cells:

• Genomic mutations - changes in the haploid set of chromosomes (aneuploidy or euploidy).

• Chromosome aberrations (structural changes in chromosomes - fragmentation).

• Gene or pinpoint mutations (changes in the molecular structure of genes).

The spectrum of mutations induced by ionizing radiation, is no different from spontaneous (natural) mutations, since they main factor for this is the natural background radiation (other factors are free radicals and peroxides, formed in metabolic processes in the cell, also viruses). Mutations are persistent - they are transmitted to the next generations or cell are stored in non-breeding cell. When damage to the genotype of germ cells, depending on the degree of dominance (F_1) and the decrease in viability, it is eliminated, but recessive mutations remain and be transmitted to the next cell populations (F_r F_2, etc.), resulting in to hereditary diseases, teratogenesis, etc. in organisms. By mutations in somatic cells they die or acquire new properties, resulting in processes of carcinogenesis.

General radio sensitivity of cell. Determined largely by the flow rate of the metabolic processes in it. Cells with intensive metabolism, rapid growth and significant energetic potential damaging stronger from ionizing radiation. Radio sensitivity a of various cells (tissues) in the degree of morphological changes, in ascending order, is: nervous tissue, osseous and cartilage, muscle, connective, thyroid, lung, skin, gonads, lymphoid tissue, bone marrow. With regard to functional changes radio sensitivity however, is quite different.

In multicellular organisms with higher radio sensitivity are warm-blooded animals and mammals - LD_{5Q} for amoeba is 100 thousand cSv *, 1000-1500

* 1cSv = 10 mSv = 1 ber (rem)

cSv - fish, birds - 600-800 cSv, mammals and man 500-800 cSv. Organisms with a higher activity of catalase, capable of decomposing the peroxide (insects); higher content of methionine and sulfhydryl groups (crustaceans) show small changes. More susceptible are young and old organisms - the first following intensive division of cells (foetus is especially sensitive), and the old - due to reduced capacity for recovery. With much higher radio sensitivity are mammals during pregnancy, etc. These features are important for realizing the radiation protection of man.

Radiation damage to the human body. They may be of mild to severe functional structural damage and death. They may affect only iraiated individuals - somatic damage, and its progeny - genetic damage of germ cells. Furthermore, somatic disabilities can be early - occurring up to several months after exposure, and later - after years.

Radiation is classified as *stochastic and non-stochastic effects*. Stochastic effects are a linear function of the absorbed dose and are considered non-threshold, while non-stochastic effects occur when exceeding a certain threshold radiation dose. In stochastic effects the dose/effect is expressed in statistical probability (but improbable) the occurrence of disability (illness) and increase their frequency for the entire population (or very large group) and not amplified the severity of the injury (increased risk for disease) .

1. Non-stochastic effects. In non-stochastic effects in excess of a certain dose will receive disability (illness) all exposed persons ($P<0.05$) by increasing the dose intensifies the severity of the injury. Non-stochastic effects are acute and chronic radiation sickness, radiation skin burns, eye cataracts, reduced life expectancy, damage to the embryo and fetus.

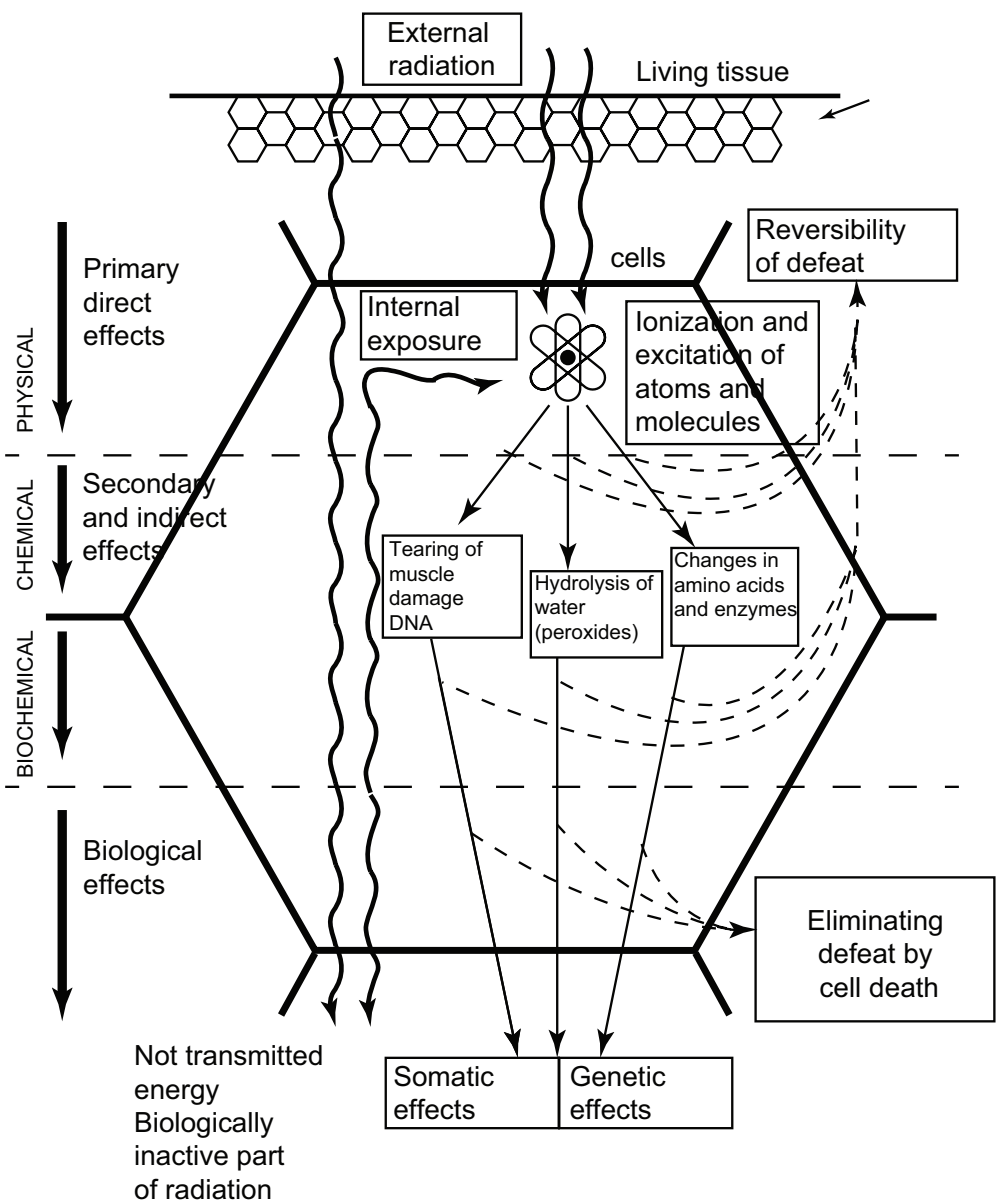


Fig. 8.2. Stages of action of radiation on living organisms (in R. Popitz, 1989)

The extent and nature of damage in a single irradiation of the body depend primarily on the absorbed dose. At the dose to 25 cSv (ber) did not show any clinically detectable effects; at doses up to 100 cSv - relatively small changes such as temporary changes in blood cell counts, abnormal autonomic nervous system functions; at doses above 100 cSv develop acute radiation syndrome **(Tab. 8.3)**. Doses above 500-600 cSv considered deadly for people, at doses above 10 thousand cSv death occurs within minutes - i.e. "Death under the beam." Acute radiation sickness is now in extremely rare - in emergency situations.

For skin doses of 500 to 1200 cSv and more acute radiation diseases manifest themselves as so-called. ray burns of varying degrees - I-IV.

In repeated radiation develop with different latency period - months, often years - chronic radiation sickness. It is a disease of the whole organism, with the effect on the nervous and cardiovascular system, haemapoiesis, gastrointestinal tract, kidney, lung, metabolic processes, endocrine organs.

When a single radiation doses cSv 200, can be obtained the development of cataracts, the latency period 2-7 years.

In experiments with experimental animals was found decreased life, of up to 25-50% for a single irradiation with a sublethal dose. At lower doses (100 cSv - too high dose) life expectancy reduced by 2-4%. It is believed that this is due to accelerated aging processes and increased susceptibility to infections. There are no reliable data on reduced life expectancy in chronically exposed people with small doses.

Prenatal exposure to maternal causes damage to the embryo and fetus. Children irradiated in utero in Hiroshima and Nagasaki (doses 50-70 cSv) have lower growth and observed an increased incidence of microcephaly and mental retardation. Exposure in early pregnancy (preimplantation period and to 8^{th} week) causes most often spontaneous abortion, and exposure through 8^{th}-18^{th} week causes as abortion and various malformations. As a threshold dose for embriotropic action indicating 10 cSv. This is base for termination of pregnancy, but they are also very high doses that result in emergency situations or gross violations using ionizing radiation. Exposure of the embryo and fetus may be referred however to stochastic (non-threshold) disabilities, associated with increased incidence of malignant neoplasms and congenital anomalies (malformation, hereditary disease) in the postnatal development of the fetus and its progeny, resulting gene mutations somatic (formation of protooncogenes, for example.) and sex cells (oocytes of the embryo).

2. Stochastic effects. To stochastic effects include impacts on the genetic apparatus of somatic and germ cells. The incidence of stochastic effects depends on the population (collective) effective (equivalent) dose, ie not only from the individual dose (Def., Deq), but also the total number (n) irradiating persons. In *somatic cells* that is manifested by

Fig. 8.3.

dose – cSv (ber)	Severity	Leading syndrome - clinical form	Stages, duration and forecast	Clinical picture (Symptoms, syndromes)
100-200	I – light	bone marrow	I – primary response - no, hours II – latency period – 1 m. III – expressed reaction IV – recovery - complete, favourably	**I stage:** √ dyspeptic √ neurovegetative √ skin √ bone marrow **II stage:** √ without subjective complaints √ pancytopenia √ depilation **III stage:** √ toxico - infectious √ bone marrow √ haemorrhagic √ gastrointestinal √ neurovegetative √ cardiovascular √ respiratory
200-400	II – average	bone marrow	I – 1 twenty-four hours II – 15-20 days III – pronounced reaction IV – relatively favorable	
400-600	III – severe	bone marrow	I – 2 twenty-four hours II – 8-17 days III – pronounced reaction IV – doubtful	
600-1000	IV – very severe	bone marrow and intestinal	I – several days II – will not, in 6-7 days III – pronounced reaction IV – unfavorable, high mortality	
1000-5000	IV – very severe	intestinal	100% mortality after 8-16 days	
5000-10 000	IV very severe	toxic, cardiovascular	100% mortality after 4-7 days	
up to 10 000	IV – very severe	cerebral lightning	100% mortality after 1-3 days or "death under beam"	

the development of leukemia and other limfo- and hemoblastosis, malignant tumors (thyroid cancer, osteosarcomas, etc.). Latency period for the development of malignancies is 10-25 years.

Since 1952 established an increased incidence of diseases from leukemia in irradiated populations in Hiroshima and Nagasaki (1945), the expected number of cases for 20 years was 20.10^{-6}.n for 1cSv (ber) collective dose of irradiation with gamma rays (n-total number of exposed people). This is four times the frequency of leukemia for the entire population of Japan. Individual cases occurred 2-22 years after exposure. Children latency period is lower. After 30 years, the risk disappears.

Studies in 680 and 1500 suffering from bone tuberculosis and ankylosing spondylitis treated in 1946-1964, with the short-lived radionuclides - ^{224}R, in skeletal doses respectively of 90 and 67 cSv found 18 and 2 cases of osteosarcoma. Increased incidence of thyroid cancer has been described in survivors of Hiroshima and Nagasaki; exposed children (due to increase of the gland); inhabitants of the Marshall Islands (nuclear-armed tests). The frequency is two times higher in men, but mortality from this type of cancer is low. It is believed that the hazard ratio (k) the disease is 100.10^{-6} - 1 cSv, and mortality - 5.10^{-6} - 1 cSv.

Cancer and angiosarcoma of the liver BEIR - Committee of the United States (Committee for the biological effects of ionizing radiation) indicates ratio of the risk 15.10^{-6} to 300.10^{-6} - 1 cSv irradiation respectively with alpha- particles or gamma- X-ray radiation.

Studied here are the risk groups of patients injected with Thorotrast for radiographs (introduced in 1928, containing ^{232}Th, separating alfa- particles and a dose of 25 rad/a); population in Hiroshima; working with plutonium or persons who have been introduced plutonium for metabolic studies. Increased incidence of lung cancer was found in large groups of miners from uranium mines in the US, Canada and Czechoslovakia exposed to radon and its daughter products. Indicate a high degree of risk in these occupational groups - 1.10^{-4} - 2.10^{-4} for 1 month constant irradiation in production.

An important late effects of ionizing radiation is their genetic effect on *germ cells*, leading to a change in heredity. It is, however, primarily studied in experiments on animals. Studies of this effect in humans are still controversial. And at the most irradiated group of people - in Japan in 1945, there is no statistically significant evidence of an increased incidence of congenital abnormalities or reduced life expectancy in their offspring (with themselves irradiated is established, however, an increased incidence of chromosomal aberrations in the germ cells) . Explanation for this is the high spontaneous incidence of congenital anomalies (about 4% of all live births) and high natural mutation of the male sex cells - about 140 to 1000 cells.

Studies of some authors indicate that among mothers who had children with Down's syndrome, two times are the ones subjected to multiple X-ray procedures, but other authors have not observed such dependence. Indicate and an increased incidence of spontaneous abortions in advance (before pregnancy) application of radiotherapy in women (but without statistical accuracy or determining the level of risk).

Established a change in the sex ratio - a decrease in the number of boys born from previously irradiated mothers and decrease the number of girls in previously irradiated fathers. Similar changes were observed in the largest group of individuals exposed in Japan.

It is believed that the dose, doubling the frequency of spontaneous mutations is 10-100 cSv (ber). Now state and higher values - 50-250 cSv, i.e. genetic risk is not so high as that of stochastic somatic effects (primarily due to the elimination of non-viable and low reproductive germ cells).

The risk of genetic damage resulting in death were determined 40.10^{-6} n for 1 cSv (ber) for the first two generations and 80.10^{-6} n for 1 cSv for first ten generations.

3. THE RADIATION RISK AND RADIATION DOSE

Unlike previous opinions on the paramount importance of genetic factors (the sex cells) in exposure to small doses, now as a major limiting factor adopt stochastic radiation effects in somatic cells - carcinogenic effect of ionizing radiation . The assessment of this risk further (above background) irradiated groups of people is difficult because of the high incidence of cancer mortality for the entire population (13-16% of the total mortality in Bulgaria, reaching up to 20% in some countries). Also difficult and high variability of this frequency at less authority groups of individuals - for example, indicate the US average rate of death from leukemia of 3.5 per year at 50,000, variability from 0 to 11 cases, i.e. very difficult and it is impossible to accurately assess the risk of: exposure to small doses; small populations groups; in different forms of cancer (leukemia, lung cancer, etc.).

Risk assessment is done by:

1. Experiments with animals.

2. Epidemiological studies of groups of people with different doses of natural background.

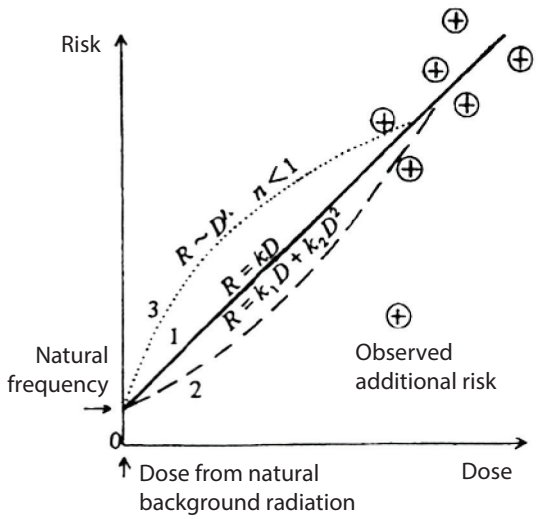


Fig. 8.3. Relations of the additional radiation risk for stochastic effects and the dose (by R. Poppitz, 1989)

3. Epidemiological studies in large groups of people influence with higher doses.

The most accurate data are obtained by the latter type of studies and are above all: the people of Hiroshima and Nagasaki; miners of uranium mines in Canada, Czechoslovakia, USA; large groups no cancerogenic treated and diagnosed with radionuclides and X-rays with high doses of radiation. Based on the data models are developed for the expected additional risk (additional cases of the disease) according ingested doses **(Fig. 8.3)**.

Basic and adopted by the ICRP (ICRP - International Commission on Radiological Protection) is the linear non-threshold model (right one in **Fig. 8.3**), where additional risk R = k. Def. There are two other models: the linear-quadratic (graph 2) and stage (graph 3). At first there is some reduction in the level of risk at less doses (which can be linked to allow the existence of a threshold at low doses, i.e. to think of non-stochastic threshold effect), while the second model the degree of risk is increased.

Estimates of the risk quotient (k) according to studies of ICRP, UNICEAR (SCNRI at UN - Scientific Committee on the Effects of Atomic Radiation), NCRP US (National Council on Radiation Protection) and NRPB UK (National Council on Radiation Protection) are shown in **Table. 8.4.**

The additional risk is estimated by the expected deaths and no morbidity - eg., In cancer of the thyroid gland, because of the effectiveness of treatment morbidity is 20 times higher, i.e., assessment on the expected deaths in somewhat understates the actual expected risk of disabilities. According to BEIR-USA (III Report - 1980), using the linear-quadratic model indicates additional risk of induced cancer (general) 260-800.10^{-6} 1 cSv (1ber) in men and 550-1600.10^{-6} 1 cSv women for 1 million irradiated persons. These are much higher values than those indicated in the **Table. 8.4** - 95-145.10^{-6} 1 cSv. In women, the values are twice as high because of the high incidence of breast cancer.

Prices quoted are for the lifetime risk of radiation. In leukemia additional cases occurred around 2 years after irradiation, the maximum is after 6-8 a. and the total risk period around 25 a. (27 - since the beginning of irradiation). In other tumors, the risk occurs after a latent period about 10 a. Additional risk here is 4-5 times higher, because after 40 years of irradiation cases can grow like spontaneous (natural) risk of malignant neoplasms in the elderly.

The risk of genetic damage has been studied primarily in experiments with animals. As stated, the risk of genetic damage fatal, indicated by the ICRP and UNICEAR at the UN - 40.10^{-6}.n 1 cSv for F_1-F_2 and 80.10^{-6}.n 1 cSv for F_1-F_{10}, is lower than for stochastic somatic disabilities (125.10-6.n 1 cSv).

Table 8.4. Odds risk of radiation for induced malignancies fatal - number of expected cases per 1 million persons irradiated with a dose 10mSv (ber 1) (in R. Popitz, 1989)

Type of malignant neoplasm	Risk ratio, k.10^{-6} 10 mSv (1 ber)			
	ICRP (1977 and 1984)	UNICEAR UN (1977r. and 1982)	NCRP (USA) (1983)	NRPB (England) (1980)
Leukemia	20	15-25	20	20
Lung cancer	20	25-50	25	20
Breast Cancer	25	10 (Japan) 60 (USA)	20	25
Thyroid Cancer	5	5-15	5	5
Bone Cancer	5	2-5	5	5
Everyone else	50	40	50	50
Total (for the whole body)	125	95-145	120	125

Note: Years in parentheses after the relevant international or national organisation are respectively the year of publication and reaffirmation of these odds risk.

4. SOURCES OF EXPOSURE TO IONIZING RADIATION IN COMMUNAL AND OCCUPATIONAL ENVIRONMENT

In the first 20 years after the discovery of X-rays and the natural radioactivity small number of people have been in contact with created and used by human, sources of ionizing radiation - some scientists, physicists, medical staff, suffering from malignant neoplasms. Currently repeatedly it is grown, and continues to grow contingent of people, where there is a professional and non-professional risk of harm to ionizing radiation.

All people, however, are exposed to natural background radiation and no data suggestive of significant changes in its intensity by the existence of mankind to now. This gives reasons for it to be considered as a natural factor associated with biological evolution (mutations in germ cells) and human development at organisms in nature (ecosystems).

4.1. NATURAL BACKGROUND

Natural background radiation include:

1. Ionizing radiation of cosmic origin and the natural radionuclides present in the environment - air, water, soil.

2. Building materials, plants and animals (used for human nutrition) and in the body of the man himself.

Irradiation is externally and internally.

◆ ***Cosmic radiation***

It is a flow of nuclei particles - mostly protons (92%) and alpha-particles (7%), as nuclei of atoms of beryllium, lithium, carbon, nitrogen and oxygen (about 1%). The energy of these particles up to 10^{19} eV (average 10^{10}eV). Cosmic radiation comes from various space objects, particularly active sources are so-called supernovae (new stars). Greater role in the intensity of cosmic radiation reaching the earth, the sun plays (in a period of increased activity it causes his rise to 2 times and includes intense electromagnetic field). This is so called primary radiation (reaching sea level it is at a rate of only 0.05% of its value at the boundary of the atmosphere). However, when switching of the primary radiation in the atmosphere, it reacts with atmospheric air, causing the occurrence of secondary radiation, consisting of electrons, positrons, neutrons and photon radiation (gamma rays). The greatest intensity of the secondary radiation has a height of 20-30 km (this represents a major problem in flight in such heights, where the power of dose absorbed can reach 3-6 μGy/h or more in giant solar flares).

The average annual dose from cosmic radiation at sea level and at mid-latitudes is around 280 μSv. This dose is fewer to the equator and more to the poles (14% increase).

Cosmic radiation - primary and secondary, is the only external source of radiation.

◆ ***Natural (land) radioactivity***

Due to natural radionuclides in air, water, soil, plants, animals and humans. Natural radionuclides are sources of external and internal exposure in a ratio of approximately 1: 3.5.

Natural radionuclides can be divided into two main groups:

1. Isotopes which are located in the crust even in the formation of the Earth which (or their ancestors) have a half-life above 10^8. This group can be divided into two subgroups: isotopes belonging to the three radioactive families - uranium (^{238}U), thorium (^{232}Th) and actinium (aktinouran - ^{235}U *); standing outside lighter elements - potassium (^{40}K), calcium (^{48}Ca), rubidium (^{87}Rb).

2. Radionuclide continuously formed in the air under the action - of an estimated 20, to cosmic radiation, the most important are tritium (^{3}H), carbon (^{14}C), beryllium (^{7}Ve), sodium (^{27}Na), but this subset is involved in the formation of minor dose - about 0.75% thereof.

- **Radioactivity of soil**

In the soil radioactive substances coming from the magmatic breeds, that are the main sources of receipt of radionuclides in all components of inanimate and animate nature (without cosmogeneous). In the soil the radioactive elements, included in three families and also potassium (^{40}K) and rubidium (^{87}Rb). With high radioactivity are clay soils compared to sandy (the latter with fewer sorption capacity), and magmatic breeds - granite and basalt, are higher radioactivity of sediment - sand, clay, limestone.

Average from soil person receives external radiation (gamma radiation) about 440 μSv/a. (260 - 613 μSv/a.).

In some areas of the Earth - eg. in Kerala - India, Tibet, in areas of the state Rio de Janeiro - Brazil, Lazio - Italy, areas in Iran, France, etc., the high content of uranium and thorium oxide in surface species and the soil, causes a significant increase in natural radioactive background - dose rate 40-50 times above average. In these areas live tens thousands of people, but there is no reliable results for increased radiation risk.

* The group of ^{235}U is only 0,7% of uranium contents in the crust, no practical influence on radiation dose.

- **Radioactivity of air**

In the air natural radioactivity is determined by radionuclides generated by:

• *Cosmic radiation* (^{3}H, ^{14}C, ^{7}Ve etc.).

• *Radioactive gases coming from the upper layers of the Earth's surface* - radon (^{222}Rn), thoron (^{220}Tn), actinon (^{219}An) and their progeny.

• *Some radioactive aerosols resulting from radon, thoron and actinion decay* (isotopes of polonium, bismuth, lead).

• *Radioactive aerosols from falling soil dust and splashing water from open basins* (by the wind) containing radioactive substances (their share in the total radioactivity of the air is negligible).

Total natural radioactivity of air fluctuates from 1.10^{-4} to $1,6.10^{-2}$ Bq/l, such as over the land it is higher than that over the oceans. By air person is subjected mainly to internal exposure by inhalation of the above radioactive substances, emitting alpha-, beta- gamma- rays, to a lesser extent the external radiation from gamma emitting radon, thoron and their progeny. Mainly is irradiation of ^{222}Rn - internal exposure dose of it and its daughter products is over 800 μSv/a. Thoron is 10-100 times less in air and aktinon is practically very small contribution to the total activity (for this matter and their half-life period - respectively 54 s and 3,9 s, versus 3.8 days for radon).

- **Radioactivity of the water**

In the water natural radioactive elements come from the soil. Rainwater is weakly radioactive - it contains traces of tritium (^{3}H), carbon (^{14}C), beryllium (^{7}Be) formed by the interaction of primary cosmic radiation with the ambient air. It also contains ^{40}K and ^{238}U, through aerosols come from the soil and water and of the various air pollutants containing radioactive substances.

The content of radioactive substances in groundwater is determined exclusively by the quality of the seam. In groundwater contained primarily ^{40}K, ^{226}Ra and ^{222}Rn. More highly radioactive are deeply lying mineralized waters.

The radioactivity of open basins depend on the content of radioactive substances into the soil layers closely fitting and that of the flowing water therein.

Radionuclides in the water are the most common form of solutions, but also incorporated in larger particles of organic and inorganic matter, or in microorganisms and plankton. The world's population consumes drinking water most often with total activity 1,5 - $2,2.10^{-3}$ Bq/l.

- **Radioactivity of animals and plants used as human food, building materials, clothing, etc.**

Determined by radionuclides contained in them. They can be divided into 2 groups.

1. The first group include radionuclides stable elements involved in basic functions and metabolic processes of the body - the ^{40}K, ^{14}C, ^{3}H. Their content in different types of organisms, tissues and organs is proportional to the stable element contained in them - eg. potassium-rich red blood cells, brain, muscle, and liver, legumes and others contain most of ^{40}K.

2. The second group includes the radionuclides of heavy elements - ^{238}U ^{226}Ra, ^{232}Th, ^{210}Po and others. Their participation and importance for metabolic processes of organisms is unclear and entering them in proportion to the amount of content in the environment.

- **Radioactivity of the human body**

It is determined also by various radioactive substances whose grouping and features correspond generally to the above-discussed radioactivity in animals and plants.

The body contains ^{3}H, ^{40}K, ^{14}C in quantities proportional to those contained stable elements. The body also contains ^{226}Ra, which accumulates mainly in the bones. The content of the radionuclides is quite different and is determined by their content in food products, and much less than that in the water.

- **Technogenically amended natural background radiation**

It is the result of human activity - the use of technologies directly norelated to sources of ionizing radiation.

The use of *coal* for power and heating needs of the population - in thermo-electric heating plants (TEP) and domestic hot household, is connected to the global production of about 4 billion tons of coal annually. Burning them devote much aerosols (as well as in unburnt ash and slag - solid waste) containing natural radionuclides, of which the most essential to raise the collective dose (CD) are ^{238}U, ^{232}Th, ^{226}Ra and ^{40}K. Approximately CD of the world's population is estimated at about 2,000 man. - Sv/a of coal combustion in power plants and 100,000 man. - Sv/a - burn household.

Such "outsourcing" of radionuclides from deep earth layers represents the use of *geothermal energy* - mainly in Iceland, Italy, Russia, USA. This is related to high levels of radon (^{222}Rn) in steam or hot water, but although perspective, yet this limited energy production (only about 0.009% of the world's energy production) has negligible contribution to the increase of CD. Conversely, a low content of radionuclides in liquid and gaseous fuels, more efficient combustion technologies and products they receive also lead to insignificant contribution to the increase of CD, despite their large global yield.

The extraction of *phosphate ores* for production

of phosphorus, phosphate fertilizers for agriculture (second in use since nitrogen fertilizers), building materials (phosphogypsum), due contained breakdown products of the family of ^{238}U, leading to CD for the world's population of about 6000 man. - Sv/a in terms of their use as fertilizers (70% of their production). However, the use of phosphogypsum as a building material (only about 10% of the resulting secondary product) in buildings gives CD earthly population of about 300 000 man. - Sv/a.

Increasingly widespread use of public *air transport* and flight at high altitude - interstate and intercontinental of 10-12 km, interior - of 4-8 km, and ultrasonic - to 18-20 km, is related to getting higher exposure doses of cosmic radiation (at sea level it is 0,03 μSv/h, 8 km -1,35 μSv/h, at 20 km - 12,75 μSv/h). Estimates for 1978*, a total of 1.6 billion man-hours flights on average height of 8 km, humanity got CD 2000 man. - Sv/a **(Fig. 8.4)**.

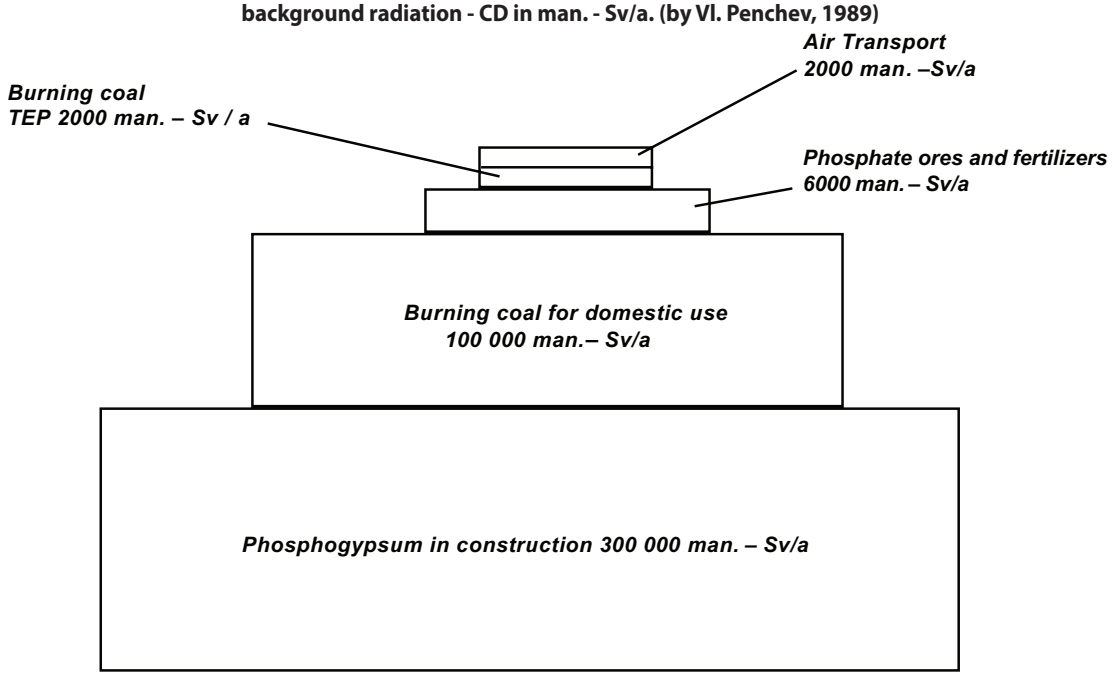
On incomplete data CD of technogenic changes background is only about 5% of the natural background radiation, but it tends to grow, and there are also significant differences in large populations (countries, regions, professions).

More interesting is the *problem of buildings* (residential, industrial) in which people spend about 80% of the day, and background radiation in them. Human exposure depends on both their shielding effect (reduction) and those contained in building materials and soil radionuclides, furniture and ventilation of premises. In buildings made of wood and light concrete panels irradiation premises is less than that outside (ratio 0.7 to 1.0), in spite of their poor shielding effect. The higher content of natural radionuclides in the brick, concrete, stone (granite, basalt), the greater wall thickness causing greater exposure within the premises (ratio 1.0 to 2.0), despite a higher shielding effect these buildings. UNICEAR at UN assumes that the world average ratio is 1.2, i.e. in premises the dose rate is higher. This concerns only the external irradiation of human gamma- rays (slightly increase the dose given beta-radiation - about 2%, and even less gamma- radiation from radon and thoron in the air).

However, the use in construction materials with increased content of radionuclides - granite, clay flooring and fly ash, phosphogypsum and slag calcium silicate, and construction on soils or dumps with high radionuclide content (^{226}Ra, ^{238}U, etc.) can cause high exposure of people in them. Indicate doses of 30 mSv/a in buildings constructed on embankments of waste of uranium mining industry.

Many current *problem with radon* (^{222}Rn) and thoron (^{220}Th) in modern buildings. In buildings with fixed windows and air conditioning with air recirculation (to save energy for heating or cooling in summer) are found in the air concentrations of ^{222}Rn from 8 to 5000 times higher than those outdoors. Radon enters the premises of water, natural gas, construction materials, soil, but the main cause of the accumulation is insufficient ventilation. Data on concentrations of radon in various areas show

Fig 8.4. Additionally exposure of technogenically amended natural background radiation - CD in man. - Sv/a. (by Vl. Penchev, 1989)



* Now data are: 928 mil. in EC for 2015 – growth 22% to 2009;
1,7 bill. in World for 2012 - anual growth 5%

very large differences, but on average the population of the earth SCNRI at UN stated dose to 1000 μSv/year (half of the total dose of natural radiation background).

In summary it can be said that the average population dose from internal exposure from natural background radiation is two times higher than the external and most important source for this ^{222}Rn (60% of dose), less than ^{40}K and ^{220}Th (in 13%). Cosmic radiation is only an external source and given half the dose external radiation. Referred to in the **table. 8.5** total dose of 2000 μSv/a is adult. For children up to 10 years it is 3000 μSv/a, due to intensive pulmonary ventilation and increased entry of ^{222}Rn inspired air. For Bulgaria the dose of natural background radiation (gamma-radiation) averaged 0,13-0,17 μSv/h (higher values - up to 0,20 μSv/h and to 0,35 μSv/h respectively in the region of Balkan, Rila and Rhodope Mountains).

Table 8.5. Average equivalent doses for the population in the world (μSv/a) data of UNICEAR at the UN - 1984

Sources	μSv/a
Natural:	
• Cosmic radiation	300
• Flights Aircraft	0,5
• γ-radiation:	
■ background	350
■ additionally from building materials	–
• Internal exposure:	
■ β-radiation	200
■ α-radiation	170
■ further:	
fertilizers into the soil	–
discharges from nuclear power plants	–
smoking	50
• Radon (^{222}Rn and ^{220}Rn)	
■ background (air)	–
■ building materials (on the premises)	970
■ soils	–
All	2000
Medical: • Radiology • Radionuclide diagnostics	 1000* 40*
All	1040
• Testing of nuclear weapons • Nuclear power plants • Occupational exposure	15 0,1 4*
TOTAL	= 3050
Note: – no data * in developed countries	

Apart from natural background radiation population is subjected to exposure to ionizing radiation from:

- *Exposure of natural and artificial radioactive substances into the environment caught there in human activity.*
- *Exposure in professional conditions.*
- *Medical exposure.*
- *Exposure to other sources of ionizing radiation.*

4.2. RADIOACTIVE MATERIAL INTO THE ENVIRONMENT DUE TO HUMAN ACTION

◆ *Nuclear test*

They are the most powerful source of global pollution of the biosphere with radionuclides. Especially dangerous are nuclear explosions in the air - in the period 1945-1980, there have been a total of 423 nuclear test (underground nuclear tests practically do not pollute the biosphere).

In a nuclear explosion generated over 200 different isotopes of 36 chemical elements with a half-life of 1 s (^{144}Xe) to 1,7.10^{7}a (^{129}J). They are mainly beta- and gamma emitting radionuclides. Due to the small half-life or a small amount, dosage form only 21 of them, the main are ^{14}C, ^{131}J, ^{90}Sr, ^{96}Zr, ^{137}Cs. The most dangerous due to their involvement in the biological cycle and the large half-life are ^{90}Sr and ^{137}Cs (half-life of 28.5 and 30a respectively). Moreover, powerful neutron radiation in the blast caused a secondary radioactivity. In a nuclear explosion in the atmosphere, depending on the height and of its power, much of the radioactive substances fall into the stratosphere, where they take hold in a few years and repeatedly circling the globe. Gradually caught up in the troposphere, they stay there 30 days with precipitation or by gravity fall to the ground. Following the peculiarities of atmospheric circulation, although global contamination with radioactive substances is unevenly - more in the Northern Hemisphere, in medium and large widths.

Radioactive fallout cause internal and external exposure as the absorbed dose is mainly formed (80%) of consumed contaminated food and water (^{14}C, ^{90}Sr, ^{137}Cs), the remaining dose (18%) is formed by external radiation (^{137}Cs). ^{14}C affect the dose of future generations for millennia, but for one generation dose is very small.

◆ *Nuclear energy*

It is a perspective of the energy sector, which in 1987 was producing approximately 16% of world production of electricity. In Bulgaria TEP Kozloduy "NPP" gives about 40% of produced electricity, and the first in the world is France - 70% of produced

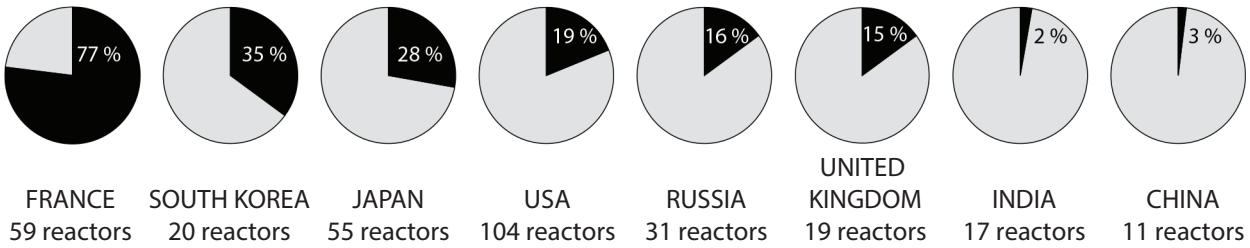


Fig. 8.5. Electricity produced from nuclear power (2008)

electricity. NPP can disposed in the air ^{3}H, ^{131}J, ^{85}Kr, ^{133}Xe, etc; the water coolant - ^{3}H, ^{60}Co, ^{59}Fe and others. Atmospheric radioactive emissions (gases, aerosols) provide 95% of over the background, radiation on the population. Radiation protection measures at Kozloduy in 2000 will give (while maintaining the same technology and the expected increase in number) radiation no exceeding 0.05% of the annual dose of natural background radiation. And the risk is minimal for those living in nearby areas (it is estimated that the risk of damage to their health is very lower that for people living near heating or chemical plants) **(Fig. 8.5)**.

In nuclear reactors (NPP), however, are especially dangerous emergency situations. More severe accidents in the recent past was mostly in experimental reactors without major environmental pollution (Chalk River - Canada Uindsket - Britain, Vinca - Yugoslavia, Idaho - USA).

The accident at the Chernobyl Nuclear Power Plant (Ukraine) in 1986 caused significant pollution in Europe, by CD 740 million population is estimated at 40% of the annual dose from natural background radiation (1, 6.10^{6} man - Sv/a). In accidents at nuclear reactors released into the environment most ^{131}J (but with a half-life of eight days), also i^{132}Te, ^{137}Cs, ^{89}Sr, ^{90}Sr, ^{95}Zr and others (depending on the type of reactor, the duration of operation following loading, etc.). In the Chernobyl accident most irradiated population was in the European part of the former Soviet Union, followed by that of Romania, Austria, Switzerland, Yugoslavia, Finland, Greece, Sweden, Germany and Bulgaria. For Bulgaria additional lifetime effective dose for the population is about 1,6 mSv (about 65% of the annual dose from natural background radiation). The estimated number of extra cases of fatal malignancies, according to the linear non-threshold model would be around 180 (260-147) and would occur in the next few decades (in Bulgaria a year diseased and die from cancer, approximately 24-30 thousand and 17 thousand people).

◆ ***Mining and processing of uranium ore and produce nuclear fuel***

This includes uranium mines, sinter plants to enrich uranium ore (uranium concentrate), plants for purifying the concentrate and to obtain nuclear fuel (the latter are minor doses of radioactive contamination).

Extraction and processing of ore to obtain a large amount of solid waste from uranium ore containing uranium (^{238}U), radium (^{226}R), their decay products. Businesses spend and waste water with radionuclides -^{60}Co, ^{90}Sr, ^{134}Cs, 3H and many others. The air throw up ^{3}N, ^{90}Sr, radioactive emanations - ^{222}Rn, ^{85}Kg, ^{133}Xe. It is estimated that the plant, processed 500 t of uranium ore per day, spending about 500 t solid and 200 t liquid waste.

◆ ***Establishments, enterprises and laboratories using radioactive substances***

These include a variety of radioisotope laboratories and radiology departments of medical facilities, laboratories of departments and research institutes with different profiles. They separate different liquid, solid and gaseous wastes containing radionuclides. Their share in the total pollution is very small compared to other sources.

Compared doses received from various sources of radioactive contamination of the environment, show that the nuclear weapons tests in the atmosphere (held until 1980) to 2000, the population will receive additional doses equal to those of a 2-year exposure to natural radioactive background (and did for millennia - 4 annual doses from natural background), by nuclear explosions for peaceful purposes (performed until 1990) - on 2 h; nuclear power - 0.05% of the annual dose.

4.3. EXPOSURE IN PROFESSIONAL CONDITIONS

Ionizing radiation is used more widely in industry, agriculture, energy, transport, various fields of science:

• ***Use in industry*** are diverse contactless devices for control and automation of the production process - level gauges, signaling counters articles and so on.

• ***In the chemical industry, they are used,*** for example, as a means for improving the durability of tires.

• ***The textile industry*** - as an antistatic agent in spinning and weaving.

• ***In oil production*** - in geological prospecting for the detection of oil (neutron gamma- ray sounding).

• ***In metallurgy and shipbuilding*** - non-destructive gamma- detection of defects in the metal products and welds.

• ***Nuclear energy is an important factor in fighting the "water famine"*** of our planet - used combined nuclear power plant to produce electricity and a refresh of seawater.

• ***In maritime transport*** - military ships and submarines, icebreakers and passenger-cargo ships used nuclear fuel.

• ***In agriculture and the food industry*** ionizing radiation used, eg., for sterilization of artificially bred male insects, allowing to sharply reduce meat fly to Florida - United States, or to killing the fly tsetse (glossina morgitans) in vast areas in Nigeria and Tanzania; genetic engineering for the irradiation of grain (it becomes more productive, yielding new improved varieties); the so-called "cold" or gamma sterilization of milk, meat, fruit juices and more.

• **In science** (nuclear physics) work with different particle accelerators and nuclear reactors. Ionizing radiation is used in a variety of other sciences - biology, physiology, engineering sciences, etc.

Professionally exposed persons are a small part of the population - from 0.1 to 1% in most developed countries, our country - about 10,000 people, including medical personnel - 4,000 people.

The use of numerous and highly respected measures for radiation protection of personnel exposed to ionizing radiation in manufacturing, conditions, makes it possible to obtain doses significantly lower than the dose limits. Studies in Bulgaria have shown that only about 10% of staff received doses approximately 20% of the eligible and the remaining 90% - 10% below the dose limit of 50 mSv. The average annual equivalent doses (Deq) for 10 a. period (1983 - 1993) for professional exposed persons are: for industry - 0,21 cSv, medicine - 0,08 cSv, science -0,11 cSv, gamma- detection - 0,4 cSv, radiotherapy - 0,2 cSv. Higher values are obtained in very rare cases - accidents, negligence and others. Only in the mines for extracting uranium (now inoperative) and some non-ferrous metals doses received by personnel are higher. In them there is a significant occupational risk for the development of radiation sickness, especially for lung cancer due to the combined effect of: ionizing radiation (primarily ^{222}Rn - its daughter products); powder with a high content of silica, nickel, cobalt, arsenic; fumes containing polycyclic aromatic hydrocarbons.

Relatively high doses received and staff working with gamma- radiographers; loading reactors with nuclear fuel and repair them; working with powerful accelerators and neutron generators; therapy with open and closed sources of ionizing radiation.

4.4. MEDICAL EXPOSURE

It is effected for the purpose of diagnosis and therapy. Great possibilities in this respect of ionizing radiation make them as necessary to modern health care, and place them first among all other sources of exposure of the general population. The dose

Table 8.6. Effective doses in medical diagnostics

Survey	Effective dose (mSv)	Equivalent exposure from natural background
X-ray studies - radiography		
X-rays of bones and limb	<0,01	under 1.5 days
X-ray of lungs	0,02 – 0,04	3 – 10 days
X-ray of the lumbar vertebrae	1,3	7 months
Venous urography	2,5	14 months
Contrast examination of stomach	3,0	16 months
Irrigography	7,0	3 years
Computed tomography of the head	2,3	1 year
Computed tomography of the abdomen and pelvis	10,0	4,5 years
Cardiac catheterization, coronary		
Angiography, coronary angioplasty	> 14	Over 6 years
Nuclear medicine research		
Pulmonary ventilation (^{81m}-kripton)	0,09-0,12	2 – 3 weeks
Pulmonary perfusion (^{99m}-technetium)	1-1,4	5,1 – 7.2 months
Dynamic imaging of the kidneys (^{99m}Tc)	0,5-1,2	2,5 – 6,2 months
Scintigraphy of thyroid (^{99m}Tc)	1-2,5	0,5 – 13 montsh
Scintigraphy of thyroid (^{131}-iodine)	5,5-14	2,3 – 6 years
Dynamic imaging of bones (^{99m}Tc)	1 , 9 - 4	1 – 2 years
Exploring the heart (^{99m}Tc)	4 - 6 , 2	2 – 2,7 years
Myocardial perfusion (^{201}-thallium)	1 3 - 1 8	5,5 – 8 years

here exceed 10 times the dose of any other artificial sources together and in developed countries are already close to the dose from natural background radiation **(Table 8.5.)**. Similar findings were reported for Bulgaria (1990): general background radiation - 2283 μSv; X-ray diagnostics - 802 μSv; total - 3337 μSv. This risk can be justified only if it is balanced with the benefits of improving the health of the patient.

◆ ***X-ray diagnostics - radioscopy and roentgenography***

It is recognized for their continued trend growth - for different countries by 4-5% annually. Diagnostic radiology provides over 50% of the exposure of the population - the average dose is 1,400 μSv/a. The dose at radioscopy can reach (skin dose) to 15 cGy/min (rad/min), recommended at 5 cGy/min (rad/min). Hazardous are gonadal high doses which can be obtained by examination of the abdomen, the lumbar vertebrae, pelvis in urography and other.

◆ ***Radionuclidic diagnostic***

So far, these modern methods are still much less widespread than the X-ray diagnostics - the number of test thereof is only about 1-3% compared to the number of these with the use of X-ray methods. Therefore, the total population average dose to the whole body is low - at us about 115 μSv/a or 8% of the dose at radioscopy. In individual patients and individual studies, however, the dose which results in critical organ can reach and exceed 50 cSv (ber.). In medical practice using over 40 mostly short-lived radionuclides (with a half-life of less than 10 days). Preferred gama- radionuclides (^{99}Tc, ^{131}In), beta-gamma sources (^{131}J, ^{133}Xe), positron sources (^{11}C, ^{68}Ge) **(Table 8.6.)**.

◆ ***Therapeutic application of ionizing radiation***

Ionizing radiation is mainly used for the treatment of malignancies. As the treatment of these diseases is a lifesaving procedure, allows the use of very high doses - several hundred Sv (thousand rad) and more than the irradiated area, yielding very high doses of neighboring healthy tissue. Ionizing radiation is used for treatment of other diseases, especially skin, also osteoarthritic, thyrotoxicosis, gynecological. Therapy is most commonly used sealed sources: remotely located body - x-ray therapy systems, systems for gamma-therapy ^{60}Co, ^{137}Cs, accelerators of charged particles (betatron, linear accelerators), radionuclides - ^{90}Sr, ^{60}Cs, ^{198}Au, housed in needles, cylinders, capsules, placed in cavities of the body or in the tumor mass. And radionuclides used in open type - ^{131}J, ^{32}P, ^{198}Au and many others.

Although the treatment of patients with malignant neoplasms in every second patient is administered radiotherapy with very high doses, due to their relatively small number, mostly elderly with expected short duration of life and not creating generation, doses here are not taken into account when calculating the collective doses to the population.

Must be assigned and radiation in medical treatment with radon mineral waters - radioactive adopt water with radon over 130 Bq/l **(Table 8.7)**. Should know that concentrations of radon and its breakdown products in the air space of the bathroom may exceed the average annual concentration limit for occupational exposure persons (staff) and are close to those obtained in the uranium mines.

Table 8.7. ^{222}Rn content in some mineral springs in Bulgaria

Source	Contents ^{222}Rn [Bq/l]
Narechen - Salt spring	4113
Momin prohod	2000 – 2110
Narechen - bats	1400 – 1710
Pchelin, Ihtiman (110 °C)	410
Klisura, Karlovo	728
Gorna banya	4,1
For comparison: Sofia plumbing	0,2

◆ ***Other sources of radiation.***

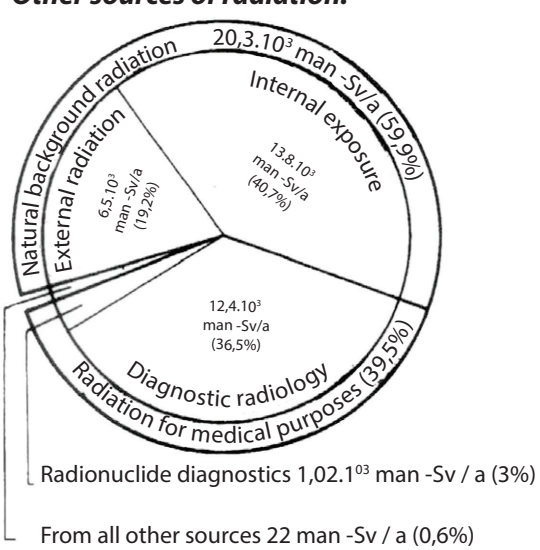


Fig. 8.6. Annual effective collective dose of bularian population from all natural and technogenic sources of radiation (by Vl. Penchev, 1989)

Population may be irradiated and for loss, theft, transport accidents involving radionuclides. Irradiation can also be emergency - eg., accidents with nuclear reactors.

Other sources of radiation are connected to the way of life of the population. Eg., in older watches with luminous dials are used paint containing radi-

um and phosphors (or mezotoriy), which gave gonadal dose above 100 μGy/a (10 mrad/s). Currently used in watches -^{3}H tritium and promethium -^{147}Pm. It is believed that collective dose to the population of the Earth from the current watches is about 2,000 man - Sv/a. It is equal to that received from flights with airplanes and is 4 times greater than CD received from the NPP for 1980.

Summary of CD of bularian population from various sources of radiation are presented in **Fig. 8.6.**

5. PREVENTION IN ACTION OF IONIZING RADIATION

Main purpose of prophylaxis against ionizing radiation (radiation protection) is to minimize the absorbed dose, to be removed (respectively decrease) the risk of non-stochastic and stochastic damages in persons affect them in professional and unprofessional conditions. Radiation protection is a complex of various events and resources - organizational, engineering, medical, health-educational, architectural and planning, etc.

◆ ***Organization of radiation protection in Bulgaria***

Under the low of safe use of nuclear energy (2002) Health Act and Food Act (2005), the main authority for the safe use of nuclear energy is the Nuclear Regulatory Agency and the specialized controls and other activities related to radiation protection of population, the environment and food, are managed and organized by the Ministry of Health (M3), Ministry of Environment and Water (MoEW) and the Ministry of Agriculture and Food (Bulgarian Agency for Safety Food).

The problems of radiation protection, the effects of ionizing radiation and the treatment of radiation damage in the health system work the National Centre of Radiobiology and Radiation Protection and offices for radiation injuries to big hospitals. Radiation protection is implemented and monitored by all licensed agencies and organizations that use sources of ionizing radiation.

International bodies dealing with radiation protection are ICRP - (created in 1928, UNCEAR at the United Nations - 1955, IAEA (International Atomic Energy Agency) at the UN - 1957, IRPA (International Association for Radiation Protection).

5.1. STANDARDS FOR RADIATION PROTECTION

Professional risk when working with ionizing radiation should not exceed that of other occupational hazards, thus allowing such radiation, which in even dose accumulation over 50 a. no changes in the health status of exposure and his descendants, changes that can be detected with current methods (including increased incidence of malignancies and hereditary diseases). In justifying the allowable radiation dose to the entire population starting from genetic effects of ionizing radiation and the size of the contingent exposures (collective dose), i.e. the danger of large populations and all mankind to increase the malignant neoplasms and mutations in the offspring. In both cases account impossible removal doses from natural background radiation, and the benefits so far (and the need, combined, however, with the danger!) of radiation for medical purposes.

Historically, the first proposals for limiting the doses of exposure to ionizing radiation appear almost immediately after the discovery and their use in medicine and physics - 1902 W. Rollins offers a safe dose that causes blackening of photo emulsions, now estimated at about 10 R for day exposure (more than twice the limit now adopted annual dose!).

A more accurate description of the adverse effects of radiation lead to a significant decrease in dose - in 1925 Mutscheller and R. Sivert offered as norm so-called tolerated dose - 0.01 the threshold erythematous dose or 100 mR dayly exposure. In 1934 ICRP provides as tolerated dose states to establish 200 mR/24 h - 60 R per year (12 times more than the current limit for personnel working with ionizing radiation).

The accumulation of knowledge for non-threshold (linear) stochastic effects of ionizing radiation on the genetic apparatus of cells requires removal of the term tolerated dose (tolerance means tolerance of radiation) with maximum (or limit) tolerated dose and even more explicit - limit dose. In 1948, ICRP provides further reduction of the limit dose of 50 mR/24 h - 15R year. Setting the dose, doubling the frequency of spontaneous mutations in humans is within the 10-100 ber (a top norm, at contingent with 40 a. work with ionizing radiation, will give a total dose of 600 ber.!) has led to a new proposal of the ICRP (1958) for maximum permissible dose for 5 ber annually (0.1 ber. weekly). This is already a total dose of 200 ber for 40 y., it is recommended not to be irradiated in the proceedings persons under 18 y. and in so-called reproductive period (age 18-30), the dose should not exceed a total of 60 ber, i.e. further significantly reducing the risk of damage to the

progeny and relatively limited contingent of individuals included in the "staff working with ionizing radiation". This norm, as the limit of exposure of personnel remains now (adopted in Bulgaria in 1960).

What are currently the main principles of radiation protection and limiting radiation exposure - ie. "Philosophy of the ICRP radiation protection"?

1. Justification for the practical application (Justification). Any exposure to ionizing radiation, however small it may be, carries some risk, ie any exposure is not permitted without appropriate justification for the benefit of individuals and society. The latter requires a very accurate and comprehensive assessment of all kinds of benefits and harms (health, economic, social, moral, alternatives decisions, etc.) Eg., the benefits of nuclear energy - need to have more capacity for the country, economically you use existing facilities, more they pollute with radionuclides other sources of energy and can improve their performance in this respect, etc., etc. In the medical field - can be replaced and when the X-ray studies (apparatus) and radionuclidic diagnostic with ultrasonography, nuclear magnetic resonance, is it necessary now to use radon mineral waters in balneotherapy etc. And this justification is made on the basis of the current situation, proximal and distal outlook (prognosis). For ex. at TEP Kozloduy should justify the security of storage of high level and long-lived solid radioactive waste from spent nuclear fuel so as not to contaminate the biosphere for millennia.

2. Optimization of radiation protection (Optimisation). Doses of exposed individuals and the population to be as low as reasonably achievable - ie. principle ALARA (As Low As Reasonably Achievable). Take into account social and economic criteria. This requirement is primarily a qualitative nature, is connected with the first principle - constantly striving to reduce doses, in developed countries is average radiation doses of staff 10 or more times lower than the dose limit. And make attempts to quantitative judgments regarding economic reasonably achievable - offer models to detect so-called "Maximum benefit", i.e. the lowest value of the sum of the expected damage (increased incidence of disease - treatment costs and losses from pension funds, etc.) with increasing dose and the cost of radiation protection. Here intervene, however, a number of ethical considerations in the valuation of "reasonable limit" costs to maintain health.

3. Establish boundaries of the exposure (Recommendation).

• LD for category A.

The recommended 1958 by ICRP maximum tolerated dose (later called more precisely **''limit dose - (LD) of 5 ber (5 cSv)* per year for staff** (i.e. category A) remain in force now, does not mean that exposure levels above this value are dangerous, and below this value - safe (they are safe, but only for non-stochastic effects). In the 26th report of the ICRP (1977) states that and recommends the average actual levels of exposure of personnel to be 10 or more times lower and introduce control dose limits - lower than the LD and already reached the level of lower average actual irradiation dose. The dose limit reduces the probability of stochastic effects to an acceptable level and a small population, but still high, if accepted estimates of the ILO (International Labour Organization) and the ICRP that an industry is well protected, if the annual mortality due accidents and injuries, not exceeding 100 cases per 1 million workers, i.e. hazard ratio of 1.10^{-4} per year. If the average radiation dose in the country is equal to the LD (50 mSv), then, according to the adopted model, expected deaths from malignant neoplasms **(Table. 8.4)** will be six times more - risk 6.10^{-4}. The need to lower real radiation doses of LD (and here is the principle ALARA) illustrate the state of this risk in the US. The irradiation total contingent of 772 000 people (working in the defense ministry, medicine, research centres, nuclear power stations and so on.) in 1970 showed the average value of equivalent dose absorbed by the whole body of 210 mrem (0,2 cSv) and collective dose equivalent to 164 000 man-rem (cSv). This real annual dose is more than 20 times lower than LD (50 mSv) and for 50 years (maximum occupational exposure), it is clear that the same cumulative dose will be 100 mSv. Multiplying this dose-$1,2.10^{-4}$ risk factor **(Table. 8.4)**, the risk of radiation-induced tumors will be $1,2.10^{-3}$. This risk is about 40 times lower than the risk of fatal accidents in mines, 25 times - for agriculture, 15 times - for transportation, three times - total for production, also about 3 times - trade (analogous data for the same duration of life - 50, calculated data on fatal accidents in the industries in the US in 1972). Since malignant neoplasms develop later, they will cause less reduction in life expectancy than that of fatal accidents. It is estimated that the population in the United States indicate that annual exposure 5 mSv (10 times less than LD) for the period from age 20 to 65 years the days loss of life expectancy is 12, versus 74 days for all Industry in the US and about 300 days for industries such as mining, construction, agriculture, work in quarries.

• LD population.

To limit exposure of the population as a whole, before offering the so-called genetically significant

* $5cSv = 50\ mSv = 5.10^{-3}\ Sv$

dose - 5 ber. (5cSv) for 30 y., i.e. for reproductive period (from birth to 30 years of age)*, which meant exposure of global radioactive fallout. From 1977 ICRP does not offer determining the dose for the population as a whole and recommended that in case of situations of increased public exposure to doses above natural background to implement the first principle - justification of practical application (Justification). **In Bulgaria was LD population effective dose of 1 mSv.**

Adopted country Basic Standards for Radiation Protection (2004) state:

The effective limits dose for occupational exposure

100 mSv for a period of five consecutive years as the maximum effective dose for each year can not exceed 50 mSv.

For the purposes of radiation control and monitoring workers and employees are divided into two groups irradiated staff: *I group (category A)* - the staff could receive an annual effective dose of more than 6 mSv or annual equivalent doses over three tenths of the dose limits (20 mSv); *Group II (Category B)* - the staff does not fall in the I group.

Dose limits for public exposure

Annual effective dose for each individual of the population - 1 mSv;

The annual effective dose of 5 mSv may be allowed only in specific circumstances and provided that the average annual effective dose for 5 consecutive years does not exceed 1 mSv.

The limits of the doses are the sum of doses from external and internal exposure. On **Table. 8.8** gives the annual limits of radiation of different organs and tissues.

Category A is introduced control limit 2 cSv year. As limit control, which "... is intended to reduce the exposure of persons to category A low as reasonably achievable" (OBSRP-2004), however, is a high value, knowing the situation in the country - 90% of those using doses 10 times less than LD. It can be understood only as a starting point for the introduction of a new limit dose, as recommended by the ICRP. *

This category does not allow persons under 18 and for training purposes in subjects aged 16-18, LD is 6 mSv. For women of reproductive age (to 45) the individual dose for every two consecutive months should not exceed 1/6 of the LD, and for persons aged 18-21 LD is 2 cSv year. Not allowed to work with ionizing radiation pregnant women or during breast-feeding (allowed only if the annual effective dose of 1 mSv). Allow opportunities for increased exposure to accidents and identifies the requirements for offsetting it. Not allow increased exposure in persons under 21, and the women of reproductive age.

The effective doses and for the three categories do not include doses received from natural background radiation (from technogenic changed background include) and medical research.

The limits of the annual doses (ALD, abbreviated LD) are expressed in equivalent dose - even when total body irradiation of ionizing radiation with one or several components (different QR) or of effective dose. The latter is the sum of the average equivalent dose to each organ or tissue, multiplied by a so called weighting ratio (Wt). This ratio characterizes the ratio of the probability of occurrence of adverse stochastic effects (carcinogenesis) in the organ or tissue to the overall probability of stochastic effects in whole body irradiation. Values to W_t are:

- ***gonads - 0.25;***
- ***mammary glands - 0.15;***
- ***red bone marrow - 0.12;***
- ***lung - 0,12; thyroid - 0.03;***
- ***bone surface - 0,03/other organs (total) - 0.30.***

(It is noted that the value of $W_t = 0,06$ can be applied for each of the other five organs or tissues, that receive the highest radiation. Stomach, small intestine, upper and lower portion of the colon are treated as four separate organs. Skin $W_t = 0,01$).

These dose limits are generally applicable as for external and internal exposure to the body. However, while external radiation they can be used directly in internal exposure, based on them and radiotoxicity of the radionuclides, are determined so-called secondary or derived limits - the annual limit of their entry into the body through the respiratory and digestive tracts and their average allowable concen-

Table 8.8. Annual limits exposure to individual organs and tissues

Organs and tissues (mSv)	Occupational exposure (mSv)	Exposure of students and trainees (mSv)	Public exposure (mSv)
Ocular lens	150	50	15
Skin*	500	150	50
Hands to forearms, feet, ankles	500	150	

* This limit applies to the average dose received by each surface area of 1 cm2, regardless of the area of the irradiated surface.

* During this period bear 90% of children and up to 35 years - 97%.

* New proposal ICRP (Publication 60 - 1990) is the maximum equivalent dose to be reduced to 10 cSv (ber) for five years at an average annual dose 2 cSv (ber). This recommendation is based on new data from the irradiated group in Hiroshima and Nagasaki.

tration in the air and drinking water - the latter is particularly important in operational radiation monitoring of the environment.

The extent of the damaging effects of radioactive isotopes is determined primarily by their radioactivity. Physico-chemical properties of the substance, however, identify a number of points related to its absorption, metabolism, accumulation, excretion, etc., of which depends on the type of exposed tissue, the absorbed dose of them, the exposure time.

Radiotoxity. The ability of radionuclides to induce specific changes in various organs falling into body, properties defining of their radioactive and physicochemical properties, is called radiotoxity. It is determined by:

1. The type of radioactive decay - substances with alpha- radiation (QR = 10) will be with higher radiotoxity of beta- radiating (QR = 1).

2. Level of the average energy of an act of decay - substances with high average power (^{32} P-0,68 MeV) compared to those with lower average energy (^{14}C-0,053 MeV), while emitting the same types of radiation (beta- rays) will be of higher radiotoxicity.

3. Scheme of radioactive decay - with higher radiotoxity to radionuclides, which give rise to a family of other radionuclides - eg .:

$$\overset{\alpha}{\underset{}{}}\quad\overset{\alpha}{\underset{}{}}\quad\overset{\beta}{\underset{}{}}\quad\overset{\beta}{\underset{}{}}$$
$$^{222}\mathbf{Rn} \rightarrow {}^{218}\mathbf{Po} \rightarrow {}^{214}\mathbf{Po} \rightarrow {}^{214}\mathbf{Bi} \rightarrow {}^{214}\mathbf{Po}.$$

4. The way of entrance of radioactive isotopes

The most dangerous is inhaled, followed by digestive and skin way. This relates to the volumes of the air in the lungs - the adopted annual averages are 2,4.103 m^3 air (category A) and 8.1.10^3 m^3 air and water 0,73 m^3 (population)*, and the extent of absorption (eg. through the intact skin absorption is 200-300 times lower than that through the gastrointestinal tract). Importance for absorption has the type of radionuclide and chemical form (eg. dispersity of aerosols determines entering the lungs).

5. Distribution in various organs and tissues. Based on that radionuclides are divided into: osteotropic - ^{45}Ca, ^{90}Sr, ^{140}Ba, ^{226}Ra, etc., In the liver - ^{134}C, ^{131}La, ^{141}Pm; thyroid gland - ^{131}J; muscle - ^{40}K, ^{79}Pv, 1^{25}Cs; uniformly distributed are ~ ^{3}H, ^{14}C, inert gases. With a high radiotoxicity are the long-lived osteotropic isotopes.

6. Time of entrance of the isotope in the body. It is determined by the period of radioactive half-life and the speed of elimination of substance by the body - the period of half-discharged. On the basis of these values is determined so-called an effective period - the time over which the activity of the radionuclide in the body is reduced by half. Substances with a high effective period are with high radiotoxicity - eg. ^{226}Ra, ^{90}Sr, with effective period for decades.

7. Time of receipt of the isotope in the body. Radionuclides with low absorption at a single contact with body will have little radiotoxic effect, but at chronic receiving effect will be pronounced.

Based on the combination of all these factors, the radionuclides are grouped into five groups of radiotoxity:

1 - very high - ^{227,228,229,230}Th, ^{223,225,226,228}Ra, ^{210}Po and others. (41 total)

2 - high - ^{90}Sr, ^{236}U, ^{124,125,126,131}J, ^{212}Pb and others. (50 total)

3 - medium - ^{32,35P,35S,83,85,89,91,92}Sr, ^{14}C and others. (186 total)

4 - lower - ^{3}H, ^{15}O, ^{113}In, ^{96,99}Tc and others. (76 total)

Limits for annual submission of radionuclides (ALS) is the activity of a radionuclide (Bq) received for a calendar year, for the next 50 years (cat. A) and 70 (population) ** will create in body dose equivalent or less of the LD for the category each year.

Average allowable concentration (AAK) in Bq/m^3 for a radionuclide is equal to the corresponding ALS divided by the corresponding amount of inhaled air or water for the respective categories. In determining the exposure of the body's authoritative is evaluation of radionuclide (compared with ALS) and not their concentrations in air and water (compared with AAC). The numerical values of LD, ALS and AAC refer only to one radiation factor, a kind of radiation (external or internal) and one way of entrance. If more than one impact (radiation factors, type of exposure, ways of entry), applies the principle of cumulative effect, i.e. sum of the ratios received corresponding effective (equivalent) doses in their respective LD, ALS or AAC must be less than or equal to one.

Other secondary or derived limits for exposure of personnel (cat. A) are: permissible density particles and permissible contamination of various surfaces (skin, clothing and footwear, PPE, surfaces in operating rooms and vehicles). For purposes of control, useful unit, when external radiation, is permissible dose rate, which is equal to LD, divided by the exposure time of the category for a calendar year. For category A time is 1700 h, category B (on the premises) - 2000 h, population - 8800 h.

* These values are lower in children and adolescents - indicated are for 5 respectively 4 subgroups (to 1 y. ..., up 12-17 years).

** These dates were selected for early occupational exposure (18) and the latency period for developing cancer (15-20 years), life expectancy (80 years), expected risk of cancerous growths.

5.2. GENERAL REQUIREMENTS FOR RADIATION PROTECTION

When working with ionizing radiation should take into account all types of radiation impact and to provide comprehensive protective measures to ensure non exceeding the norm (LD, ALS, AAC, control limits) for the relevant categories of persons.

◆ ***Location of establishments***

They should not be located in buildings shared with flats and childcare. Premises with sources of ionizing radiation can be a separate part of the building. Around them determines the amount of the controlled area for category B.

◆ ***Work organization***

All sites in which work with sources of ionizing radiation or stored radioactive substances, before commissioning, shall be adopted by a committee comprising representatives of the State sanitary control and Inspection of technical control. Issued passport - work permit for the facility for a specified period. In the passport indicating the type and category of the facility, premises, which will work with ionizing radiation, the nomenclature of authorized radionuclides, the type of sealed sources of radiation, etc. Prepare a list of the staff, held in advance and periodic training and instructions for safe handling and labour hygiene, determine the persons responsible for the maintenance of the sources of radiation, responsible for radiation monitoring and radiation protection. Prepare instructions for the procedure to work, radiation control, personal hygiene, storage, allocation and reporting of radionuclide. Develop and plan in an emergency.

◆ ***Dose control***

At the facilities in which to work with radioactive sources, it is carried out by specially designated by the Office, radioactive protection service (or one person in a small volume of work).

• ***Category A.*** The personnel is held personal dosimetry control by individual dosimeters for external radiation and also control of radiation environment - contamination of work surfaces, air, clothing, leather, solid and liquid waste, vehicles.

• ***Category B.*** Persons of cat. B at job, controlling the dose of external radiation and the concentration of radionuclides in the air. In areas where lives are controlled and concentrations of radionuclides in water and food. Assess receipt of radionuclides in the body and the cumulative effect of radiation.

• ***Population.*** Population control: the concentration of radionuclides in water, air, food; natural background radiation and technogenic increased (building materials, phosphate fertilizers, coal, etc.) - gamma-radiation; doses from medical exposure; concentrations of radon and its daughter products in premises; technological process which may result in environmental contamination with radionuclides.

◆ ***Medical supervision***

Medical supervision of staff (category A) is carried out special medical monitoring before, during and 30 y. after leaving work. To work with sources of ionizing radiation are allowed individuals over 18 who have'nt disease such as: blood diseases and sustainable changes in the peripheral blood; organic diseases of the central and peripheral NS; drug addiction; precancerous conditions; chronic diseases of the gastrointestinal tract, liver and kidneys, cardiovascular system; chronic infectious diseases; chronic diseases of the eye, etc. (Decree 29/2005 by MH for medical contraindications).

Periodic medical examinations are performed once or twice a year (in emergency cases and repairs associated with a significant one-time exposure above 10 cSv, people immediately undergo a medical examination and observation).

◆ ***Other requirements***

Running with ionizing radiation receive additional remuneration, reduced working hours, additional, paid annual leave, no paid nutrition - A diet under regulation 8 of the MH (1987).

5.3. PRINCIPLES AND BASIC REQUIREMENTS OF RADIATION PROTECTION AT WORK WITH CLOSED SOURCES. PROTECTION AT WORK WITH X-RAY UNITS FOR DIAGNOSIS AND USE OF CLOSED RADIONUCLIDES FOR TREATMENT

Closed sources of ionizing radiation generally only suggest radiation protection from external exposure (to them is possible accidental internal exposure - eg. dehermetisation the packaging of radionuclide).

These sources can be divided into two main types:

1. A continuous action, in which the radiation source is a radionuclide in a hermetic package. These are neutron beta-gamma emitters with different activity.

2. A periodic action where radiation is derived from the acceleration of charged particles - X-ray units, linear accelerators and betatrons.

◆ ***Basic principles of radiation protection***

They are aimed at reducing the dose absorbed and are:

- ***protection through power;***
- ***protection by distance;***
- ***protection through time;***
- ***protection by shielding.***

The above principles apply complex and specific. They apply also to open source (and other harmful factors), but their defense by distance and by shielding is less important.

1. Protection by reducing power. Used within certain limits depending on the characteristics of the device. It should not be linked, however, to increase the exposure time.

2. Protection by distance. Based on regularity, that the dose reduced in proportion to the square of the distance, i.e. doubling the distance between the source and the object will cut 4 times the dose received. Protection by distance is the most important protection against primary radiation with little penetrating power (alpha- beta- rays and low-power sources of photon radiation), as and secondary absently radiation. Protection distance by using different tools and remote manipulators.

3. Protection by time. Based on the dependence of the resulting radiation dose is proportional to the dose rate and the irradiation time. For example, radiographs are recommended to radioscopy because high dose rate with them (current pipe here is 1000 mA, and in radioscopy - to 3,5 mA) is combined with a small exposure - from milliseconds to 1 -2 s (e.g., images of the lung dose absorbed is on average 90-100 times less than that of radioscopy). The staff also received lower doses as the apparatus for one shift emits no more than 10 min, and installations for enlightenment - 2,5 h, apparatus for treatment - 3,5 h.

Regulation of working time source of ionizing radiation-according to factor of employment of a protected area (eg. room) and factor use (i.e. directing the rays to the protected space) allows the calculation of the necessary radiation protection by shielding (so as not to exceed the relevant standards for those categories A and B).

4. Protection by shielding. Based on the interaction of ionizing radiation with matter that the latter absorbs and weakens them. The calculation of protective screens - materials used and their thickness, shall conform to the type and capacity of radiation; distance and time of operation of the source; factors of employment and use; the category of protected persons (A or B); mode of operation of the source; the adequacy and effectiveness of the guards.

• *To protect against X-ray and gamma-radiation* most effective are screens with elements of the high serial number - lead, barite, tungsten. As they are expensive metals used in the construction of relatively small and light shields. For example, in X-ray systems for lightening they are used in protective leaded glass screen, protective gloves, protective screen for the controls, subscreen apron, rolling protective chair and stage.

Stationary shield here used; normal concrete, "heavy" concrete (with metal impurities) baritconcrete, solid bricks and even water. Besides screens against direct radiation is needed and protection of secondary scattered radiation sources which are all objects, floor, walls, ceiling, which falls on the primary radiation. For this they have to be away from the source of primary radiation (protection by distance) and used absorbing secondary radiation barrit plaster on walls and ceiling of the room.

• *To protect against neutron radiation required three-layer screens.* The first layer slows the fast and ultra fast neutrons, turning them into slow and resonant. For this purpose, materials of components with small serial number - water, paraffin, concrete. The second layer absorbs slow neutrons and resonance - used cadmium and boron. The third layer is constructed of lead or other equivalent materials, for the absorption of the secondary gamma radiation.

• *To protect against beta-radiation* is most commonly used material from the elements with a small atomic number, because of low penetrating power of the rays in the substance - screens of plexiglass, plastic, aluminum.

By its use protective screens are:

- *Containers for transportation and storage of radionuclides in no working mode.*
- *Shield devices.*
- *Moving screens, themselves building elements of the room.*
- *Individual - aprons, gloves, goggles.*

Other: Common requirements for radiation protection and work with sealed sources:

1. When not working with sources, radionuclides must be in appropriate protective equipment and storage facilities, and installations generating radiation - with the electric power off.

2. Control panels must be in a separate room from this source - only moving radiographers and x-ray systems for diagnosis and therapy with power up to 100 kV the panel is allowed to be in the same room.

3. Storage facilities for indoor radioisotopes should be placed in the lowest floors (cellar), be well protected - walls of fire resistant materials, the door locked from the outside (inside to be opened without a key). The walls and floor are smooth. Total activity stored in repositories radionuclides should not exceed that in the passport of the object. In repository to maintain good lighting and stayed in it for the shortest possible time.

4. When using sources outside the permanent premises or in general production areas (eg. In portable gamma- radiographers) is required: directing radiation to the ground or in a direction where there are no people; maximum distance of sources of service

personnel (remote control); to prevent sources close to others; to provide mobile screens; to display the warning signs and boards for radiation hazard.

5. To establish artificial ventilation in the working premises to remove the formed toxic substances in the air (ozone, nitrogen oxides) and the high number of air ions.

◆ ***Protection when working with X-ray equipment for diagnosis***

Minimal power source. In a procedural room should not have more than one X-ray system. To reduce the power source should not be used in anode current over 3,5 mA.

Source power depends very much on the sensitivity of the registering system. For this purpose x-ray images to use appropriate to the type apparatus films and films amplifier folio. Do not use with overexposure of the film with higher doses in order to more rapidly developing (in order to avoid this, and a higher quality have long been used machines for automatic processing of the films). When old models X-ray equipment is very important sensitivity of the eyes of the radiologist - for it to be high, it is necessary initial adaptation in the dark and at least 20 min. Especially significantly reduces the power source when a lightening in modern apparatus used enhancing image electronic intensifiers - the dose is reduced 7-15 times. **(Tab. 8.9., Tab. 8.10.)**

Reducing the power of the unused diagnostic radiation. Each plant (for radioscopy and for radiograms) there should be a set of aluminum filters in the output of the beams with a thickness of 2 to 5 mm. The aluminum filter retains low energy spectrum of X-rays that is absorbed only from the body and there is no diagnostic meaning. To reduce secondary absently radiation X-ray equipment must be positioned so that the center of lightening or photographed part of the patient's body to be away at least 2 m from the walls, ceiling and any other distracting objects with surface area greater than 1 m^2.

Decreasing the exposure time. At radioscopy, when the image is not observed (reverse patient, consideration), the high voltage is switched off.

Other recommendations for patients radioprotection. For children up to 12 years diagnostic radiology can be made only on urgent medical indications, radioscopy is done only when absolutely necessary (after preliminary radiogram). Enlightening here be performed at reduced voltage, amperage and good filtration so that the dose does not exceed 5 cGy/min (rad/min) - recommendation of the ICRP. The required brightness of the image can be achieved by increasing the voltage. Long radioscopy be made with electron-optical amplifiers. Recommended for radiodiagnostic skin dose does not exceed 6,5 mC/kg (25R) at an interval of 1 month, and in children - 10 times lower dose. To repeal requested X-ray examinations with inadequate justification. To require photos and results from previous studies. To prevent travel or other outside persons when performing

Table 8.9. National diagnostic reference levels incoming surface dose at an X-ray radiography for a standard adult patient

Type radiography / projection	Incoming surface dose, * mGy
Thorax - lung and heart (PA)	0,9
Thorax - lung and heart (Lat)	1,5
Lumbar (AP)	10
Lumbar (Lat)	30
Low back link (LSJ)	40
Pelvis (AP)	10
Cranium (PA)	5
Cranium (Lat)	3
Excretory system - before and after the contrasting (AP)	10
Mammography (CC)	13**
Mammography (MLO)	13**

* Measured on the patient's skin in the central X-ray beam turned back distraction.
** Reflates to the magnitude incoming air kerma without backscattered, measured with a standard phantom of PMMA thickness 45 mm, in the presence of the counter-grille and provide an optical density of the film 1,2 OD over the veil.

Table 8.10. National diagnostic reference levels of computer tomography dose index for a single section and dose-length product for a comprehensive study on computed tomography for a standard adult patient

Studied area	CT dose index for a single section, mGy	Dose-length product of the irradiated area, mGy.cm
Head	60	1050
Torax	30	650
Abdomen	35	780
Pelvis	35	570

diagnostic radiology, and if their presence is imperative that they be protected screen - best behind the radiologist and the side - a protective apron and gloves. Once a year (maybe 6 months, or changes in radiation protection X-ray tube) is performed physical technical quality control of X-ray systems and their compliance with the relevant values for: limits of normal and limits of safe operation.

◆ ***Protection when working with radionuclides for medical purposes in hermetic containers (closed sources)***

The time for leaving in the body of the patient to be reduced to a minimum, which requires pre-workout models. All manipulations can be performed remotely. Immediately touch the capsules, needles, plates and so on... with hands is prohibited. In the absence of other remote tools to use tweezers or holders providing distance between the source and the hand over of 10 cm. Patients were placed in a room with a maximum of 2 beds of a spacing between them not less than 3 m. In the service of the sick should be reduced to the minimum required stay with them. Servicing the patient to be done so that the servant to stand as far away from the source. Leaded glass screens, remote manipulators use mandatory for handling radioactive sources.

For ex, in gynecological practice is used most frequently introducing in the cavity of the vagina or uterus of radionuclides by various means: a linear system; complex (monoblock) system; consistent method of implementation and remote (hoses) input. Radiation protection is particularly good at the latter method where by special equipment (automatic entry and removal of radionuclide capsule) at an effective shielding, locking and remote control are minimized exposure of personnel and risk moments. Often used herein operational input in the tissues of needles containing ^{60}Co or ^{198}Au or treatment of applications by placing plastic plates containing ^{32}P, ^{90}Sr, ^{147}Pm. Radiation protection here is more difficult and requires the use of remote instrumentation, shielding containers for storage of needles and plates, fast and accurate operation.

5.4. MAIN REQUIREMENTS OF THE RADIOPROTECTION IN WORKING WITH OPEN SOURCES. PROTECTION AT WORK WITH OPEN RADIONUCLIDES FOR TREATMENT AND DIAGNOSIS

Requirements for radiation protection here are aimed at minimizing the risk of contamination with radionuclides the labour and the environment. Radiation protection includes, besides the above general requirements for radiation protection and radiation protection measures, and those of sealed sources (mostly through protection by reducing power and protection through time), as well as other specific measures. In open source, no specific measures for radiation protection, if used in very low activity in the workplace - to $3.7.10^3$ Bq (0,1 μCi) with radionuclides included in Group 1 radiotoxity; to $3,7.10^4$ Bq (1 μCi) - Group 2; to $3,7.10^5$ Bq (10 μCi) - Group 3; to $3,7.10^6$ Bq (100 μCi) - Group 4 (but practicaly are rarely used activities). In higher activity of the radionuclides their operation is subdivided into three classes (I-III), depending on the activity and radiotoxicity group **(Tab. 8.11)**. The class specifies the requirements for the layout, furnishings, personal protective equipment, sanitary treatment of personnel and work sites.

1. The layout of the premises. Works of class III can be carried out in separate independent laboratories (no special requirements). Premises for use of Class II should be located in a separate part of the building isolated from other rooms. In Class I work premises must be in separate buildings (or isolated part of the building with a separate entrance). The rooms here are grouped in three areas: I zone ("hot") - in this area are radionuclides, but to work with them from a distance; Zone II - includes premises periodically used for repair and transport work (carrying radioactive materials, repair); III zone - ("clean") - including the operator premises where staff via console controls and remote manipulators work with radioactive substances present in the first zone. I and II areas are contaminated with radionuclides

Table 8.11. Works classes with open radionuclides

Radionuclides in groups of radiotoxity	Activity on workplace		
	Works from class I	Works from class II	Works from class III
Very high	over 0.1 GBq	0.1 MBq to 0.1 GBq	under 0.1 MBq
High	over 1 GBq	1 MBq to 1 GBq	under 1 MBq
Average	over 10 GBq	10 MBq to 10 GBq	under 10 MBq
Low	over 100 GBq	100 MBq to 100 GBq	under 100 MBq

(permanently or periodically), and in the operator area pollution not cause exceedances of standards for staff (Category A).

2. Hermetisation of equipment. Basic requirement for work with radionuclides is to prevent dispersion into the work area. For this purpose are used: airtight "hot" cameras with remote manipulators (handling class I with gamma- radiation from radionuclides), sealed boxes with rubber gloves (sleeves) and metal walls (when working class I alpha- beta-emitting radionuclides), radiochemical ventilated camera (operating class II and III), plexiglas boxes (also II and III class work with alpha- beta-emitting isotopes). All these facilities must be smooth walls, bottom slope for drainage and collection of spilled solutions, ventilation. Depending on the type and activity of the radiation, performance therein is monitored by remote systems and television or through lead glass or plexiglass.

3. Sanitary device. Premises for work with radionuclides should have separate ventilation, flow-suction, predominantly aspiration Aspirated air can not be cleansed before disposal into the air, only if the concentration of radionuclides in it does not exceed AAS air of workplaces. Otherwise, use different filters, activated charcoal, gas holder and others.

Water should be central, with hot and cold water. Cranes should have a crank or elbow devices for opening and closing.

At work I and II class to remove the wastewater is arranged two sanitation systems - economic-faecal and special. Only in the second cast out liquid radioactive waste. If their activity does not exceed more than 10 times AAS in the water for the population, they can be put into urban sewage after 1:10 dilution with non-radioactive water. Otherwise build special treatment facilities. In a small volume of radioactive waste water can be collected in special containers and disposed of with solid waste.

4. Surface work furniture, floor and walls of the premises. For better removal of radionuclides from surfaces in the room they need to be smooth, bright, not to enter in a physico-chemical and chemical interactions with the substance, can be treated with various agents for decontamination. The floor to be covered with linoleum (without slits) or other plastic, resistant materials. The walls are painted with latex or alkyd paints. Working furniture to be smooth, corrosion-resistant - best coatings are made of stainless steel or resistant, bright plastic coatings.

5. Personal protective equipment (PPE). They protect the respiratory system and skin from radioactive substances. Use a variety of PPE - eg. when working class II and some works of class III personnel must be equipped with a coat, hat, gloves, shoes and also need the means to protect the respiratory organs.

6. Sanitization of staff. In operation first and second grade arranged mandatory sanitary service, including room radiometric control of the body, clothing and PPE. When working class III recommended the setting up of a shower bath.

7. Personal hygiene at work. Should be respected so called. "radiation aseptic", i.e. use working methods and rules of personal hygiene in order to prevent the entry of radioactive substances on clothing and skin. When inserting or removing protective gloves, to protect hands from skin contact with the external surface. When working with solutions to use automatic pipetting. To use plastic sheets to reduce surface contamination. Not allowed to be stored on the premises food, tobacco, cosmetics, pet clothing and other items unrelated to work. Eating and smoking is allowed only in certain places.

8. Sanitary regime of premises and cleaning of radioactive contamination. All rooms are cleaned daily by wet process, and marked for each room and stored in a particular place equipment. After completion of the work to clean jobs and performed radiation control. Periodically, no less than once a month, general cleaning is done. Purification of radioactive contaminants using mechanical methods, water, detergents, complex formators, organic and mineral acids and oxidizing agents. Individual protection for staff are cleansed in special washing, then perform radiometric control.

9. Removal of solid radioactive waste. Collection and disposal of solid radioactive waste is carried out separately from regular garbage. Created for this system (includes also transportation and disposal of waste) must be centralized. If solid waste contains short-lived radionuclides with a half-life of 15 days, they are stored until they radioactivity reduce below that defining them as radioactive, then disposed of with ordinary trash.

Containers for radioactive waste must be well sealed and uniform. Interior surfaces are smooth and allow treatment solutions for decontamination. Can be used and disposable utensils. If broadcast and penetrating radiation, containers should be stored in properly protected trenches and niches. Transportation of containers with waste is done by special transport. Cargo area should be covered and lined on the inside with a material that allows easy decontamination. The driver's cab must be protected from penetrating radiation. The waste is removed by a final burial ("inhumation") in their specially arranged, organized and guarded around the clock points (radioactive "cemetery"). For them to choose a suitable location, as radionuclides are placed in un-

derground concrete bunkers with asphalt insulation to prevent infiltration of groundwater. In high-level and long-lived radionuclides are used and additional protection - their inclusion in glass (vitrification) and placing in airtight containers made of stainless steel.

10. Protection when working with open sources for treatment. Prepare a preliminary treatment plan. The used radionuclides in ampoules or vials, diluted and distributed to remote automatic pipettes. Take sick of oral or injection introducing. Due to an increased risk of contamination premises - planning, equipment etc. and way of working are both class II work with open radionuclides. Should not be carried out activities endangering personnel incorporation of activities - eg. oral pipetting, venting the syringe without the needle cover base with filter paper and others. The patients themselves are radiation risk due to penetrating gamma- radiation and due to release of radioactive substances with organic products. Patients are not more than two in a room. Each room should have its own bathroom. The service is performed only by trained personnel who must wear special clothing. The ward suits sanitary service for staff and a separate one for the sick. Patients are written for home treatment (but in a separate room) or for treatment in other departments (in common rooms with other people, but not treated with ionizing radiation) in the drop in activity incorporated under certain values depending on the type of radionuclide.

11. Protection when working with radioactive materials for diagnostic purposes. The device of laboratories using radioisotopes for diagnostic purposes is similar to that of laboratory II and most class III work, due to the small activities of radionuclides. Reveal the following areas: distribution, laboratory, application space, room for radiometric measurements, sanitary service for staff. In one room must be only one unit of measurement. In order to reduce the exposure of patients and staff, there are used short lived radioisotopes of low activity (^{99}Tc, ^{113}In, etc.) **(Tab. 8.12)**. During the study, the operator can not be excommunicated by the device. In each study is necessary to note in the journal of the laboratory type of isotope introduced and estimated dose received in the examinated organ.

The use of ionizing radiation in medicine irradiate patients with relatively large doses, but not often, and staff - with small doses, but daily. Complex and directed (according to specific conditions) the use of radiation protection activities ensure: radiation protection personnel; significantly reducing the doses received by patients; protection of individuals from the population (who have not used medical procedures, but can be exposed for their conduct). "The high qualification of the medical personnel using these methods for diagnosis and treatment, is one of the most important factors for radiation protection" (Report of the Committee of Experts of the WHO -1966). No less important (and obligatory!) is the awareness of patients, their health culture and active behaviour.

Table 8.12. National reference diagnostic levels of activity of the radiopharmaceutical introduced in nuclear medicine research

Type of radiopharmaceutical	Type research	Activity, Mbq a certain body mass
I. Radiopharmaceuticals with ^{99m}Tc		
^{99m}Tc-MDP	Scintigraphy of bones and joints	(370-740) / 70 kg
^{99m}Tc-MAG$_3$ (EC)	Dynamic renal scintigraphy	74-185
^{99m}Tc-DTPA	Dynamic renal scintigraphy	74-185
^{99m}Tc-DMSA	Static renal scintigraphy	120-150
^{99m}Tc-MIBI (tetrofosmin)	Myocardial perfusion scintigraphy	560-740
^{99m}Tc-MIBI	Tumurotropic scintigraphy	(370-740) / 70 kg
^{99m}Tc-MAA	Lung perfusion scintigraphy	(111-222) / 70 kg
^{99m}Tc-sulfo-colloid	Liver scintigraphy	111-185
^{99m}Tc-pertechnetate	Thyroid scintigraphy	74 / 70 kg
^{99m}Tc-pertechnetate	Salivary glands scintigraphy	37
II. Radiopharmaceuticals with ^{131}I		
^{131}I-hippuran	Isotope nefrography and determination	
^{131}I-sodium iodide	of residual urine	1
^{131}I-sodium iodide	Thyroid scintigraphy	1,8-3,7
	Thyroid scintigraphy after thyroidectomy (for thyroid cancer)	74-370

REFERENCES

1. BEIR Report I. Effects on Populations of Exposure to Low Levels of Ionising Radiation, Washington, DC, National Academy Press, 1980.

2. **Breitenstein, B. D. Jr., J.K. Spickard.** Ionizing Radiation. Physical and Biological Hazards of the Workplace. Ed. Peter Wald, Gregg Stave; Van Nostrand Reinhold, NY, 1994.

3. **Burikina, L.N.,** Ionizing radiation. in Manual of labour hygiene, V. 1 ed. NF Izmerov. M. Med., 1987. (in russ.)

4. **Cherry R.N.Jr., Upton A.C., Gordon M.L., Porter S.W.** Radiation, Ionizing. in Encyclopedia of Occp. Health and Safety, 4-th. ed V.II, 48.1-48.42, ed. J.M.Stellman, ILO, Geneva, 1998.

5. **Chever, C. L.** Ionizing Radiation. Fundamentals of Industrial Hygiene, III edtion. National Safety Council, USA, 1988.

6. **Christova, M.** Ionizing radiation, Physical factors of the environment. ed. E. Efremov. Sofia Med. and phys.., 1988. (in bul.)

7. **Cohen B.L.** Perspective on occupational mortality risks. Health Phys., 40,703,1981.

8. Fundamentals of nuclear medicine. ed **I. Konstantinova**, Med. and phys., Sofia, 2006, p. 240 (in bul.)

9. ICRP - Recommendations of the International Commission on Radilogical Protection. ICRP Publication 26, Pergamon, 1977.

10. ICRP, 1990 recomendations of the International commission on Radiological Protection. ICPR Publication no. 60, NY, Pergamon, 1990.

11. **Kirilov, V., F., E. F. Cherkasov.**, Radiation hygiene. Moscow, Med., 1982. (in russ.)

12. Law for the safe use of nuclear energy. SG 63/2002 (amend. and suppl. 2002-2004) (in bul.)

13. Law for Health SG. 70, 2005. (in bul.)

14. **Mc Donald, E.W., W.M. Charles,** Ionizind Radiation. Environmental and Occupational Medicine. Ed. W. N. Rom, Little, Brown and co., Boston, 1983.

15. Ordinance on ensuring the safety of nuclear power plants. SG 66/2004 (in bul.)

16. Ordinance on the safety of radioactive waste management. SG. 72/2004 (in bul.)

17. Ordinance on basic standards of radiation protection. SG. 73/2004 (in bul.)

18. Ordinance on radiation protection during activities with sources of ionizing radiation. SG. 74/2004 (in bul.)

19. Ordinance № 30 on the conditions and procedures for ensuring the protection of individuals in medical exposure. SG. 91/2005 (in bul.)

20. Ordinance № 21 for health standards and requirements for work in an environment of ionizing radiation. SG. 78/2005 (in bul.)

21. **Poppitz, P., V. Penchev B. Konstantinov.** Ionizing radiation and radiation protection. Sofia, Science and art., 1976. (in bul.)

22. **Poppitz P., V. Penchev.** Living with radiation, doses, risk, protection. Sofia, "Lodos" 2003. (in bul.)

23. **Presiyanov, Db.** Radon problem. Science, 4,2011 v. XXI 16-20 (in bul.)

24. Regulation № 22 for establishment of the medical standard "Imaging diagnosis". SG br.76/2004 (in bul.)

25. **Vasilev G.,** Radioecology, Titus Consult, 2005. (in bul.)

9 FOOD HYGIENE / NUTRITION

Eating a set of biological processes in which the body accepts certain substances from the environment to maintain its specific energy and material needs.

Foods are natural products and with oxygen and water implement continuous connection of human life with its environment. The food includes essential nutrients that are differentiated into 5 groups: protein, fat, carbohydrates, minerals (bioelements) and vitamins. Through them in the body are imported:

1. Material for building and restoring cells, tissues and organs.

2. The energy required for basal exchange and various activities.

3. Substances needed to regulate various functions in the body.

This determines the 3 main functions of food, support life: plastic, energy and regulatory.

Five main groups of nutrients, in different proportions, includes in the composition of individual foods, which determines their specific nutritional and biological value. According to its origin food products are divided into plants and animals. The main products of plant origin differentiate into 4 groups:

1. Grain.
2. Legumes and nuts.
3. Vegetables.
4. Fruit.

The products of animal origin are also four:

1. Meat.
2. Fish.
3. Milk.
4. Eggs.

A separate group of foods are fat (animal and plant). The range of food, however, is considerably wider, thanks to various products from the processing of basic foodstuffs.

In various socio-historical epochs was organized sanitary controls to combat counterfeiting of food products. Even in ancient Greece and Rome special authorities (the so-called in Rome ediles) have performed the function of sanitary police for surveillance sale of food products - their eatable, deterioration, falsification.

Elements of dietetics, forming the foundations of the science of nutrition are also in antiquity and the early Middle Ages - in the writings of Hippocrates (460-337 BC) Galen (200-130), Horace (65-8), Avicenna (Abu Ali Ibn Sina - 980-1037), Anaxagoras (600-428), Empedocles (490-430), Herodotus (487-380), Aristotles (384-322), Asklepiad (124-40) have a very right concepts for food and nutrition and recommendations for correctly nutrition.

The modern science of nutrition is developed and formed mainly during the XIX and XX century. In the 40s of XIX century Justus Liebig (1803-1873) for the first time determine the importance of essential nutrients and provides scientifically based classification, dividing them into plastic, respiratory and salts (classification used until the beginning of XX century.) Max Pettenkofer (1818-1901) studied the needs of nutrients in different living conditions and activities. The founder of the modern science of nutrition is accepted Carl Voigt (1831-1908). He has developed and offered the daily body needs of proteins, fats and carbohydrates in accordance with metabolism energy; determining the intensity of protein exchange in the amount of food received and urine separate nitrogen; the importance of oxygen for the process of "burning" of nutrients and the like. M. Rubner (1854-1932) and Etuoter (1844-1907) set the energy equivalent of burning nutrients (proteins and carbohydrates - 4,1 kcal/g, fats 9,3 kcal/g), but according to developed their theory of "izodynamics"indicate that it is possible interchangeability of nutrients. The development of nutrition science major contributions have: A.P.Dobroslavin (1842-1889) studied and defined the needs of nutrients for military contingents and research food quality for them; F.F.Erisman (1842-1915) - features of feeding in industrial and agricultural workers, creating sanitary control station of foodstuffs, etc.

Three basic concepts characterize human nutrition:

1. Theory of a balanced diet, according to that nutrition should make optimum ratios of nutrients and bioactive substances to occur maximum beneficial physiological effect on the body.

2. Theory adequate nutrition, formulated after the opening of membrane digestion in the early 60s. According to her nutrition than balanced, should be adequate to match the functionality of the digestive system.

3. Homeostatic-functional theory supplementing the above concepts, under which the food must comply with the metabolic needs of the body, to maintain nutritional homeostasis. Complex science for food and human nutrition is called **nutritiology (nutrition)** . It is an interdisciplinary science with clinical and preventive guidelines, including a number of questions concerning the physiology, biochemistry, chemistry, internal medicine and pediatrics, hygiene, toxicology, microbiology and other, sciences. In recent decades, by modern methods, are clarified a number of important issues related to digestion and absorption of ingested food, its metabolism in the body, and its utilization at tissue and cellular level. Schematic nutrition science differentiate into the following sections:

1. Physiology, pathophysiology and biochemistry of nutrition.

- *Biological and nutritional value of basic nutrients.*
- *Healthy (balanced) nutrition.*
- *Preventive nutrition.*
- *Curative nutrition-dietic; recreational, parenteral and tube feeding.*
- *Reduced: intermittent; parting; vegetarian diet.*

2. Pathology of nutrition.

- *Diseases due to unbalanced nutrition.*
- *Diseases of hypersensitivity to food.*
- *Diseases due to poor absorption of food - maldigestion and malabsorption.*

3. Foods knowledge.

- *Physiological importance of food.*
- *Food/medicines and interaction between them.*
- *Functional foods and dietary supplements*
- *Culinary processing and preservation of food products.*
- *Food safety - chemical contaminants (toxicology of nutrition); biological contaminants (microbiology, micotoxicology and parasitology of nutrition).*

4. Epidemiology of nutrition - psychosocial and economic factors, diet, nutritional status.

5. Nutrition and ecology.

6. Nutrigenomics

7. Genetically modified food

8. Sanitary controls on food and nutrition.

In the broadest sense term preventive health, food hygiene of and nutrition science would be almost identical, as in each of these sections occupies an important place occupy preventive role of food and nutrition to improve, maintain and restore health. Adopted a unified doctrine of nutrition for healthy, diseased and by disease threatened man.

However food hygiene is aimed at feeding of healthy person (danger or not of disease and poisoning).

"En étudiant comment et pourquoi l'homme mange,
cést l'homme lui-même, dans son comportement le plus fondamental,
que lón découvre."

Jean Trémolières

B. Popov, P. Nikolova

9.1 NUTRITION AS A BIOLOGICAL AND SOCIAL PROCESS

Food is one of the main factors for normal physical and mental development, performance and creative longevity of preserving and strengthening health. According to the temporary food concepts must not only meet the needs of the body of energy and nutrients and ensure good health but also to prevent disease and accelerated aging, i.e. feeding should have a prophylactic purpose. Eating adjusted and modeled not only metabolic processes, but the reactivity of the organism to constantly changing conditions of work and life in particular - to numerous and too diverse environmental factors **(Table. 9.1)**.

Changes in nutrition may, however, and actively contribute to the emergence and deepening of diseases or toxic damage, ie manifest negative effect.

Malnutrition. Main socio-economic and health problem in developing countries and of the part of population of developed countries is malnutrition. Severe malnutrition (hunger, malnutrition) is widespread in large geographical areas. It specifically affects adversely on children, whose needs for energy and nutrients per kg body weight are about 2 times greater than adults. Early childhood mortality, violations in physical and neuro-psychical development, reduced body mass, more frequent and more severe course of infectious diseases are consequences of malnutrition - mothers during pregnancy and children - after birth.

According to WHO, about 10-15% of the population of our planet starving, and partial malnutrition affects about 50%. At present there is a sharp population growth, that is not accompanied by a parallel increase in food production. It is estimated that the population of developing countries with their daily food accepts 1/3 to 1/2 less energy, almost 2 times less protein and 5 times less animal protein than residents of developed countries. Most of the people in Africa, Asia and Latin America consume only a 6-15 g animal protein per day, with a minimum rate of 35-40 g. Apart from a lack of protein and energy, about 1 billion of the population consistently do not get enough dietary iron, vitamin A and iodine.

Consequently malnutrition, millions of people worldwide suffer from kvashiorkar, cachexia, maras-

Table 9.1. Features food and provided factors (by V.V. Vanchanen, 1993)

Features food	Composition and properties of food	Food products
Energy	Carbohydrates, fats, proteins, ethanol *	Bread, baker's and pastry products, sugar and confectionery, fat and others.
Plastic	Proteins, minerals, fats, lipids, carbohydrates and more.	Meat, fish, milk and milk products
Bioregulators	Protein, vitamins, trace elements, essential PUFA	Vegetables, fruit, eggs, unrefined oils and others.
Adaptive - regulatory	Dietary fiber, water	Full-grainy bread, beans, oatmeal, vegetables, fruits, fruit-juices
Immuno-regulatory	Protein, vitamins, minerals	Products rich in essential factors (complete proteins, vitamins, polyunsaturated fatty acids, minerals, etc.)
Rehabilitation	Pharmacological properties of nutrients in the reduction or increase in diets, cookery	Products with low sodium content, a modified carbohydrate component, low-fat or improved composition, reduced energy value (fillers, other diet products)
The signal-motivation	Taste and extract substances	Spices (leaf - parsley, dill, celery, savory), fruit (black pepper, cumin, coriander, etc.), onions, garlic

* ethanol is not the food but the oxidation in the body releases energy

mus, hypo-and avitaminosis, anemia, infectious and parasitic diseases. Malnutrition is the direct cause of the high infant mortality in developing countries. In some of them she reaches 40-50°/$_{00}$ (during 1980-85, and by over 90°/$_{00}$) while in countries with a high standard of living is below 6-10°/$_{00}$. Malnutrition associated with protein deficiency is the cause of high morbidity and mortality due to the low immunity of the population - it more often and more severely ill from a number of infectious and noninfectious diseases.

The reasons for the scarcity of food in the world are complex. Firstly it is insufficient arable land area of the Earth. Currently only about 20% of the land is used for agricultural purposes. In Australia spent only 16% of the land, in South America - 21%, in Africa - 32%. In Europe, arable land is 88% of the possible, and in the US - 55%. Second is the problem with the irrigation of arable land. Currently only about 30% of arable land is likely to be watered. Thirdly, it may be noted the low level of farming practices in developing countries, which is the reason for low yields. For example, if the US and Germany by 1 hectare yield 6,5 t of grain it in India and Pakistan in the same area collected only 1 t. It is estimated that with proper treatment of the available agricultural land could feed 100 billion people on our planet.

Food and Agriculture Organization (FAO) of the United Nations offers as key measures to overcome the global food deficit: expansion of arable land, increase crop yields and obtaining several harvests per year in humid tropical areas. It is further recommended more efficient use as food biomass of the seas and oceans.

Over nursingand unbalanced composition of food intake. According to the FAO in recent years increasing numbers of poor and undernourished in developed countries, mainly in connection with the economic recession and unemployment. But the main problem in developed countries are linked by over-nourished and unbalanced composition of food intake.

Scientific and technological revolution that began in the mid XX century, brings significant changes in the forms of work and physical load of the body, the environment, the modern diet and nutrition of people in industrialized countries.

1. Changes in the forms of labour. Characterized by the introduction of automation and mechanization of manufacturing processes - reducing the physical load (and energy consumed), an increase of neuro-sensory and psycho-emotional stress, hypokinesia. On the health of the population have a big impact combined effect of hypokinesia, insufficiency of motor-visceral reflexes, significant neuro-emotional stress and norational nutrition, bad habits related to nutrition.

2. Changes in the environment. They are generally characterized by increasing pollution of industrial, agricultural, municipal and other toxic compounds. Food as an element of the environment are the mirror of her condition, the food is a major determinant of the level of receipts of xenobiotics in the human body. In terms of pollution of the biosphere, back - very broad range of issues to improve the body's resistance by feeding and use of the protective effect of composition and properties of food to increase the overall resistance and functional abilities of organs and systems, mostly defeated by xenobiotics, to reduce puffing and accelerate their removal from the body.

3. Changes in modern food. Associated mainly with the industrial revolution and changes in the infrastructure of society. Food away from the place of production, which creates an opportunity to increase diversity in remote areas, but also for changes in the organoleptic, physico-chemical properties of food and biological value of food due to prolonged transport, camping, conservation, etc. . This leads to the need for increased use of various additives in food. Refining and processing of food products decreased content of bioactive essential ingredients. Food becomes more poor in fiber. Amendment tolerate and technologies for food preparation - more often apply intense heat treatment that produces high active flavors and derivatives of overheated fats, which are known to be carcinogenic (acrolein).

4. Changes in the type of nutrition. Characterized by increased energy intake, exceeding sometimes too much physiological needs: increased fat consumption, mainly "hidden" with meat, sausages; increased consumption of sugar, easily assimilated pastry products; insufficient - fruit and vegetables, complex carbohydrates and reduced consumption of fiber and high - salt intake. In the food ration is increasing the share of canned products; simplifies menu, associated with shortening the time for cooking at home and use of manufactured products; replacement of full midday meal with a variety of sandwiches and pasta, etc.

Over-nursing is a major cause of various metabolic and degenerative disease in developed countries, such as gout, diabetes, obesity, hyperlipoproteinemias, gallstones and kidney stones, fatty liver, hypertension, atherosclerosis, malignant tumors, coronary heart disease and the like.

On the background of characteristic immobilization in humans in these countries, than hiperenergy meal, there is excessive intakes of fats, mostly of animal origin and abuse of sugar. For example, the consumption of sugar in France in 1985 was 33,8 kg per year per person. Its consumption is even higher in the US, Canada, England and Belgium. On the contrary, in Spain and Italy, its consumption is lower. At the end of the XX century in France consumes 2 times more sugar from the beginning of the century, two times more meat than 50 years ago, and 2 times more cheese than 20 years ago. The energy share of lipids in France before World War II was 28% and at the end of XX c. is 38 to 42%.

In connection with the increased consumption of refined foods, the population of Western Europe and North America consume low amounts of certain vitamins, dietary fiber and bioelements. Therefore, the characteristic is the so-called "Deficiency in a state of abundance."

State of nutrition of the population in Bulgaria. Studies focused on nutrition of bularians in the past have not been made. Historically, it is known that for centuries at eating prevailed carbohydrates to fats and proteins, and plant foods are prevalent significantly to animals. The bread was the main product, being equated with the concept of food.

The first extensive research on actual nutrition of the population in Bulgaria were conducted in the period 1960-1974. The large-scale studies of nutrition in six regions showed that in all age and professional groups food satisfies physiological needs of energy, from protein and fat, but significantly exceeds the needs from carbohydrates. After about 20 years in two of the previously studied counties (Burgas and Dobrich) committed the same complex studies.

Registered trend is towards overeating fat, and highlighted in the previous survey high consumption of carbohydrate foods.

Particularly unfavourable trends in nutrition Bulgarians in recent years in relation to socio-economic changes. It finds high intake of fat, sugar, salt and alcohol and consume enough fruits, vegetables, pulses, milk, meat, fish and eggs. Registering nutritional deficiencies of protein, minerals, vitamins and fiber. In children, due to insufficient consumption of milk and dairy products are accepted and smaller amounts of calcium and riboflavin. In them, as in pregnant and lactating women is characterized by deficiency of iron. In elderly low consumption of meat create conditions for the deficiencies of zinc and iron. Typical of our entire population is deficient in vitamin A and C, especially during the winter-spring season. From bio-element most often a deficit of potassium, magnesium, copper and zinc.

Characteristic is also incorrect diet - the food is taken mainly in the evening instead of the afternoon and morning.

All this is the main reason for the sharp increase in the incidence of cardiovascular and malignant diseases, metabolic disorders, obesity, diabetes and others. In our registered after 1986 the highest mortality from cerebrovascular pathology in the world and first in Europe in ischemic heart disease (IHD and BVDs determine now over 60% of all deaths). Obesity covers about 35% of adults and 8-12% of students. Hypertension affects 21% of the population, as are increased and school age (6-7% of students).

REFERENCES

1. **Balabanski, A.** Nutrition and Dietetics. Med. and phys., Sofia, 1988. (in bul.)

2. **Dupin, N., C. Leynaud-Rouaud**. Evolution de la consomation des divers aliments en France, au cours des derniere decennies, 51-67. **Debry G.** Evolution des concepts en nutrition humaine, 68-86. In: Alimentation et nutrition humaines, ESF edit., Coord. H. Dupin et all., Paris, 1992. 1533.

3. Food and nutrition policy in Bulgaria. MH, NCHME, NCHP, Sofia, 1992. (in bul.)

4. Health. Statistics Pocket Book. MH, NCHME, Sofia, 2005. (in bul.)

5. Modern nutrition in health and disease. **Ed. Shills M.E.**, **Olson J.A., Shike** M., 8-hth ed., Williams/ Wilkins - USA, 1994.

6. **Petrovskiy K.S.** Food hygiene, Moscow, Medicine, 1976, 400 p. (in russ.)

7. **Rumyantsev G.I., E.R. Vishnevskaya**, **Kozlova T.A.** Rational nutrition, prevention of alimentary disease and poisonings, 24-105, in. General hygiene, Moscow, Medicine, 1985, 430 p. (in russ.)

8. **Tsvetkov L.** Food Hygiene, 228-393. in. Textbook of hygiene V. I, Sofia, Med. and phys., 1957,611 p. (in bul.)

9.2 METABOLISM, BIOLOGICAL SYSTEMS AND NUTRITION. GENE EXPRESSION

9.2.1. DIGESTION AND ABSORPTION OF FOOD. B. Popov

Digestion is a complex of occurring in the gastrointestinal tract processes, turning complex chemicals that are used in the food into simple compounds capable of being transported in the vascular bed.

Processes, realizing the transport of substances in the internal environment of the body are united with the name "suction" (transport, absorption).

Principal organ of digestion is the small intestine, which virtually completed the process of digestion and absorption of nutrients.

According to classical concepts it is considered that the process of digestion is completed almost entirely in the lumen of the small intestine. They digestive enzymes, received by the pancreatic and intestinal juice are mixed with the chyme of the intenstine. Along with incoming bile, these enzymes break down nutrients to the respective simple monomers that are sucked from the intestinal wall.

Thus until recently digestion in higher organisms differentiate to:

1. Extracellular.
2. Membrane.
3. Intracellular.

Extracellular digestion. When it secretory cells expressing the enzymes are located at a distance from the site of enzymatic activity, and therefore is also called remote. If it is carried out in a special cavity and is designated as a substantially hollow or lumenal digestion. In the lumen of the small intestine is realized initial hydrolysis of nutrients, so that a substantially hollow digestion is an effective mechanism for degradation of large food biopolymers.

Membrane digestion. When it hydrolysis of nutrients is carried out by enzymes, related structures enterocytic membranes.

Intracellular digestion. Is realized as partially digested food substrates penetrate the enterocytes in intact form and is there subjected to hydrolysis by the enzymes of the cytosol. Most authors are of the opinion that the intracellular digestion no significant role in securing the nutrition needs of higher organisms.

With the opening of membrane digestion in the early 60s of XX c. by Ugolev has proved that the interim and final stages of hydrolysis for most nutrients identifies by the membranes from the apical surface of intestinal epithelial cells (enterocytes).

◆ **Early stages of digestion**

Digestion begins in the mouth due to the secretion of the 3 pairs of salivary glands. Salivary amylase performed initial digestion of cooked starch, but it is rapidly inactivated by acidic stomach contents. The initial stages of protein hydrolysis are realized in the stomach, thanks to the impact of pepsin from gastric juice, which attacks some peptide bonds of proteins.

Recent studies in humans have demonstrated the presence of gastric lipase. It hydrolysed fatty acids with short and medium chains, because what matters mainly for hydrolysis of milk. The composition of the diet influences the amount and concentration of the gastric juice. Gastric secretion is greatest when consumption of meat, less when taking bread and lowest in receipt of milk. The residence time of food in the stomach depends on its structure and texture. In general, foods rich in fats, remain a long time in the stomach.

◆ **Digestion in the duodenum**

Under natural conditions of digesting the acidic gastric contents (PH -1,8-2,2) is evacuated in portions into the lumen of the duodenum, the contents of which has a slightly alkaline reaction (pH - 7.1 -7.6). There it is exposed to pancreatic juice and bile. The pancreatic juice contains sodium bicarbonate and different range of digestive enzymes. Last differentiate into 4 groups: proteolytic, glycolytic, lipolytic and nucleases.

The main pancreatic proteases secreted form of proenzymes trypsinogen and chymotrypsinogen, which, after activation in trypsin and homotripsin continue the action of gastric pepsin.

Glycolytic enzymes are represented by pancreatic alpha-amylase which degrades starch to dextrine and maltose. Pancreatic lipase hydrolyses the

triglycerides to monoglycerides, glycerol and fatty acids.

Part of pancreatic enzymes attack the respective substrates in the intestinal lumen, duodenum, small intestine and part of them are adsorbed onto the lining of the small intestine, where the last stages of their hydrolysis. Primary site of action of proteolytic and glyukolytic enzymes are the upper and middle sections of the small intestine, whereas for lipolytic enzymes is that duodenum. This is conditioned by the secreted bile, which facilitates the action of lipase on lipids in the duodenal lumen. Bile favours and the absorption of fat-soluble vitamins A, D, E and K.

◆ **Digestion in the small intestine**

In the intestinal lumen primarily takes place early stages of hydrolysis, while intermediate stages of hydrolysis and absorption of nutrients is realized by the structures of the intestinal mucosa. The latter is made up of specific cylindrical cells equipped with microvilli. The latter are covered with a thin fibrous growths together by bridges and carve layer called glycocalyx. Above it has been formed mucus layer, as a result of the secretory activity of goblet exocrinocytes.

Intestinal epithelial cells (enterocytes) are the principal element of the digestive-transport system in the gastrointestinal tract at the same time perform a number of other functions. They are constantly updated with an average life expectancy in the jejunum is 5-6 days.

Microvilli of enterocytes form villi's strip, which is the structural basis of membrane digestion. Microvilli are plasma processes of enterocyte limited to a three-layer membrane. On the apical surface of enterocytes are each about 3,000-4,000 microvilli. Thanks to them, digestive-transport surface of the small intestine is increased 30-60 times compared to the flat membranes. Microvilli space between is filled with glycocalyx (he was on them). The elements of the glycocalyx serve as receptors for bacterials, toxins and antibodies thereby except nutritive, have protective functions also.

Glycoproteins are basic structure of mucus layer, which is assumed to have the following key features:

- *Protective (mechanical and chemical).*
- *Buffer.*
- *Digestive.*
- *Transport.*
- ***Enzymes, embodying intestinal digestion***

Nutrients entering the lumen of the small intestine, are partially degraded mainly by enzymes of pancreatic juice and to a lesser extent by the enzymes of the intestinal juice. The further hydrolysis of the substances is realized in the structures of the intestinal mucosa. There are located more than 20 enzymes which carry out the final stages of hydrolysis practically all nutrients. These enzymes are of two types: adsorbed mainly of pancreatic origin and intestinals. The two groups differ besides origin also by the nature of their specific functions. Adsorbed are mainly endohydrolases and realize degradation molecules of nutrients of large fragments. Intestinal's exoensimes are involved in intermediate and final stages of hydrolysis of pre-decomposed biopolymers. They, unlike in the adsorbed are permanently linked to the membranes of enterocytes and are divided into three groups: carbohydrases, peptidases other enzymes.

Carbohydrases of most importance are gamma-amylase, lactase, sucrase and maltase.

The hydrolysis of the proteins of the food starts by endopeptidases - pepsin, trypsin and chymotrypsin, and continues due to exopeptidase activity on the pancreatic juice (carboxypeptidases A and B). Later in the interim and final stages of this process involved various intestinal aminopeptidase and complete enteral oligo- and dipeptidases. Peptidases performed hydrolysis of a huge amount of different peptides: only for dipeptide their number reached 400, for tripeptides to 8000, and for the tetrapeptide - 160 000. It is difficult in this case to prevent the presence in microvilli an amount of enzymes and thus is supposed that in the intestinal mucosa, a limited number of peptidases (2 to 6) having a wide spectrum.

While oligo- and disaccharides is demonstrated that their hydrolysis practicaly ends on the apical surface of the enterocyte, the exact location of the final stages of hydrolysis of the oligo- and dipeptides, is also being discussed. According to most authors the intracellular peptidases have no real meaning in the digestive process. It is believed that some of them are pro-enzymes, and others involved in the catabolism of plasma proteins. Studies have shown that apical glycocalyx on the surface of enterocytic membranes contain no more than 10% dipeptidase, therefore mainly a place for their optimum performance should be lipoprotein membranes. The concept of intramembraneous location of some dipeptidase respectively, the existence of intramembraneous digestion is confirmed by modern molecular structure of membrane enzymes. It proved that they are transmembrane proteins, some of them are partially covered, while others are entirely in lipoprotein membranes. Localization of the catalytic part of the enzymes in membranes is the most conducive to optimal function, because there they are best protected from adverse external and internal conditions.

Of the other intestinal enzymes matter the monoglyceridelipase, realizing final stages of membrane digestion in triglycerides.

- ***Suction of nutrients in the small intestine***

1. Suction of water-soluble nutrients. Water-soluble nutrients - monosaccharides, amino acids, mineral salts and water soluble vitamins in the blood pass. Liposoluble nutrient-alimentary lipids and vitamins A, D, E and K, after their exit from intestinal cells, pass into lymph capillaries.

The mechanisms of transport for the products of carbohydrate and protein hydrolysis are broadly similar. It is believed that the simplified diffusion and active transport are the main routes of entry of amino acids and sugars in enterocytic membranes. The active transport determines the movement of substances across membranes against a concentration gradient, by means of carriers, at the expense of energy forming as a result of cellular metabolism. Active carriers are proteins with a molecular mass of 10,000 to 70 000. On the surface of the enterocyte membranes has two types of carriers: one is available and connect to the monomers, and others are included in the final enzyme, forming a so-called enzymtransport complexes. It is assumed that the specificity of the carriers is not absolute but relative and each of them can carry several types of substances. It has been shown that the D-isomers of glucose and galactose, as well as all L-isomers of amino acids are transported by active transport mechanisms.

An interesting phenomenon has recently proven, it is that at mixed feeding, lipids and carbohydrates, securing basic energy needs of the body, are transported from enteric environment in the inner, more proximally and earlier than proteins. The active entry of amino acids into the body is performed later, after becoming the suction of the bulk of carbohydrates and lipids. This helps the main quantity of the amino acids to utilize for the plastic, and not for energy purposes.

2. Suction of liponutrients. Sucked up into the small intestine takes place at a different mechanisms from those for carbohydrates and proteins. Released as a result of the action of pancreatic and intestinal lipase free fatty acids - di- and monoglycerides, enter the enterocytes by passive absorption. In enterocytes triglycerides resinthesized again, as with cholesterol esters are wrapped in "shell" containing specific apoprotein, free cholesterol and certain phospholipids. The spherical microstructures form so-called intracellular chylomicrons, which, owing to the hydrophilic surface, is conveyed through the basolateral membranes of the enterocytes into the lymph and blood. The main part of the fat-soluble vitamins is directed at the vascular bed also in the composition of chylomicrons. In blood chylomicrons degrade due to enzyme lipoprotein-lipase, whereby the liberated fatty acids and glycerol are utilized of the cells by the mechanisms of the passive transport.

- ***Paracellular transport and intercellular digestion***

In addition of described mechanisms of transcellular absorption of nutrients in the small intestine, there are paracellular transport, which occurred between the lateral intercellular spaces of enterocytes. Moreover, with modern methods has been shown and the presence of enzymes in the lateral enterocyte membrane. This determines the possibility of Intercellular hydrolysis of nutrients received here. It is assumed moreover that at paracellular transport some of nutrients are in complex with their corresponding enzymes, involved with the water flow, entering the intercellular spaces, and there is realized partly or completely their hydrolysis. In such a case it may be assumed that in the intercellular microcavities realize both "static" (on the membranes) and "dynamic" (in the microcavities) digestion.

◆ ***Colon and functions***

In humans, although individual features, the average rate of occurrence of the first portions of chyme in the initial sections of the colon was 3.9 hours. The time for passage of the chyme in the small intestine depends on both the composition of the ingested food, and the intestinal peristalsis. It was found that from nutrients lipids significantly slow the transit of chyme in the intestinal tract, while dietary fiber significantly stimulate it. The colon was filled for 24 hours, and the completely emptied for 48-72 hours. It has no relevance to the digestion of nutrients. It has been demonstrated for water absorption, mineral salts, bile acids, vit. B_{12} and less carbohydrates, mainly in the right column. The colon are isolated over 400 different types of bacteria, some of which produce vitamins B_{12} and K.

◆ ***Rating absorption of ingested food***

Assessment absorption of various nutrients in the composition of food intake is performed by digestive utilization coefficient.

$$K = \frac{\text{amount received in the stomach} - \text{an amount paid in faeces}}{\text{amount received in the stomach}} \times 100$$

Realistically estimate for the absorption of nutrients is hampered, as faecal materials are not composed solely of unabsorbed food residues, and contain such ingredients of endogenous origin of intestinal cells, digestive juices, mucus, microorganisms.

Digestive utilization coefficient of the main macronutrients are:

- *Protein* - animal – 90-99%, of plant origin – 60-87 %.
- *Carbohydrates* - 90-98%.
- *Fats* – depending on the melting point, the coefficient of absorption is, at m.p. below 37° C - 97-98%, with m.p. from 37 to 50° C - 90% and m.p. above 50 ° C - less than 80%.

The current three-stage scheme of assimilation of food, including a substantially hollow, membrane digestion and absorption, however, does not fully reflect the actual digestive and transport processes in the small intestine.

Digestion in solid and liquid phase of chyme. In recent years it was shown, that enzymes, entering the lumen of the small intestine in the composition of digestive juices, are allocated between the structures of the liquid and solid phase of enteric environment. Thus we can talk about the initial stages of digestion in the intestinal lumen, but differentiated digestion in the solid and liquid phase of chyme.

Mucus digestion. In the transport of nutrients from the intestinal lumen to enterocyte membranes they pass through preepithelial layer, comprising a stationary water and mucus layer and glycocalyx. Recently they received irrefutable evidence of their role in the digestive process. Currently, there is considerable information on the role of parietal layer of mucus in the digestive process of the small intestine. Morphological and histochemical studies have shown that there are localized enzymes, produced by both enterocytes and adsorbed by the enteric environment, i.e., that it represents a distinct zone in which the cleavage of poly- and oligomers, including the formation of monomers. Therefore degradation processes of nutrients in this layer can be called mucus digestion.

In apical glycocalyx probably processes of hydrolysis and transport are similar to the processes in the pre-wall mucus layer. It is logical to assume that the enzyme spectrum includes mainly inestinal enzymes and less absorbed by the intestinal lumen.

Extraintestinal digestion. Recently it proved that some of the enzymes synthesized in the digestive tract may enter into lymph and blood and there to participate in the intermediate exchange, turning the vascular bed in an internal digestive surface. The ability of the vessels of various organs to hydrolyze the nutrients can be efficiently used for the purposes of parenteral nutrition. Hydrolysis of certain nutrients by enzymes in the vascular bed, warrants it be called *extraintestinal digestion*.

Based on the data it is assumed that there are sequential zones of enzymatic action in the small intestine:

1. Substantially hollow digestion.

2. Parietal digestion, including processes at premembraned structures of the intestinal mucosa.

3. Membrane digestion, which cuts across different layers of enterocytic membranes.

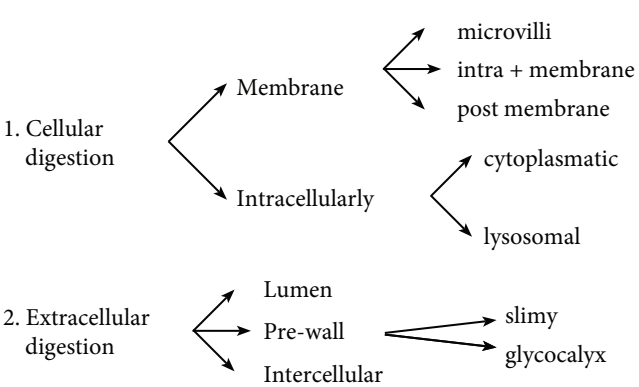
4. Intracellular digestion, which is cytoplasmatic and lysosomal.

In this scheme is not included intercellular digestion, which is the immediate phase after mural digestion at paracellular transport of nutrients. Each of the zones described is characterized by a specific range of enzymes, embodying hydrolytic degradation of substrates having varying degrees of polymerization.

The stages of transcellular transfer of nutrients through enteric wall can be differentiated as follows:

- *Transportation from solid to liquid phase of chyme.*
- *Transport of the liquid phase of the chyme to the lumenal surface of the intestine.*
- *Carry in the still water layer.*
- *Transport in mucus layer.*
- *Transport in glycocalyx.*
- *Sucking in enterocytic membranes.*
- *Transport in the cytoplasm of enterocytes.*
- *Carry in the basolateral membrane of enterocytes.*
- *Transport in own plate of the intestinal mucosa.*
- *Transport through the walls of the vascular bed in the blood and lymph capillaries.*

Differentiation until now of enteral digestion only of extracellular, cell, and membrane is incomplete. Considering the concepts of intramembrane and intercellular digestion and presented successive stages of hydrolysis and transport in the small intestine, the main types of digestion can be classified as follows:



REFERENCES

1. **Bazanova, N., R. Faytelberg.** Regularities of digestive activity of stomach-intestinal tract. Ed. "Science," 1985. (in russ.)
2. **Galyperen, Y., P. Lazarev**. Digestion and homeostasis M "Science", 1986, p. 303. (in russ.)
3. **Gardner, M.** Gastrointestinal absorption of intact proteins. Ann. rev nutr., iv. 8. 1988. p.329-350.
4. Gastroenterology, p. 2. Small intestine ed. Chadvig B. and C. Fillips. M., Medicine, 1988, p. 382. (in russ.)
5. **Kushak, R.** Digestion-transport system enterocytes. Riga "Zinatne", 1983, p. 304. (in russ.)
6. **Madaza, J.** Structural basis for physiological regulation of paracellular pathways intestinal epithelia. J. Membrans Biol., 1988,100, N2, p. 148-165.
7. **Malewia, K. M., G. Pequignot.** La Digestion in: Alimentation et nutition Humaines, Coord. H. Dipin. ESF editor, Paris, 1992. p. 195-291.
8. **Popov, B.** Theoretical and methodological, alimentary and hygienic aspects of enteral membrane digestion. Doctoral thesis. Sofia, 1991. (in bul.)
9. **Popov, B.** On the possibilities of exsistence of ensymatic hydrolysis in the membranes themselves of the intestinal epithelial cells. Acfa Phys. Hungarica vol 83. Pr 259-265 (1995).
10. **Ugolev A.** Membrane hydrolysis and transport: new data hypothesis, L., "Science", 1986, p. 240. (in russ.)
11. **Ugolev, A.** Theory adequate nutrition and trofology. L., "Science", 1991, p. 272. (in russ.)

9.2.2. FOOD AND HUMAN GENOME - NUTRIGENOMICS. K. Angelova, D. Tsvetkov

Numerous studies and collected data on molecular mechanisms of interaction between genes and nutrients led to the development of a new scientific field - **nutrigenomics** exploring the relationship between food, nutrients and gene expression.

Unlike genetics, investigating the structure and function of individual genes, genomics integrally includes study of the genome. Nutrigenomics applying genomic technologies (microarray-technologies), PCR, 2D-electrophoresis, mass spectrometry, NMR-spectroscopy, etc. examines the processes at the DNA level - **genotype**, and RNA - **transcriptome**, proteins - **proteome** and metabolism - **metabolome**. The analysis, based on these so-called. "Omics"-technology allows simultaneous determination of multiple changes - of the order of thousands of genes and proteins in thousands of biological fluids or cells.

Nutrigenomics reveals the mechanisms of effect of nutrients on genes, examine the impact of epigenetic changes and genetic variants - single nucleotide polymorphisms (SNPs), variations in the number of copies (CNV) and others, on nutrient needs and health risks and genetic predisposition to development of chronic diseases related to nutrition.

In the field of nutrigenomics, the most common categorysation of mechanisms of interaction nutrient-gene and gene-nutrient covers:

◆ **Direct effects** of nutrients on gene expression;

◆ **Epigenetics and epigenetic regulation**;

◆ **Gene variants single nucleotide polymorphisms (SNPs)** and differential response to micronutrient exposure as a basis for individual differences in **nutrient needs** and individual **health risk**.

- **Nutrients directly affect gene expression** by mechanisms for regulation of transcription (copying the genetic information). Nutrients function as **ligands**. They activated nuclear receptors, occurs intracellular synapses transduction, activated transcription factors, are associated with target genes. This group of nutrients (ligands) belong fatty acids, eicosanoids, fat-soluble vitamins - vitamin A and vitamin D (1,25-dihydroxycholecalciferol) and zinc with metal-associated transcription factor 1.

Fatty acids and eicosanoids represented ligands of transcription factors PPARs. Polyunsaturated fatty acids are more potent activators when compared with the saturated and monounsaturated fatty acids. They induce transcription of enzymes that break down fatty acids and suppress synthesis of fat.

Polyunsaturated fatty acids and cholesterol metabolites are ligands for liver receptor (LXRα), associated with the metabolism of cholesterol.

Zinc is a key factor in maintaining DNA integrity.

- When **epigenetic regulation**, nutrients cause inheritable changes in gene expression without structural changes in DNA. This is accomplished through a mechanism of methylation of cytosine in the sequence cytidinphosphat-guanosine of the promoter regions, as well as by modification of chromatin complex of acetylation/deacetylation of histone pro-

teins. Unlike direct mechanism of interaction nutrient-gene, epigenetic dysregulation occurs gradually, defined as "genetic drift" and contributes to a change in the risk of chronic diseases.

Hypomethilation of DNA can cause overexpression of oncogenes, but there is evidence that hypermethilation of promoter regions can inactivate tumor suppressor genes and also is associated with a neoplasm in a human.

Nutrients defining the epigenetic regulation of gene expression, represent a methyl group donor - choline, methionine and vitamins, involved in the metabolism of the methyl groups - folate and vitamin B_{12}.

In experimental models deficient intake of choline and folate during pregnancy expressed *agouti* gene and synthesis associated with this gene protein AGRP, stimulating appetite, and in the generation of a phenotype is the increase in body weight. In obese people also detected elevated plasma concentrations of AGRP.

• **Single nucleotide polymorphisms (SNPs)** are the main representatives of the **genetic variability** and determine the molecular basis of phenotypic variability. SNPs are variations in DNA sequence between individuals and represent a substitution of one nucleotide base pair with another base. There are over 10 million SNPs in the human genome but only a small percentage of them have a functional effect. Polymorphisms are distributed with a frequency of 1% in human populations. Some SNPs have a frequency of 50%, others up to 5%, most SNPs are from 1 to 5%. Genetic variants with a frequency less than 1% are defined as mutations.

Some SNPs contribute to the genetic predisposition to chronic diseases, other for varying effectiveness of drugs between individuals or differences in individual needs of nutrients.

Frequent **genetic variant influencing nutrient demand**, is linked to the enzyme methylenetetrahydrofolate reductase-5,10 (MTHFR), involved in the metabolism of **folate** - a single nucleotide polymorphism C677T, (change of base cytosine (C) to thymine (T) in the coding region of the gene and accordingly a change in the amino acid alanine with valine *Ala222Val* in the structure of the enzyme). This change leads to a reduction of the enzymatic activity in which the homozygous individuals have elevated levels of homocysteine in the blood and therefore increased demand for folate. The frequency of this genetic polymorphism is a single nucleotide 15-30% in the human population. A deficiency of folate in these individuals increases the risk for cardiovascular disease and in pregnancy - the risk of faults and neural tube defects in the fetus. But it is interesting that this same polymorphism is a protective factor against colon cancer - homozygous individuals with mutant allele *MTHFR677T (T/T)* showed a decreased risk for colorectal cancer compared to carriers of the wild-type allele *MTHFRC*.

Other genetic variants are also associated with the metabolism of methyl groups, affect physiological needs of **choline** (a nutrient that is already standardized in the US recommendations of the dietary population). Three genetic variants herein are associated with an increased risk of developing hepatosteatorrhea, muscle damage and increased lymphocyte apoptosis, in the presence of a deficient intake of choline.

The variant of the gene associated with the metabolism of **iron** *HFE Cys282Tyr* predisposed to hemochromatosis, led some countries to the termination of health policy on food fortification with iron because of the potential risk for carriers of this genetic allele.

Genetic variability affecting **lipid and cholesterol metabolism**, are associated with the need to differentiate the dietary recommendations - under certain genetic polymorphisms, it appears that increasing the intake of n-3 polyunsaturated fatty acids, rather than to increase, resulting in lowering of the protector against cardiovascular risk - HDL-cholesterol.

Nutrigenetic interactions and cardiovascular risk.

There are many genetic polymorphisms that affect cardiovascular risk factors such as their phenotypic expression can be modified by dietary intake.

The gene encoding apolipoprotein (apo) A-I, (*APOA1*), represented by multiple (more than 20) polymorphisms. Apo A-I is a key component of high density lipoproteins (HDL). Apo A-I and HDL are identified as key protective factors for cardiovascular disease and therefore most intensively studied SNP appears *APOA1 -75G* → A with three genotype *G/G*, *G/A* and *A/A*, affecting the level of plasma HDL- cholesterol and concentration of apo A-I. Studies have shown that increasing intake of polyunsaturated fatty acids increased significantly HDL-cholesterol in female carriers of the A allele, while homozygotes for the G-allele (*G/G*), the effect is opposite (in male individuals not detected significant effects).

The gene for PPAR-α, nuclear receptor of fatty acids with a key role in the regulation of expression of genes of oxidation of the fatty acids, show polymorphism *PPARA Leu162Val*, connected with changes in the levels of LDL-cholesterol and apo-B - in men carriers of allele *V162* are found at higher levels of total cholesterol, LDL-cholesterol and apo-B, compared

with the carriers of allele *L162* (female changes are less pronounced). Increasing the intake of polyunsaturated fatty acids causes a decrease in the levels of blood triacylglycerols in allele carriers *V162*, but without significant effect on carriers of allele *L162*.

Found variants of the 5-lipoxygenase gene encoding the enzyme of the biosynthesis of the pro-inflammatory eicosanoids leukotrienes (LT), which are associated with increased risk for atherosclerosis and myocardial infarction in humans; observed reduction of risk in exposure of the n-3 (omega-3) polyunsaturated fatty acids, but only to the carriers of a particular variant genotype.

Intake of sources of bioactive isothiocyanates from plants of the genus Brassica (cruciferae, broccoli, etc.) to induce gene *GST*, however, only genotype *GSTT1* this intake is associated with a reduction in risk of myocardial infarction, whereas in genotype *GSTM1* and *GSTP1* not observed preventive effect.

Nutrigenetic interactions and carcinogenic risk

And intake of isothiocyanates be investigated in connection with the preventive potential against carcinogenic risk. Nutrigenetic studies of induction of the gene, encoding the enzyme glutathione-S-transferase (phase II detoxifying and conjugating enzyme system), showed that the genotype *GSTP1 Val/Val* is associated with risk of breast cancer in women, the risk is increased particularly at low intake isothiocyanates (the frequency of the allele genotyping *GSTP1 Val/Val* is greater than 18%).

New research on the relationship between the intake of folate and carcinogenic risk showed an increased risk of breast cancer by about 20% in supplementation of postmenopausal women with folic acid 400 μg daily. Folate is reduced by dihydrofolate reductase, such as *DHFR* polymorphism genotype is associated with altered transcription. Studies of supplementation with high doses of folic acid showed that genotype with allele *DHFR* –/– (deletion of 19 bp) were associated with a higher risk of breast cancer compared to women who do not take multivitamin preparations.

Nutrigenetic studies of newly gene, essential for the absorption of magnesium show that often meeted polymorphism *Thr1482Ile* is associated with increased risk of colorectal neoplasia.

Nutrigenetic studies in type 2 diabetes, metabolic syndrome and obesity.

Type 2 diabetes and related metabolic disorders in lipid phenotype - hypertriglyceridemia, and obesity, represent highly inheritable conditions. Nutrigenetic studies found that persons of male carriers of the *T* allele rs1042615 of arginine vasopressin gene *AVPR1A*, show higher levels of blood glucose and increased risk of diabetes, when increased fat intake or concomitant overweight, compared to those carriers CC allele.

Low plasma concentrations of HDL-cholesterol appear characteristic of diabetic dyslipidemia. The gene encoding the transport protein of cholesterol esters (*CETP*) with an important role in regulation of the metabolism of HDL, showing polymorphism *TaqIB*, associated with elevated levels of HDL. Individuals with genotype B1B1 have significantly lower levels of HDL-cholesterol in a high intake of saturated fatty acids (of animal origin), in comparison with individuals carriers B1B2 or B2B2 genotype.

Abdominal obesity and insulin resistance are characteristic of the **metabolic syndrome**. Other characteristics herein include abnormal glucose metabolism, dyslipidemia, hypertension, predisposition to type 2 diabetes, as well as accompanying abnormal events such as inflammation, endothelial dysfunction and the like. The pathogenesis of the metabolic syndrome is still poorly understood, but it was found that dietary and genetic factors interact in the development and progression of the metabolic syndrome. Gene-nutrient interactions in the dietary intervention study, indicate a effect on insulin resistance for people with metabolic syndrome, carriers of two polymorphisms - in adiponectin gene *ADIPOQ* rs266729 and rs10920533 in adiponectin - receptor gene *ADIPOR1* rs10920533 variant. Personalized nutritional recommendations to reduce plasma saturated fatty acids appear effective and as therapeutic measures to improve insulin sensitivity in these subjects.

Nutrigenetic studies with the intake of foods with a low glycemic index, inducing low insulin response in subjects with metabolic syndrome showed that the profile of gene expression in the abdominal subcutaneous adipose tissue is characterized by the suppressed activity of 71 genes, including genes associated with insulin signal transduction and apoptosis, although there was no reduction in body weight respondents.

Obesity contributes to genetic factors - human gene map of obesity shows change in 300 genes and chromosome regions.

Under reducing energy intake for 10 weeks in obese women, gene expression (by applying microarraystechnology - microarrays with 8500 genes) in adipocytes is altered - 52 gene with increased activity and 44 gene are of reduced activity.

It has been found that obesity associated and with changes in expression of certain genes associated with inflammation. Nutrigenomic approach to double-blind, placebo-controlled, crossover-study with intervention of 5 weeks in men with overweight, intake of bioactive supplements (resvera-

trol, lycopene, flavonoids, n-3 polyunsaturated fatty acids) and integral analysis of the "omics" - data from about 400 metabolite, shows the modulation of the metabolic and oxidative stress and inflammation in adipose tissue, to improve endothelial function and increases in hepatic fatty acid oxidation.

It was established Nutrigenomics Organisation (NuGo, http://www.nugo.org), as the association responsible for the coordination, development and supporting "Nutritional phenotypic database" - dbNP as an information infrastructure to integrate many studies **(Fig. 9.1)**.

This will enable the realization of the ultimate goal of nutrigenomics - the provision of individualized dietary recommendations based on individual genotype.

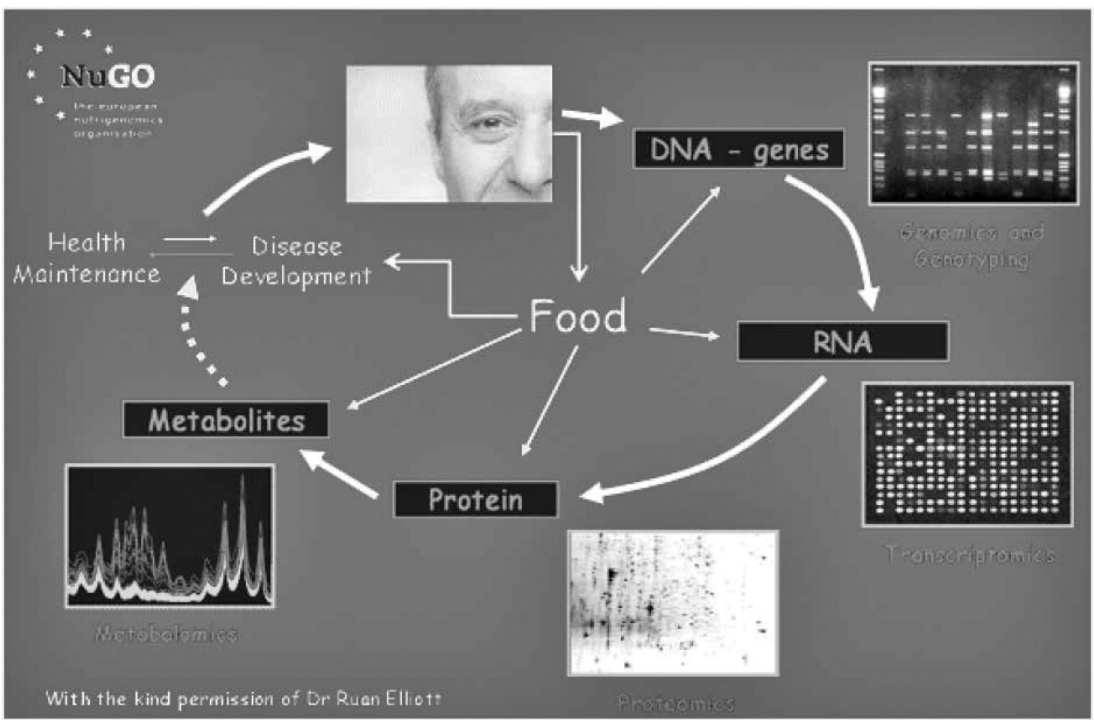


Fig. 9.1. Science "Nutrigenomics", bringing together researchs of genomics, nutrition and health, according to the European Nutrigenomics Organisation (www.nugo.org)

REFERENCES

1. **Assfalg M, Bertini I, Colangiuli D, Luchinat C. Schafer H, Schutz B, Spraul M.** Evidence of different metabolic phenotypes in humans. Proc Natl Acad Sci US 2008; 105 (5): 1420 - 1424.

2. FNB, IOM (Food and Nutrition Board, Institute of Medicine). Nutrigenomics and Beyond. Informing the Future. The National Academies Press, Washington DC. 2007.

3. **Gibney MJ, Walsh M, Brennan L, Roche HM, German B, van Ommen B.** Metabolomics in human nutrition: opportunities and challenges. Am J Clin Nutr 2005; 82: 497 - 503.

4. **Hinds DA, Stuve LL, Nilsen GB, Halperin E, Eskin E, Ballinger DG, Frazer KA, Cox DR.** WholeGenome patterns of common DNA variation in three human populations. Science 2005; 307 (5712): 1072 - 1079.

5. **Kaput J.** Fundamentals of Nutritional Genomics. In: The Second Bruce Ames International Symposium. NCMHD Center of Excellence in Nutritional Genomics, 2007.

6. **Ordovas JM.** Genetic interactions with diet influence the risk of cardiovascular disease. Am J Clin Nutr 2006; 83 (suppl.): 443S - 446S.

7. **Stover PJ.** Influence of human genetic variation on nutritional requirements. Am J Clin Nutr 2006; 83 (2): 436S - 442S.

8. **Van Ommen B, Bouwman J, Dragsted LO, Drevon CA, Elliot R, de Groot P, Kaput J, Mathers JC, Muller M, Pepping F, Saito J, Scalbert A, Radonjic M, Rocca-Serra P, Travis A , Wopereis S, Evelo CT.** Challenges of molecular nutrition research 6: the nutritional phenotype database to store, share and evaluate nutritional systems biology studies. Genes & Nutrition DOI 10.1007/s12263-010-0167-9; 2010.

9. **Zeisel SH.** Nutrigenomics and metabolomics will change clinical nutrition and public health practice: insights from studies o dietary requirements for choline. Am J Clin Nutr 2007; 86 (3): 542 - 548.

10. **Zeisel SH.** Epigenetic mechanisms for nutrition determinants of later health outcomes. Am J Clin Nutr 2009; 89: 1488S - 1493S.

9.2.3. OXIDATIVE STRESS, ANTIOXIDANT PROTECTION AND NUTRITION.

F. Ribarova M. Lyapin, D. Tsvetkov

Name antioxidants and their application in disease prevention sounds paradoxical, given the essential importance of oxygen for aerobic organisms.

The wise epigram of the Greek philosopher Kleovoulos ***"Moderation in all things" or "Anything in excess wear problem,"*** uttered in the sixth century BC, exactly corresponds to the "oxygen paradox", because on one hand oxygen is vital for aerobic organisms on the other hand its presence in the form of its radicals, dangerous toxic factor. The supply of oxygen in higher concentrations than those required in the normal physiology of the organism, leading to toxic effects in plants, animals and aerobic microorganisms. Damaging effect varies greatly depending on the type of organism, its age, physiological condition and diet. Different tissues, even of the same type of organism attack to varying degrees and in different mechanisms. Pathogenesis of more than 100 diseases is associated with the action of free radicals, which include the reactive forms of oxygen, nitrogen, sulfur-centered radicals, and various other active radical forms. They are generated endogenously in the body in the way of normal metabolism and exogenous from environmental pollutants, nervous, strain and stress, that accompany our existence.

It has long been known, and the role of free radicals in the oxidative degradation of food. Redox reactions in food, in some cases, are relevant to its better quality, but in most cases they have certain harmful effects leading to degradation of lipids, vitamins, pigments, etc., with loss of nutritional value, development of unpleasant odor and taste. Control over the oxidative processes in the food, than chemical analysis and specific technological treatments include dietary supplements of various antioxidants (food itself is a carrier of antioxidants, but they are not always sufficient to neutralize free radicals).

The classification of the free radicals is different depending on their chemical nature, by their stability and degree of activity. Classification **in terms of chemical nature**:

Inorganic free radicals	**Organic free radicals**
* radicals of oxygen and water: $0'^{\cdot}_2$, OH, HOO, H	* radicals of amino acids
* radicals of nitrogen $NO'^{\cdot}$, NO_2	* radicals of pyrimidine bases
	* radicals fatty acids and lipids
	* chromanols radicals
* radicals of chlorine: Cl	* radicals of xenobiotics (including SH, L^N-group or aromatic structures)

Classification **for the activity** of radicals is associated with their stability. Unstable radicals are highly reactive and usually induce chain reactions, until stable radicals exhibit less activity. For biological systems, among a variety of free radicals, with greater importance stand out reactive oxygen species (ROS) and nitrogen (RNS).

Reactive oxygen species (ROS) - summary term comprising radical other noradical active derivatives of oxygen, most of which act as potent oxidants.

Free radicals	**Nonradicals (particles, molecules)**
$0'^{\cdot}2$ - superoxide	H_20_2 - hydrogen peroxide
OH - hydroxyl radical	HOCl - hypochlorous acid
L00 - lipid peroxyl radical	0_3 - ozone
	$^1O_2$ - singlet oxygen

Similar is **distribution at RNS**, who are its activity in reactions of nitrosylation and in detoxification mechanisms, naturally occurring, accompanying the metabolism of xenobiotics in the body.

Free radicals	**Noradicals**
N0 - nitric oxide	N_20_3 - dinitrogen trioxide
$N0_2$ - nitrogen dioxide	$HN0_2$ - nitrous acid
	$N0_2Cl$ - nitrohlorid

Generation of free radicals is a natural process, pass constantly in the body by way of enzymatic reactions (mitochondrial electron transport, metabolism of arachidonic acid, processes of phagocytosis and the synthesis of nitric oxide, xanthine oxidase and monoamine oxidase reaction) or non-enzymatic mechanisms (processes of auto oxidation of hemoproteins, quinones, catecholamines and the like; redoxiprocesses with participation of metals of variable valence, processes of lipid peroxidation, etc.) - **Table. 9.2.**

The chemical activity of free radicals can damage all cell macromolecules: proteins, carbohydrates, lipids and nucleic acids. The result manifests their harmful effect not only on the molecular level, but also respectively at the cellular, tissue and organ level in the affected organism (**Fig. 9.2.**). Not always, however, free radicals have a negative effect. Their participation eg. in the process of phagocytosis leads to the destruction of microbes responsible for a variety of diseases, in which they marked and its role in protecting the body. Nevertheless, the science stands today a major task for the prevention of harmful effects of free radicals, since for him the data are much larger than those showing and their positive role. A huge number of studies proving the role of free radicals in the initiation and progression

Table 9.2. Sources of free radicals

ENDOGENOUS SOURCES
Mitochondria
Phagocytes
Xanthine oxidase
Reactions involving iron and other transition metals
Pathway of arachidonic acid
Peroxisomes
Physical load
Inflammatory processes
Ischemia / reperfusion
EXOGENOUS SOURCES
Cigarette smoke
Environmental pollutants, Radioactivity, Ultraviolet light
Some drugs, anesthetics, organic solvents ...
Ozone

of a number of diseases: cardiovascular, cancer, neurodegenerative, ophthalmic and other. No fewer and research on their role in activation of the aging process that led to the creation of "free radical theory in the biology of aging" still in the middle of the twentieth century by Denham Harman. Evolutionary development of organisms, however, provide the necessary safeguards to prevent uncontrolled development oxidative-radicaly processes through construction of antioxidant protection.

As an **antioxidant** may be included all factors that slow or prevent oxidative damage to biological structures.

Protective antioxidant mechanisms of the body can be divided into three successive levels. At the first level includes all factors which prevent endogenous formation of free radicals called. **"Preventative antioxidants"** (transfer, ferritin, hemosiderin, lactoferrin, ceruloplasmin, albumin).

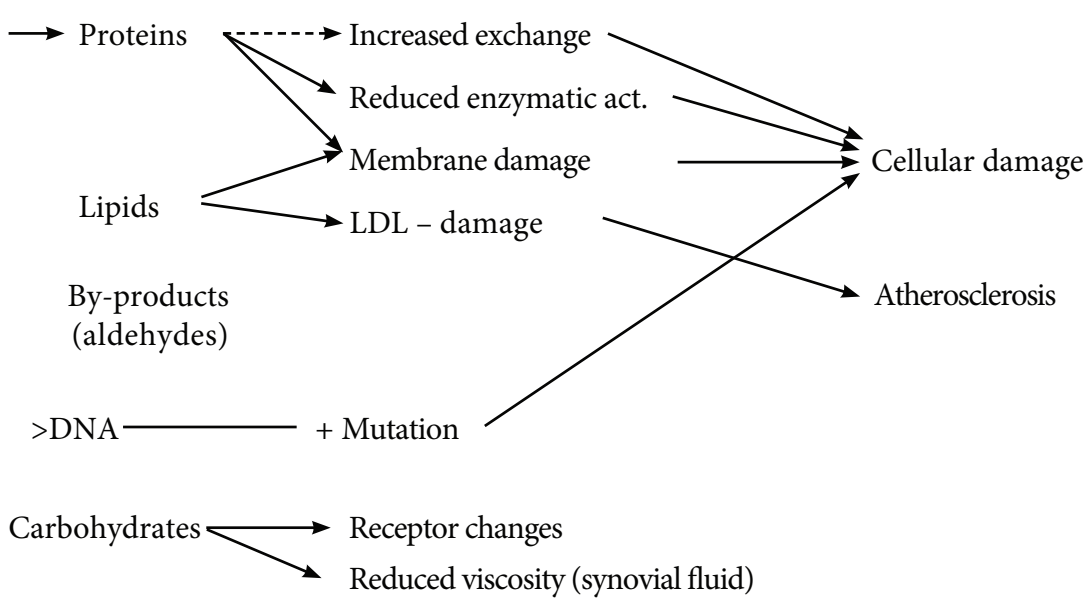


Fig. 9.2. Damaging effect of free radicals

Second and a basic level of protection in the body provides tracking and disposal of already formed free radicals, making them noradical particles or radicals with lower reactivity. This process is realized with participation of enzymatic and non-enzymatic antioxidants. Refer to the enzyme superoxide dismutase (SOD), catalase, glutathione peroxidase and glutathion reductase.

Non-enzymatic antioxidants fall into two groups: water-and lipo- soluble. To first apply fat-soluble vitamins - vitamin A, vitamin E (mainly alpha-tocopherol, but the latest scientific information communicated data for antioxidant activity of gamma tocopherol) and carotenoids. At soluble antioxidants belong vit.C, thiol compounds, uric acid, flavonoids and others.

The third protection level qualify enzymes that partially recover the damage caused by free radicals. Such activity have, for example phospholipase A2, some proteolytic enzymes, reparative enzymes for DNA and the like.

Oxidative stress is a process in which a natural balance between oxidants and antioxidants is shifted to the side of the oxidation causing biological damage.

The oxidative stress is an adaptive process and caused by a disease, physical load, resistance to a number of environmental factors, but it is associated with detrimental effects on the body. The mechanisms by which antioxidants work at the molecular and cellular level, including their role in gene expression and regulation, signal transduction, apoptosis. **Fig. 9.3** shows some ways to mobilize the defense mechanisms in oxidative stress in the body. The balance between the presence of free radicals and antioxidants that is of importance for the prevention of oxidative stress (**Fig. 9.4.**).

DISEASES, PATHOLOGICAL CONDITIONS AND OXIDATIVE STRESS

Oxidative stress and lipid peroxidation are key in the pathogenesis and progression of many socially significant diseases and pathological conditions. It should be borne in mind that the most likely process of generating free radicals, reactive metabolites of oxygen is particularly intense in tissues rich in polyunsaturated fatty acids.

Atherosclerosis and hypertension. To explain the pathogenesis of atherosclerosis is proposed hypothesis of the oxidative modification. According to it for initiating atherogenesis and for the formation of atherosclerotic plaques are determining oxidative stress and lipid peroxidation of low density lipopro-

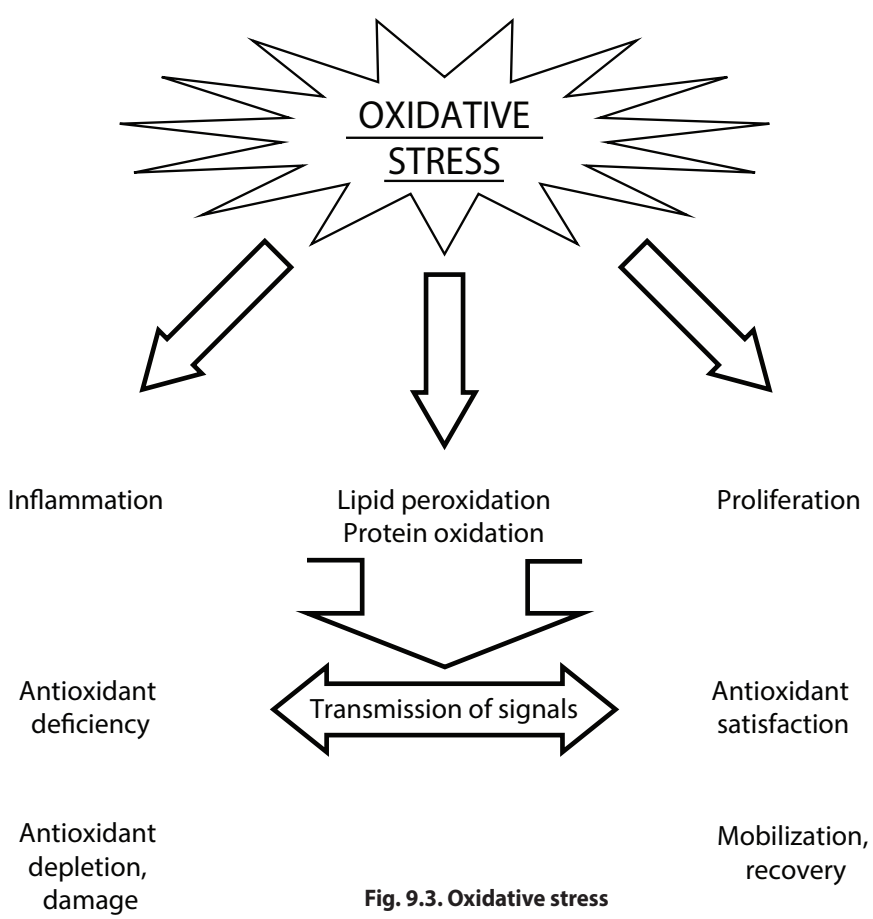


Fig. 9.3. Oxidative stress

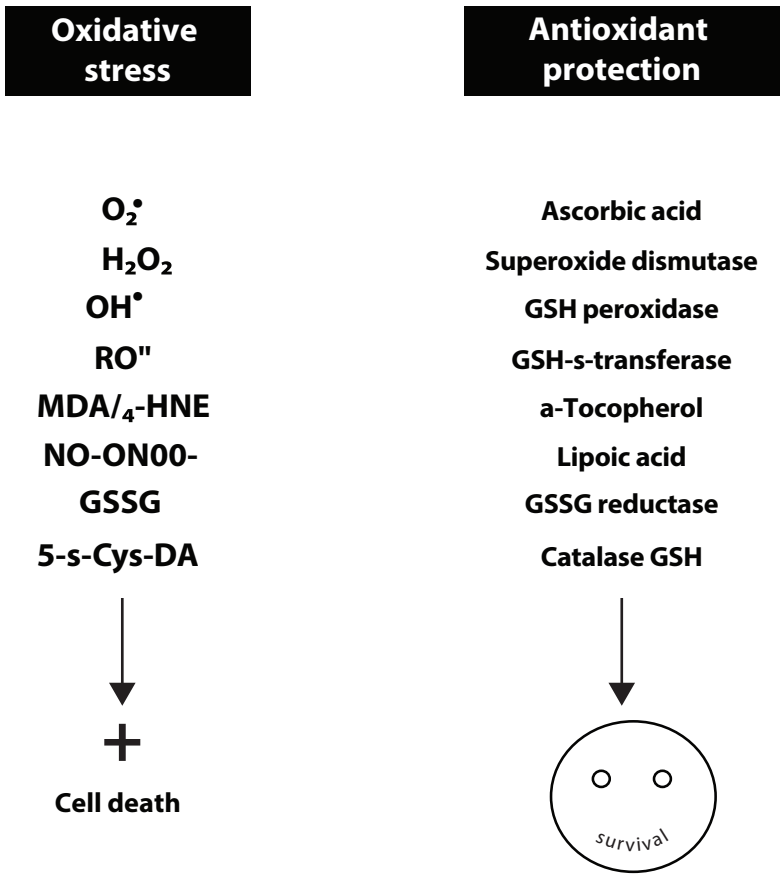


Fig. 9.4. Balance between free radicals and antioxidants

teins. Triggering factor considered lesion of endothelial cells. In the subendothelial space of the arterial wall entering lipoproteins, this process is a function of the concentration gradient of elevated serum low density lipoproteins (LDL). Oxidative products (and secreted by endothelial cells themselves), in the absence of plasma soluble antioxidants, initiate or enhance lipid peroxidation deposited LDL - so called mild oxidation. Mildoxidated LDL induced the production of monocyte activators of endothelial cells, resulting in the accumulation of macrophages in the subendothelial space. Through his "respiratory burst" macrophages are a powerful source of reactive metabolites of oxygen that perform full oxidative modification of LDL. It affects both lipid and protein ingredient them - apolipoprotein B. Macrophages recognize oxidative modified LDL through specific receptors - cleaners, absorb them and become "foam cells". This form "fat spots" in the arterial wall. Excessive production of reactive metabolites of oxygen in the vessel wall, which is also observed in hypertension, leads to inactivation or destruction of the endothelium produced physiological vasodilator - nitric oxide. In this respect, some authors consider that a leading role in the pathogenesis of hypertension has production from endothelial cells superoxide radical.

Carcinogenesis. The role of free-radical processes is justified both in radiation and in chemical carcinogenesis. It has long been discussed and the connection between cancer and dietary factors - malnutrition with systemic deficiency of vitamins and trace elements or overfeeding. Increased calorie intake leads to increased oxygen consumption and increased production of reactive oxygen metabolites. The combination of high-calorie diet and excessive use of fat is associated with increased risk of cancer of the colon, breast, gallbladder, and others. Especially risky is considered systemic excessive use of polyunsaturated fatty acids that are easily oxidizable and metabolism further increase free radical production. Obesity is also strongly associated with an increased risk of developing cancer.

In connection with the proven role of oxidative stress in carcinogenesis antioxidants can be regarded as anticarcinogenic. Extensive epidemiologic studies have shown that the incidence of cancer is inversely related to the plasma levels of vitamin A, vitamin E and vitamin C, leading predictive value of β-carotene. Increased risk of carcinogenesis is established at low plasma levels of selenium. Here discusses the protective role of other carotenoids (lycopene), of bioflavonoids, vitamin B_6, folic acid and the like.

Ischemia - reperfusion injury. Reperfusion of ischemic tissue is a frequent phenomenon - eg. in patients with coronary - or perifpherel artery disease observed frequent ischemic attacks, followed by reperfusion. Free-radical mediated reperfusion injury, plays an important role in myocardial diseases, brain, small intestine, lung, transplantation of organs and tissues, and at acute course - in circulatory shock. Briefly, anoxia during ischemia results in the accumulation of hypoxanthine and xanthine, and the conversion of the enzyme xanthine dehydrogenase to xanthine oxidase. Restored oxygen supply during reperfusion causes explosive oxidation of the accumulated purines of xanthine oxidase with the formation of superoxide radicals. SOD dismutated superoxide to hydrogen peroxide; superoxide and hydrogen peroxide are reacted in the Haber-Weiss reaction to the generation of hydroxyl radical. Reactive metabolites of oxygen cause lipid peroxidation and enzyme deactivation. Ischemic damaged tissues release chemoattractants that promote the migration and adhesion of neutrophils. The interaction between endothelial cells and activated neutrophils (with the "respiratory burst" and released by proteolytic enzymes and pro-inflammatory mediators) plays an important role in the propagation of the injury. Damages, arising under this facility can be successfully influenced by the implementation of xanthine oxidase inhibitors (allopurinol, folic acid), SOD, or non-enzymatic free radical interceptors (mannitol).

Cataracts and eye damage. It is known the importance of free radical processes for the occurrence of both **senile** and the **radiation cataract**. The lens is highly sensitive to oxidative damage target because it is exposed to continuous light and a significant number of oxidizing agents. Concentrations of glutathione and glutathione reductase in lens are high. It is assumed that free radicals lead to deterioration of lens-proteins that are rich in methionine and cysteine groups and are easily oxidized. As risk factors for developing cataracts are considered and low serum levels of α-tocopherol and β-carotene. On the other hand, epidemiological studies demonstrate the prophylactic effect of dietary antioxidants (vitamin C, carotenoids and vitamin E). Studies show that dietary intake of vitamin E helps in the prevention of ocular lesions in infants exposed to high concentrations of oxygen in incubators.

ANTIOXIDANT PROTECTION – FOOD AND SUPPLEMENTS

Need for a strong antioxidant defenses, developed and so-called "Antioxidant hypothesis", clarifying the role of diet in the prevention of diseases of our time and its importance for the effectiveness of their treatment. According to this hypothesis ingredients in food are divided into two groups - nutritive and antioxidant nonutritive (**Tabl.9.3.**).

Plant foods are the richest source of antioxidants, which property has been used rationally by folk medicine since ancient times. Dietary supplements are the first steps in the pursuit of science to improve the health benefits of dietary intake in humans, providing in concentrated form nutrients and biologically active ingredients it needs.

Table 9.3.

NUTRIENTS	*NONNUTRIENTS*
** Ascorbic acid (vit.C)*	**Carotenoids: lycopene, lutein, alpha and γ - carotene*
** Riboflavin (vit.B_2)*	**Flavonoids: flavones, flavanons, flavanols, catechins, anthocyanins, isoflavones*
** a- Tocopherol (vit.E)*	**phenolic compounds*
** Retinol (vit.A)*	**indoles*
** Provitamin A - carotene P*	
**S – containing amino acids*	
** Selenium*	

The rich variety of antioxidants in food is a result also of evolutionary development, improvement and refinement of their composition, ***in terms of plant resistance to environmental and their biological role in the health of the body (Table. 9.4)***.

For comprehensive evaluation of the biological role of antioxidants is not enough only their content in foods, but must take into account many other factors - supporting nutrients and nonutritive substances, technological processing of food, digestibility of the body and others.

By naturally occurring antioxidants in foods, the most popular are ascorbic acid (Vit.C), which is the most rich in citrus fruits and tocopherols (Vit.E) - in sunflower seeds, soybeans and nuts. Higher the antioxidant activity of carotenoids (orange colored fruits and vegetables) and flavonoids (purple and blue colored vegetable fruit). A number of data have demonstrated the positive role of carotenoids particularly effective, positive results in the prevention of prostate cancer through increased dietary intake of lycopene (tomatoes most abundant source), while cataracts and age-related muscular degeneration - by intake of the carotenoids lutein and zeaxanthin. An example of the effect of antioxidants is the explanation of the so-called. "French paradox," according to what a low level of cardiovascular disease in French, despite the relatively high amounts of fat intake in them, due to the extensive import of

flavonoids with typical French diet in which almost necessarily present glass of red wine.

Antioxidants are widely used in the food industry as food additives in order to preserve the taste, color and nutritional value in the process of production and storage of food - their antioxidant protection is inadequate only by their natural content in products. That is why they are produced and as extracts synthetically. Modern technology allows the synthesis, which does not establish the smallest difference in the chemical structure of these compounds, which are referred to as "natural-identical." To this group and the galaties who are extracts from different plant species. Many widely used synthetic antioxidants are and butylhydroxyanisole (BHA) and butylhydroxytoluen (BHT). On **Table. 9.3.** are presented the most widely used synthetic and natural antioxidants in their role as dietary supplements. Although vitamin C and vitamin E have a role in the body such as vitamins, their use as additives comply with relevant regulations to levels which must be labeled (Directive 95/2/EC), as class (antioxidants, dyes, etc.) and their E - number. Authorized for use as food additives are those antioxidants that prove positive technological effect and which do not constitute a health hazard to the consumer. The list is given in Directive 95/2/EC, and the requirements for labeling is regulated by Directive 2000/1 H/EU. Bulgarian laws are harmonized with European and reflected in Ordinance № 8 of MH/2002.

Table 9.4. Antioxidants in food: sources, absorption and plasma concentration

Antioxidants	*Sources*	*Digestibility*	*Plasma concentration*
Ascorbic acid (vitamin C)	*Fruits, vegetables, especially strawberries, kiwi, citrus fruits, sprouts, leafy green and many others*	*100% at low doses [<100mg reduced to <15% at> 10g]*	*25-80μmol/l*
Vitamin E (a-, P-, y-tocopherols and tocotrienols)	*Green leafy vegetables (spinach), nuts and seeds (sprouted grain) vegetable oils (sunflower)*	*10-95%; absorbed in liver - process saturation*	*15-40μmol/l*
Carotenoids (hundreds of kinds)	*Orange / red fruits and vegetables (carrots, tomatoes, apricots, melons, broccoli, leafy green)*	*It is not clarified yet, it depends on the form and dose, probably <15%*	*very low (1 < μmol/l)*
Flavonoids (a huge number of different classes and types)	*Blackberries, raspberries, blueberries, onions, red wine, grapes, spices (parsley, dill)*	*Most have low absorption. It depends on the type and concentration. Quercetin: 20-50%; Catechins: <2%*	*No evidence of most representatives. It is supposed to the total is likely> 3μmol/l*

Tab. 9.5. Antioxidants used as dietary supplements

E – number	*Substance*	*Food to be added*
E 300 E 301 E 302	*Ascorbic acid Sodium ascorbate Potassium ascorbate*	*Soft drinks, jams, condensed milk, sausages*
E 304	*Ascorbyl palmitate*	*Sausages, chicken soup*
E 306-309	*Tocopherols*	*Vegetable oils*
E 310-312	*Galaties*	*Fats and oils for technological production, frying oils, spices, soups, chewing gum*

REFERENCES

1. **Benzie, J. F. F.** Evolution of dietary antioxidants. Comparative Biochemistry and Physiology, Part A, 136, 113-126, 2003.

2. **Esterbauer H, Wag G, Puhl H.** Lipid peroxidation and its role in atherosclerosis. Br Med Bull 49 (3), 1993, 566-576.

3. **Gey KF.** Prospects for the prevention of free radical disease regarding cancer and cardiovascular disease. Br Med Bull 49 (3), 1993, 566-576

4. **Herbaczyńska-Cedro K., Kłosiewicz-Wasek B., Cedro K. et al.** Supplementation with vitamins C and E suppresses leukocyte oxygen free radical production in patients with myocardial infarction. Eur Heart J 16, 1995, 1044-1049.

5. **Knekt P et al.** Serum antioxidant vitamins and risk of cataract. Br Med J 305, 1992, 1392-1394.

6. **Knight JA.** Diseases related to oxygen-derived free radicals. Ann Clin Lab Sci 25, 1995, 111-121.

7. **Moskovitz J., Yim M. B., Chosk P. B.**, Free Radicals and Disease. Archives of Biochemistry and Biophysics, 397, 2, 354-359, 2002.

8. Ordinance № 8 Ministry of Health, SG 44/2002 on the requirements for the use of food additives. (in bul.)

9. **Punnonnen K** et al. Antioxidant enzyme activities and oxidative stress in human breast cancer. J Cancer Res Clin Oncol 120, № 6, 1994, 374-377.

10. **Sies H.** What is oxidative stress? In: Keaney J.F., ed. Oxidative stress and vascular disease. Boston: Kluwey Academic Publishers; 1-8, 2000.

11. **Sohal, RS, Mockett, RJ, Orr W. C**, Mechanisms of Aging: An Apprasial of the oxidative stress hypothesis, Free Radical Biology and Medicine, 33, 5, 575-586, 2002.

12 . **Stadtman E.** Importance of individuality in oxidative stress and aging. Free Radical Biology and Medicine, 33, 5, 597-604, 2002.

13. **Thomas M.J.** The role of Free Radicals and Antioxidants. Nutrition, 16, 7/8, 716-718, 2000.

9.2.4. NUTRITION AND IMMUNITY.

K. Angelova

Immune system, a complex afferent, efferent and memory function in identifying his/foreign and integrated immune response, is highly dependent on **nutritional status** of the organism. Malnutrition affects both the immune system and its organs, especially the thymus, and the gastrointestinal mucosa-associated lymphoid tissue (GMALT) and diffuse MALT.

Malnutrition suppress immune function due to **deficient** intake of **essential nutrients,** as well as of macronutrients - essential amino acids and both essential fatty acids (linoleic and alpha-linolenic) and so of micronutrients - vitamins and minerals. **Immunomodulators** represented certain metabolites and non-nutritive bioactive plant substances (primarily exhibiting antioxidative activity) as flavonoids, as well as the probiotics, acted on the immune function of GMALT.

Numerous studies have shown damage to the immunity from **protein-energy malnutrition (PEM) and deficient** intake especially zinc and vitamin A, the beneficial effects of vitamin E on the immune system, the importance of taking iron, selenium, B vitamins, copper, manganese , vitamin C and long-chain polyunsaturated fatty acids on immune function. **Nutritional immunomodulation** of specific metabolites and bioactive substances is also a subject of intensified research interest.

Protein-energy malnutrition, expressed in varying degrees and occurring primarily among risk populations such as young children, hospital patients, the elderly, alcoholics, individuals with anorexia neurosis, affects most cell-mediated immune response causes atrophy of the thymus, lymph nodes, tonsils and spleen. The number and function of circulating T lymphocytes is reduced, while humoral immunity and B-lymphocytes prejudice relatively weak. Serum levels of IgG and IgM are retained, serum IgA may be slightly elevated, and the secretory IgA in nasopharyngeal mucus is lowered. The bactericidal activity was reduced, irrespective of the maintenance of the total number of leukocytes. There is also a reduction of many of the components of the complement. Comorbidities, the presence of infection further affect nutritional deprivation and a vicious cycle is deepening suppression of the immune system.

Zinc shows a key role in immune competence. Zinc deficiency causes multiple immunological disorders including atrophy of the thymus with lower levels and activity of thymulin (biologically active form of the hormone of the thymus containing zinc in their structure), impaired maturation and replication of T lymphocytes, lymphopenia, abnormal responses in cell-mediated and humoral immunity. Impacted bone marrow and reduces the number of lymphoid progenitor cells. The activity of NK cells and lymphocyte proliferation is reduced. Is reduced production of the cytokines IL-2, IFN-γ, TNF-α by lymphocytes stimulated with mitogen. Because of the role of zinc in oxygen "bang" impaired function of mononuclear phagocytes. A diet low in animal protein and prevalence of intake of grains, containing, chelator phytates (inositol hexaphosphate) induce zinc deficiency due to reduced intestinal absorption of zinc. Zinc deficiency is associated with an increased incidence of respiratory and skin infections

and diarrhea, especially in children, whereas supplementation with zinc formulations that reduces morbidity. Excess intake of zinc supplements, however, damages the immune response, violates lymphocyte and phagocyte function and result in increased excretion of copper and copper deficient status.

Vitamin A for its role in cellular differentiation and maintenance of the functional integrity of the epithelium and mucous membranes, it is particularly important for immune function. Vitamin A deficiency is associated with an increase incidence of infection, due to epithelial changes, and the reduced cell-mediated and humoral immunity. Reduce the number and function of T-lymphocytes and suppress production of antibodies by B-lymphocytes.

Ex vivo observations have demonstrated reduction of the lymphocyte response to mitogens phytohemagglutinin (PHA), concanavalin A (ConA) and lipopolysaccharide (LPS). Supplementation with vitamin A in the case of deficiency restores immunocompetence. Some data supplemented with vitamin A cancer patients indicates the presence of increased mitogenic lymphocyte response, stimulation of cytotoxic T cells and NK cells, but it is unclear whether vitamin A inhibits initiation and malignant cell growth. Vitamin A stimulates the function of the macrophages and the production of IL-1.

Vitamin E deficiency hardly occurs in humans, with the exception of premature infants and patients with lipid malabsorption syndrome. Vitamin E, a fat-soluble antioxidant, that provides protection of membrane lipids from peroxidation. Since free radicals and lipid peroxides exhibit immunosuppressive effect, it is considered that vitamin E optimizes the immune response. Experimental achieved deficiency of vitamin E induces reduction of lymphocyte proliferation in the spleen, reduction of the activity of the cells NK, decrease in phagocytosis by neutrophils. Vitamin E, unlike toxic high doses of fat-soluble vitamin A and vitamin D, can be taken in elevated quantities, tolerant upper level of intake without the risk of adverse effects up to 300 mg daily (in some countries be allowed to 1000 mg per day). Studies of supplementation for people with high doses of vitamin E showed a beneficial effect on the immune system. Supplementation of the diet of adults and older subjects with 800 mg of vitamin E daily for a period of 4 weeks increases lymphocyte proliferation, production of IL-2 increases the number of $CD4^+$ cells, the level of circulating immunoglobulins. New, more detailed studies of differentiation of doses of supplement vitamin E - 60 mg, 200 mg and 800 mg per day, found that the 200 mg dose appears to be optimum for inducing a maximal effect on the immune function in humans. These observations suggest that increasing the intake of vitamin E above usual levels of food imports - 15 mg, can stimulate the immune function and increase resistance to infections, especially in adults and the elderly.

As **iron** deficiency, and excessive intake of iron preparations is associated with an increased risk for infections in experimental animals and in humans. Since iron also constitutes an essential element for optimal immune response, but factor for multiplication and growth of the pathogen bacteria, treatment of iron deficiency used with caution, especially in children with malnutrition and related infections. Mild iron deficiency without anemia and iron deficiency anemia result in various disorders in immune function - atrophy of lymphoid tissues, reduction of lymphocytes with subsequent reduction in antibody titer. Detecting a decreased number and suppression of T-lymphocytes function. Iron deficiency results in decreased activity of the myeloperoxidase of neutrophiles, a reduced level of oxygen "burst" with subsequent production of the superoxide radical, hydroxyl radical and hydrogen peroxide with their key role in the cytotoxic effect on bacteria.

The role of **selenium** in the immune response is associated with its function as cofactor of the enzyme glutathione peroxidase, that catalyses the reduction of hydroperoxides with an electron donor antioxidant glutathione. Generated by neutrophils and macrophages in oxygen "bang" reactive oxygen species with cytotoxic function represent a risk for oxidative stress in excess synthesis. It is believed that selenium plays an important antioxidant role in phagocytic defense and in the control of potentially auto-toxic damage.

The function of the trace element **copper** is associated with cupric enzime superoxide-dismutase, an antioxidant controlling and destroying free radicals. Copper deficiency leads to impairment of cell-mediated immunity, inhibition of T-cells, especially the T-helper activity and decreased and delayed maturation of neutrophils. The role of the deficit of other trace elements, such as **manganese**, **iodine**, have been studied in experimental animals and is found suppression of immunocompetence.

The **importance of B vitamins** for immune function is most pronounced in terms of **pyridoxine** (**vitamin B_6**), **folate** and **vitamin B_{12}**. A deficiency of riboflavin, thiamine, niacin, biotin and pantothenate have a weak effect on the immune response. Vitamin B_6 deficiency affects 10-20% of the population (malabsorption, alcoholics). In volunteers with vitamin B_6 deficiency has been demonstrated hypogammaglobulinemia and impairment of cell-mediated immunity. In folate deficiency inhibited the synthesis of thymidylate and affect the synthesis of

DNA, resulting in megaloblastic anemia, reduced response to the mitogen PHA, a decrease of T-lymphocyte population. Vitamin B_{12} is essential for the synthesis of nucleic acids and its deficiency resulting in pernicious anemia, affect bone marrow, reduces the phagocytic activity of neutrophils.

Vitamin C has a key role in the protection of cells from oxidative damage, but in the presence of metal Fe (III) and Cu (II) acts as a pro-oxidant and promotes the generation of reactive oxygen species (OH, O_2, H_2O_2 and ferric ions). The ability of phagocytes and lymphocytes to concentrate vitamin C at levels up to 100 times higher than its content in the plasma, represents an indication of the physiological role of ascorbate in the immune function. Vitamin C increases the proliferative response of T-lymphocytes *in vitro* and the production of interferon in cell cultures. There have been many studies on the role of supplementation with large doses of vitamin C in preventing colds with inconsistent and unreliable statistical results. In some studies supplementation with 80 mg daily achieved a similar result to that of doses of 1 to 2 g per day (must be borne in mind that a single dose of vitamin C, the maximum dose that is absorbed 200 mg). Some authors warn that high doses of ascorbic acid do not act as antioxidants, and exhibit pro-oxidative action (especially at doses above 500 mg).

Immunomodulation of specific metabolites, bioactive substances, including nonutritive ingredients, administered in amounts higher than normal content in the usual diet and so-called functional foods, is a currently an intense area of research (**Table. 9.6**).

L-arginine, it is considered that in addition to a substrate for protein synthesis, and acts as an immunomodulator and supplementation with increased dose favourably influence the immunity for infections, malignancies and syndrome acquired immune deficiency by stimulating NK cells and lymphocyte proliferation. Another immunomodulator defined as "imunonutrient" is a **glutamine**, a precursor to glutathione, a key component of the antioxidant status. **N-acetyl-cysteine**, also a precursor to glutathione, supplied as a supplement to HIV-positive patients, causes an increase in the activity of NK cells and T-lymphocytes, a reduction in plasma interleukin IL-6.

The long chain n-3 polyunsaturated fatty acids are crucial components of a number of "imunonutritive 'formulas and supplements of fish oil, due to the anti-inflammatory properties. A high intake of long-chain n-3 polyunsaturated fatty acids - eicosapentaenoic (EPA) and docosahexaenoic acid (DHA), which are rich in oily fish, respectively fish oils, results in a reduction of the production of the pro-inflammatory eicosanoids and cytokines, reactive oxygen species and the expression of adhesion molecules, and induce the synthesis of antiinflammatory mediators - so-called rezolvins.

Other immunomodulators represented **flavonoids** (polyphenol compounds) with antioxidant-properties. A subgroup of the flavonoids - soy isoflavones and derivatives their daidzein, genistein and glycitein modulate immune function and supplementation with these drugs increase the population of B-lymphocytes, affects as protective agents against DNA damage, stimulating the activity of the cells "natural killer" - NK, modulate cytokine production.

Probiotics - functional food components also affect immune function by contributing to the immunological protection of the body by inducing a barrier to the development of pathogenic bacteria.

WHO defines the relationship **nutrition, infection and immunity** as synergistic. The interaction between the nutritional status of the body and the incidence and severity of infectious diseases is reciprocal, wherein the malnutrition enhances clinical manifestation and potentiate the risk of complications, and vice versa, the infection induced nutritive disorders and progressive development of malnutrition, and the immune system plays a mediating role in the **cycle nutritional status - infection**.

Metabolic cascade of the immune response induced by infection is analogous with that in trauma, burns, surgery - production by macrophages and endothelium of inflammatory mediators, such as cytokines, eicosanoids, reactive oxygen species and nitric oxide, which in turn induce systemic effects such as fever, decreased appetite, to the extent of anorexia, proteolysis in skeletal muscle, lipolysis in adipocytes and reduced protein synthesis in the liver. Febrile reaction due to endogenous pyrogens secreted by activated leukocytes - the peptides cytokines IL-1, IL-6, TNF-α and the like. Lipopolysaccharide (LPS) component of the cell wall of bacteria stimulates the production of eicosanoids prostaglandin E_2 (PGE_2) and the cytokines IL-1, IL-6, TNF-α from monocytes/macrophages, which in turn stimulate T and B lymphocytes. Catabolic processes are amplified in all infections, even in subclinical and not accompanied by fever conditions. For the mechanism of catabolic syndrome in HIV-infected persons is assumed imbalance in the levels of pro-inflammatory and anti-inflammatory cytokines, produced by mononuclear cells. Infections cause a decrease in the levels of vitamin A, iron, zinc and copper in the serum to the negative metabolic balance of these essential elements. Research on disease "Keshan" - cardiomyopathy, caused by infection by Coxsack-

Table 9.6. Nutritional immunomodulation

Immuno nutrients and bioactive substances	*Function*
Long chain n-3 polyunsaturated fatty acids - eicosapentaenoic (EPA) and docosahexaenoic (DHA) acids	*Reduced production of pro-inflammatory eicosanoids - prostaglandins, thromboxanes and leukotrienes, ROS, adhesion molecules, inducing synthesis of rezolvins*
Flavonoids / soy isoflavones - daidzein, genistein, glitsitin	*Increase the population of B-lymphocytes, stimulate NK cells, modulate cytokine production*
Supplements - tocopherols and tocotrienols (vitamin E)	*Amplifies the lymphocyte proliferation, cytokine production - interleukin IL-2, $CD4^+$ cells, circulating immunoglobulins activity of NK cells*
L-arginine	*Substrate for the synthesis of NO, stimulates the activity of NK cells, increased T-helper activity, stimulates CTX*
Glutamine	*Precursor of glutathion stimulates synthesis of T-lymphocytes and B-lymphocytes*
N-acetylcysteine	*A Precursor of glutathion stimulates NK cells and T-lymphocytes*
Nucleotides	*Precursors of DNA and RNA, and improve the function of T-lymphocytes*
Probiotics	*Induce GMALT (gastrointestinal mucosa associated lymphoid tissue)*

ie-virus to persons deficient in selenium, populating the province in China, shows that the antioxidant deficiency induces development of highly-virulent form of the virus causative. For many RNA viruses (incl. HIV) RNA in the replication of the genotype is changed to specific nucleotide positions, leading to changes in virulence of the virus, but selenium deficiency leads to the onset of infection even by weakly virulent form of the virus.

New scientific technologies such as proteomics, genomics and nutrigenomics, initiated by the project "Human Genome" have the potential to detect the specific mechanisms of interaction and synergy among nutrients, infection and immune system.

REFERENCES

1. **Calder PC** (2006) n-3 Polyunsaturated fatty acids, inflammation, and inflammatory diseases. Amer J Clin Nutr 83 (suppl): 1505S-1519S

2. **Calder PC, Kew S.** (2002) The immune system: a target for functional foods. Brit J Nutr 88: S165-S176

3. **Ferguson A,** Griffin GE (2000) Nutrition and the immune system. In: Human Nutrition and Dietetics 10th ed. (Eds) JS Garrow, WPT James, A Ralph, Churchill Livingstone pp. 747-764

4. **Fraker P** (1996) Nutrition and immunity: disruption of lymphopoiesis in zinc-deficient mice. In: Present Knowledge in Nutrition 7th ed. (Eds) EE Ziegler, LJ Filer Jr, ILSI Press Washington DC, pp. 557-562

5. **Grimble RF** (2001) Nutritional modulation of immune function. Proc Nutr Soc 60: 389-397

6. **Keusch GT** (2003) The history of nutrition: Malnutrition, Infection and Immunity. J Nutr 133: 336S - 340S

7. **Meydani SN, Beharka AA** (1998) Recent developments in vitamin E and immune response. Nutr Rev 56: S49-S58

8. **Meydani SN, Meydani M, Blumberg JB** et al (1997) Vitamin E supplementation and in vivo immune response in healthy subjects. J Amer Med Assoc 277: 1380-1386

9. **Myrvik QN** (1994) Immunology and nutrition In: Modern Nutrition in Health and Disease 8th ed. (Eds) ME Shils, JA Olson, M Shike, Williams & Wilkins pp. 623-662

10. **Rees DR, Miles EA, Banerjee T et al** (2006) Dose-related effects of eicosapentaenoic acid on innate immune function in healthy humans: a comparison of young and older men. Amer J Clin Nutr 83: 331-342

11. **Ryan-Borchers TA, Park JS, Chew BP et al** (2006) Soy isoflavones modulate immune function in healthy postmenopausal women. Amer J Clin Nutr 83: 1118-1125

12. **Scrimshaw NS** (2003) Historical concepts of interactions, synergism and antagonism between nutrition and infection. J Nutr 133: 316S - 321S

13. **Stephensen CB, Kelley DS** (2006) The innate immune system: friend and foe. Amer J Clin Nutr 83: 187-188

14. **Villalpando S, Gopal J, Balasubramanyam A et al** (2006) In vivo arginine production and intravascular nitric oxide synthesis in hypotensive sepsis. Amer J Clin Nutr 84: 197-203

9.2.5. FOOD AND CARCINOGENESIS.

K. Angelova. L. Ivanova

Induction of malignant neoplasms is associated with genetic determinants and interaction of the genome with environmental factors, but due to the multifactorial etiology and pathogenesis and progression of the disease over a prolonged period of time, identification of risk factors is difficult and requires complex approaches in epidemiological, clinical and experimental studies. Discriminatory phases in the process of carcinogenesis - initiation, promotion and progression of their distinctive molecular and cellular changes can be influenced by nutritive factors, by affecting the gene expression, and by modulation of key enzyme activities involved in cell proliferation and differentiation.

WHO in global health statistics in 2005, stresses that the overall mortality from chronic non-communicable diseases in the world is leading with 61%, whereby the mortality associated with cancer ranked second (13%) after cardiovascular diseases (30%). Europe in 2002, after mortality from diseases of the circulatory system (~ 50%), malignant neoplasms appear responsible for around 20% of total mortality by lung cancer, colorectal cancer, breast, stomach and prostate exceed morbidity and mortality than all other cancers combined. The highest incidence of malignant neoplasms in Europe with respect to lung cancer for men and breast cancer in women, followed by colorectal cancer in both sexes and prostate cancer in men. WHO predicts rise in the incidence of cancer in the coming decades due to an increase in the proportion of population of older people.

The World Cancer Research Fund and the International Agency and other institutions for Cancer Research (WCRF, IARC, AICR) estimated in 2004 that the global scaling of the causes of death from cancer - first with about 35% occupied exposure of nutritional factors and high-risk diet (eg. high intake of saturated fatty acids in combination with low intake of fiber, vegetables and fruits), followed by smoking - 30%, risk reproductive behaviour - 7% and addiction to alcohol - 3%, or about 75% of cancer deaths are caused by unhealthy diet and lifestyle; 20% - of other risk factors, such as environmental pollutants (11%) and infections (9%); 5% are caused by hereditary disposition (genetics). The risk of carcinogenesis is most pronounced in smoking, other determinants of risk include diet, exposure to chemical carcinogens, biological agents (oncogenic viruses), infections, alcohol intake, hormonal factors and ionizing radiation. The protective potential of the diet (anticancerogenesis), however, varies from 10% for lung cancer to 80% for colon cancer.

Reasons links between dietary factors and the occurrence of cancer is very difficult to establish, assessing the relative risk of large cohorts, in order to accumulate a sufficient number of cases in prospective intervention studies, is expensive and comparison with clinical and epidemiological studies not rarely gives conflicting results.

WHO stresses the importance of hierarchy in the strength of the association (of convincing evidence, followed by probable and possible links) - different force correlation relationship between the intake of certain foods or nutrients and incidence of cancer, for example correlation between colorectal cancer and breast cancer and high intake of meat and fats reaches high values ($r \approx 0,8$), as well as the correlation between long term dietary exposure to aflatoxin B1 and liver cancer.

The induction of neoplasms occurs in phases **initiation, promotion and progression, at disbalance** between disabled genome and processes of DNA repair.

In phase **initiation** highlights the risk of exposure to a number of genotoxic compounds, the involvement of oxidative stress by reactive oxygen species (ROS), biotransformation of chemical carcinogens to reactive electrophiles by metabolizing enzymes of Phase I (cytochrome P450 flavinmonooxygenases-FMO, NAD (P) H-quinone oxidoreductases), as well as inactivation of the enzymes at their phase II, affected by food ingredients. In the phase of **promotion** of carcinogenesis, stresses the importance of tumor promoters - deoxycholate and lithocholate (secondary bile acids, associated with cytosignal processes of epithelial hyperproliferation by diacylglycerols and proteinkinase C), as their synthesis (from the intestinal microflora) is increased by high intake of saturated fat; as well as other tumor promoter - ammonia (an inducer of proliferation colonocytes), at high intake of animal protein. At the stage of **progression** is significant apoptosis (programmed cell death) and angiogenesis (neovascularization), but in these processes nutritional factors are examined mainly as protectors.

Carcinogens in food. Exogenous **non-nutritive natural metabolites in plants,** used mainly as spices, acted like carcinogenic compounds in experimental models - such as safrole (black pepper), estragole (in dill, basil), caffeic acid (in coffee beans) and others., but the doses inducing cancer in animal models repeatedly exceed their exposure to human food. **Pyrolysis** at the heat treatment of meat and fish generates carcinogenic heterocyclic amines, eg. PhIP (2-amino-1-metil6-phenylimidazole [4,5-b] pyridine), and grilling and smoking - polycyclic aromatic hydrocarbons such as benzo [a] pyrene and ben-

zo [a] anthracene - risk mutagens in animal models. Exposure to mycotoxins **aflatoxin B1** (contaminated peanuts) and its metabolic activation by cytochrome P450 in the liver generates highly reactive electrophile carcinogenic aflatoxin 2,3-oxide, attacking nucleophilic centres of the DNA. **Carcinogenic nitrosamines** such as N-nitroso-dimethylamine, and N-nitrozopirolidin found in meat products, using nitrite as preservatives. Moreover, nitrates, introduced with the feed or water are reduced from the bacterial nitrate reductase to more reactive nitrites reacting with amines and amides formed by bacterial decarboxylation of amino acids and are produced N-nitroso compounds (NOS) such as N-nitrosamines, N-nitrosoamides, N-nitrosoguanidine, and N-nitrosourea - carcinogenic DNA alkylating agents. High intake of meat increases the level of fecal NOS and especially in the presence of nitrosating agents such as nitric oxide - NO. However, genotoxic and carcinogenic risk of NOS is not well established (especially bearing in mind that the high levels of nitrates and nitrites are produced endogenously from arginine to generate NO, and the antioxidant ascorbate inhibits the formation of nitrosamines). Excessive consumption of salt canned fish **Sanma hiraki** in Japan is associated with risk for stomach cancer.

Oxidative stress and reactive oxygen species (ROS). Oxidative stress represents an imbalance between the generation of ROS in the body and antioxidant defense system, involving the participation of specific enzymes, antioxidant vitamins E and C, reduced glutathione and some other endogenous metabolites. ROS comprise mainly free radicals - the hydroxyl radical (OH), superoxide (O_2), nitric oxide (NO), etc., as well as noradicals as singlet oxygen, hydrogen peroxide and others. The oxygen radicals attack lipids in the body and in lipid peroxidation generate a peroxy radical (ROO) and aloxy radicals (RO.), coupling with a DNA to exocyclic DNA - adducts (etheno- and propano-adducts). Eg. the major product of lipid peroxidation, *trans*-4-hydroxy-2-nonenal formed DNA adducts at codon 249 of the human p53 gene, mutation locus in hepatocellular carcinoma.

Tumor-promoting activity related to nutritional factors. Secondary bile acids, deoxycholate and lithocholate are known tumor promoters and in animal models induced in column DNA damage, apoptosis, cell hyperplasia and necrosis. It is assumed that deoxycholate (DCA) affect colorectal cancer by selective effects on apoptosis-resistant cells and cell signaling system (diacylglycerol and proteinkinase C). The concentration of DCA is increased in **high fat diets** rising bile acids, some of which avoid enterohepatic circulation and reach the column with the metabolism of bile conjugates of beta-glucuronidase of gut microflora to secondary bile acids, as well as in delayed passage. **High protein diets** lead to increased formation of ammonia by bacterial enzymes, such as ammonia is a tumor promoter, inducing proliferation of colonocytes in animal models. Butyl hydroxy toluene **(BHT)**, a synthetic antioxidant and an additive to foods, exhibits tumor-promoting activity towards liver in animal models when administered in high doses, however, surpass many times the food exposure in humans.

Protective dietary factors against carcinogenesis. Increased intake of vegetables and fruits, rich in **fiber and non-nutrient bioactive plant substances such as antioxidants - flavonoids (polyphenols) and carotenoids, glucosinolates, allyl-sulfides and others**, are main modulating agents and protective food, tested for reduction of the carcinogenic risk. Of the more than 250 epidemiological studies of the risk for various cancers by applying a high intake of vegetables and fruits, 205 of them found a protective effect (cancer localization esophagus, stomach, colon, lung, pancreas and bladder). The connection is not however relevant to cancer in hormone-dependent tissues - prostate and breast. Genisteinat of soybean except antioxidant activity, inhibit angiogenesis of the growing tumor. Allyl sulfides of onion and garlic also show inhibition of angiogenesis and growth of cancerogen-induced tumors on breast, colon, esophagus, stomach, and liver. Conjugated linoleic acid isolated from dairy products inhibit progression and suppresses angiogenesis in model experiments. Activity as inducers of apoptosis have been shown to retinoic acid (the active metabolite of vitamin A), flavonoids - quercetin, apigenin, epigalocatehingalat (EGCG) of green tea, genistein from soya and glucosinolates by hydrolysis of their products - isothiocyanates and indoles, rich in that are cruciferous vegetables - cabbage, broccoli and others. The polyphenols of green tea also induce glutathione -S- transferase. Lycopene (a carotenoid without provitamin A activity), the most abundant source are tomatoes, which has shown a protective role against, some cancers-epdemiologichni studies of people, in model experiments and clinical trials. In a prospective study of risk for prostate cancer by administration of various carotenoids and retinol, is found that only lycopene shows an inverse correlation and reduce the carcinogenic risk. Increased intake of fibers (pectins, cellulose, hemicellulose, lignin) with vegetables and fruits are considered a protective factor against the development of cancers, due to a reduction of potential carcinogens in food, accelerating the time of passage through the intestinal tract, the binding of bile acids and reduction of conversion into deoxycholate. Fiber cause in-

creased production of intestinal microflora to short chain fatty acids - acetate, propionate and butyrate, whereby it is established that butyrate (butyric acid) manifests itself as an anti-neoplastic agent by inhibiting the genotoxic effect of nitrosamines and peroxides in the cells of the colon. Polyfructosane inulin from artichoke increases production of short-chain fatty acids, and fiber from whole grains selectively rising butyrate. Probiotics Lactobacillus spp and Bifidobacterium spp from yogurt, except stimulating the synthesis of butyrate, have been shown in model systems and suppressing mutation and antigentoxical activity. More recent studies have shown that vitamin D_3, exhibits as an antiproliferative and prodifferentive agent, induces apoptosis, inhibits tumor invasion and angiogenesis.

Feeding and some cancers. Cancer of the oral cavity, pharynx and esophagus in developed countries are primarily associated with excessive alcohol consumption and smoking. Obesity is also a risk factor for esophageal adenocarcinoma. Taking many hot drinks and food also increases the risk. In developing countries are important and micronutrient deficiencies and malnutrition. **Stomach cancer** has a higher incidence in Asian countries compared to Europe, probably due to the traditional consumption of salty canned fish, meat and vegetable dishes. Helicobacter pylori infection is not considered a sufficient causal link to the development of stomach cancer. **Colorectal cancer** is tenfold higher rate in developed countries versus developing countries, assuming risk up to 80% associated with nutritional risk factors. There is a positive correlation between increased consumption of meat, canned meats and fat and mortality from colorectal cancer.

Severe obesity is also considered a risk factor, while diets rich in fiber, fruits and vegetables, calcium and folate are associated with risk reduction. **Liver cancer** dominates in developing countries (about 75% of cases), the frequency variated and is up to 20 times higher in Africa and Southeast Asia compared to Europe. Major risk factors for HCC are Hepatitis B and Hepatitis C, intake of foods contaminated with aflatoxin. In developed countries risk factor is high alcohol consumption with the development of cirrhosis. **Pancreatic cancer** has a higher incidence in industrialized countries, but there is no clear evidence of a risk assessment. **Lung cancer** is the most common type of cancer in the world. Regular smoking increases the risk 30-fold. Data to influence the risk of nutritional factors, however, are controversial. **Breast cancer** is the second highest rate in the world. The frequency of occurrence was 5 times higher in developed countries. Estradiol and possibly other hormonal agents play a leading role in the etiology such as influencing the risk of diet-related factors such as alcohol and obesity may be mediated by hormonal mechanisms. For other cancers, data on the association with nutritional risk factors are controversial.

REFERENCES

1. **Archer MC (1996)** Cancer and diet In: Present Knowledge in Nutrition 7th ed. (Eds) EE Ziegler, LJ Filer. ILSI Press, Washington DC, 482-487

2. **Bingham S (2000)** Diet and cancer prevention In: Human Nutrition and Dietetics 10th ed (eds) JS Garrow, WPT James, A Ralph. Churchill Livingstone, Edinburgh, London etc, 765-777

3. **Giovannucci E (1999)** Tomatoes, tomato-based products, lycopene, and cancer: review of the epidemiologic literature. J Natl Cancer Inst 91: 317-331

4. **Ivanova L, K Angelova, H Vasilevski (2004)** Nutrition and malignant neoplasms - Recommendations for reducing the risk, in Nutrition and chronic non-communicable diseases. General principles of good preventive practice on nutrition problems in the areas of CINDI program. NCPHP, Sofia, 66-74 (in bul.)

5. **Jacobs ET, Lanza E, Alberts DS et al (2006)** Fiber, sex, and colorectal adenoma: results of a pooled analysis. Amer J Clin Nutr 83: 343-349

6. **Langseth L (1995)** Oxidants, Antioxidants, and Desease Prevention. ILSI Europe ILSI Press, Washington DC, pp24

7. **Larsson SC, Bergkvist L, Rutegard J et al (2006)** Calcium and dairy food intakes are inversely associated with colorectal cancer in the Cohort of Swedish Men. Amer J Clin Nutr 83: 667-673

8. **Macho A, Lucena C, Sancho R et al (2003)** Non-pungent capsaicinoids from sweet pepper. Synthesis and evaluation of the chemopreventive and anticancer potential. Eur J Nutr 42: 2-9

9. **Pavia M, Pileggi C, Nobile CGA, Angelillo IF (2006)** Association between fruit and vegetables consumption and oral cancer: a meta-analysis of observational studies. Amer J Clin Nutr 83: 1126-1134

10. **Rafter JJ (2002)** Scientific basis of biomarkers and benefits of functional foods for reduction of disease risk: cancer. Brit J Nutr 88 Suppl 2: S219-S224

11. **Rafter J, Govers M, Martel P et al (2004)** PASSCLAIM - Diet-related cancer. Eur J Nutr Suppl 2, 43: 48-84

12. **Shils ME (1994)** Nutrition and diet in cancer management In: Modern Nutrition in Health and Disease 8th ed. (Eds) ME Shils, JA Olson, M Shike, Williams & Wilkins, Baltimore etc, vol 2 pp 1317-1348

13. **Vineis P (2001)** Diet, genetic susceptibility and carcinogenesis. Public Health Nutrition 4 (2B): 485-491

14. **WHO (2003)** Diet, Nutrition and the Prevention of Chronic Diseases. WHO Techn Rep Ser 916, WHO Geneva, 95-104

9.2.6. ENERGY CONSUMPTION AND THE ENERGY VALUE OF FOODS, P. Nikolova

The body continually expends energy performance of complex biochemical processes: for eating (digestion, absorption and assimilation of food), to perform work, sports, etc. Expend energy furnished by the diet. To maintain energy balance in accordance with the characteristics of an individual or population is an important daily food intake to supply the body as much energy as is consumed, ie energy value of the food ration to be balanced with power consumption.

Negative energy balance. Obtained when food is imported less energy than is needed. The resulting energy deficiency leads to the use of the body of all energy resources, incl. and energy of protein breakdown of the food and their tissues. Mostly using protein instead of plastic needs to cover energy needs can be seen as a major disadvantage of negative energy balance. Prolonged negative energy balance in the body gets protein deficit. Negative energy balance is seen as a single complex of protein energy malnutrition.

Prolonged positive energy balance. It also adversely affects the body, especially in people engaged in mental or mechanized or automated work without additional exercise. Excess body weight and obesity, atherosclerosis, hypertension significantly develop and progress based on continuous and significant positive energy balance. Therefore, both negative and positive energy balance adversely affect the body, leading to significant abnormalities in metabolism, functional and morphological changes in various organs and systems. Normal in physiologically conditions are created in providing energy balance.

◆ **Energy consumption**

Spending each day the body energy is formed by:

1. Energy spent on basic metabolism to maintain vital functions. It depends on age, sex, size and body composition, physiological condition, endocrine functions, climate and more. The basic metabolism kg/body weight of women is less than men. Increases in growth spurts, pregnancy and lactation. With age the intensity of metabolism decreases.

2. Consumption of energy required for digestion and absorption of food (specific dynamic action of food). Nutrients (proteins, fats, carbohydrates) have different specific dynamic action and influence on the basal metabolism. Carbohydrates increase it by 4-7%, fat - by 4-14%, and most - by 30-40% - protein. When mixed meal basal exchange increased by 10-15% per day.

3. Energy consumption related different types of activities (physical activity). Ex., at rest, the energy consumption is about 0,3 MJ/h, during walking - about 1,05 MJ/h, swimming - 2,1-3,4 MJ/h. The energy consumption for different types of activities (work, home, sports) can increase or decrease depending on the conditions, the wishes, the will of man. With age the energy consumption decreases due to changes in the composition and body mass, intensity of metabolic processes and functional status of various organs and systems, of physical activity at work and outwork time. Accordingly, to maintain energy balance necessary adjustments for imported food energy.

◆ **Physiological needs of energy and nutrients**

Are defined as the amount (values) nutrient and energy intake daily that ensure normal growth, physical and neuro-psychological development and lasting good health and refer to groups with similar anthropometric indicators (height, body weight). Differentiated by age, sex, physical activity. At the base of their development are the development and deepening of the understanding of the role of individual nutrients in ensuring vital processes and changes in energy intensity of labour processes. A key role is the recommended level of energy intake. It should be sufficient to maintain the desired bodyweight and provide optimal physical activity, without resulting in a disproportion between incoming and expended energy. Respecting interrelated factors, determining the energy needs of healthy people: energy expense, age, sex, body weight, climate and so on. The values vary depending on age, and after 10 y. - and sex. The separation by sex is because the difference in body size, average body weight and intensity of the metabolic processes of men and women of the same age. Take into account physical activity, which for boys, and in most cases for men is higher than that of girls and women. The age groups are 3 - infants, children and adolescents, adults with respective subgroups.

For the working population into account and intensity of physical activity, according to which was assigned to 3 groups:

1. Low intensity: persons engaged mainly in mental labour, leaders, teachers, academics, doctors (without surgical specialties), researchers , tailors, secretaries, dispatchers on the panel and others.

2. Moderate intensity: workers in automated processes, chemists, agronomists, veterinarians, nurses, technicians, telephonists and others.

3. High intensity: medical - surgeons, obstetricians, textile industry, drivers, turners, miners and others.

Persons of the same professional group spent different amounts of energy depending on age. Is the most active age 18-30 years **(Table. 9.7)**.

The above table values are averages. Individuals differ in body mass, ability to digest, absorb and metabolize food. Meaning a degree of skill, fitness level and so on. Due to the peculiarities of some individuals recommended amounts exceed their needs.

Recommended import of nutrients (food imports). Average amount of each nutrient for 1 person per day, to meet the needs of a homogeneous population group and provide good nutritional status for all individuals **(Fig. 9.5)**.

In determining the recommended dietary intake, into account not only the nutritional needs but also the absorption and bioavailability of nutrients, and dietary habits (if they are not harmful to health).

Nutritional needs. Defined as small amounts of a nutrient, accordinly the age, sex, body mass, physical activity, state of the environment and others, needed to compensate for any losses of the body, to provide metabolic functions, in which the nutrient is involved and to maintain reserves in the body **(Tab. 9.8 and 9.9)**.

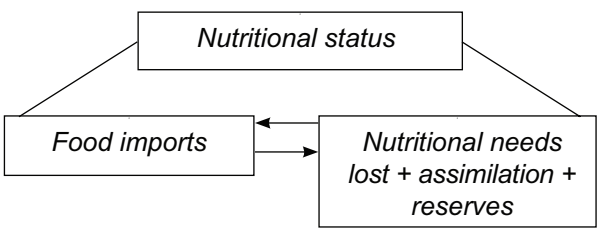


Fig. 9.5. Factors affecting the nutritional status

Table 9.7. Average energy needs of the adult population

Age (years)	Physical activity	Average energy needs *			
		man		woman	
		MJ/day	(kcal/day)**	MJ/day	(kcal/day)
1	2	3	4	5	6
19 – 30	low moderate*** high	11,3 12,8 14,3	2710 3071 3432	8,5 9,7 10,8	2041 2313 2586
30 – 60	low moderate high	10,8 12,2 13,7	2583 2927 3272	8,3 9,4 10,5	1988 2252 2518
60 – 75	low moderate	9,1 10,3	2181 2472	7,4 8,5	1792 2030
75 +	low moderate	8,8 10,0	2111 2393	7,4 8,4	1764 1999
Pregnancy - trimester I II III Breastfeeding 0 – 6 months 6 – 12 months				 +0,287 +1,1 +2,1 +2,8 +1,9	 +68 +266 +496 +675 +460

* The average energy needs for an appropriate level of physical activity (low, moderate, high) is determined on the average of the basic metabolism for the day, multiplied by a factor of magnification, respectively:
low physical activity - 1.5;
moderate physical activity - 1.7;
high physical activity - 1.9.
** 1,000 kcal = 4.184 MJ
*** To ensure good health recommended moderate physical activity.

Table 9.8. Recommended and adequate intake of complete (standard) protein

Age / sex	Bodyweight (BW) (kg)		Recommended dietary intake			
	male	female	year/kg BW /day		g/day	
			male	female	male	female
0 – 6 months	6,0	6,0	1,52*	1,52*	9,1*	9,1*
6 – 12 months	8,9	8,2	1,5	1,5	13,4	12,3
1 – 3 years	13,1	12,4	1,1	1,1	14,4	13,6
3 – 7 years	20	20	0,95	0,95	19	19
7 – 10 years	27	27	0,95	0,95	26	26
10 – 14 years	45	44	0,95	0,95	43	42
14 – 19 years	64	54	0,85	0,85	54	46
19 – 30 years	74	59	0,8	0,8	59	47
30 – 60 years	74	59	0,8	0,8	59	47
60 – 75 years	74	59	0,8	0,8	59	47
75 + years	70	57	0,8	0,8	56	46
Pregnancy - trimester			g/kg BW /day + supplement		g/day	
I			0,8 + 0 g/day		47	
II			1,1 + 25 g/day		90	
III			1,1 + 25 g/day		90	
Breastfeeding						
0 – 6 months			1,1 + 25 g/day		90	
6 – 12 months			1,1 + 25 g/day		90	

*Adequate diet.

Table 9.9. Recommended and adequate intake of fat-soluble vitamins (average daily)

Groups	Age/sex	Vitamin A (μg RE[a])	Vitamin D[b] (μg)	Vitamin E (mg alfa-TE)[c]	Vitamin K[d] (μg)
Infants	0 – 6 months (m, f)	375*	5*	2,7*	2*
	6 – 12 months (m, f)	400*	5*	2,7	2,5*
Children and adolescents	1 – 3 years (m, f)	400	5	6	15
	3 – 7 years (m, f)	450	5	7	20
	7 – 10years (m, f)	500	5	7	30
	Boys				
	10 – 14 years	600	5	11	45
	14 – 19 years	800	5	15	65
	Girls				
	10 – 14 years	600	5	11	44
	14 – 19 years	700	5	15	54
Adults	*Man*			15	74
	19 – 30 years	800	5	15	74
	30 – 60 years	800	5	15	74
	60 – 75 years	800	10	15	74
	75 years +	800	15		
	Woman				
	19 – 30 years	700	5	15	59
	30 – 60 years	700	5	15	59
	60 – 75 years	700	10	15	59
	75 years +	700	15	15	59
Pregnant women	≤ *18* years	750	5	15	59
	≥ *19* years	800	5	15	59
lactating women	≤ *18* years	1100	5	19	59
	≥ *19* years	1200	5	19	59

a RE - retinol equivalent
1 retinol equivalent = 1 mg retinol (6 mg beta-carotene) = 3,33 IU vitamin A.
b Vitamin D - presented as cholecalciferol
1 mcg cholecalciferol = 40 IU of vitamin D.
c TE - alpha-tocopherol equivalents
1 alpha-tocopherol equivalent = 1 mg d-alpha-tocopherol = 1,49 IU vitamin E.
d Vitamin K - presented as phyloquinone, the main form of the vitamin K in the foodstuffs.
* Adequate dietary intake.

9.2.7. NUTRIENTS. ANTIVITAMINS. P.Nikolova

9.2.7.1. PROTEIN

Proteins are required for the realisation of many life processes of the organism.

◆ Biological function of proteins

Main functions of proteins are:

Plastic. Associated with the regeneration of cells and tissues growth and development. In the human body proteins are 18-21% of the gross weight and about 85% of dry residue of tissues and organs. They are the basic building material of cells, intracellular structures, of the intercellular substance. Along with phospholipids participate in the construction of biological membranes.

Catalytic. Protein is the main component of all enzymes and in metabolism play the role of biocatalysts. Simple enzymes are pure protein compounds, and complex are based on protein molecule bonded to the coenzyme.

Transport. Proteins bind and transport oxygen in the blood (hemoglobin), fats (lipoproteins), carbohydrates (glycoproteins), metals (transferrin, etc.), vitamins, hormones, drugs.

Hormone. Proteins are the basis of endocrine function. A significant part of the hormones in nature are proteins or polypeptides: insulin, pituitary, thyroid and parathyroid hormones.

Protective. Proteins involved in the formation of immune bodies. Tissue and species specificity, underlying immunity and allergy, are also associated with the protein. They increase the body's resistance to the action of various infectious and toxic agents, in neuro-psychological stress and stressful situations.

Proteins are the base material of many other vital processes such as digestion, muscle contraction, cell irritability, blood clotting, vision and more.

Proteins are the sole source of nitrogen as nutrient for the body.

Energy. Some of the proteins are oxidized in the body and used to meet energy needs. They significantly (compared to carbohydrates and fats) increased oxidative processes in the body. Upon decomposition of 1 g protein is obtained 17,48 kJ (4 kcal). The share of energy from protein of total energy imports 10-15%. The use of proteins as an energy source is significantly amplified in the starvation and insufficient import of carbohydrate and fat.

The proteins in the human body are dynamic structures that are constantly updated. It is therefore necessary to constantly bring food. The human body is virtually devoid of reserves of protein, and fats and carbohydrates can not serve as precursors to protein. Single source to replenish the fund amino acid the body and ensuring a balance between the processes of synthesis and degradation of proteins are dietary protein. For a healthy adult is characteristic condition of nitrogen balance. In amplification of the processes of decay occurs negative nitrogen balance. He was seen in full or partial starvation in low-protein and low-energy rations, impaired absorption of protein due to diseases of the digestive system or hard breakdown in the body (massive burns, tuberculosis, tumors). A positive nitrogen balance is observed in children, adolescents, pregnant women, nursing mothers, after illness when processes of protein anabolism are accelerated.

◆ Absorption of proteins

Dietary proteins are broken down in the intestines to amino acids, which are sucked through the intestinal barrier by active transport along with the amino acids, were formed in the breakdown of the body's own proteins, constitute the amino acid pool, which is mainly used for the synthesis of their own protein. The intake and absorption of protein is a complex process that depends on many factors, among which are essential composition of food, the balance between amino acids, culinary food handling. Absorption of proteins from different food products ranges from 75 to 98%.

◆ Abnormal proteins intake

Protein deficiency. Prolonged lack of protein in the diet leads to increased protein catabolism for energy generation and a negative nitrogen balance. Reduce the intensity of the basic exchange, heat production, the contents of serum proteins. In children, slow growth and development. One of the earliest events is the reduction of defenses, the body becomes more sensitive to adverse environmental factors - hypothermia, infection, industrial poisons. The earliest signal of protein deficiency is reduced mental capacity. Due to poor digestion deteriorates the absorption of fat, carbohydrates, minerals and vitamins, are aggravated course of some defficient diseases primarily hypo-and avitaminosis. Protein starvation and lack of energy are the basis of protein energy malnutrition (kvashiorkor and marasmus). *Overfeeding with proteins.* Due to the high reactivity their excess is tolerated harder than excess of carbohydrates or fats. Especially susceptible are young children and the elderly. Difficult primarily digestion, in the gut intensify decay processes and accumulate toxic products. The liver is overloaded by the huge amount of products from their intermediate metabolism. Prolonged excess of protein in food leads to metabolic acidosis, agitation of the nervous system,

disturbances in the metabolism of vitamins and others.

◆ **Structural elements**

Amino acids. They are essential building blocks of proteins. Known 80 amino acids, for human matter 22, entering the composition of food products.

Non replaceable (essential) amino acids. In the human body can not synthesize all the necessary amino acids, but also the possibilities for converting them into each other are limited. The amino acids that can not be synthesized in the body and must be supplied with the diet, are non replaceable (essential). For their complete assimilation is necessary to have a balance not only between themselves, but also with replaceable. In the human body can not synthesize and need to be introduced with the feed 8 amino acids: valine, leucine, isoleucine, threonine, phenylalanine, tryptophan, methionine, lysine. Them in childhood was added and histidine.

Essential amino acids are required for the synthesis of proteins in the cell, but each of them has specific functions.

• *Methionine* is a major dietary source of labile methyl groups necessary for the synthesis of primary lipotropic compound - choline, a pyrimidine base thymine, adrenaline and others. Methionine plays an important role in the metabolism of nicotine and folic acid, histamine, lipids, phospholipids, vitamin B_{12}. Of methionine in the body can be synthesized nonessential sulfur-containing amino acids cystine and cysteine. Methionine and other sulfur-containing amino acids are involved in a number of detoxification processes in the body which determines their importance in professional protective diet.

• *Lysine* is one of the essential amino acids and together with tryptophan and methionine serves to assess the biological value of the protein. A deficit of lysine in the diet violated nitrogen balance, haematopoietic, bone calcification. Plant products, except legumes and nuts, are deficient in lysine.

• *Leucine and isoleucine* are precursors of acetoacetic acid. Leucine is the "growth" amino acid. The lack of isoleucine leads to negative nitrogen balance.

• *Tryptophan* is the precursor of nicotinic acid and serotonin, is needed for the growth and maintenance of nitrogen balance, together with lysine and methionine serves to assess the biological value of the protein. It is necessary for synthesis of nicotinic acid and its deficit is one of the reasons for the development of pellagra. The protein of maize - zein was deficient in tryptophan.

• *Phenylalanine* is necessary for the synthesis of tyrosine and through - the functions of the thyroid and adrenals.

• *Histidine*, growth amino acid, was converted to the decarboxylation of histamine, which is a powerful mediator tissue, stimulates the secretion of hydrochloric acid in the stomach, is involved in the synthesis of hemoglobin and the like.

Replaceable (non essential) amino acids. They are not less important for the organism, but can be synthesized from intermediate metabolites of the metabolism and metabolize one another.

• S*ulfur-containing amino acids cystine and cysteine*, in addition to common function with methionine, together with a glutamic acid and glycine are involved in the synthesis of glutathione.

• *Glutamic acid*, a major component of the wheat protein gliadin, is important to the function of the central nervous system, for the disposal of ammonia, for the synthesis of hemoglobin; It has detoxifying and cytoprotective properties.

• *Arginine* is associated with growth, involved in the synthesis of urea in the liver.

• *Alanine* is one of the main substrates for gluconeogenesis.

• *Tyrosine* involved in the construction of the catecholamines, of thyroid hormones and so on.

For the construction of the own proteins human organism needs equally from essential, and the non essential amino acids in optimal ratios. The absence or lack of one essential amino acid limits the use of others for their own synthesis of proteins. Lately, however, it makes the assessment that the limiting factor is "replaceable nitrogen" and not essential amino acids. For proper functioning of protein synthesis is important not only the amount of the dietary amino acids is sufficient, but the ratio of their in food ration to be similar to their ratio in organism proteins **(Table. 9.10)**.

◆ ***Biological value of proteins***

Importance of various dietary protein to the body is determined by their biological value, which depends on the content of essential amino acids and the absorption of proteins. The biological value of proteins expressed degree of retention of nitrogen from food into body growth of the young organism and for maintaining nitrogen balance in adult. It can be gauged by chemical or biological methods, allowing food proteins can be classified by their relative benefit to man. The most commonly used method of chemical (amino acid) score. Compare amino acid composition (the quantities of amino acids) of the test protein with those of appropriate protein standards **(Table. 9.11)**.

The biological value of dietary protein is determined in relation to the amino acid with the largest deficit (the most limiting amino acid). Knowing the

Table 9.10. Necessities of essential amino acids for different age groups (FAO/WHO, 1986)

Amino acids	mg/kg Bodyweight			
	Infants (3-4 months)	Children up 2 year	Students (10-12 year)	Adulthood
Histidine	28	?	?	?
Isoleucine	70	31	28	10
Leucine	161	73	44	14
Lysine	103	64	44	12
Methionine + cystine	58	27	22	13
Phenylalanine + tyrosine	125	59	22	14
Threonine	87	37	28	7
Tryptophan	17	12	3	3
Valine	93	38	25	10

Table 9.11. Balance formula of amino acid composition in complete (standard) dietary protein per 100 g protein (%)

Amino acid	%
1. Isoleucine	4,0
2. Leucine	7,0
3. Lysine	5,5
4. Sulfur containing (methionine + cystine)	3,5
5. Aromatic (phenylalanine and tyrosine)	6,0
6. Threonine	4,0
7. Tryptophan	1,0
8. Valine	5,0
Ratio H:0 = 1:2,8*	Total: 36,0
* H – essential amino acids O – total amino acids	

Table 9.12. Protein content in some food products (in g/100 g of net product)

Product	Proteins
Milk cow	3,1-3,8
Whole cottage cheese	13,2
Cottage cheese from skimmed milk	17,2
White brined cheese	16,9-17,1
Yellow cheese	24,4-25,8
Mackerel ocean	24,3
Meat chicken	21,6
Beef	18,9-21,9
Porcine	9,8-21-9
Hen egg	12,9
Green peas	6,7
Beans, lentils	23,0
Peanuts	26,5
Walnuts	14,8
Almonds	15,0
Oat flakes	13,0
Rice	7,4
Wheat	12,1-14,0
Corn	11,8
Bread "Dobrudzha"	7,1
Bread "Graham"	7,8

biological value of the proteins in foodstuffs allows the proper selection and combination.

◆ **Sources of protein**

Sources of protein are foods of animal and plant origin **(Table. 9.12)**.

Complete are proteins that contain balanced proportions of essential amino acids - protein from meat and meat products, milk and dairy products, fish, eggs, nuts. Most plant products are of insufficient content of one, even two or three essential amino acids. In cereals, flour, bread and pasta relatively little lysine, in corn - tryptophan, potatoes and some pulses - methionine and cysteine.

The quantity and quality of protein determine the nature of nutrition. Animal proteins provide a qualitative balance of amino acids, and the plant depends much receipt of the necessary body nitrogen.

◆ **Body's need for protein**

Depends on the age, sex, weight, physiological condition, characteristics of labour and production environment. According to WHO recommendations, the energy imports of protein should be 10-15% of total energy imports. These limits shall be amended depending on age, gender and intensity of physical labour **(Table. 9.13)**.

Recommended benchmarks for average daily in-

Table 9.13. Share of proteins of the energy value of food

Age (years)	Intensity of physical labor	Energy rates (%)	
		man	womman
1-19	_	13,0	13,0
	low	12,0	12,5
19-60	moderate	11,5	12,0
	high	11,0	11,5
	very high	10,5	–
60-75	–	12,5	13,0
over 75	–	13,0	13,5

take (RDI) * protein are presented in **Table. 9.8.**

9.2.7.2. FATS

Fats (lipids) are a heterogeneous group of organic compounds and components of cells in a living organism. In the body synthesize of fat food, carbohydrates, if in excess, very rarely - of proteins. Partially deposited as a reserve in fat stores and are reserve food material in the event of a significant energy consumption. For human nutrition the most important are triglycerides, fatty acids, sterols, phospholipids and fat-soluble vitamins.

◆ Biological function

The biological role of fat is too diverse.

Source of energy. They are a major source of energy. The energy equivalent of 1 g of grease was 37,7 kJ (9 kcal). Around 40-50% of released from oxidation in the body's energy is stored in macroergic links.

Plastic function. Lipids play an important plastic function. Together with proteins involved in building cells, subcellular organelles and tissues. Especially significant is the role in the construction of the cell membranes and intracellular formations - nuclei, mitochondria, ribosomes, lysosomes, etc.. The important role of lipids plastic testify and specific lipid composition, and fatty acid spectrum of various tissues and organs. The gonads are rich in phospholipids, of polyunsaturated fatty acids, esterified fat; adrenal cortex contains high amounts of cholesterol esters; brain tissue is made up of phospholipids.

With dietary fat in the body brings several substances with high biological value. Fats are the sole source of essential fatty acids, solvents and carriers of fat-soluble vitamins. Lipid regulating the composition and metabolism of plasma lipid transport - lipoproteins.

Through its effects on plasma lipoproteins, on platelet activity and rheological properties of the blood, dietary fats play a role of factors modifying the atherogenic risk.

Fat in the body involved in the regulation of water exchange, preventing the loss of water through the cover tissue. Themselves are a source of fat "internal water", forming in the course of their oxidation.

Fats are important for culinary and technological processing of food products, improving the taste of food; help maintain a feeling of fullness after eating; affect the absorption of other nutrients; stimulate bile secretion, incretory pancreatic function and motility. Grease influence the functional status of the nervous system (tonic or irritating, depending on the quantity), increase the resistivity of the organism from adverse environmental factors. They are an important factor in saving proteins in the body.

◆ Disorders in fat intake

Limit fat. During prolonged and substantial reduction of fat in the diet reduces weight, growth and development is slow, degenerative changes occur in the liver, kidneys, central nervous system, ectodermal formations, visual analyser; weaken defenses. Lack of polyunsaturated fatty acids, phospholipids and cholesterol is important for the clinical protein-energy malnutrition.

Excess of fat. Leads to increased body weight and obesity, disturbances in the digestion and absorption of food, in the functions of the pancreas and liver, while limiting and carbohydrates - contributes to the development of acidosis. High fat meal stimulates the secretion of bile acids, which are a risk factor for colon cancer. It is believed that overfeeding of fat increases the risk of developing a neoplasm and in other locations (breast cancer).

◆ The structural components of the fat

Biological role and significance of dietary fats are determined by the content of a number of substances with high biological activity: phospholipids, fatty acids, fat soluble vitamins and sterols.

• Fatty acids

They determine significantly the properties of fat - physically, taste, biologycal. Divide on saturated and unsaturated.

* RDI - Recommended Daily Intake

Saturated fatty acids. Found in large quantities in animal fats. The greater is their molecular weight, the higher is the melting point and less than the absorption rate. High-molecular - stearic, arachidic, palmitic - have a solid consistency and a high melting point. They are in larger quantities in bovine and sheep tallow. Low molecular weight - oleiferous, capronic, caprylic and others are liquid, more are in the milk fat and give them a specific taste and smell. In biological properties saturated fatty acids, retreat of unsaturated. With saturated fatty acids are associated perceptions of their negative impact on fat metabolism, the status and functions of the liver. These, depending on the ratio of cholesterol, determined atherogenic potential of various animal products and play a role in the formation of atherogenic risk.

Unsaturated fatty acids. They are widely present in fats, particularly vegetable oils **(Table. 9.14)**.

The most commonly occurring unsaturated fatty acids with one, two and three double bonds, and in fish oil - and 4, 5 and 6 double bonds. Unsaturated fatty acids are:

1. Monoenic (with one double bond - oleic acid).

2. Polyenic (with more than one double bond).

• *Monoenic oleic acid* is most spread. It represents about 30% of unsaturated fatty acids. It is found in large quantities in sunflower, corn, pumpkin, especially in olive oil (up 90%). Oleic acid plays an important role in maintaining the level of blood lipids. It has proved its ability to reduce cholesterol in low-density lipoprotein, without changing its content in high-density lipoprotein. It is not as prone to oxidation as linolenic.

To polyunsaturated fatty acids include essential α-fatty acids (EFAs), linoleic - with two double bonds; linolenic - 3 double bonds, and arachidic (C - 20: 4), derived from linolenic. They are not synthesized from animal organisms, but only in plants and are imported mainly by vegetable fats. PUFA to refer eicosopentaenoic and dokosopentaenoic (clupanodonic - S - 22: 5) fatty acid from fish oil.

• *Linoleic* acid, except for the plant is contained in some animal fats - dairy, poultry, fish, but with age of the animal reduces its contents. From there, through intermediate stages, are prepared dihomogama-lin-

Table 9.14. Content of essential fatty acids in certain products (g/100 g feed)

Food product	Linoleic acid (C – 18:2)	Arachidic acid (C – 20:4)	α- linolenic acid (C- 18:3)
Sunflower oil	66,9	–	–
Soybean oil	49,7	–	7,07
Butter	1,3	0,28	0,5
Fish oil	1,3	0,28	0,5
Peanut (cashew)	13,58	–	0,37
Eggs (whole)	1,13	0,15	0,04
Liver (lamb, raw)	0,38	0,39	0,29
Beef (lean)	0,16	0,05	0,05
Lamb meat (lean)	0,17	0,05	0,08
Chicken	0,14	0,03	0,01
Fish (white)	0,03	0,09	0,01
Oatmeal	333	–	0,18
Wheat flour (Wholemeal)	0,83	–	0,06
Green beans	0,05	–	0,06
Spinach	0,05	–	0,25

olenic and arachidonic acid. For the synthesis of arachidonic acid in the body is needed vitamin B_6. These fatty acids are precursors of the two series of biologically active tissue hormone - endoperoxide: prostaglandins, prostacyclins, thromboxanes and leukotrienes. They play a crucial role in the regulation of vascular tonus and the tone of smooth muscle organs. Involved in steroidogenesis, in the reproductive functions, in platelet aggregation, have lypolitic effect at the level of fat.

• *The third essential fatty acid - a-linolenic*, is a precursor of fatty acids having 5 and 6 double bonds, - eicosapentaenoic and docoahexaenoic. Eicosapentaenoic fatty acid is a starting material for endoperoxide of series III, and pronounced antithrombotic and alleged anti-atherogenic effect. EFA and their derivatives are necessary to ensure the optimal composition of phospholipids in the membrane structures.

PUFA's exert a normalizing effect on blood vessel walls, increasing elasticity and reduce their permeability. They are linked to metabolism of vitamins B_1 and B_6; promote the deposition of fat-soluble vitamins in the body; contribute to the synthesis of choline in the organism and enhance its lipotropic effect; increasing the resistivity of the organism to adverse environmental factors. PUFA and EFA have hypolipidemic and hypocholesterolemic action and hypotensive effect, improves functional status of the heart muscle.

PUFA are biologically active in natural appearance. Under the effect of high temperatures or prolonged storage, especially for direct access to sunlight, they are inactivated. Therefore, the most appropriate is the vegetable oils to be used without heat treatment (in salads).

The shortage of PUFA's in food hampers growth and development of young organism and adversely affect the health of the elderly; reduced elasticity of the vessel wall and immunological reactivity; increases cholesterol in the blood; to suppress reproductive functions; occur kidney and skin changes.

The considerable content of polyunsaturated fatty acids in vegetable fat contributes to the formation of aggressive toxic products, and this can cause damage to liver and kidneys. The uncontrolled introduction of food, there is a risk of auto-oxidation of lipids of the membrane level. It is proven, but unconfirmed in human, that eats too high content of polyunsaturated fatty acids have a carcinogenic effect. Diets rich in EFAs and low in cholesterol, increase the frequency of biliary lithiasis in humans.

• Lipoids (phospholipids and sterols)

This complex lipids, involved in the composition of all cells.

Phospholipids. Phospholipids are the major component of the protoplasm fat. They are an essential component of a plastic cell and subcellular membranes and intracellular structures - nuclei, ribosomes, mitochondria and the like. The content of phospholipids is particularly large in the nervous tissue, especially in brain, phospholipids have a lipotropic action, contributing to the transport of neutral fats in the liver, are stabilizers of lipoproteins.

• *Lecithin.* Chief representative of phospholipids is lecithin. It has lipotropic action, related to the presence of choline in its composition, prevents deposition of excessive amounts of cholesterol and promotes its removal from the body. Lecithin accelerates oxidation processes, promotes deposition of protein in the body, bile secretion, formation of red blood cells and the synthesis of hemoglobin. Lecithin and other phospholipids of food, play an important role in the formation of lypotropic, anti-atherogenic focus of the ration, and therefore must be regularly included in the diet of older people. No lesser role are for growing organism, especially for the proper development and functioning of the central nervous system.

Rich in lecithin are: egg yolk - 8.6%, unrefined vegetable oils - from 1.5 to 4.0%, milk fat - up to 0.4%, cereal grains and seeds - about 0.7%, oats, legumes, nuts, fish, roe. Lecithin may be synthesized in the body from choline and PUFA.

Sterols. The sterols are required structural components of every living cell. They stabilize cell membranes, increasing the rigidity, reducing the ionic permeability. Plant sterols are; sitoergosterol, steosterol and others. Rich in phytosterols are unrefined vegetable oils, germ of seeds, mushrooms. Most plant sterols are sucked actively in the small intestine and competitively inhibit the absorption of cholesterol.

• *Cholesterol.* The human body prevailed animal sterols and foremost - cholesterol. It is widespread in animal organisms in free and esterified form. Cholesterol is involved in the construction of membrane structures, predecessor of the adrenal and sex hormones, is needed for the synthesis of vitamin D_3; bound saponin and other toxic products in the digestive system; facilitates the absorption of fatty acids through the intestinal mucosa and their transport in the blood.

Dietary sources of cholesterol are: fat meats, some internal organs (liver, kidneys - up to 400 mg%), brain - to 3000 mg%, eggs - 470 mg%, milk fat - up to 190 mg%. Imports of cholesterol by food is 200 to 700 mg per day and more. Endogenous biosynthesis is several times greater than the exogenous import. It is influenced by both-exogenous import, and the

nature of the fatty acids entering the food. At predominantly saturate fatty acids - it increases. The amount of imported dietary cholesterol is particularly important in disturbances in metabolism and in plasma cholesterol transport. When disturbances in lipoprotein metabolism, increased concentration of cholesterol in plasma is considered as a factor of the atherogenic risk. In this regard, the WHO recommends that the amount of cholesterol, incoming daily intake to no more than 300 mg.

◆ Biological value of fat

Digestion and absorption of fat carried in the intestines. Plant and animal fats are digested in 90-98%.

Fatty acids and triglycerides of short and medium-chain, contained relatively more in milk fats are deposited less fat mass, which determines their high biological value, in particular in such diseases such as diabetes, obesity, hyperlipoproteinemia, etc.

◆ Needs organism of fat

Depends on the age, sex, physiological state, the energy expense, of the climate and production microclimate. The allowable percentage of energy from fat should be 15-30%, for children up to 10 years - up to 32%. According to WHO energy percentages of fats are a measure of the rationality of nutrition. The lower this percentage, the feeding is more rational. Vegetable oils, mainly providing the necessary import EFA, must be between 6 and 10 percent of energy imports and not more than 28% of the total fat in the diet **(table. 9.15)**.

Recommended intake of unsaturated fatty acids are recommended to be no more than 3-7% saturated - up to 10% on energy imports. Preventive focus of nutrition in modern conditions it is recommended to reduce the consumption of fat, of saturated fatty acids and cholesterol.

Table 9.15. Recommended fat intake

Age (year)	Sex	Intensity of physical labor	Fats, g/day	
			total	vegetable
19-60	m	low	90	25
	f	low	70	20
	m	moderate	103	29
	f	moderate	77	22
	m	high	117	33
	f	high	83	23
60-75	m	–	70	20
	f	–	61	17
over 75	m	–	67	19
	f	–	58	16

9.2.7.3. CARBOHYDRATES

Carbohydrates are the most accessible food ingredient. Represent 55-75% (E%)* of the total amount of nutrients in the diet. They are a major supplier of energy needed to perform all vital processes and muscle activity. The energy equivalent of 1 g of carbohydrate was 16,7 kJ (4 kcal). As a high-energy source they have a protective effect to proteins.

◆ Biological function of carbohydrates

Carbohydrates, associated in complexes with lipids and proteins, involved in plastic processes. They play an important role in the synthesis of amino- and nucleic acids, glycoproteins and other vital substances. Absorbed by the body, help maintain a certain level of blood sugar and serve for the synthesis of glycogen. Some carbohydrates have specific biological activities and play an important role in the human body:

- *Ascorbic acid is an important redox vitamin.*
- *Heparin is a powerful anticoagulant.*
- *Lactose of women milk and hyaluronic acid possess bacteriostatic effect.*
- *Heteropolysaccharide in blood determine the specificity of blood groups and the like.*

◆ Disorders of intake of carbohydrates

Increased imports. The excess of carbohydrates can lead to amplification of lipogenesis, increased fat deposition in landfills, obesity. Frequent consumption of carbohydrate foods, especially sticky consistency, has cariesogenic action. Too many carbohydrates in childhood, adversely affected immunological reactivity.

Limited intake. Excessive restriction of carbohydrate intake can lead to metabolic disorders; increased oxidation of endogenous lipids, accompanied by enhanced ketogenesis and accumulation of ketone bodies in the body, expressed intensification of the processes of gluconeogenesis and protein catabolism for energy needs.

In food carbohydrates are in the form of mono-, oligo- and polysaccharides.

◆ Types of carbohydrates

• Monosaccharides (simple sugars)

Monosaccharides (trioses, tetroses, pentoses and hexoses) containing 3-7 carbon atoms in the chemical structure. For the man prevailed hexoses (glucose, fructose, galactose). Simple sugars are water soluble. Final degradation products of other sugars, they are directly absorbed by the small intestine.

Under the influence of high temperature melt and caramelize. They are sensitive to the fermentation (by the brewer's yeast) at which decompose to carbon dioxide and alcohol.

Glucose. It is most common in nature monosaccharide. In the free state occurs in almost all fruits **(Table. 9.16)**, but most is in grapes, cherries, raspberries, strawberries, some vegetables (carrots, cabbage).

Table 9.16. Contents of glucose fructose and sucrose in some fruits and vegetables (g/100 g)

Product	Glucose	Fructose	Sugar
Apples	2,0	5,5	1,5
Pears	1,8	5,2	2,2
Peaches	2,0	1,5	6,0
Tangerines	2,0	1,6	4,5
Plums	2,5	1,5	4,8
Cherries	5,5	4,5	1,3
Choke -cherries	5,5	4,5	0,6
Grapes	7,8	7,7	0,5
Strawberries	2,7	2,4	1,1
Raspberries	3,9	3,9	0,5
Blackcurrant	1,5	4,2	1,0
Watermelons	2,4	4,3	2,0
Melons	1,1	2,0	5,9
Cabbage	2,6	1,6	0,4
Tomatoes	1,6	1,2	0,7
Carrots	2,5	1,0	3,5
Beet	0,3	0,1	8,6
Pumpkins	2,6	0,9	0,5

It is the main product of the digestion of carbohydrates in the body, basic blood sugar and mainly metabolic fuel. Glucose is structural material of polysaccharides and is a component of sucrose, lactose and maltose. It is important to maintain blood sugar levels, for the synthesis of glycogen and create a depot in the liver and muscles.

Glucose is rapidly sucked into the lining of the small intestine, and quickly enters the blood and hence - in the cells of various organs and tissues, where they are involved in a process of biological oxidation. Absorbance it is influenced by the condition of the organism. A deficiency of vitamins (B_6,

* E% - share of total energy value of food.

B_1, pantothenic acid), prolonged malnutrition, infections, intoxication and others, worsed absorbance.

Glucose is the most easily used (in comparison with other nutrients) energy source. Oxidation it is associated with formation of considerable amounts of ATP. Its role is particularly important for central nervous system (most important substrate oxidation). In all cases of great physical load glucose it can be used as a source of energy and quickly meet the body's sugar. It is an effective means for maintaining the body after surgery and severe exhaustion after illness. In excess, then restock the liver, glucose quickly turns into triglycerides that are deposited in the reserve depots.

Fructose. It is less common than glucose. It participates in the composition of sucrose and some hemicelluloses and also serves as a fast source of energy. In free states found in honey and many fruits. Richer in fructose are pome fruits. Fructose more slowly absorbed and more rapidly removed from the blood, the larger part is retained in the liver in the form of glycogen, in the other organs and tissues more easily and completely be recovered due to more efficient involvement in metabolic processes. The activity of the enzymes, involved in the metabolism, it is not associated with insulin; due to the greater its sweetness with significantly less fructose can achieve satisfactory sweetness, i.e. to limit the use of sugar.

Galactose. Does not occur in the free state in nature. It is a component of lactose and participate in the construction of the cerebrosides and indigestible hemicellulose.

Mannose. Also not found in the free state in nature. In vegetables in the form of mannosan - partially digestible polysaccharide.

Pentoses. Not found in the free state in food and in the body enter by nucleoproteides of meat and fish. More important are ribose, a component of riboflavin and RNA and DNA, of nucleoproteides, ATP and many co-enzymes.

- **Oligosaccharides**

Oligosaccharides are more complicated compounds composed of 2 to 10 monosaccharides residues - disaccharides, trisaccharides, etc.. For human nutrition the most important are disaccharides - sucrose, lactose, maltose.

Sucrose. Enter inlarge quantities of food in comparison to other disaccharides is of the greatest importance for human nutrition. After digestion to glucose and fructose is quickly sucked through the lining of the intestine to the blood and serves as a highly bioavailable source of energy. It is one of the most important precursors of glycogen and triglycerides. Almost pure sucrose (up 99.9%) is refined sugar. It is manufactured from sugar beet, in which the sucrose content is 14-18%, and from sugar cane (10-15% sucrose). Natural source of sucrose, honey and some fruit. Rich in sucrose are melons, peaches, tangerines, plums, carrots.

The excess sucrose taken with food, becomes a spare fat. Overfeeding with sucrose stimulates endogenous synthesis of cholesterol and maintain consistently high levels in blood serum. Excess sucrose adversely affect normal intestinal microflora, amplified decay processes. High intake of sucrose leads to hyperglycemia, which especially in the frequent repetition, causes exhaustion of insular apparatus.

Lactose (milk sugar). It is found only in milk and some dairy products. It has a least sweetness. The main source of energy for children in infancy. In the digestive system, under the influence of the enzyme lactase breaks down into glucose and galactose. Hydrolysis of lactose in the intestine proceeds slowly, thereby stimulating the development of lactic acid bacteria and suppress putrefactive microflora. Compared with other sugars lactose least serve for the synthesis of fat and cholesterol. Lactose facilitates intestinal absorption of calcium. In different milks its content is about 4, 5% in breast - about 7%.

Maltose (malt sugar). It is an intermediate product from the degradation of starch. It consists of two glucose molecules. In the free state occurs in honey, beer, malt and products made with yeast.

Trisaccharides. From trisaccharides best known is raffinose (fructose, glucose, galactose), which in the free state is found in legumens, rye, sugar beet and other vegetable products.

- **Polysaccharides**

Complicated carbohydrates (polysaccharides) are complex compounds containing more than 10 sugar units with different levels of digestibility. They are sugar similar – starch and glycogen, and no sugar similar (indigestible) - cellulose, hemicellulose, pectins, and the like (dietary fiber).

Starch. It is a depot of carbohydrates in plants, accruing in grains and tubers them. Most starch person gets from daily consumption of bread and pasta. Starch is composed of two polysaccharides - amylose (20%) and amylopectin (80%). Amylose is soluble and treatment with hot water forms a clear colloidal solution, while amylopectin is insoluble. Their content in different types of starch (wheat, potato, oats) is different, which affects its properties.

Starch is digested difficult and it is necessary pretreatment products for softening and rupture of cellular cellulose casings and its partial degradation to

dextrin. The gradual disintegration and absorption of starch does not cause hyperglycemia, glycogenesis is normal and the liver is no overburdened. In comparison with mono- and disaccharides it to a lesser extent are used by the body for the synthesis of fat, but overfeeding of products rich in starch, resulting in positive of energy balance, enhancement of lipogenesis, increase of body weight.

Inulin. This is similar to starch polysaccharide contained in some tubers (Jerusalem artichoke), mushrooms, dandelion and others.

Glycogen (animal starch). He was a reserve carbohydrate of animal tissues. As direct food has little meaning, since shortly after the killing of animals destroyed. In the human body contains approximately 500 g of glycogen, from which 1/8 of the liver and to 2/3 - in the muscles. Under normal conditions the glycogen in the liver up to 20% of its total mass and muscle - 0.5-2%. Liver glycogen is the main source of glucose in the blood and is used as an energy material for working muscles and organs. When a food is not do enough carbohydrates, glycogen stores decreased, and this leads to enhancing the fatty acid oxidation and gluconeogenesis. Excess carbohydrates entering the food is converted into glycogen, which is deposited in tissues as depot.

◆ Assimilation of carbohydrates

In the digestive tract under the influence of saliva and especially pancreatic amylase carbohydrates are degraded progressively to dextrin, maltose, fructose, galactose, and finally to glucose. Importance of good digestion is right cooked through which the cellulosic skeleton is destroyed and the action of digestive juices is facilitated. Resorption, in the form of simple sugars is performed in the small intestine. If for glucose absorption is considered to be 100, to galactose 119, fructose - 43, to mannose - 9.

Carbohydrates have high assimilation: from confectionery - up 95%, from bread, pasta, potatoes - 93- 95%, milk - 98% fruit - about 90%, from vegetables - about 85%. Sucrose is assimilated almost completely - 99%.

◆ Body's need for carbohydrates

Satisfies exclusively from vegetable products **(Table. 9.17)**.

Needs depend mainly on energy consumption.

Carbohydrates should provide no less than 55% of the energy value of the daily ration **(table. 9.18)**.

The recommended average daily amounts for different age, gender and professional groups of 178 to 564 g **(Table. 9.19)**.

When designing the ration it is necessary not only generally meet the needs of the body from carbohydrates, but also to select optimal ratios in products supplied as easy-and hard assimilated carbohydrates. According to WHO recommendations for healthy eating sugar should not provide more than 10% of energy imports (up 10%). Needs of carbohydrates increase in hypothermia, nervous tension, emotional stress. In short considerable energy

Table 9.17. Main sources of carbohydrates (g/100g net product)

Product	Carbohydrates
Bread wheat	43-50
Rye bread	42-45
Rice	72
Pulse	55-58
Potatoes	20
Nuts	16-19
Fruits	10-18
Fruit preserves	20-76
Pastry	60-70
Sweets	40-80
Honey	78
Sugar	99

Table 9.18. Share of carbohydrates from the energy value of food

Age (years)	Intensity of physical labor	Energy rates	
		man	woman
1-7	–	55,0	55,0
7-10	–	56,0	56,0
10-19	–	57,0	57,0
	low	58,0	57,5
19-60	moderate	58,5	58,0
	high	59,0	58,5
60-75		58,5	58,0
over 75		58,0	57,5

Table 9.19. Recommended carbohydrate intake

Age (years)	Sex	Intensity of physical labor	Carbohydrates g/day
19-60	m	low	392
	f	low	302
	m	moderate	454
	f	moderate	333
	m	high	516
	f	high	366
60-75	m	–	322
	f	–	277
over 75	m	–	306
	f	–	259

expense it is important to use easy assimilated, fast supply energy carbohydrates.

9.2.7.4. FIBER (FOOD FIBERS, BALLAST SUBSTANCES)

Fiber, normal constituent of plant products are a heterogeneous group of compounds with different structure and physico-chemical properties.

◆ Types of fiber

Classifications of fiber are associated with their structure, properties and biological activity **(Table. 9.20)**.

Table 9.20. Classification of fiber (at R. Kay)

Chemical structure:
1. Polysaccharides: cellulose, hemicellulose, pectin, slimy substances (resins), clay, seaweed polysaccharides (agar-agar and the like.).
2. Lignins.

Biological:
1. Structural fibers (cellulose, hemicellulose, pectins, lignins).
2. Resins and mucilaginous substances (gum arabic, acacia resin).
3. Spare polysaccharides (guaran etc.).

Depending on the solubility in water:
1. Water-soluble (pectin, hemicelluloses, some, slimy substances).
2. Water insoluble (cellulose, lignins, some hemicelluloses, agar-agar).

Table 9.21. Pectin content (in g/100g product)

Food product	*Pectin*
Cabbage white	*0,6*
Potatoes	*0,5*
Carrots	*0,6*
Cucumbers	*0,7*
Fruits	*0,4*
Beet	*1,1*
Watermelons	*0,5*
Melons	*0,4*
Apricots	*0,7*
Pears	*0,6*
Peaches	*0,7*
Prunes	*0,9*
Apples	*1,0*
Oranges	*0,6*
Grapes	*0,7*
Strawberries	*0,7*

Cellulose. Cellulose is the most common structural polysaccharide. It participates in the composition of the shell of the plant cells associated with hemicellulose and pectin. Do not be degraded by digestive enzymes of man, but some intestinal bacteria produce an enzyme - cellulase, who hit it breaks into soluble, partially suction connections. The more gentle is cellulose, more fully decomposed (pulp of potatoes, vegetables). Many cellulose is in cereals, bran, rye and wholegrain bread, legumes, cabbage and more.

Hemicellulose. Hemicellulose is also a widespread non digestible polysaccharide, component of the cell envelope of the plants, mainly performs a supporting function. It has a more delicate structure of the cellulose and an easier to be degraded by the enzymes of the intestinal microflora.

Pectins. Pectins accompany the cellulose and hemicellulose in the composition of the cellular skeleton in the barrier and the supporting tissue of the plants and their fruit **(Table. 9.21)**.

They are high molecular acidic mucopolysaccharides, derivatives of galacturonic acid part of the carboxyl groups of which are esterified with residues of methyl alcohol. Depending on the degree of methylation of the carboxyl groups, the pectins are divided into low - and high esterified. Their main feature is a water in the presence of organic acids and sugars, to form a jelly. Gelling ability is proportional to the degree of esterification. In fruits - apples, quinces, cornels, pears, apricots, lemons and more, pectins are usually high esterified, and in vegetables - beetroot carrots, etc., and sunflower seed - low- and moderate esteriefid. In green fruit pectins are associated with cellulose and hemicellulose into insoluble complexes - protopectins. In the ripening of fruit the connections are broken, to give pectin, the texture of the fruit becomes softer.

Agar-agar. It is a heteropolysaccharide which is derived from seaweed. Does not dissolve in water, but forms a solid gel.

Mucous substances. Mucilaginous substances in oats are soluble homopolysaccharides - beta-glucans. In the small intestine was partially digested by digestive enzymes, and in the large - ferment. Because of these properties, they prevent the degradation of intracellular proteins, fats and carbohydrates of oat grains and reduce their absorption.

◆ Biological function

The biological action of the fiber is related to the physico-chemical properties. They increase the volume of food and the feeling of satiety after eating. Fiber influence digestion, absorption and metabolism of nutrients through the absorption of water

and bile acids, gelation, exchange of cations, alter the absorption of glucose, cholesterol, medicinal agents, toxins.

Insufficient use of a fiber of the modern people is one of the reasons for the increase in the frequency of a number of metabolic diseases - obesity, hyperlipoproteinemia, diabetes mellitus, coronary artery disease, cholelithiasis, gout and the like. Numerous studies have shown the role of poor fiber diets and the emergence of certain diseases of the digestive system: diverticulosis, polyps, colon cancer and others. The importance of fiber for the prevention of colon cancer is associated with their influence on the transit time of food in the intestines. Moreover, fiber inhibit the growth of anaerobic microorganisms and exert a normalizing effect on intestinal flora. Upon of degradation acidic products are formed that protect mucous membrane of the malignant degeneration, help to remove mutagenic substances, to reduce free ammonia in the gut. Bring out cholesterol and bile acids, fiber maintain a certain level enterohepatic circulation of bile stones and development of cholelithiasis. Therefore expressed their absorption properties, the simultaneous intake of considerable quantities, reduces the absorption of protein, vitamins, mineral substances (calcium, iron, zinc, copper, magnesium).

Mucous substances, pectins and guarena have the ability to connect not only water but also endo- and exogenous toxins (aflatoxins, radionuclides, different chemical compounds). The property of pectins, especially low- and moderate esterified, to bind metal ions with high catalytic activity - chelation, with heavy metals (lead, mercury, cadmium, strontium, etc.), is used to the protect professional catering. Excess pectin can, however, reduce the absorption of vitamin B_{12}. Pectin and beta- glucans have hypocholesterolemic and hypolipidemic pronounced effect due to their high sorption capacity. Pectins increasing satiety in the stomach and have more expressed, compared to the other fiber, a normalizing effect on glucose tolerance. Hypocholesterolemic action of beta-glucans are associated with their active involvement in the catabolism of cholesterol and fatty acids, with changes in liver production of lipoproteins. Cellulose and lignin have less effect on lipid and carbohydrate metabolism compared to pectins, but affect the motor and secretory function of the stomach and intestine and on intestinal microflora, and thus help to reduce serum lipids and normalize impaired glucose tolerance.

◆ Sources of fiber

Fiber supplied exclusively from plant products. The reduced consumption of fiber is associated with reduced use of cereals and whole grain products **(Table. 9.22)**.

Table 9.22. Content of fiber in food products (in g/100 g product) (in D. Sauthgate et all., 1976)

Food product	*Total amount of fiber*
Bran	*44*
Peanuts	*9,30*
Whole grain bread	*8,50*
Beans	*7,28*
Peas	*6,28*
Carrots	*3,70*
Potatoes	*3,20*
Cabbage	*2,83*
White bread	*2,72*
Peaches	*2,28*
Salad	*1,53*
Plums	*1,52*
Apples	*1,42*
Cherries	*1,24*

This reduction can not be compensated only by consuming more fruits and vegetables.

Daily intake should be taken 25-30 g fiber. This is especially important for aging and older people, for people with hypokinesia and suffering from constipation.

9.2.7.5. MINERAL SUBSTANCES

Mineral substances involved in plastic processes - primarily in building bone and teeth: in maintaining acid-base status; normal saline composition of blood and form elements; in an aqueous salt exchange; in the activity of the endocrine glands and cofactors of enzyme systems - in the regulation of vital processes in the body. Depending on the effect on acid-base status of the body contained in the mineral food elements are divided into alkali (potassium, sodium, calcium, magnesium) and acidifying (phosphorus, sulfur, chlorine). As an independent group - biomicroelements (trace elements) - are separated mineral elements whose content in tissues is between 10^{-3} and 10^{-5}%. To this group include: iron, copper, zinc, cobalt, iodine, fluorine, selenium, manganese, nickel, chromium, strontium, and the like.

◆ **Mineral elements alkalising**

• Calcium

In the body of an adult contains calcium 1200-1500 g, 99% of which is connected to bones and teeth.

Biological function. Calcium is a permanent part of the blood and cell structures. The ions impart a stability of cell membranes and regulate the active transport of ions, binding of thiamine to membrane structures of nerve cells. Calcium is an activator of several enzymes and hormones, necessary for the processes of coagulation, of glycogenolysis in muscle, normal excitation of the nervous system and muscle contraction, assists nonspecific immunity.

Assimilation of calcium. The assimilation of calcium from food is carried out by active transport in the upper small intestine and is regulated by 1,25-dihydrocholecalciferol. In mixed feeding is normally absorbed (by an adult) about 30% of calcium; more - children and pregnant women. The absorption of calcium is favoured by acidic pH, vitamin D, an adequate amount of protein, due to the action of amino acids (especially serine, arginine and lysine), of sufficient content of unsaturated fatty acids, the lactose and citric acid, which form soluble complexes. What matters is the relationship calcium: phosphorus in the diet, that optimal intake of them is 1: 1.5. Excess animal protein rich in phosphorus can cause an imbalance in this respect and to increase calcium needs. A deficiency of protein, polyunsaturated fatty acids and vitamin E in food slows the absorption of calcium in the small intestine. Free fatty acids bind calcium into insoluble calcium soaps, that excreted from the colon. To the factors limiting the absorption and utilization of calcium from food, refer excess carbohydrates, phosphates, fiber, phytic and oxalic acid. They can put calcium into insoluble compounds. Rich in phytic acid are cereals, but in rising of the dough, under the influence of phytase in yeast, phytic acid is decomposed and its ability to bind calcium decreases. Weaker absorption of calcium from fruits and vegetables is due to oxalic acid.

Sources. Most rich of easy assimilated calcium salts are milk (about 125 mg%), cheeses - 500 mg%, curd - 160 mg%, which produce 70% of the required amount of calcium to the body. In breast milk has about 300 mg% calcium with a very high degree of absorption. 2-3 cups for adults and for children 3-4 glasses of milk a day, enough to meet the daily needs of calcium. From plant products relatively more calcium there is in white cabbage (50 mg%), potatoes - 18-35 mg%, fruits (peaches, apricots, strawberries, raspberries).

The recommended amounts of calcium for various adult-sex groups are presented in **Table. 9.23**.

• Magnesium

In the adult organism has 20-35 g magnesium greater part of which is in the bone, complexed with calcium and phosphorous. Magnesium, together with calcium, is the main intracellular ion - only about 2% is extracellular.

Biological function. Magnesium, as a cofactor for a number of enzyme systems, is actively involved in carbohydrate, and phosphorus-energy metabolism, in the synthesis of nucleic acids, in the process of oxidative phosphorylation. Magnesium is involved in the absorption of lipid, the formation of chylomicrons in the metabolism of circulating lipids, in conducting nerve impulses. Plays an important role in the functioning of the cardiovascular system; it has antispasmodic and vasodilating action. Magnesium has a calming effect on the central nervous system. Promotes the excretion of excess water from the meninges, which is very important in hypertension, meningitis. It strengthens the antioxidant action of β-carotene and vitamin E.

Deficiency of magnesium leads to deposition of calcium and loss of potassium from the cells. There is evidence that increases susceptibility to peroxidation of lipoproteins. Amplified constrictive action of noradrenaline and angiotensin. In the serum content of free cholesterol and triglyceride increases, and esterified cholesterol - decreased. Elastin in the walls of arteries also decreased. In the vascular wall, in the heart and muscles, especially for carbohydrate-rich food, are deposited calcium salts.

Assimilation of magnesium. When mixed meal, is absorbed in the small intestine 40-50% of the magnesium in the diet, factors which inhibit the absorption, are: an excess of fat (especially rich in saturated fatty acids), phosphates, oxalic and phytic acid, fiber

(wheat bran). Since calcium and magnesium compete in the intestinal absorption, the high content of one in the diet increases the need for the other. Changes in the balance lead to neuromuscular irritation. The optimum ratio of absorption for calcium and magnesium was 1: 0.6.

Sources. Magnesium is widespread in foods and at mixed diet needs body satisfy without the risk of deficiency. Most rich are cereals (80-180 mg%), oats, pulses (up to 240 mg%), cabbage - 25 mg%, fruits -15-20 mg°/o), tea.

For adult recommended daily intake should do about 330 mg magnesium **(Table. 9.23)**.

Pregnant, amount increased by 40-80 mg, and nursing - 40 mg. Needs are growing also in the presence of stressors.

- **Potassium**

Most potassium is contained in the cells of muscles, liver, skin, myocardium.

Biological function. Potassium plays an important role in maintaining fluid and electrolyte balance in the processes of water movement between intra- and extracellular spaces. It is necessary for the persistence of acid-base status, contributes to the removal of sodium and fluid excretion, triggering enolase, regulate intracellular osmotic pressure, plays an important role in conducting nerve impulses and normal heartbeat. Potassium is involved in acetylcholine synthesis, glycogen and protein in the cell, metabolism of carbohydrates, affects the activity of several enzyme systems. The potassium ion is a physiological antagonist of sodium and calcium ion.

Sources. Rich in potassium are leafy vegetables (onions, green garlic, rhubarb, spinach, salads) - 250-900 mg%, potatoes - up to 500 mg%, pulses - 500-1200 mg%, fruits (cherries, choke-cherries, strawberries, apricots, plums, raspberries) -150-900 mg%, cabbage - 300 mg%. Since animal products are relatively rich fish, beef and veal. Rich in potassium are nuts (walnuts, hazelnuts, peanuts) - 450-835 mg%.

Daily requirements of potassium for an adult is 4000-5000 mg.

- **Sodium**

Biological functions. Sodium is the most important cation of extracellular fluid - blood serum, lymph and the like, which together with chlorine provides the osmotic pressure of biological fluids. Ions his cause swelling of tissue colloids and contribute to water retention in the body. The salts of sodium - hydrocarbons and phosphate, are involved in buffer systems for the maintenance of acid-base status of the body. Sodium is necessary for the activity of the renal epithelium, enters into the composition of the digestive juices of the intestines and helps create necessary for digestion in the intestinal alkaline environment. Together with calcium, potassium, magnesium and hydrogen cations maintain neuromuscular excitability.

Sources. Natural sodium content in food products is negligible. Such as sodium chloride is present in small quantities mainly in animal products - fish, especially marine, meat, eggs.

Usually one taken daily 10-15 g sodium chloride, of which 3-5 g - contained in nutrient products of

Table 9.23. Recommended daily intake of minerals

Category	Age (years, months)	Sex	Calcium mg	Phosphorus mg	Magnesium mg
Infants	0 – 6 m		210	100	30
	6 – 12 m		270	270	50
Children and adolescents	1-3		500	500	80
	3-7		800	550	120
	7-10		1000	700	160
	10-14	m	1300	1250	250
	14-19		1300	1250	370
	10-14	f	1300	1250	250
	14-19		1300	1250	320
Adults	19-30	m	1000	700	330
	30-60		1000	700	330
	60-75		1200	700	330
	75+		1200	700	330
	19-30	f	1000	700	280
	30-60		1000	700	280
	60-75		1200	700	280
	75+		1200	700	280

the menu, 3-5 g - the bread and the remainder - with added salt. According to WHO recommendations, salt consumption must be limited to 7 g/d.

Excess sodium in the body can occur with prolonged use of increased amounts of salt. Develops hypernatraemia to fluid retention in the body, increasing the output of potassium, increase in the excitability of the nervous system and the rest of nitrogen in the blood.

The interval safe levels of sodium for an adult is 575 to 2600 mg/day.

◆ **Mineral elements with an acidic action**

• **Phosphorus**

In the body of an adult contains 600-900 g phosphor, 80-90% of which is in the bones, associated with calcium as calcium phosphate and organic compounds.

Biological function. Phosphorus has important structural and metabolic functions. Furthermore, in the construction of bone, such as phospholipids involved in the construction of cellular membranes, subcellular organelles, nuclei, mitochondria, in the composition is of nucleotides and nucleic acids (DNA and RNA). Phosphoric anion - $P0_4^{2-}$, enters into the composition of most of the enzymes. Macroergic phosphorus compounds - adenosine triphosphate (ATP) and creatine phosphate, accumulated energy required for biosynthesis of the compounds, conducting nerve impulses, transmembrane transport of substances, muscle contraction. Phosphorus plays a leading role in the functions of the central nervous system. It participates in the construction of buffer systems, activation of B vitamins; much phosphorus compounds with protein, with fats and other acids have significant biological activity. They include nucleoproteins cell nuclei, phosphoproteides (casein), phospholipids (lecithin, kefalin, sphingomyelin).

Assimilation of phosphorus. The assimilation of phosphorus is carried out in the small intestine in the form of inorganic phosphate. For the assimilation of dietary phosphate is required decomposition of its organic compounds to inorganic phosphate from the intestinal phosphatase. The efficiency of absorption depends on the Ca: P in gut (optimal is 1:1.5). Excess of calcium binds phosphorus in insoluble triphosphate and assimilation decreases. Normally, when mixed diet, are assimilated to 70% of the phosphorus of the feed, factors affecting the absorption of calcium, and interfere with the assimilation of phosphorus. A deficiency of vitamin D and the presence of it binding agents, such as iron, calcium, aluminum, can lead to inhibition of assimilation.

Most foods are rich in phosphorus and mixed diet deficient in phosphorus of alimentary origin practically does not exist. A more serious problem in many cases is an excess of phosphorus in the diet. It is therefore particularly important in the diet to maintain optimal assimilation respect to calcium.

Sources. Most rich easy assimilated phosphorus are milk and dairy products in which the ratio of calcium is close to optimal. Significantly phosphorus content in meat, fish, legumes, internal organs (liver, kidneys) - up to 380 mg%, egg yolk - 590 mg%, pulses - 350-500 mg%, nuts - up to 380 mg%, potatoes, cabbage and more.

The needs of the phosphor depends on the content of proteins, fats and carbohydrates in food. To increase during pregnancy and lactation, in exposure to lead, aluminum, manganese. Adult required 700 mg/day.

• **Chlorine**

Chlorine is the most important anion of biological fluids in the body. Together with sodium involved in the regulation of the osmotic pressure in the cell and the water exchange, in the synthesis of hydrochloric acid from the gastric glands. Absorbed mainly in the stomach and in the large intestine. In food products the content of chlorine is minimized, available mainly of salt and other chlorides - calcium, potassium.

The range of safe intake for an adult is 900 to 3800 mg/day.

• **Sulfur**

In the human body contains about 175 g sulfur. It is present in all cellular proteins in the form of amino acids cysteine and methionine. It is a constituent of mucopolysaccharides, involved in building tendons, cartilage, skin, bones, nails, contained in insulin, thiamine, biotin, bile acids (taurine), coenzyme A, glutathione. It plays an important role in the mechanisms of detoxification and maintenance of acide-base balance.

Sources are mainly products of animal origin: meat beef, pork - 220-230 mg%, marine fish - about 220 mg%, poultry and eggs -180-190 mg%, milk and dairy products - 25-30 mg%.

Sulfur needs are not accurately identified, but a diet adequate in methionine and cysteine is adequate and sulfur **(Table. 9.24)**.

◆ **Trace elements/biomicroelements**

• **Iron**

Biological functions. Iron plays a vital role in transporting oxygen and energy production and is therefore an essential component of any diet. It is found in the body in very small quantities - approximately 4 g for adult man (2,5 g - woman). In the body, iron is in two forms - heme and noheme. About 3 g are an active and functional form, as a component of he-

Table 9.24. Macroelements (summary) (in C. Luke, 1984)

Element	Site of absorption	Primary functions	Interaction with other elements	Route of administration	Food sources
Calcium	Upper small intestine	Bone and tooth structure Coagulation Nervous excitability Muscle contraction	Zinc Fluoride	Large intestine	Milk and milk products
Phosphorus	Upper small intestine	Bone and tooth structure The composition of DNA and RNA Phosphorylation Participation in buffer systems Composition of vitamin B Transport - phosphate groups	Calcium Fluoride	Large intestine	Milk and dairy products, meat, eggs, pulses
Magnesium	Small intestine	Transmembrane transport Electric potential of the nerves and muscles	Calcium Phosphorus Manganese	Kidneys	Cereals, nuts, vegetables
Potassium	Small intestine	Fluid and electrolyte balance Acid-base status Regulate intracellular osmotic pressure Participation in buffer systems diuretic action Synthesis of acetylcholine, glycogen in the cells beltachnii	Sodium Magnesium	Kidneys	Vegetables, fruit, nuts
Sulfur	Small intestine	Ingredient of teeth, bone, cartilage, thiamine		Large intestine	Milk, meat, eggs, pulses

moglobin and myoglobin, cytochromes and a redox enzyme catalase, peroxidase and cytochromoxydase. About 15% of body iron depot as a reserve in the form of ferritin and hemosiderin in the liver and spleen, and the minimum part in transport form, associated with protein transferrin.

Assimilation of iron. The assimilation of iron takes place in the duodenum and upper jejunum. Iron in hemoglobin and myoglobin is drawn completely out of the cells of the intestinal mucosa, without suffering changes and is not affected by the other ingredients of the ration. Absorbance is increased in an acidic environment in which the trivalent iron is converted into divalent. Noheme iron is less assimilated and less influenced by other ingredients of the ration. Absorption is more efficient in the presence of ascorbic acid, sulfur-containing amino acids, fructose.

Phosphates, oxalates and phytates, forming insoluble compounds, as well as increased fiber content of the diet, inhibit the absorption of iron. Tea (presence of tannin) and coffee (presence of polyphenol) also inhibit the absorption of noheme iron. In case of mixed feeding the bioavailability of iron is 10-15%.

Meaning a functional state of the stomach, pancreas, liver, intensity of erythropoiesis, the state of stocks of iron in the body, of the specific mechanisms in the relevant organism. The rate of absorption is greater in women, increases during pregnancy and iron deficiency states.

Sources. Relatively much iron there is in leafy vegetables (2,7-3,9 mg%), in pulses (6-9 mg%), in some fruit, rich in blood organs (spleen, liver, kidneys, meat). The easy absorption of iron from fruits (apricots, apples, quinces, peaches) is explained by its favourable combination with fructose, ascorbic and other organic acids and rutin. Of leafy vegetables (presence of oxalates) and cereals (presence of phytates) iron was digested to a lesser extent.

Availability, respectively absorption of noheme iron is classified as low, medium, and high **(Table. 9.25)**.

The body needs iron. The average daily needs of iron, according to the age, sex and physiological conditions are 6-18 mg/day. The needs of women are iron 2 times greater than men (12 mg/day), but because of the greater efficiency of the suction recommended 15-18 mg/day. Pregnant increased by a further 9 mg, and for breastfeeding - with 4 mg/day. The needs for iron are greater in periods of growth, spurts in blood loss, occupational exposure to toxic substances (lead, manganese, aniline, benzene), a deficit of oxygen (climbers, workers in caissons)

Table 9.25. Availability of iron from various feed rations (in C. Luke, 1984)

Type of food ration	*Absorption of iron from the diet (%)*	
	nonheme	*heme*
Food ration with low accessibility *<30 grams of meat, fish, poultry <25 mg ascorbic acid*	*3*	*23*
Food ration with an average accessibility *30-90 g meat, fish, poultry or 25-75 mg ascorbic acid*	*5*	*23*
Food ration with high availability *> 90 g of meat, fish, poultry or> 75 mg ascorbic or complex and 30-90 g meat, fish, poultry + 25-75 mg ascorbic acid*	*8*	*23*

- **Zinc**

In the body of an adult man containing 2-3 g zinc, of which 99% is intracellular. They have relatively high concentrations in bones, teeth, liver, pancreas, brain, prostate, testicles.

Biological function. Zinc is a vital trace element for normal growth, development and puberty, to maintain reproductive and immunological status, blood formation, taste and smell, trauma healing and tissue repair. Molecular mechanisms of action associated with participation in the structure and function of many enzyme systems (carboanhydrase, alkoholdehydrogenase, alkaline phosphatase, carbopeptidase etc.). Zinc is involved in the biosynthesis of proteins and nucleic acids in the construction and function of cellular membranes and intracellular structures, ingredient is insulin, potentiates hypoglycemic effect and the effect of pituitary hormones has lipotropic action.

When mixed diet, is absorbed in the upper small intestine 20-40% of the dietary zinc. Its assimilation from animal products is greater than the plant. Increased amounts of calcium, phytates and fiber (hemicellulose) inhibit intestinal absorption, associating zinc in insoluble complexes.

Sources. Meat, poultry, fish and other seafood. Milk and dairy products are low in zinc.

With food the man should receive 8-11 mg of zinc daily. Needs increase during pregnancy (+3 mg) and lactation (+ 4-5 mg), exposure to lead.

- **Cuprum**

In the body of an adult contains an average of 75-150 mg copper. Its concentration is highest in the liver, brain, heart and kidneys.

About 50% of the copper is in muscle and bone tissues. Copper is sucked from the upper part of the small intestine and partially - in the stomach.

Biological function. The biological role of copper is linked to the participation in the construction of a number of enzymes and proteins (cytochromoxydase, tyrosinase, monoamineoxidase, superoxydismutase, ceruloplasmin, etc.). Copper is involved in the regulation of biological processes of oxidation and generation of ATP, in the synthesis of important connective proteins - collagen, elastin, in the metabolism of iron, in the antioxidant defenses. Enhances hypoglycaemic effect of insulin and activity of hormones of the pituitary gland.

Sources. The richest by copper is the liver. Copper is easily assimilated by meat, fish, seafood. From plant products relatively rich in copper are legumes, oats, walnuts, mushrooms, cocoa; cow's milk is low in copper.

For adult recommended by daily diet to enter 0,7-1 mg copper.

- **Iodine**

In the body of an adult contains about 20-50 mg iodine. 1/3 is concentrated in the thyroid gland and the remainder is distributed in the muscles, skin, bones and other endocrine glands.

Biological function. Iodine is required exclusively for the synthesis of thyroid hormones. In insufficient food imports, especially in biogeochemical provinces, hypertrophied thyroid gland - goiter. Insufficient imports of iodine is a necessary condition for the occurrence of the disease, but have important genetic factors, violations in hormonogenesis and others. Some food products, e. cabbage and vegetables from the family "cruciferous", especially in some areas contain thiocyanates and similar compounds, linking iodine can also cause disturbances in the synthesis of thyroid hormones.

Sources. More than 90% of the required the body iodine is obtained with food. Richest are seafood: fish, about 135 μg, marine cabbage - 200-220 μg, algae -160-800 μg. By moving away from the coast iodine in the biosphere reduced. From plant products relatively rich in iodine are legumes (beans, lentils), nuts (walnuts, peanuts), garlic, spinach, cherries, potatoes, bananas and others. When camping and cooked, products lose 14-65% of iodine. For the prevention of endemic goiter recommended the use of iodized salt. Improper storage and preparation of food, iodine in iodized salt reduced by 20-60%.

Daily necessities are 90 μg to children, 150 μg to adults. During pregnancy and lactation - + 100-140 μg.

- **Fluorine**

Fluorine (as fluoride-ionized fluorine) participate in the development of dentin and enamel, in bone formation and phosphorous-calcium metabolism.

Biological function. It has a protective role against dental caries and osteoporosis, so it is regarded as essential biomicroelement. It is very important in early childhood and school age, when you build your teeth.

Absorbed predominantly in the small intestine, and less in the stomach, depending on the content of calcium, phosphorus, magnesium and silicon in food, which forms insoluble complexes.

In the body (in the bone skeleton) retained about 50% of the dietary intake fluorides.

Sources. Fluoride is found in many foods, but in small quantities, depending on the geochemical characteristics of the area. They are rich seafood (fish, oysters, crabs, etc.), liver, meat (up to 3 mg%,), eggs, cheese, and the plant - walnuts, cherries, grapes, lettuces, cabbage, carrots, cereals (wheat), oatmeal, tea (especially green is seen as a "battery" of fluoride, but most excreted noassimilated). At feed fluorine is digested with 20% less than water. Approximately 2/3 of the required quantities of the body are supplied with drinking water and beverages.

For adult recommended 1.5 to 4,0 mg/day, for children of different ages - from 0,1 to 1,5 mg/day.

- **Manganese**

Manganese is an essential element for many animal species and humans. In the adult organism is 12-20 mg manganese. Particularly high content in brain, liver, kidneys, pancreas.

Biological function. Manganese is needed for normal growth and maintenance of reproductive functions; participates in the process of osteogenesis and erythropoiesis, in the normal metabolism of the connective tissue, in the regulation of carbohydrate and lipid metabolism. Component has a number of enzyme systems involved in the energy and protein metabolism, in the synthesis of mucopolysaccharides, prothrombin, in gluconeogenesis. Manganese stimulates the synthesis of cholesterol, have hypoglycemic action.

Manganese is poorly absorbed in the small intestine.

Sources. Main plant products - cereals, pulses, nuts. Relatively rich are liver, rice, green leafy vegetables, mushrooms.

The daily needs are from 0.5 to 5 mg.

- **Chromium**

In the body of an adult is 6-12 mg chromium compounds of trivalent chromium. Located mainly in the skin, bones and muscles. With age and disease of diabetes chromium in the body decreases.

Of chromium, adopted by the food are absorbed small amounts (0.5-5%).

The biological role of chromium is associated with its involvement in the regulation of fat and carbohydrate metabolism, especially in the maintenance of normal glucose tolerance.

Sources. The content of chromium in foods is very small. When mixed meal enters the body in quantities slightly exceeding the lower limit of the physiological needs of an adult. Good sources of chromium are brewer's yeast, meat products, cheese, whole grains, legumes. Poor chromium are green leafy vegetables, polished rice, sugar.

With food should be given from 50 to 200 μg chromium.

- **Selenium**

Selenium is a trace element essential to human. Has antioxidant properties, the synergistic and mutually potentiated with those of Vitamin E. Selenium protects membrane lipids from oxidation, increases the body's resistance to adverse environmental factors. Associated with some metals (mercury, cadmium, lead) to form less toxic compounds. It is experimentally proven protective role against neoplasms.

Sources. From plant products relatively rich in selenium include: soy beans, wheat bran and germ, corn, bread, peanuts, and by animal - fish, especially herring and other seafood (crab, shrimp, squid), liver, kidney, eggs, honey. Prevent with the absorption excess of refined carbohydrates and oligosaccharides **(Table. 9.26)**.

As **needed daily** necessities indicate from 0.01 to 0,04 mg for children from infancy to 14 years and 0,055 mg for adults.

- **Cobalt**

Cobalt is involved in the composition of the vitamin B, stimulates the synthesis of hemoglobin and reticulocytes, contributes to assimilation of a number of vitamins in the body, affects the activity of certain enzymes (bone - and intestinal phosphatase).

Sources. Relatively rich in cobalt are liver, kidney, fish and seafood, milk, beans, beets, oatmeal, strawberries.

- **Strontium**

Strontium is involved in bone formation. Retention in the body depends on the type of food and increases with age. When food low in calcium, retention of strontium in the body increases (a condition known as strontium rickets in animals - i.e. Urovska disease in humans), where rich - decreases.

Table 9.26. Trace elements (summary) (in C. Luke, 1984)

Element	*Site of absorption*	*Primary functions*	*Interaction with other elements*	*Route of excretion*	*Food sources*
Zinc	*Small intestine*	*Metabolism of vitamin A* *Synthesis of DNA, transport* $C0_2$ *Metabolism of protein and glucose* *Complexes with insulin*	*Cuprum* *Calcium*	*Pancreatic and intestinal secretion (large intestine)*	*Meat, eggs, seafood*
Iodine	*Stomach and small intestines*	*Synthesis of thyroid hormones*		*Large intestine*	*Seafood, iodized salt*
Cuprum	*Stomach and small intestines*	*Formation of hemoglobin* *Bone development* *Synthesis of phospholipids* *Formation of pigments* *Maintenance of myelin* *Production of energy*	*Zinc* *Molybdenum*	*Bile (intestine)*	*Nuts, grapes, seafood liver, kidney, vegetables*
Manganese	*Small intestine*	*Synthesis of cartilage* *Development of bones* *Lipid metabolism* *Regulation of nervous excitability* *Hydrolysis of proteins*	*Magnesium*	*Bile (large intestine)*	*Nuts, liver, cereals, vegetables*
Fluoride	*Intestines*	*Bone and tooth structure*	*Manganese* *Phosphorus* *Calcium*	*Kidneys*	*Water*
Chromium	*Intestines*	*Normal glucose tolerance*		*Kidneys*	*Meat, cheese, cereals*
Selenium	*Intestines*	*Antioxidant, synthesis of ATP* *Mechanisms of immunity*	*Sulfur*	*Large intestine*	*Seafood kidney, liver*

9.2.7.6. VITAMINS

In antiquity and then, in relation to the manner and living conditions, specific activities and respective diet, existed knowledge - descriptions and treatment of vitamin deficiency conditions and diseases (avitaminosis). Even in 2697 BC. BC. in Chinese medical book describes the disease "beri-beri." Night blindness was well known in ancient Egypt, it has been applied and topical treatments from juice liver oil. Advanced navigation in Egypt, ancient Greece and Rome and then in the Middle Ages and the great geographical discoveries in XVI-XVIII c. are associated with the problem of scurvy in sailors. In 1747 the British fleet has been applied successfully experimented consumption of lemons and oranges for the prevention of this disease.

In 1911 Casimir Funk (1884-1967), working at the Institute of Lister in London isolate chemical substance amine group of husks of rice and first introduced the concept of **vitamins** (vital amine) - first discovered thiamine and proves its therapeutic action in "berry -berry. "

He introduced the term **vitamin deficiency** and suggests the presence of other vitamins deficiency of which develop scurvy, rickets, pellagra and other avitaminosis. Great research in the study of vitamins in the twentieth century, creating a new science in nutrition science - **vitaminology**.

Vitaminology studied vitamins - low molecular weight organic compounds with different chemical nature. They are extremely important for the body because they are necessary for the proper functioning of all biochemical reactions, the absorption of other nutrients, for growth and repair of cells and tissues. By participating in the biosynthesis of coenzymes and prosthetic group of proteins, play a role of regulators and catalysts for oxidation and reduction processes in the body. Vitamins enhance immunological reactivity and the body's resistance to adverse environmental factors, promote blood formation, the functions of the liver and endocrine glands.

Vitamins are a very close relationship with each other and with other nutrients. The absence or lack of one or a group vitamins can lead to inadequate absorption of others. Absorption and biological activity of vitamins in the body depend on the protein content in food - in protein deficiency and vitamin occurs, despite adequate vitamin intake with food. Shortage of fat in the diet disturbing conversion of carotenoids into vitamin A. Insufficient vitamin A, C, B_1, B_2, B_6, PP in the diet of modern man is associated with the use of smaller quantities, but mostly refined and canned food.

The needs for vitamins depends on age, sex, occupation, climate, physiological condition, working conditions. Significantly influenced by the nature of nutrition. The degree of saturation of the organism with vitamins depend not only on their content in food, but also by the body's ability to synthesize them and used.

If a long time, imports of vitamin intake is inadequate, arise hypo- or avitaminosis. Hypovitaminosis conditions usually occur in winter and spring weather, since then has limited assortment of fresh fruits and vegetables. Hypovitaminosis develop and normal content of vitamins in food, but at elevated needs or poor absorption, increased destruction or accelerated decommissioning of vitamins from the body. When a long time in the body do minor amounts of vitamins, can develop so called subhypovitaminosis conditions. They occur with deterioration of confidence and efficiency of labour and reduce the resistivity to harmful factors. The resulting vitamin deficiency can be avoided by extra vitamins food. The introduction of large amounts of predominantly synthetic vitamins may cause intoxications, however, vitamin intoxications (hypervitaminosis), of which the most common is hypervitaminosis D. On the other hand large amounts of synthetic vitamins increase the activity of enzymes that degrade not only unnecessary, but also other quantities of available vitamins and this may be the cause of the occurrence of hypovitaminosis conditions - vitamin imbalance can occur if a long time to accept one or more synthetic vitamins.

On the content of vitamins in food products and prepared meals affect the original appearance and condition of the product storage conditions (temperature and humidity, light), the type and duration of heat treatment and standing of the finished dish. Upon gradually heating the product in cold water and warmers, activity of oxidative enzymes is retained a long-time and vitamins are destroyed. The presence of starch, glutathione, carotene slows the effect of oxidants, baking soda back - destroys vitamins.

◆ **Water-soluble vitamins**

- **Vitamin B1 (thiamin, aneurine)**

Biological function. The biological role is related to participation as a co-enzyme of many important enzymes in the metabolism of various nutrients, mainly - carbohydrates (oxidative decarboxylation of pyruvic acid to acetyl-Co-enzyme A), is needed for the synthesis of acetylcholine. Vitamin B_1 plays an important role in the metabolism of protein and fat, in the process of preaminity of amino acids. Increases the tone of the intestinal muscles.

Vitamin B_1 deficiency. Leads to disturbances in the oxidation of carbohydrates, accumulation of pyruvic acid and other acid products in blood and tissues, suppresses acetylcholine synthesis. Disabilities arise in the functions of the nervous system (headache, irritability, memory loss, polyneuritis), cardiovascular (chest pain, tachycardia, etc.). Clinical expressions of prolonged and significant vitamin B_1 deficiency are known as disease "beri-beri."

Possible causes of hypovitaminosis B_1: lack of food, mainly with products of fine flour, excess carbohydrates, chronic alcoholism, chronic colitis and enterocolitis. Deficiency in the body can occur by eating raw fish and other seafood, plenty of tea, containing thiaminase and other thiamin antagonists, that can inactivate or to bind the vitamin from food.

Sources. Rich in thiamine are beer's/bread's and yeast. Of food rich are bread and pasta from wholegrain flour, raw rice, oats, legumes, certain varieties of corn, potatoes, cauliflower, and from animal products - liver, kidney, meat (pork, beef). Milk and milk products and vegetables and fruits are low in vitamin B_1.

Vitamin B_1 is stable in acidic media, but is sensitive to heat and alkali. At ambient culinary processing contents in the plates decreases by 10-40%, depending on the pH of the medium. The addition of alkali to rise (baking soda) it destroys and the pasta, so prepared with baking soda, do not contain vitamin B_1. Upon heating of milk 20-30 min at a temperature of 75-80°C to destroy about 25%, and in the sterilized canned reduced by about 60%.

The average daily needs are presented in **Table 9.27**.

The needs are increasing in excess of carbohydrates in the diet, exposure to neurotropic poisons (lead, manganese and others.), during pregnancy and lactation.

- **Vitamin B_2 (riboflavin, lactoflavin)**

Biological function. Vitamin B_2 essential ingredient of flavoprotein co-enzymes - flavin-mononucleotide and flavin adenine-dinucleotide, through which participates in the development of respiratory enzyme systems - flavoproteidi - actively involved in oxidation-reduction processes, and plays an important role in the metabolism of proteins, fats, carbohydrates. Needed to transport oxygen to tissues, for the oxidative degradation of short-chain fatty acid, oxidation of amino acids, purines. Riboflavin, is involved in the construction of the visual purple (improves dark adaptation, night vision and color vision), is needed for the growth and maintenance processes of the epithelium of the mucous membranes. By enzyme systems play a role in the metabolism of other vitamins - folic acid, B_{12}, pyridoxine and others.

Deficiency of vitamin B_2. Prolonged shortages in food:

- *Weakened tissue respiration.*
- *Increase decay of tissue proteins.*
- *Delay growth and body mass in childhood.*
- *There are changes in mucosal: inflammation* of the oral mucosa with vertical cracks and desquamation of the epithelium, angular stoma-

Table 9.27. Recommended average daily intake of water soluble vitamins

Category	Age (years)	Sex	Vit. C (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg NE*)	Vit. B_6 (mg)	Folat (µg)	Vit. B_{12} (µg)
Nurslings	0-6 m. 6-12 m.	m, f m, f	25 30	0,2 0,3	0,3 0,4	2 4	0,1 0,3	65 80	0,4 0,5
children and adolescents	1-3 3-7 7-10	m, f m, f m, f	30 30 35	0,5 0,6 0,9	0,5 0,6 0,9	6 8 12	0,5 0,6 1,0	160 200 300	0,9 1,2 1,8
	10-14 14-19	m	45 75	1,3 1,3	1,3 1,3	16 16	1,3 1,3	400 400	2,4 2,4
	10-14 14-19	f	45 65	1,0 1,0	1,0 1,0	14 14	1,2 1,2	400 400	2,4 2,4
Adults	19-30 30-60 60-75 75+	m	80 80 80 80	1,3 1,3 1,3 1,3	1,3 1,3 1,3 1,3	16 16 16 16	1,3 1,3 1,7 1,7	400 400 400 400	2,4 2,4 2,4 2,4
	19-30 30-60 60-75 75+	f	70 70 70 70	1,1 1, 1 1,1 1,1	1,1 1,1 1,1 1,1	14 14 14 14	1,3 1,3 1,5 1,5	400 400 400 400	2,4 2,4 2,4 2,4

* NE – 1 niacin equivalent = 1 mg niacin or tryptophan 60 mg

titis, glossitis ("geographic tongue"), conjunctivitis, vascularity of the mucous membranes, seborrheic dermatitis.

The main reasons for the deficit indicate: a sharp reduction in the consumption of milk and dairy products, chronic diseases of the digestive system, accompanied with violations of intestinal absorption, medication, antagonists of riboflavin.

Sources. Riboflavin is found in many products of plant and animal origin. Relatively rich are milk, dairy products, offal, meat, eggs, fish, cereals, some vegetables. The bioavailability is greatest from bovine liver (100%), milk (80%) and of cereals - 40-70%. Riboflavin is relatively resistant to heat, acids and oxidizing agents, but is readily destroyed by light, and in an alkaline medium (addition of baking soda). It is poorly soluble in water and ordinary cooked lost 5-40%. When roasting reduced by 25%, while the pasteurization of milk - by 10-20%.

The average adult needs around 1,1-1,3 mg. Increasing at an increased fat content of the diet, when working in excessive heat or cooling microclimate.

- **Vitamin B_3 (pantothenic acid, panthenol)**

Vitamin B_3 (pantothenic acid, panthenol) in the composition of coenzyme A plays an important role in the processes of acetylation in the Krebs cycle, in the degradation of amino acids, in the oxidation of fatty acids and acetylcholine.

Sources. Foods rich in B vitamins, are rich in pantothenic acid: brewer's yeast -12 mg%, liver - 30 mg%, eggs -1,5-2,7 mg%, fish, milk and dairy products - to 0 5 mg%, pulses - 0,6 - 0,8 mg%. In large quantities synthesized by the bacteria in the gut. Vitamin B_3 is soluble in water, stable at ambient culinary preparation, but is destroyed upon standing the product in an alkaline or acidic medium.

B_3 vitamin deficiency has not been established in humans.

- **Vitamin B_6 (pyridoxine, adermin)**

Biologically active are compounds of phosphorus oxidized, respectively aminated pyridoxine-pyridoxal -5 phosphate (PALP) and pyridoxamine-5 phosphate (PAMP).

Biological function. Vitamin B_6 performs vital metabolic functions as a coenzyme in the composition of aminotransferase, involved in the *processes* of transamination, decarboxylation of several amino acids. It is necessary for the synthesis of arachidonic acid from linoleic, for the metabolism of glycogen, regulates the metabolism of cholesterol. Involved in blood formation, has lipotropic action.

Deficiency of vitamin B_6. Deficiency of vitamin B_6 leads to impaired metabolic processes, with signs or symptoms of the nervous system (irritability, somnolence, peripheral polyneuritis), skin and mucous membranes (seborrheic dermatitis, angular stomatitis, cheilitis, conjunctivitis, glossitis). Sometimes, especially in children, B_6 deficiency can lead to microcytic hypochromic anemia. Aside from the alimentary deficiency, B_6 deficiency can occur with prolonged use of anti-tuberculosis preparations antagonists of the vitamin, diseases of the digestive system, inherited defects in the functioning of B_6 dependent enzymes.

Sources. Vitamin B_6 is widely distributed in nature. Relatively rich are liver, meat, certain fish, beans, cereals, potatoes, semolina.

Vitamin B_6 is relatively stable to heat and acids, but is sensitive to light, is degraded in alkaline medium. In freezing and preservation of products the losses are insignificant, and cooked - 20-35%.

Daily needs of vitamin B_6 are presented in **Table 9.27.** They are based protein intake - 0,02 mg B_6/g protein.

- **Vitamin PP (nicotinic acid, nicotinamide, niacin, antipellagrous)**

Main representatives are nicotinic acid and nicotinamide.

Biological function. As a co-enzyme of nicotinamid adeninnucleotide (NAD) and its ester form-nicotinamid dinucleotidphosphat (NADP) in the composition of the redox enzymes - dehydrogenases, involved in the processes of biological oxidation and energy metabolism. The biological role of vitamin PP is associated with the metabolism of protein, in the endocrine regulation of the functions of the nervous, digestive and cardiovascular systems. There lipotropic and vasodilating action. Involved in the metabolism of sulfhydryl compounds and porphyrins in the liver, in the regulation of blood coagulation.

Disorders by intake of vitamin PP

1. Deficiency of vitamin PP. It grows hypovitaminosis, characterized in tiredness, asthenia, muscle aches, insomnia, psychotic and dyspeptic disorders, skin changes. Prolonged and significant deficit developed pellagra (ital. "Pella agra"), whose main events are:

- *Dermatitis.*
- *Inflammatory lesions of the mucous membranes of the mouth and tongue.*
- *Neuropsychic (dementia).*
- *Digestive disorders (diarrhea).*

The incidence of pellagra in some countries is associated with malnutrition (mostly maize containing vitamin PP associated in low assimilated form - niacitin) and enough complete protein in the diet and low content of tryptophan in zein (protein maize). Hypovitaminosis PP may occur in disorders of intestinal absorption, due to illness of the digestive sys-

tem, or prolonged use of anti-tuberculosis agents and antagonists of vitamin B_6, which is needed for the conversion of tryptophan into vitamin PP.

2. An excess of niacin (50 mg/day). It leads to peripheral vasodilatation, skin rash, tachycardia, fatty infiltration of the liver, decrease of blood pressure and serum cholesterol.

Sources. Vitamin PP enters the human body with cereal products - bread, especially whole wheat, bakery products, oatmeal, rice, semolina, beans. Rich in vitamin PP are brewer's yeast, and animal products - liver, kidney, fish. A precursor for forming the niacin in the body is tryptophan. 60 mg of tryptophan is formed about 1 mg of vitamin PP. In this connection, in assessing food sources of niacin should be taken into account and tryptophan in them - ie. niacin equivalents. A niacin equivalent is equal to 1 mg niacin or tryptophan 60 mg. Most niacin equivalents is in meat, eggs, milk, and the least - in corn. Vitamin PP is moderately soluble in warm water and poor - cold. It is stable to heat, alkalis and acids, oxidation. In plain cooked products lose 5-40%. Canning, freezing and drying, little influence its content in food.

Daily needs of vitamin PP increase with age and are highest for men age groups of 14-50 years **(Table. 9.27)**. It is based on the average energy needs for the population group, namely 6,6 mg niacin equivalents/4185 kJ (1000 kcal). Needs vitamin PP increased by imbalance of amino acids and increased fat in the diet.

- **Folacin (vitamin B_9 folic acid)**

Folacin (vitamin B_9, folic acid) with the main representatives folic acid and its active co-enzyme form - tetrahydrofolic acid (folinic acid, leykovorin, citrovorum factor)

Biological function. Plays an important role in the biosynthesis of protein, creatine, nucleic acids, purines, pyrimidines; involved in the synthesis and metabolism of amino acids (methionine, serine, glycine, glutamic acid), vitamins (B_{12}, PP), choline; it has lipotropic and hepatoprotective effect. It is an active antianaemic factor (synergist of vit. B_{12}), necessary for synthesis of hemoglobin and regeneration of erythrocytes in the bone marrow. Due to its participation in the synthesis of proteins and nucleic acids is important for the growth and development of young organisms.

Folic acid deficiency. It is characterized by megaloblastic anemia, similar of pernicious. It is frequent, especially among premature infants, in irrational chemotherapy with sulfonamide preparations, blocking its synthesis of intestinal microflora, in adopting the preparations, that are antagonists of folic acid, chronic alcoholism, chronic enteritis and others. Used in the treatment of Addison - Biermer disease, sprue.

Sources. Leafy vegetables, cauliflower, carrots, almonds, whole wheat flour, oat starch, eggs, cheese, cottage cheese, liver.

Folacin is slightly soluble in water, easily oxidized to light and in an acidic medium. It is labile and decreases its contents during storage of the product at room temperature, and of heat treatment at 80-90% are lost. Losses increase with grinding and continuous cooking of products in water.

The average daily needs are 65-400 μg.

- **Vitamin B12 (cyanocobalamin, antianaemic factor)**

Biological function. The biological role of vitamin B_{12} is associated with his participation as a coenzyme in various enzymatic systems. Plays an important role in the processes of blood formation, metabolism of proteins and carbohydrates, in the synthesis of amino- and nucleic acids, choline, helps increase glycogen stores in the liver, has lipotropic and hypocholesterolemic action. Lipotropic properties associated with active participation in the processes of transmethylation.

Deficiency of vitamin B_{12}. Distort the processes of blood formation, with the development of macrocytic hyperchromic anemia, damage the nervous and digestive system. The reasons for B_{12} avitaminosis can be endo- and exogenous. Alimentary deficiency can occur after prolonged lack of animal protein in the diet (absolute vegetarian), because vitamin B_{12} is present only in animal products. Relative deficiency can occur during pregnancy and chronic alcoholism. To endogenous factors related offenses in the synthesis of intrinsic factor of Castle, hereditary defects in the synthesis of specific transport proteins in diseases of the digestive system.

Sources. Sources of vitamin B_{12} are animal products (meat, milk, cottage cheese, egg yolk) - 0,001 - 0,05 mg%. In limited quantities are also found in some vegetable products - beets, mushrooms, strawberries. In free form of vitamin B_{12} (external factor Castle) is inactive. In the body is absorbed after connecting with gastromucoprotein (internal factor of Castle). Unlike other vitamins in the B group, vitamin B_{12} is completely lacking in bakery and pastry products.

Vitamin B_{12} is poorly soluble in water, stable to heat, but decomposes in acidic or alkaline medium. In plain cooked losses are insignificant.

Daily needs **(Table. 9.27)** are 0,4 μg for nurslings, up to 2,4 μg for children over the age of 10 and adults, without distinction of sex. Increase by 0,2-0,4 μg/day during pregnancy and lactation.

- **Vitamin C (ascorbic acid, antiscorbutik)**

Vitamin C (ascorbic acid, antiscorbutic) in plant

and animal tissues and food occurs in two forms - free (L - ascorbic acid and L - dehydroascorbic acid) and connected - with proteins, nucleic acids, bioflavonoids (ascorbigen).

Biological function. The biological role of vitamin C in the body is mainly related to oxy-reduction action. Participates in many metabolic processes: oxidative phosphorylation, acetylation, etc., reduction of the disulfide bonds of proteins in sulfhydryl, thereby activating enzymes containing SH groups.

Vitamin C is linked to collagen formation, by participating in the hydroxylation of proline and maintain normal permeability of vascular walls, while maintaining their elasticity. It is necessary for the conversion of phenylalanine into tyrosine, for the synthesis of corticosteroid hormones from cholesterol, plays an important role in the metabolism of catecholamines and thyroxine. It has strong antioxidant effect and is involved in intracellular metabolism and function of cell membranes, reduces blood cholesterol and enhances his bring out by bile, promotes deposition of glycogen in the liver and increase it's antitoxic function. Vitamin C affects the use of a number of vitamins - B_1, B_2, B_3, A; synergist is of vitamins A and E in antioxidant defenses of the cell, contributes to the conversion of folic acid into active form. Significant influence on the reactivity of the body and increases its resistance to adverse environmental factors and to emotional distress; promotes regeneration of tissues; has a protective effect against some toxic substances (lead, manganese, mercury, aniline nitosamines, hydrogen sulfide, etc.).

Defiiciency of vitamin C. Develops in principle at low content in food. Hypovitaminosis C is characterized by general weakness, decreased performance and rapid fatigue, increased capillary fragility and tendency to bleeding, joint pain, growth retardation, pale skin and mucous membranes, reduced resistance to infections and some toxins, irritability, bleeding gums. Damage to the synthesis of collagen intracellular substances.

In a systematic and prolonged shortage or complete absence of ascorbic acid in the diet developed scurvy.

Main reasons for hypovitaminosis C, especially hidden forms, according to modern authors are incorrect weight loss diets, lack of breakfast or poor breakfast (containing insufficient protein), smoking, use of canned and cooked foods.

Sources. Especially rich in vitamin C are ripe rose hips (up to 1200 mg%), which do not contain askorbinaza, destroying vitamin C, hawthorn berry, meadow grass (clover, alfalfa), pine needles. Main sources in the diet of people are fruits and vegetables. Most are rich red peppers, in which vitamin C, because binding protein, is stable, leafy vegetables - herbs - parsley, dill (100-182 mg%); significant amounts contained in watermelons, melons, citrus and others. Breast milk contains 30-50 mg% vit. C.

Vitamin C is easily oxidized and is unstable. Improper and prolonged storage of fruits and vegetables (high temperature and low humidity, access to sunlight), irrational cooked (long simmering, especially in open court, long standing in water, warmers dishes) contribute to substantial reductions vitamin content. For the oxidation of vitamin C helps chlorine from the drinking water and the presence of metal ions (iron, copper), oxygen, alkali; oxidative enzymes and salt accelerate the destruction. The rate of destruction increases in proportion to the heating temperature. Stabilizing influenced flour, starch, sugar, glutathione, bioflavonoids, tannic substances, organic acids, phytoncides of the onion and garlic.

The needs for vitamin C are shown in **Table 9.27.** They are higher (per kg body weight) for children. Adult healthy person is 70-80 mg. Larger have in smoking (about 40%), acceptance of oral contraceptives, in emotional distress, presence of adverse environmental factors ("ecological stress"), exposure to high temperatures, toxic substances, vibrations.

- **Vitamin P (citrine, rutin, bioflavonoids)**

Vitamin P (lat. permeabilitas - permeability) have capillary strenghtened action. Reduce the permeability of the vascular walls; potentiate the action of vitamin C and help deposition in the body. Bioflavonoids activated oxidation processes in tissues, have antihistamine and hypotensive action.

Deficiency of vitamin P. Deficiency in the body, due of alimentary insufficiency, often combined with deficiency of other vitamins, leading to increased capillary fragility, tendency to haemorrhage, malaise, infirmity, rapid fatigue.

Sources. Bioflavonoids are widespread in plant products. They are rich rosehips, citrus fruits, berries, peppers, grapes. In general, fruits and vegetables rich in vitamin C, contain sufficient amounts of vitamin P. Tea contains catechins, possessing the activity of vitamins P.

- **Vitamin H (Biotin)**

Vitamin H (biotin) as a co-enzyme of several enzyme systems involved in the metabolism of proteins, carbohydrates, in deamination of threonine, aspartic acid, serine, stimulates the synthesis of unsaturated fatty acids in the liver, is involved in the synthesis of purine bases and is required for the conversion of tryptophan into nicotinic acid, for growth, the construction of the skin and ectodermal forma-

tions (hair, nails), bone marrow.

Sources. Vitamin H is widespread. Located in yeast (brewer's and baker's yeast), liver, kidney, egg yolk, carrots, tomatoes, raspberries, peaches and more.

Biotin is resistant to high temperatures, light and acids, but in an alkaline environment is unstable.

- **Lipoic acid (vitamin N)**

Lipoic acid (vitamin N) participates in the process of biological oxidation, related to the protein, especially lysine. Involved in the metabolism of proteins, fats and carbohydrates, has an antioxidative effect on ascorbic acid and tocopherols. It has expressed protective properties against a variety of toxic substances (arsenic, mercury, lead, etc.). There lipotropic properties. At insufficiency develop so call "Pyruvism" - a state of compensated metabolic acidosis (increase of pyruvate), polyneuritic syndrome.

Sources. Relatively rich in lipoic acid are milk, beef liver, rice, leafy vegetables. Needs about 0,5 mg/day.

- **Vitamin-like substances**

They have a number of properties intrinsic for vitamins, without meeting all the requirements to them. Vitamin - like substances play an important role in metabolic processes in the body.

Orotic acid (vitamin B_{13}). Orotic acid stimulates the synthesis of proteins, methionine, nucleic acids, beneficial effect on the liver; involved in the metabolism of folacin and metabolism of pantothenic acid. It is found in yeast, liver, dairy products and others.

Pangamic acid (vitamin B_{15}). The most important and essential to pangamic acid lies in its lipotropic properties and its functions of donor of unstable methyl groups. She is involved in the processes of transmethylation, in the synthesis of creatinephosphates through it - in energy processes, improves tissue respiration and use of oxygen by tissues, ie it is an important antisclerotic factor. Pangamic acid is considered as a factor normalizing lipid metabolism.

Choline. Choline is a source of labile specific methyl groups, important ingredient for lecithin, and acetylcholine; affects cholesterol metabolism, detoxify a number of toxic substances. It is a powerful antisclerotic and lipotropic factor. Stimulating effect on lipotropic activity of choline have PUFA - arachidonic, linoleic, and depressing - thiamine and nicotinic acid.

Sources of choline are mainly products of animal origin: beef liver - 635 mg%, bovine kidneys - 320 mg%, eggs - 252 mg%, oats - 200 mg%, less - in meat, wheat bread, cottage cheese, cow milk.

Inositol. Inositol is expressed lipotrpic, sedatives and antiketogenic properties and helps to reduce serum cholesterol. In vegetable foods in the form of phytic acid. Especially high-inositol has a brain and muscles, in many vegetables and fruits, eggs, liver, fish, poultry. Cereals, especially wheat bran are rich in inositol, but there it is in the form of phytin - hard degradable, unassimilated from the body.

Vitamin U (S-methylmethioninesulfonchloride, "antiulcus factor"). It is donor of unstable methyl groups, possesses anti-ulcer, anti-histamine, antiatherosclerotic action. Contained in the cabbage, beets, parsley and other leafy vegetables, ripe tomatoes, potatoes, carrots, pumpkins and more.

Vitamin U is thermolabile. When cooking cabbage, depending on the duration, losing 3-65%. Well remained a long time in the frozen and canned products.

p-Aminobenzoic acid (PABA). Participates in the composition of folic and folinic acid - leykovorin, and plays a role in numerous physiological processes - metabolism of biogenic amines, synthesis of purines and pyrimidines, decreases the secretion of thyroid hormones, slows down the action of adrenaline.

It is widespread in nature, but are rich in animal products - liver, kidneys, muscles, cow's milk, eggs.

In summary, water soluble vitamins are presented in **Table. 9.28.**

◆ **Fat-soluble vitamins**

- **Vitamin A (group vitamins A, retinol, axerophthol)**

Vitamins Group A include a substantial number of compounds, most important of which are: retinol, retinal, retinoic acid, esters of retinol. In the food products contained as esters (retinyl acetate, retinyl palmitate, etc.), and as provitamins-carotenoids. Importance for human nutrition are alpha-, beta- and gamma- carotenoids. The greatest activity is a beta-carotene, from which, by hydrolysis of 1 molecule was obtained 2 molecules of vitamin A.

Biological function. Vitamin A is multilateral action in the human body. It is necessary for proper growth and development of the young organism, for normal synthesis of protein, mucoproteins, mucopolysaccharides, progesterone, epithelium formation and sustainability of the epithelium and ectodermal formations, for the development of bones and teeth, for spermatogenesis. Vitamin A affects lipid metabolism and processes of they peroxide oxidation.

Participate in photochemical processes, basis of light perception (for resynthesis of visual purple-rhodopsin). It plays an important role in humoral and tissue immunity. Beta-carotene exhibits antioxidant properties - can neutralize oxygen radicals and free radical oxidation of unsaturated fatty acids. Experimental studies prove his involvement in anti-tumor immunity.

Table 9.28. Water-soluble vitamins (summary)

Vitamin	Basic functions	Events deficit	Result of toxicity	Sources	Daily need
B_1 thiamine	*Exchanging carbohydrates Formation of energy Supports transmission of nerve impuls Regulates the metabolism of proteins, fats Digestion Growth*	*Slow growth Degeneration of the nervous system anorexia Psychiatric disorders Muscle atrophy Beri-beri*	*Swollen Tremor Tachycardia Fatty infiltration of the liver*	*Brewer's yeast, bran cereals, bread and pasta from whole-grain flour, raw rice, oatmeal, legumes, liver, kidney, meat, etc.*	*0,5 - 1,3 mg*
B_2 riboflavin	*Participation in the respiratory enzymes (oxidation processes) Construction of visual purple Keeping the epithelium of the mucous membranes growth*	*Angular stomatitis Glossitis Conjunctivitis Photophobia Seborrheic dermatitis*	*Non-toxic*	*Milk, dairy products guts, meat, eggs, fish, cereals*	*0,3 - 1,3 mg*
PP niacin	*Metabolism of proteins, fats, carbohydrates Co-enzyme in the metabolism of amino acids Lipotropic factor*	*Fatigue Asthenia Psychiatric and dyspeptic changes Pellagra*	*Peripheral vasodilatation, flushing skin Itch Tachycardia Fatty infiltration of liver*	*Cereals (bread, pasta), oatmeal, rice, semolina, beans Liver, kidney Fish*	*2 - 16 mg*
B_6 pyridoxine	*Participation in the exchange of protein, fats, carbohydrates Metabolism of amino acids Synthesis of arachidonic acid Regulate cholesterol metabolism Formation of erythrocytes*	*Irritability Polyneuritis Seborrheic dermatitis Conjunctivitis Anemia Convulsions*	*Limited toxicity (Only at a dose 3 mg/kg)*	*Liver Meat Fish Beans, grains food, meal, potatoes*	*0,1 - 1,7 mg*
B_9 folacin	*Synthesis and metabolism of amino acids, vitamins Lipotropic factor Synthesis of choline Synthesis of hemoglobin*	*Megaloblastic anemia Leukopenia Glossitis*	*No evidence of toxicity*	*Leafy vegetables, flowers cabbage, carrots, almonds, wholemeal flour, oat starch. Liver, cheese, cottage cheese*	*65 - 400 µg*
B_{12} cyanocobalamin	*Co-enzyme in the synthesis of lipids, proteins, nucleic acids Stimulates the formation of choline Production of erythrocytes and leukocytes*	*Pernicious anemia Defeats of nervous and digestive system*	*Not described*	*Liver, kidney Meat Egg yolk*	*0,4 - 2,4 µg*
C ascorbic acid	*Participation in redox processes Synthesis of collagen, polysaccharides, nucleic acids Retains elasticity of capillaries Participation in the exchange of steroid hormones and thyroxine Improves iron absorption Antioxidant*	*Fatigue, decreased performance Bleeding gum, reduced resistance to infection Scurvy*	*Option for kidney stones Possible damage to the pancreas with reducing insulin secretion Abnormal iron absorption Disturbances in the activity of leukocytes*	*Rosehips, blackberries, currants, citrus fruits, strawberries, raspberries and al., red pepper, leafy vegetables, cabbage, potatoes*	*25 - 80 mg*

H biotin	***As a co-enzyme is involved in metabolism of protein, carbohydrates Synthesis of unsaturated fatty acids, purine bases Growth, build bone marrow and ectodermal formations***	***Desquamation of the skin, dermatitis, muscle aches Increases in serum cholesterol***	***Non-toxic to humans***	***Brewer's yeast, liver, kidney, egg yolk, milk and more.***	***0,15 - 0,3 mg***
B_3 pantothenic acid	***Regulates the metabolism of proteins, fats, carbohydrates The composition of co-enzyme - A - processes of acetylation Transport of lipids***	***Cardiac, nerve, digestive violations Symptom "burning legs"***	***Non-toxic to humans***	***Brewer's yeast, liver, kidneys, veal, eggs, fish, milk, pulses***	***5 - 10 mg***

Disorders by intake of vitamin A

1. Deficiency of vitamin A. It can occur when insufficient food imports, in an incomplete absorption and metabolism, in diseases of the liver and pancreas. There is a lag of growth and development (childhood), metaplasia and keratinisation of the epithelium of the skin and mucous membranes. Break the barrier function of the epithelium and immunological status of the body, leading to a sharp reduction in resistance to infections. Damage to the absorption of methionine and synthesis of sulfur-containing amino acids, worsen visual acuity at dusk and dark adaptation. They develop hemeralopia - nightblindness, xerophthalmy and keratomalacia. A deficiency of vitamin A and beta-carotene is one of the risk factors for the occurrence of epithelioma. Vitamin A and beta-carotene are considered as modifiers of carcinogenesis.

2. Hypervitaminosis. Although more rare, can occur hypervitaminosis A, manifested by anorexia, nervousness, desquamation of the skin and loss of hair, increased bone fragility, hepatosplenomegaly.

Sources. Vitamin A is contained only in animal products. The liver of fish (cod, tuna, etc.) is extremely rich in vitamin A; is rich enough and bovine liver; eggs, butter, cow's milk, meat have less vitamin A. The provitamins A contained also in animal products (liver, spleen and other offal, milk, butter), but the main sources are plant products. Carotenoids are rich in carrots, especially dark colored, leafy vegetables, apricots, melons, pumpkins, red peppers, tomatoes. During the summer, butter, milk and eggs have more vitamin A and carotenoids, due to the high content of carotenoids in the diet of dairy animals and birds.

The conversion of carotenoids into vitamin A is by hydrolysis in the mucosa of the small intestine, featuring specific enzyme carotinase. The absorption of vitamin A is facilitated by fat in the diet, especially of unsaturated fatty acids, vitamin E, by the presence of bile, thyroid hormones. Main depot in the body is the liver.

Vitamin A is resistant to high temperature, but in the open air and under the influence of sunlight, by oxidation of the fat, is destroyed by the peroxides of the fatty acids. Carotenoids are resistant to thermal effects and in sterilized canned goods are stored for long periods. In an acidic environment are destroyed quickly, so acids in salads should be placed immediately before consumption.

The recommended average daily intake of vitamin A is shown in **Table 9.29.** Adult men and women respectively 800-700 retinol equivalent (1 RE = 1 μg retinol = 3.33 IU vitamin A).

- **Vitamin D (antirachitic)**

Includes vitamins D_2 (ergocalciferol) and D_3 (cholecalciferol). In animal organisms source for the formation of vitamin D is a 7-dehidrocholesterol from which on exposure to UV light to form cholecalciferol. In plants contained ergosterin - a precursor to ergocalciferol. Greater biological activity possess their metabolites, which are formed by oxidation in the body.

Biological function. Vitamin D in the form of its active metabolites play a central role in the metabolism of calcium and phosphorus by promoting their absorption in the intestinal mucosa; facilitates active transport of calcium through the cell membranes; promotes conversion of organic phosphorus in inorganic and deposition of calcium phosphate in bone and stimulates bone growth.

Disorders by intake of vitamin D.

1. Deficiency of vitamin D. Disturb the intestinal absorption of calcium and phosphorus, mineralisation of bones and teeth deteriorate. A deficiency of vitamin D is common in infancy and is one of the reasons for the development of rickets and one of the pathogenetic mechanisms of hypocalcemia and tremor conditions of newborns. In adults develop more rarely and appears as osteoporosis (sometimes - osteomalacia), increased incidence of dental caries. Vitamin D from food is absorbed efficiently in the digestive system. Availability decreases at high pH and not enough bile salts in the intestine (in liver or pancreatic insufficiency).

2. Hypervitaminosis D. May occur in irrational application of concentrated solutions of preparations of vitamin D. The pathogenesis is associated with enhanced mobilization of calcium from bone. Developed hypercalcemia with secondary calcification of soft tissue (kidneys, blood vessels, cardiac muscle, bronchi, stomach). Symptoms of toxicity include: polyuria, night urination, diarrhea, vomiting.

Sources. Food sources of vitamin D are rather limited. Most contained in fish oil, but it is not food and can only be seen as an additional source. Butter, eggs, liver, caviar, fatty fish have certain amounts of vitamin D. It is stable when cooked, but under the influence of UV light breaks down into inactive compounds.

Daily requirements for adults are 5-15 μg, and for children - 5 μg. The greater for the miners, divers and others, operating in deficit of UV radiation and prolonged bedridden.

- **Vitamin E (tocopherols, antioxidant)**

Includes a number of compounds, of which higher biological activity is alpha-tocopherol.

Biological function. Vitamin E possesses antioxidant properties - inhibits the peroxidation of polyunsaturated fatty acids - and, therefore, plays an important role in maintaining the stability of cell membranes and intracellular structures; protects cells from the effects of toxic products formed in the degradation of unsaturated fatty acids. Takes part in the construction of cellular membranes, in the metabolism of sulfur-containing amino acids, glutathione, nucleic acids, creatine and creatinine, in the synthesis of nucleotides, increases the deposition of the other oil-soluble vitamins (vitamin A) in the liver, has lipotropic action.

E vitamin deficiency in humans is not described. Symptoms of hypovitaminoses E are: enhanced haemolysis of red blood cells, conditioned by a violation of the stability of their membranes, anemia, increased excretion of creatine in urine.

Sources. A major dietary source of vitamin E are vegetable oils, especially unrefined (60-100 mg%). Definitely important for imports of vitamins are food products of animal origin - liver (1-8 mg%), eggs (2 mg%). Relatively rich are grains (whole wheat bread, oatmeal, wheat germ), leafy vegetables, nuts.

Vitamin E is stable at high temperatures and in an acid medium, but is oxidized in the presence of iron and lead salts, of UV rays.

For absorption through the intestinal mucosa are necessary fats and bile salts. Its content in the diet varies, depending on the type of fat consumed. The needs are increasing with the increase of polyunsaturated fatty acids in the diet and are related to the concentration of PUFAs in cells.

The reference values for dietary intake of vitamin E is expressed in alpha-tocopherol equivalents - αTE **(Table. 9.29)**. Increase in periods of rapid growth, pregnancy, lactation, exposure to toxic substances, that stimulate the formation of oxygen free radicals.

- **Vitamin K (antihaemorrhagic, vitamin of coagulation)**

Key representatives of vitamins of this group are phylloquinone (vitamin K_1 and menaquinone (vitamin K_2).

Biological function. The biological role of vitamin K is determined primarily by its participation in the coagulation process. It is needed for synthesis in the liver of functionally active forms of prothrombin and other proteins involved in blood coagulation. Like other fat-soluble vitamins, vitamin K is one of the components of biological membranes, which influences actively on their structural and functional properties. Member, by enzyme systems in oxy-reduction processes and the synthesis of ATP.

Disorders by intake of vitamin K

1. Vitamin K deficiency in humans leads to delay coagulation and development of expressed hemorrhagic syndrome. The main reason for the occurrence of deficiency in humans indicate impaired suction, bowel disease or lesions of the hepatobiliary system. Alimentary factor does not play a significant role in the occurrence of deficit, due to the prevalence of vitamin K in food and its thermal stability. Deficiency can occur with the use of anticoagulants - antivitamin K (dicumarin, warfarin etc.).

2. Hypervitaminosis K. Toxicity of vitamin K: are possible thrombosis, vomiting, porfirinuriya.

Sources. Vitamin K_1 in the diet, and K_2 is synthesized by the intestinal microflora. Vitamin K_1 is found in green parts of plants, spinach - 4,4 mg%, cabbage - 3,2 mg%, tomatoes, legumes, liver, eggs.

The average daily intake of vitamin K is indicated on the **Table. 9.29.**

9.2.7.7. ANTIVITAMINS

Antivitamins are different compounds that inactivate or restrict specific properties of vitamins in the body and can cause changes similar to those occurring in the deficiency or lack of the appropriate vitamin.

Divided into two groups:

1. Structurally similar - with a chemical structure similar to that of the corresponding vitamin.

2. Structurally different - compounds primarily of biological origin.

Table 9.29. Fat-soluble vitamins (summary)

Vitamin	Basic functions	Events deficit	Result of toxicity	Sources	Daily need
A retinol, axerophthol carotene (provitamin A)	Growth and development Synthesis of visual purple Bone formation Synthesis of proteins, important role in immunity Antioxidant	Hemeralopia (night-blindness) Xerophthalmia Keratomalacia Hyperkeratosis	Abnormal bone growth Reduced time of coagulation Anorexia Bone disorders Nerve lesions	Liver marine fish and animals Egg yolk Butter. Carotene - carrots, tomatoes, pumpkins, leafy vegetables and others.	375-1200 µg retinol equivalent
D calciferol	Exchange of calcium and phosphorus (intestinal absorption, serum, deposition in bones) Bone formation Synthesis of steroid hormones	Rickets Osteomalacia Hyperpara-thyroidism	Soft tissue calcification Anorexia Diarrhea Polyuria	Codliver oil (Not food!) Butter, egg yolk liver, caviar, marine Fishes	5-15 µg
E (tocopherols)	Biological antioxidant Assists intestinal absorption of unsaturated fatty acids Maintain the stability of cell membranes Normal growth	Degeneration of reproductive tissue and muscles Necrosis of the liver Anemia Increased excretion of creatine	Possible increases in blood pressure Disturbances in the mechanisms of blood coagulation and hemostasis	Vegetable oils Germ of cereals Green vegetables	3-19 µg -αTE
K (phylloquinone)	Synthesis of prothrombin in the liver Growth Mechanism of blood clotting Stimulates the activity of smooth muscle	Hypoprothrombin-aemia	Possible thrombosis Vomiting Porfirinuriya	K_1 - leafy vegetables, cabbage, tomatoes Pulse Liver	2-75 µg

For most antivitamin action is performed on the principle of metabolic competition. By virtue of its structural similarity with the corresponding vitamin, structurally similar antivitamin compete with vitamins for protein binding, yielding inactive compounds, blocked relevant parts of the metabolism of the substances and vitamins are hard output from body.

To a *group of structurally similar* related antivitamin, are products of chemical synthesis, many of which are used as therapeutic agents. Virtually no vitamin against which are not detected substances with anti action.

For example some cyclic compounds with betayononic ring act as antagonists of vitamin A. Antagonistic relationships have been observed between vitamins A and E, A and C (with large doses of vitamin A), but true antagonist of fat-soluble vitamins can only speak for vitamin K. These are dicumarin and its derivatives warfarin, marcumar and tromecam, vicasole and synkavite, that by forming a specific polypeptide block certain units of the processes of blood coagulation.

More synthetic antivitamins are known for water-soluble vitamins. Sulfanilamide drugs that are potent bacteriostatic agents, are antagonists of PABA. They block its inclusion in the molecule of the folic acid synthesis and retain its active forms (citrovorum factor), which results in disturbances in the synthesis of nucleic acids in the microbial cell. Amprolium aminopyrimidine and others are antagonists of thiamine for microorganisms (bacteria and fungi). Piritiamin, another antivitamin B_1, accumulating mainly in nerve cells, violates conducting nerve impulses and causes paralytic form of beri-beri.

Antagonists of riboflavin (isoriboflavin, toxoflavin, acrihin, atebrin etc.) are obtained by modifications in the chemical structure. They compete with riboflavin in the role of co-enzymes of flavin enzymes. Possess potent action against a variety of microorganisms and may be used as therapeutic agents.

Toxopirimidin, antivitamin B_6, violates the biosynthesis of pyridoxalphosphate. Another analogue of pyridoxine - isonicotilhydrazine (isoniazid) is an active anti-tuberculosis agent. However, it is an analogue of nicotinic acid.

Strong antagonist of pantothenic acid is methylpantothenic acid having high antibacterial activity.

The second group antivitamins - structurally dif-

ferent - occur naturally in food. They can block the action of the vitamins by changes in the molecule or by complexation with them. In marine fish and other seafood, tea, sweet potatoes and other vegetables, contain thiaminase and other anti vitamin factors, that destroy thiamine molecule, forming inactive salts or like - salts compounds. When consuming large amounts of tea, raw fish or seafood, may develop signs of thiamine deficiency. Variety of thiaminase, that can cause so-called "Thiaminase disease" was discovered as a product of thiaminase bacteria in the intestines of humans.

In grains, mainly corn, is niacitin-related, unassimilable form of nicotinic acid, which, along with insufficient content of tryptophan, is the reason for the occurrence of pellagra in consumption of products mainly from corn.

In raw egg whites contain avidin - a substance with a protein structure that blocks vitamin H from eggs and also to other foods taken with them. But mild heat treatment destroys avidin. In plants, respectively in fruits and vegetables was discovered enzyme ascorbatoxydase (ascorbinase). It destroys vitamin C and can be regarded as a natural antivitamin. Stability of vitamin C in citrus fruits, especially lemons, explains low ascorbinase and low pH. When placing the fruit or vegetables in boiling water enzyme is rapidly inactivated and loss of vitamin C are less.

REFERENCES

1. Alimentation et nutrition humains. Coord. H. Dupin. ESF edit. Paris, 1992, p. 67. 195,291-389
2. **Balabanski L.** Nutrition and Dietetics. S. Med. and phys., 1988. (in bul.)
3. **Balabanski L.** Nutrition and metabolic diseases, S. Med. and phys.1990. (in bul.)
4. Basics of nutrition . ed./**T. Tashev**, S. Med. and phys . 1981, p. 60-95 (in bul.)
5. **Bender, A.** Perte en micronutrients particulierment en vitamins, pendant les traitments technologigues des alliments. Fondation Francaise pour la nutrition. Ed., Paris, 1980, p 49.
6. **Bourne, E.** Energy nutrition of women. Karger Bale, 1987.
7. **Cummings, J., W. J. Branch.** Dietary fiber in health and disease. Ed. G. Vahouny., D. N. Y. Kritchewsky-New York, 1982, p. 313-325.
8. **Dusheyko A.** Vitamin A - exchange and functions Kiev, Naukova Dumke, 1989. (in russ.)
9. **Falkner, F., J. M. Tanner.** Human grouth, a comprehensive treatise, press, New York, 3vol., 1986.
10. Food Hygiene. ed. **Vl. Boyadzhiev and M. Markova**. S., Med. and phys., 1987. (in bul.)
11. **Hamilton, E. M., E. N. Whitney, F. S. Sizer.** Nutrition: concents and contro-versies. West Publishing Company. IV ed., St. Paul. New York, Los Angeles. San Francisco, 1988.
12. Handbook on dietology. ed **M.A. Samsonova and A.A. Pokrovski**. M., Medicine, 1992, p. 7-52. (in russ.)
13. Modern nutrition in health and disease ed. **Shils M.E., Olson J.A., Shike M.**, 8-th ed, V1, Specific dietary components, 3-449, Wils. & Wilkins, USA, 1994.
14. National Research Council; Diet. Nutrition and Cancer. Nat. Acad. Press. Washington, D. C., 1982.
15. Nutrition and cancer; Etiology and treatment. Eds. **G. R. Newell, N. M. Ellison** - New York, 1981.
16. Nutrition et sante publique. Coord. **Herberg S., H. Dupun, L. Parts, P.Galan**. Technique et Documentation (Lavoisier), Paris. 1985, p. 31-58; 391-410; 305-327.
17. **Petrov, V. H.** Physiology and Pathology of iron exchange. L. Science, 1982. (in russ.)
18. **Petrovskiy, CS, VD Vanhanen.** Hygiene of nutrition. M., Medicine, 1982. (in russ.)
19. Regulation 23 of the Ministry of Health, SG. 63/2005 on the physiological standards of nutrition of the population. (in bul.)
20. **Somov, D., Hr. Jurukov, C. Stoilova.** Technology of culinary production. S., Zemizdat, 1990. (in bul.)
21. **Stamov, St.** Fundamentals of culinary technology. S., Zemizdat, 1987. (in bul.)
22. Tables for the composition of the Bulgarian foodstuffs. ed./**T. Tashev and D. Shishkov**, S., Med. and phys.ult., 1975. (in bul.)
23. **Tchobrotsky, G., B. Giy-Grand.** Nutrition, metabolisme et dietetique II ed. Flamarion medicine, Paris, 1979.
24. **Vanhanen, V.V., N.V. Vanhanen, B. P. Smolyanskiy, N.I. Tsipriyan.** Introduction to nutrition. Donetsk, 1993. (in russ.)
25. **Vanhanen, V.V., N.V. Vanhanen, E. T. Dorohova.** Nutrition: health and disease. Donetsk, 1994. (in russ.)
26. Vitamins and Minerals in the Prevention and Treatment of Cancer. **Jacobs, M. M.** (ed), Boca Raton, 1991.
27. **Nikolova M.,** Study of serum levels of 25 (OH) vitamin D in overweight and odese sunject and association with diertary intake anthropometric and metabolic indices. 2018 Diss., 198 p. (in bul.)

9.2.7.8. VITAMINS - SAFETY. F. Ribarova

Scientific interest today is focused not only on vitamin deficient, conditions known from the past, but much more actively targeting to the influence of vitamins as dietary factor for prevention of chronic degenerative diseases. Data from epidemiological studies can demonstrate the importance of vitamins, but not always sufficient to assess the degree of correlation between dietary intake of vitamins and studied incidence of diseases. The difficulty is determined by many external factors related to the assessment of dietary intake, presence in food of other biologically active ingredients, the selection of respondents, with the precision of the analytical methods and approaches. What is certain is that the food intake of more fruits and vegetables, which are the main source of vitamins and minerals in the diet, is inversely related to the initiation and progression of diseases of modern times. Very little, however, the percentage of people who follow the recommendations for five-time daily intake of fruits and vegetables. The solution to this problem in recent years is realized through production of vitamin supplements and enrichment of certain foods with vitamins. The intake of vitamins from the usual foods, from food fortified with vitamins and supplements, could significantly exceed the recommended daily dietary intake of vitamins, which puts on the agenda the question of safety. Thus, in recent years it began to discuss not only the question of benefit, but also for the safety of taking vitamins.

Safety. Widespread use of enrichment, such as cereals and fruit juices, the massive increase in production of food additives, the occurrence and development of functional foods, including probiotic foods, fermentation products, etc., led to a significant change in the international food market. The discussion about vitamins include not only their essential role against diseases of vitamin deficiencies, but also the ability to induce side effects and toxicity in their excesses intake **(Table. 9.30)**.

Table. 9.30. Risk vitamins harmful action

VITAMIN	*Shortage*	*Overdose*
Vitamin A	*Growth disorders*	*Liver damage teratogenic*
Vitamin C	*Scurvy*	*Gastrointestinal disorders*
Vitamin D	*Skeletal deformities*	*Hypercalcaemia*
Folic acid	*Megaloblastic anemia*	*Masking of vitamin B_{12} deficiency*

Only food now would be difficult to achieve similar effects. The rapid production of food additives, their mass consumption of the population and in particular the demand for rapid health effects create opportunities, especially in individuals defining themselves intake without control of specialist, to achieve very high and undesirable levels of the body. These facts have become a prerequisite to health, government, scientific and other institutions to create recommendations for safe levels of vitamins and minerals. Actively in this work involved the European Scientific Committee on Food (Scientific Committee on Food, European Commission - SCF, EC), English Expert Group on Vitamins and Minerals (United Kingdom's Expert Group on Vitamins and Minerals - EVM, UK) and the board in Food & feeding the Institute of Medicine, USA (Food and nutrition Board of the Institute of Medicine, component of the US National Academies - FNB).

The basic principle and objective of the European Directive on food additives, in accordance with European food law is to ensure the safety of consumers. Achieving this goal requires a risk analysis of intake of vitamins and minerals from foods, food additives and other sources of micronutrients involved in the diet. The structure of risk analysis include three interdependent components - risk assessment, management and communication of risk **(Fig.9.6)**.



Fig. 9.6. Components of risk analysis

Risk assessment forms the scientific platform, ensuring safety for the consumer and providing information to potential danger. For vitamins that assessment indicates the potential for overdose and unwanted intake of the population. The application of this approach to vitamins originates from the experience with the safety assessment in relation to chemical contaminants and food additives. But while they are necessary and experimental animal studies and use accordingly appropriate safety factors, the risk assessment of the intake of micronutrients is realized mainly on the basis of data from studies in humans. The application of traditional toxicological approach (model) for risk assessment of nutrients could lead to very low, even lower than the recommended daily intake (RDI). It is therefore

proposed another approach to risk assessment taking vitamins and minerals, different from the traditional toxicological model.

In the process of risk assessment includes four successive stages: hazard identification, hazard characterization, exposure assessment and risk characterization.

Hazard identification: Identification of adverse effects or potential side effects, occurring when taking studied vitamin, based on existing scientific, clinical, epidemiological and experimental data.

Characteristics of danger: Determination of dependence "dose-effect"; determining factors of uncertainty; determining the maximum safe level of intake (UL).

Exposure assessment: Analysis of population groups taking studied vitamin and determining the levels of intake from all sources.

Risk characterization: Assessment of population groups that would exceed the UL in their diet; an indication of the degree of potential risk; identification of risk groups.

One of the key elements of the risk assessment is to determine the **maximum safe level of daily intake, UL (Upper intake level)**. To determine the UL is necessary to know the maximum level of chronic administration, which does not establish a detrimental effect and by unpleasant effects - **NOAEL (No observed adverse effect level)**, as and at the lowest level at which is observed a detrimental effect **LOAEL (Lowest adverse effect level)**. Calculating a UL is achieved by splitting a NOAEL or LOAEL with the uncertainty factor UF (uncertainty factors), which are different in NOAEL and LOAEL.

$$\mathbf{UL = NOAEL/UF_1}$$
$$\mathbf{(or\ UL = LOAEL/UF_2);\ UF_2 > UF_1}$$

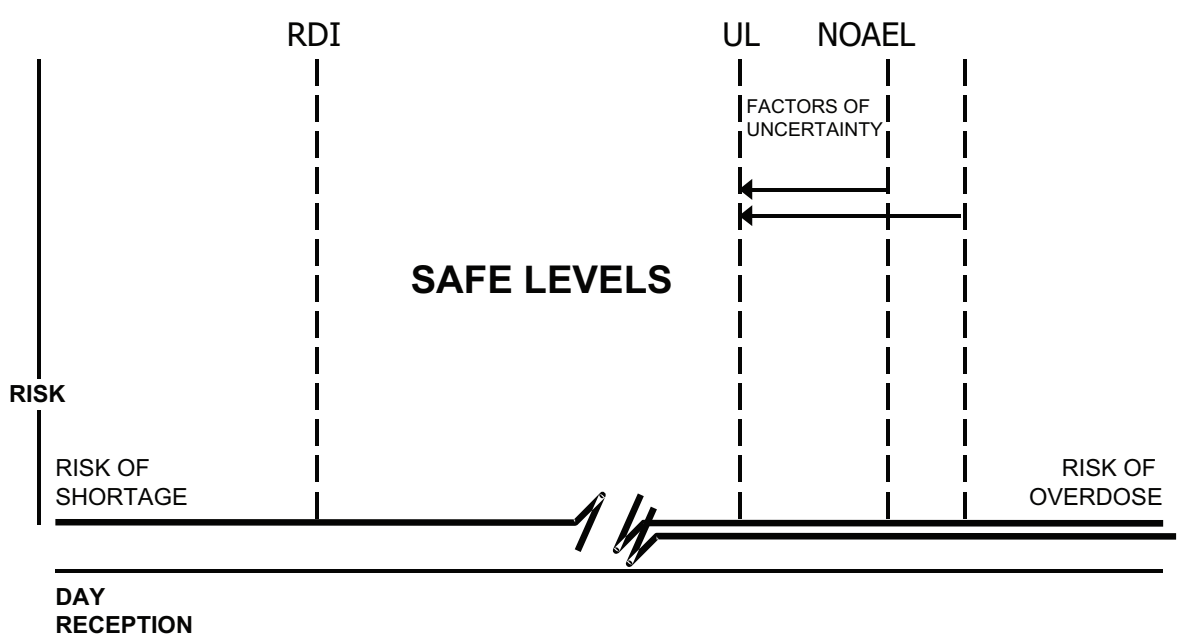
UL should be at a lower value than the LOAEL and NOAEL, to avoid and the lowest possibility of uncertainty **(Fig. 9.7)**.

Risk can be prompted by vitamin deficiency, and his overdose. Secure a safe level for intake of vitamins move into the space between RDI and UL. Getting out to a small extent of these limits is also in the area of safe intake, but less security. One of the specific features of the model for risk assessment taking vitamins is setting the lowest level at which observed adverse effect (LOAEL). There are differences between this model and the classical toxicological models for risk assessment.

In the traditional model of using toxicological safety factor 10 for the transfer of data from experimental animals and human, and again safety factor of 10 to compensate for the variation between individuals. Differences between the toxicological model and the model for assessing the risk of excessive intakes of vitamins are presented in **Fig. 9.8.**

Differences include not only factors of uncertainty, but the origin of the data obtained from animal studies or human studies, and final reading in mg/kg body weight or reception for individual/day. The term ***UL is the highest level of intake of the nutrient (vitamin), which does not indicate unpleasant side***

Fig. 9.7. Grafic figure for assessment risk of vitamins intake



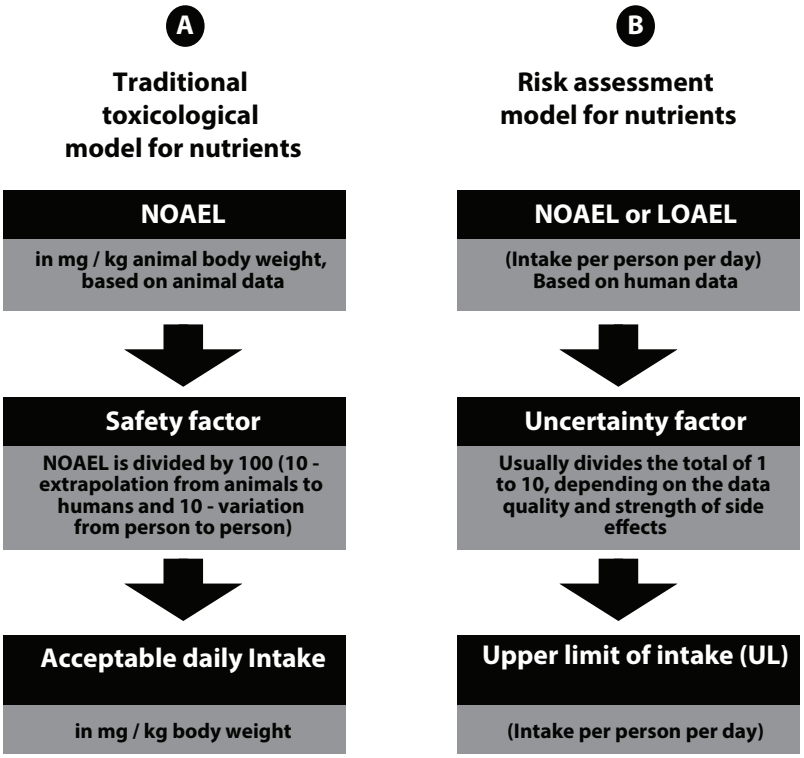


Fig. 9.7. Graphical representation of toxicological model and risk assessment model taking vitamins

effects in almost all individuals in the population. It should not be a value lower than the recommended daily intake for a particular nutrient. In accordance with the characteristics of nutrients must be selected and uncertainty factors (UF), corresponding to their individual specificity. Usually for intra- individual variability used factor 10, for specific differences also a factor of 10, and extrapolation from LOAEL to NOAEL - factor 3. Recent studies in this regard allowing the use of various factors, based on differences in toxicokinetics and toxicodynamics of nutrient research. For most micronutrients, risk associated with significantly exceeded UL, can be assessed quantitatively, taking into account the following three values: individual UL, the recommended daily intake (RDI) and specific definitions for nutrient intake. Very often the data are insufficient to assess the UL and then risk can be calculated quantitatively. The approach in this case is different - to be thorough qualitative assessment.

The reference recommended daily intake (RDI) is vitamin (nutrient) required to prevent deficiency states in the majority of the population. Individuals who chronically consumed vitamins below these levels are at risk of inadequate intake of these nutrients. RDI is not directly involved in the assessment of *risk of excess intake of the vitamin*, but is used as an indicator to help determine the degree of safe intake, i.e. when UL and RDI are more similar values, the limits of safe levels are relatively narrow and back - in a big difference between UL and RDI limits of safe intake are wider. Therefore RDI must always be taken into account in determining the extent of the limits of safe levels or risk characterization.

In order to unify approaches to assessing the risk of overdose intake of vitamins and minerals for the population has introduced a new index "Population Index safe" - PSI (Population Safety Index).

$$PSI = \frac{UL - (MHI + IW)}{RLV}$$

where PSI - population safe Index
UL - maximum safe levels
MHI - the average of the highest levels of intake (Mean Highest Intake)
IW - potential intake from water (Potential Intake from water) - for minerals*
RLV - recommended levels for labeling (Reference Labeling Values)

As UL is a general concept, involving the safety of total intake of vitamins from foods, fortified with vitamins food products and food additives, needed in data collection dietary intake of a particular vitamin include quantities from all possible sources. On **Table. 9.31** are the values of PSI for some vitamins, using data from the Scientific Committee on Food to the EC.

* In a similar manner is determined and the safety of the mineral substances and trace elements

Table 9.31 Population safety index of vitamins

VITAMIN	PSI
Nicotinamide	52.8
Vitamin E	23.2
Vitamin C	22.0
Vitamin B_6	21.9
Vitamin D	8.1

Based on the values of PSI vitamins can be divided into two groups: with minimum risk and a potential risk of overdose intake vitamins over the value of its UL **(Table. 9.32)**.

When the risk can not be quantified because no data necessary for calculation on UL, provides a qualitative description of the side effects of taking vitamins or clarified with research data, that despite the very high intakes will not be listed side effects, or scientific studies now are not enough. This group of vitamins include: B_1, B_2, B_{12}, biotin, C and K.

Table 9.32. Classification of vitamins in accordance with their PSI

Minimal risk		*Potential risk*	
Vitamin	***PSI***	***Vitamin***	***PSI***
Nicotinamide	*52.8*	*Vitamin A*	*-1.2*
Vitamin E	*23.2*		
Vitamin C	*22.0*		
Vitamin B_6	*21.9*		
Vitamin D	*8.1*		

Summarizing scientific information and expertise of committees and working groups to FAO, EC, the Institute of Medicine - USA and others, it can be made classification of vitamins and minerals into three main groups **(Table. 9.33)**.

Table 9.33. Classification of vitamins and minerals according to the degree of risk of overdosing them

Group A **No evidence of harmful effects; not pose a risk to human health**	**Group B** **Minimum risk taking, exceed levels UL**	**Group C** **Potential risk at reception exceed levels UL**
Vitamin B_1	Vitamin B_6	Vitamin A
Vitamin B_2	Vitamin C	Beta-carotene /smokers/
Biotin		
Vitamin B_{12}	Vitamin D	Calcium
Pantothenic acid	Vitamin E	Cuprum
Vitamin K	Folic acid	Fluorine
Chromium	Nicotinamide Phosphorus Magnesium Molybdenum Selenium	Iodine Manganese Zinc

REFERENCES

1. EFSA (European Food Safety Authority). Tolerable Intake Levels for Vitamins and Minerals. 2006.

2. ERNA (European Responsible Nutrition Alliance). Vitamin and mineral fact sheets. 2004.

3. EVM, UK (Expert Group on Vitamins and Minerals). Vitamins and Minerals - Risk Assessment, 2003.

4. FNB (Food and Nutrition Board), Institute of Medicine, USA. Dietary Reference In-takes for Vitamin C, Vitamin E, Selenium and Carotenoids. National Academy Press, Washington, 2000.

5. **Hathcock, J.N.** Safety of Vitamin and Mineral Supplements Safe Levels Identified by Risk Assessment, 2004.

6. **Ribarova, F., Manolova, A.** Food - Risk or Preventive Factor for Osteoporosis. Bulgarian J. of Osteoporosis 2, 24-50, 2001.

7. SCF, EC (Scientific Committee on Food, European Commission). Opinion of the Scientific committee on food on the Tolerable Upper Intake Level of Vitamins and Minerals., 2002.

9.3 NUTRITION OF POPULATION

9.3.1. HEALTHY, PROTECTIVE PROFESSIONAL AND DIETARY (THERAPY) NUTRITION. P. Nikolova, D. Popova

◆ ***Rational/healthy nutrition*. P. Nikolova**

Rational, healthy, optimal nutrition is to appropriately meet the needs of the body of energy and nutrients in certain qualitative and quantitative composition. Rational nutrition helps maintain normal weight, self confidence, high-performance, increases the resistivity to adverse environmental factors. It provides constancy of homeostasis of the body and maintain a normal level of life processes in diverse working conditions and life. Rational nutrition is physiological, sufficiently nutrition of healthy people.

To be rational nutrition must corresponde to certain requirements:

1. Nutrition must be balanced (in energy and nutrients), according to the physiological needs of the body's energy, nutrients (protein, fat, carbohydrate) and bioactive ingredients (vitamins biomicroelements etc.), can comprise an amount of fibers.

2. Food should be various. Daily, in various receptions and meals, to include food from the seven groups; one type of dish may not be available more than twice a week.

3. The food (food daily ration) to be a certain size, to create a feeling of satiety for a specified time.

4. The daily menu must include one or more raw materials (fruit and vegetables), as salads, desserts, snacks.

5. To prepare the dishes use quality products, without harmful health impurities and additives.

6. To create the correct diet. Food should be properly distributed energy value, quantitative and qualitative composition of the various parties and be taken at a certain time.

7. To ensure high digestibility and absorption of food by applying suitable culinary preparation, consistent with the traditions and national circumstances, optimal preserving food and taste of the products; have an aesthetically and attractive appearance and flavor.

The basis of rational nutrition is the principle of balance, which ensures optimally satisfy the body with nutrients and bioactive substances in strictly defined qualitative and quantitative ratios. Imbalance of nutrients and bioactive components in their ration disrupting their absorption, reduces the usability and usefulness of their action. Ensuring normal vital activity is possible if the body is supplied not only with adequate amounts of energy and protein, but also in compliance with the ratios between the many nutritional factors, each of which plays a specific role in metabolism. Recommended certain quantitative ratios between nutrients - proteins, fats, carbohydrates, mineral salts, between their biologically active components (amino acids, fatty acids, vitamins, biomicroelements). Required components of food are also dietary fiber. The food ration must not only be balanced with optimal consideration of the nature of metabolism, but also to match the mechanisms of digestion, made in the evolution of the human body. The selection of products must conform to the natural process of assimilation of food.

The basis of healthy nutrition in the contemporary conditions of work and life are the WHO recommendations **(Table. 9.34)**.

The energy contributed by protein optimally should be 10-15,% of fat - 25-30%, of carbohydrates

Table 9.34. WHO recommended limits for some nutrients

Nutrients	Low Limit	Upper limit
Total fat	15	30[1]
Saturated fatty acids	0	10
PUFA	6	10
Proteins	10	15
Carbohydrates (generally)	55	75[4]
Carbohydrates (complex)	50	70
Free sugars	0	10
Fiber	over 25[2]	–
Salt	not determined	6
Fruits and vegetables	400	(excluding potatoes, cassava)
Cholesterol	0	300[3]

1 – % energy value
2 – g/daily
3 – mg/daily
4 – population over 19 years old

- 55-65%. Essential for the absorption of nutrients is the balance between biologically active ingredients (essential and non essential amino acids, saturated, mono- and poly-unsaturated fatty acids, among vitamins, mineral salts, biomicroelements.

One of the requirements to healthy nutrition is to respect regimen of diet. It includes: the number of food intakes, the intervals between them, feeding time, volume and weight of the food for the day, sharing its energy value, qualitative and quantitative composition in individual intakes. Compliance with proper diet provides normal functioning of the digestive system more complete absorption of food, evenly supply and timely completion of metabolic tank of body with nutrients during the day. The feed should be determined on the basis of hunger and satiety. It is necessary to take into account the age, nature of work, local habits, individual characteristics, but also the influence of the regimen on the absorption of nutrients. For people of working age has a crucial mode of work. Long intervals between food intakes can lead to excitation of the center of appetite and intake of large quantities of food, and short intervals - to distortions in the absorption of food and dysfunction of the digestive system. It is essential and proper distribution of the energy value and volume of food into individual food intake. Depending on the age, characteristics and nature of work (labour with significant physical activity, shift, intense mental work) distribution of receptions can be different. For children and students recommended 5x diet: breakfast - 20-25%, morning refreshment meal - 10-15%, lunch - 30-35%, afternoon refreshment meal - 10-20%, and dinner - 25 %.

For the adult population are appropriate 3-4x modes: breakfast - 20-30%, lunch - 35-45%, afternoon refreshment nutrition - 15%, and dinner - 25%. The five-time diet is suitable for very strenuous physical and mental labour, to reduce or increase body weight.

Rational nutrition is the basis of prevention of alimentary diseases, occurring: in disorders in quantity and usefulness of food, in a combination of foods or regimen of nutrition.

◆ ***Protective professional meal.*** **P. Nikolova**

The safety professional (prophylactic) nutrition element of bioprophylaxis of workers exposed to the effects of harmful factors of production. It aims to increase the overall resistance of the organism and functional and adaptive capabilities of organs and systems exposed to harmful factors (chemical or physical), to prevent, among other preventive measures, the occurrence of occupational disease or poisoning.

Prophylactic direction of feeding is performed by the proper selection of foods and substances suitable recipes for preparing food and drinks and rational compiled daily menus. To properly compile safety diet is necessary to know the pathogenic mechanisms of action of harmful factors, changes in the metabolism of substances, that occur under their influence. It is also necessary to take into account the biological value of various foods and they contain of components with a protective or preventive effect on the pathological process, occurring in the body under the action of the harmful agent. The activity of the metabolic systems involved in the biotransformation of toxic agents, to a large extent depends on the content and the proportions of nutrients, with which they may interact. For prevention of disabilities equally essential to have both traditional notions of food as a carrier of plastic material, energy and cofactors of metabolism, and pharmacodynamic action of micronutrients, possessing biological activity.

Protective role of food. It consists mainly in supporting the body's resistance to workers of hazardous industries.

Depending on the nature of action of noxious, prophylactic role of nutrition can be expressed in:

1. Increase the body's defenses. This requires proper balance of nutrients in the prophylactic diet, to ensure that scarce nutrients to the body (essential amino acids, lipotropic substances, vitamins, biomicroelements etc.), and normal course of metabolic processes.

2. Delay in receipt of toxic substances in the body still in the digestive system, by neutralizing and putting them with faeces, through foods and nutrients that act as chelators.

3. Speeding up the release of toxic substances by saturating the body with appropriate food components (for example foodstuffs with alkali predominance) or based on the antagonism between dietary factors and the toxic agent (eg. salts of calcium and strontium, calcium and lead, iron and manganese, phosphorus and aluminum, etc.).

4. Stimulate restoring attacked by harmful factor units of metabolic processes and influence the functional status of various organs (especially the liver), by appropriate diet (high protein, lypotropic with vitamins, biomicroelements or complexes of there).

The safety professional catering is built on the principles of rational, adjusted, depending on its special purpose, according to the pathogenic action of the harmful factor. It is completed in the respective diets for practical application in nutrition of workers. Depending on the purpose of the diet, it is dominated by one or other food ingredients or

products. Proteins, the most important nutrient, play a leading role in the regulation of biotransformation processes and significantly affect, caused by harmful factors of production changes. Substantial interest ,when drawing up preventive rationing, is a specific composition of protein, especially the content of some amino acids - cysteine, methionine, tryptophan, glutamic acid. Amino acids have a stimulating effect, thereby improving and metabolism of protein and general metabolism, activate the enzyme systems and regenerative processes in the body. In addition, they can bind heavy metals in the complex compounds. Certain protective effect in exposure to lead, manganese, silicon dioxide, mercury has been proven to methionine, cysteine, glutamic acid. Of food have priority milk and milk products, especially cheese; fruits and vegetables rich in pectin; meat, fish, poultry - sources of complete proteins. In group products as preventive factors, into account their specific features: content of biologically active substances, therapeutic and curative-preventive role.

Food products for prophylactic nutrition are divided into 7 groups (M. Markova):

I - milk, meat, fish, eggs - supplying complete basic note tachini;

II - fruits and vegetables - sources of vitamins, biomicroelements, pectin and other bioactive nutrients;

III - flour, bread, pasta - rice - supplying carbohydrates, fiber, B vitamins, etc .;

IV - sugar, honey, jam, chocolate, cocoa;

V - fat;

VI - refreshing drinks;

VII - spices.

Preventive diets. In our developed 5 prophylactic diets.

Diet A. For working with radioactive substances, sources of ionizing radiation, noise, vibration, overheating microclimate. It aims at protecting the nervous system and liver and to increase the resistance of the organism. Contains products rich in essential amino acids, polyunsaturated fatty acids, complex water-soluble vitamins, biomicroelements, energizing substances (caffeine). When overheating microclimate, increase liquid foods and beverages with vitamins and mineral salts. To the diet were added 0,5 l milk and vitamin C, B_1, B_2, B_3, A.

Diet B. For working in contact with the mercury, manganese, cadmium, TEL, oil, silicon dioxide, antibiotics and the like. It includes products rich in sulfur-containing amino acids, polyunsaturated fatty acids (vegetable oil), with high bioavailability calcium (milk, cheese, cottage cheese), pectin. These substances contribute to increasing the overall reactivity of the organism and to implement the detoxicating function of the liver; pectins - removal of toxic elements in the faeces.

Diet C. For working in contact with the lead and lead compounds, nitric and sulfuric acids, potassium, aluminum chloride and the like. Includes priority alkaline foods prevail, increased amounts of pectin and vitamin C. It supports the release of toxic substances or their metabolites in urine and faeces.

Diet D. For people in contact with phosphorus and phosphorous compounds, arsenic and arsenic preparations, tellurium and others. Diet is hypolipidemic, but rich in lipotropic factors and biomicroelements, stimulating hematopoiesis (iron, copper, cobalt), vitamin B_1. Diet helps to reduce the absorption of phosphorus and its compounds, favourably affect the liver, protects the nervous system from damage. Increasing of liquids facilitates the separation of arsenic from the body.

Diet E. In working with chlorine and chlorine compounds, benzene and its derivatives, aniline dyes, vinyl chloride, hydrogen sulfide, carbon disulfide, cyanide compounds and others. It is rich in lipotropic substances that help increase the antioxidant function of the liver. Includes tonic nervous system drinks (tea, coffee, herbal potions).

In all diets using gentle liver cookery treatment, without strong spices.

The safety-oriented nutrition can be achieved and by individual food products (milk, food - concentrates, drinks, pectin), applied once daily, or complies with the protective diet varied selection of food products for one-, two-, three or four multiple regimen.

Preventive diets (menus and composition) are given in a special methodical instruction of MH and Ordinance N 8/1987, 1993 The preparation of various dishes are done in culinary technologies and recipes for catering.

Preventive diets are defined according to the prevailing harm and given in the form of one meal (lunch or dinner) and a fortifying meal (breakfast 10 h or 16 h) or at night, depending on the shift.

For prevention of complicated conditions, arising in the operation of various professional hazards are suitable as an additive to food or drinks, polycomponent complexes of vitamins and other micronutrients (bioelements), for example amino acids. The positive effect of such complexes is a proven for example in workers exposed to lead and manganese.

◆ ***Dietary (therapy) nutrition.*** **D. Popova**

The dietary (medical) nutrition is a key component of the complex therapy of patients. The main goal of medical nutrition is to assist the healing process and removal of disease violations through adequate im-

port of nutrients and energy. Building a proper diet requires knowledge of the etiology and pathogenesis of the disease and related changes in the absorption and metabolism of nutrients and energy needs. Furthermore, a precise and objective assessment of the current nutritional status of the patient.

The therapeutic diet must meet a number of **principles and requirements**.

1. The diet is always pathogenic and patophysiologicaly justified. The medical nutrition is accordingly of particular pathological alterations, of the phase and the evolution of the disease and the associated available nutritional and energy needs and somatic status of the patient.

2. Any diet possible should be varied and include a variety of food products. Mean food groups-milk, meat, fish, eggs, cereals, pulses, fruits and vegetables, are combined in a suitable form and suitable combinations and possibly at minimum limitations. For this purpose dietary intake is drawn in the form of menus - daily, weekly and seasonal.

3. The chemical and energy composition of dietary regimen must match or be close to today's dietary guidelines. Fat should not exceed 30 en.% protein 10-15 en.% and carbohydrates 55-60 en.%. Temporary and short-term deviations are allowed in the acute phase of certain diseases or in advanced disease lasting change. For example, in diabetic ketoacidosis diet is primarily carbohydrate and very low protein diet in advanced chronic renal insufficiency contains minimum protein source, according to renal function. As the improvement, however, the diet should be extended to the maximum to get closer to the requirements of a healthy diet, as long depriving the body of one or other nutrients will lead to adverse consequences.

4. Dietary sufficiently balanced. It must provide adequate nutrition of the basic and additional nutrients to the organ and cellular level.

5. The diet should always be individually built and tailored to the taste requirements, food habits and preferences of the patient, including national and religious traditions. Furthermore, the healing diet must fully correspond to all available diseases, specific nutritional and energy needs and characteristics of individual metabolism.

6. Diet Foods is mechanical, chemical and thermal sparely. Mechanical sparing is achieved by limiting or removing rough, hard-products and using specific methods of machining - milling, blending, grinding. Chemical sparing is performed by disabling chemical irritant foods or their ingredients - sharp spices, extractive substances, salty products, succagogue foods, sugars and more. Thermal sparing is achieved with moderate temper of food, excluded a strong cold or hot dishes.

7.Meals and of dishes dietary regimen prepared with suitable culinary technological processing in special containers. Most often enploy boiling, steaming, grilling. So removed extractive substances, increases the digestibility and absorption of food, avoid harmful oxidation of fats to peroxides and acrolein derivatives.

8. The medical nutrition is always dynamic. The type of dietary regimen and a diet change periodically depending on the evolution and stage of the disease and the condition of the patient. Initially more limited diet can gradually be extended or if necessary re limit. Sometimes it is appropriate to include the so called contrasting days with relatively short and sharp change of diet, appointment foods of a special composition. By thus changing the intensity foods of metabolic processes by reaction of the whole organism. Such days is administered in medical diet of gout, artrosoarthrits, cardiovascular disease, glomerulonephritis. In some cases, including the so-called discharge day with an energizing sharply restricted or changed chemical composition of sparely diets. So achieved adjust of exchange violations or saving the damaged functional mechanisms.

9. Diet regimen is distinguish by a strict diet with increased frequency of dietary intake and proper distribution of food in individual doses. For most diseases applies quintuple diet, to include morning and afternoon snacks - 20% of the energy and volume are included in the basic breakfast, 15% - in an intermediate breakfast, 30% - at lunch, 15% in snack 20% - the dinner.

10. Food and meals of dietary regimen prepared with enough good taste, pleasant aroma, appealing and appropriate form. Disease usually cause a decrease in appetite and diet requirements often reduce and eliminate traditional appetite ingredients of food. It is therefore important culinary mastery and application of appropriate authorized condiments, to ensure good and acceptable taste of diet.

11. Diet is prescribed, prepared and supervised by a physician specialist in nutrition and dietetics in

collabouration with specialist diet, which compiles and calculates the chemical and energy composition of the diet.

12. The effect and tolerance of dietary regimen subject to monitoring, clinical control and evaluation with respectively specifically selected clinical, anthropometric, biochemical and others indicators.

13. The use of dietary regimen requires mandatory training patients to build motivation and conduct an effective healthy diets. They should be familiar with the nature and duration of the diet and the expected curative effect. Often they have to build new habits and change in eating behaviour and to acquire basic knowledge of right and appropriate nutrition.

14. Curative regiment realized, organized in the medical and preventive hospitals and sanatorial health stations and after hospitalisation and constantly at home or in dietary canteens for chronic diseases.

15. Diet must be continuously updated in accordance with modern concepts and guidelines of the european nutrition science and dietology. In dietary regimen may include new health and medical food and food products with clinically proven curative and prophylactic effect. In Bulgaria was introduced and still used practical in medical institutions numerical dietary system at M.Pevsner indicating the diets of №1 to №15.

CHARACTERISTICS OF THE MAIN DIET
Diet for stomach disorders
/diets №1,1-A, 1-B, 1-D, 2/

Today settled relatively frequent presence of gastroesophageal reflux disease (GERD) in about 20-25% of the population. Dietary factors such as improper and irregular meals, alcohol consumption and obesity are known conducive role in the etiopathogenesis of the disease. The spectrum of gastric symptoms is diverse and includes mainly postprandial discomfort, heaviness in the stomach region, burning pain in the sternum, regurgitation of gastric acid into the esophagus and oral cavity, sometimes disabled in gastric and esophageal mucosa of mostly erosive type.

Dietary supplements main pharmaceutical treatment with inhibitors of gastric acid secretion, such as proton pump inhibitors and/or H2 blockers. It is necessary to make an accurate analysis of diet, then adjust individual catering in regular and well-balanced food regimen. Especially it is important to move towards taking regular, but no plentiful amounts of food, to dinner early and avoid late night meals. It is recommended to reduce the use of alcohol, caffeine-food and beverages, fats, spices and other irritating foods. It is appropriate to reduce the excess bodyweight. It is necessary to pay special attention to the position of the body when eating - seat vertically, avoiding lying down after meals, raising the head at bedtime, avoiding irritating and difficult to digest foods.

It is still not well understood issue of the use of spices for stomach disease. In several clinical trials established progression and exacerbation of gastritis and stomach ulcers when taking foods with spices. Experimental data outlines a complex role in food spices on gastrointestinal mucosa. Eg. of turmeric have been demonstrated in vitro DNA mutations in gastric mucosa, chili in high doses is an independent carcinogen, while extracts of chili protects damage to the gastric mucosa of experimental animals and extract of garlic, ginger, Indian nutmeg, cloves inhibit the growth of Helicobacter pylori.

Infection with Helicobacter pylori may be asymptomatic, but may be associated with gastritis and gastric carcinoma. Its incidence increases with age and is significantly more prevalent in developing countries in a worse socioeconomic status. Its spread is through oral and fecal-oral route and is favoured by poor personal and food hygiene. Gastritis is an inflammation of the stomach lining, which may vary from mild asymptomatic forms to deep ulceration, complicated by development of perforations. Peptic ulcers are shaped lesions in the gastric and/or duodenal wall. Typical symptoms include nausea, vomiting, bleeding and pain. In about 80% of cases of gastritis and ulcer establishes association with Helicobacter pylori, but often in combination with alcohol abuse and chronic administration of NSAIDs*.

In severe acute cases and complications take 1-2 days a full stomach rest and does not accept food orally. To avoid sharp imbalance in such period is necessary to ensure an adequate water-salt imports through intravenous infusions of glucose and water-electrolyte solutions. After it in the next 1-3 days gradually include sparely, easily digested and balanced liquid and liquids-mushy food orally, mainly from the group of milk and milk products, fresh fruit - and vegetable juices, sweetened slightly starchy cereals, semolina, rice, potatoes (dietaNº 1-a). Gradually diet is expanding with the intake of passion

* NSAIDs - nonsteroide anti inflamatotory drugs

chicken and veal, milk-egg purée and cream, cottage cheese, fresh cheese, fruit and vegetable purées, juices and sauces, rusk, crackers. Excluded are all irritating foods. Meals are taken in 5-6 doses (diet №1-B). In apparent improvement may proceed more rapidly to the main stomach diet (diet №1), which is moderately hyper protein (up to 100 grams of protein daily), normolipidic and normocarbohydratic. In dietary regimen includes predominantly alkalizing foods - milk and milk products , fruit - and vegetable juices and soups, rice and wheat mucus, porridge oats, herbal tea and alkaline mineral waters. Excluded are irritating foods - strong meat broths, sharp spices, fried and salty foods, alcohol, cola, caffeine containing drinks - coffee, tea, eating coarse fiber - whole grain bread and products, pulses, some vegetables - cabbage, cucumbers, lettuce, etc., are very limited sugar and sugar containing foods. The meat is served lean, no fatty (chicken, beef, fish), of grilled, roasted or boiled, without its own broth or sauce. This diet is administered for at least 6 months, then in the judgment can move on to more advanced sparing therapeutic feeding, to the exclusion of annoying and spicy foods. In chronic gastritis with reduced gastric secretion and acidity, include gastric secretion replacement therapy combined with sparely diet, which can be included at the discretion of some stimulating the secretion suitable food - strong broths and sauces, spices, coffee, tea (diet № 2).

Gastric carcinoma is associated etiopathogenetic also Helicobacter pylori infection, but with excessive use of smoked, salted and fried food. The most common symptoms are heartburn (acids), pain, vomiting, sometimes accompanied by bleeding, anorexia and rapid weight loss. Radical gastrectomy therapy is in combination with radiotherapy and chemotherapy. Dietary aims to maintain optimal dietary intake, often need supplementation and specialized nutritional formulas. Sometimes post-operative be realized for some time feeding gastrostomy with appropriate machined passion and sparely foods enriched with an optimum amount of vitamins, minerals, antioxidants. A major problem in these patients is the risk of malnutrition. It is therefore necessary to assess individual nutritional status and to assess specific nutritional and energy needs. In most cases patients need individual diet.

Disease of operated stomach includes a number of post-operative conditions of the stomach. Gastric operations depend on the size of the gastric lesion. These include total gastrectomy with esophago- and duoden-jejunic anastomosis, removed cardia and pyloric partial gastrectomy with pyloric removed and jejunic anastomosis, ezofago-gastrectomy with removed cardia and oesophagogastroanastomosis, vagotomy. Interruption of n.vagus reduces gastric secretion, but violates gastric emptying. These conditions violate normal eating and digestion and require special dietary treatment.

It recommended as earlier intake of food in the mouth, initially in the form of clear liquids, and then pass progressively through the liquid and pasty foodstuffs, and after 1 week and to solid foods. To avoid bulky and hard digestible food. Recommended intake of fluids to separate from food intake. Meals can be taken often, even every hour in small volumes (diet № 1-D).

Often the development of Dumping syndrome, which is caused by the rapid absorption of glucose and sugars in the small intestine. Early postprandial appears fainting, hypotension, sweating, nausea, and 2 hours after meals can occur weakness, tremor, tachycardia in connection with hypoglycaemia-induced by exessively rapid rise in insulin. These early and late symptoms can be managed with dietary steps - regular intake of small portions of food, limited sugars intake, small amounts of fiber, separation of fluid intake from food.

In the first 1-2 months after surgery may persist diarrheal syndrome in connection with violations motility, which gradually disappears during the post-operative adjustment of the gastrointestinal tract. Energy and macronutrient composition is determined by the patient's nutritional status. In the presence of malnutrition can make an individual hyperenergy diet. Particularly important is the food and drug supplementation with vitamin B_{12}, folic acid and iron to can prevent the development of anemia. There is a need-to-date assessment of the import of vitamin D and calcium, whose exchange is impaired, leading to subsequent disturbances of bone metabolism.

Diet for intestinal diseases (diets №4, 4-gluten-free, 3)

Because of the central role of the intestines to break down and absorb energy, nutrients and water from food intake, intestinal disorders occurred significantly affect the nutritional status of the whole organism. The most important disorders are malabsorption, inflammatory bowel diseases (Crohn's disease and ulcerative colitis), celiac disease, syndrome of short bowel, intestinal fistulas.

Malabsorption develops as a result of multiple etiologic factors and noxae in the intestinal wall - infectious, parasitic, radiation, lesions of systemic diseases, enzyme deficiencies, immunological and allergic reactions, pharmaceutical and toxic injuries

(the most common antibiotics and laxatives). In addition of etiological treatment, an important place in therapy loan and dietary treatment. Often there are impaired absorption of fat, that causes celiac disease and non-utilization of lactose, causing diarrheal syndrome. These violations could further reduce the absorption of many nutrients, especially vitamins and minerals.

Dietary intake of these patients is always individualized and tailor violations. In most cases it requires supplementation with pancreatic enzyme preparations to help the absorption of food. Basic requirement to diet to reduce fat in the diet. In exacerbation phase of the disease temporarily apply a very low lipid diet to 20 g fat daily. Then gradually the amount of fat is increased according to the tolerance of the patients. Most patients tolerate well about 40 g of fat per day. Since this fat provides about 20% of daily energy intake, the remaining energy needs should be met by proteins or carbohydrates or medium chain triglycerides (from 6 to 12 C atoms). MCT emulsify and hydrolyze significantly easier at a reduced and inadequate bile and enzyme secretion. They are absorbed directly into the portal circulation and not requiring chylomicron transport through the lymphatics. Medium chain triglycerides are produced industrially in the form of specific dietary lipid or mixed with other nutrients products and should be included in the dietary regimen in compliance with the relevant technological requirements.

Due to impaired absorption of fat-soluble vitamins, dietary intake should be required supplementation with oral and in extreme cases and parenteral forms by recommended daily doses: vit. A 25,000 IU, vit. E of 400 to 4000 IU, vitamin A from 50 to 200 IU, vit. K from 2.5 to 5 mg. In chronic celiac disease and evidence of bone disorders must be added supplementation with calcium supplements - 1600 mg or 40 mmol daily. Reduced lipid intake should include essential fatty acids - especially linoleic and linolenic.

Often in intestinal diseases as a result of damage to the intestinal villi and loss of lactase secretion develop lactose intolerably. For this in dietary regimen including low-lactose or lactose-free dairy foods, such as milk and products containing it are removed. As protein sources are preferred soy foods and products, beef and chicken, fish, cheese, cottage cheese, vegetables. Containing coarse fiber grains, legumes, nuts are removed. Fruits and vegetables are accepted mainly boiled, mashed, in the form of juices and nectars. Special attention is paid on imports of calcium by fish products, whole grain bread, soy beverages fortified with calcium. Lactose tolerance can be improved by gradually adding small amounts of lactose in the diet, with this the bacteria flora of the colon will be encouraged to adapt to metabolize. In cases of allergy to milk proteins dietary intake should strictly exclude dairy milk proteins. Because disaccharidasic deficit is reduced by 50% intake of saccehrides. Used is sparely culinary technologies - cooking, blending, steaming, steaming, grilling (a diet № 4).

Inflammatory bowel disease (IBD) includes the specific bowel disorders - Crohn's disease and chronic ulcerative haemorrhagic colitis (HUHC) that cause specific inflammatory damage to the gastrointestinal tract and chronic-relapsing proceed, with periods of exacerbation.

Crohn's disease is unknown etiology, localized mainly in the ileo-caecum area and causing complaints of abdominal pain and diarrhea with separation of blood and mucus in the stool. Intestinal inflammation results in ulcerations, strictures and fistulae, which requires and surgical treatment. Patients with Crohn's disease develop malnutrition based on inadequate dietary intake and increased losses due to malabsorption. Malnutrition is mostly protein-energy, but some patients are identified and micronutrient deficiencies. Especially important is the dietary intake of children and adolescents who are in a period of growth and have elevated food and energy needs, patients with a prior malnutrition, exacerbation, or partial obstruction after surgery. In their diet includes mostly protein and energy-full foods. Fiber-rich foods, especially legumes, vegetables rich in cellulose, nuts, whole grain products should be avoided. It is a moderate restriction of fat around 40 g daily in tracking tolerance of patients. The diet can be supplemented with adequate ready, balanced nutritional formulas for increased energy and protein imports, which do not contain lactose, as well as multivitamins and polyminerals supplements. Intake of omega-3 fatty acid has a beneficial antiinflammatory effect. Patients with contraindications for steroid therapy may be administered systemic take of elemental food containing amino acids or polypeptides, which contribute to achieve remission. Nutritional therapy includes systematic courses with partial parenteral nutrition, which take place in a clinical setting. In patients with fistulas held total parenteral nutrition.

CUHC* affects colonic segments, rectum and caecal and causes periodic flare-ups with abdominal pain, anemia, chronic diarrhea with mucus secretion and blood in the stool, ulcers, strictures and perforation of the intestinal wall. Partial influence is achieved with surgical treatment, which carried partial resection with colostomy or shaping ileo-rec-

* CUHC - Chronic ulcerous hemorrhagic colitis

tal anastomoses. Since in CUHC pathomorphological changes were located distal to the area of the intestinal absorption of nutrients, in these patients do not develop expressed malnutrition. Nutritional status may deteriorate due to decreased appetite or by voluntary restriction in food intake, due to fear of provoking diarrhea. Dietary intake should be sufficiently expanded and balanced. Special attention should be paid to import enough iron and calcium due to risk of anemia and bone disorders. In patients after colectomy apply gentle diet.

Gluten enteropathy (celiac disease) is due to immune-mediated damage of the mucosa of the jejunum, caused by a vegetable protein gluten, contained in wheat, rye, oats, barley. Individuals with gluten intolerance are on average from 0.5 to 1.0% of the population. Exhibit symptoms of fatigue, weakness, weight loss, anemia, gastrointestinal discomfort, intermittent diarrhea. Celiac disease is primary and secondary. Often in the course of gastrointestinal disease or disorder may develop secondary gluten intolerance. Dietary intake is the primary therapy in these patients. From the diet completely exclude gluten containing cereals, and their products - wheat, rye, oats, barley flour, and pasta, cereals and food on their basis - flours, bread, pasta, biscuits, starch, etc., as well as soups, dishes, sauces containing them. Suitable alternative is naturally gluten-free carbohydrate foods - potatoes, rice, corn, chestnuts. There are special gluten-free bakery products - bread, starch, pasta, biscuits and more. Moreover, dietary intake should be sufficiently complete and include milk products, eggs, fresh fruit and vegetables, poultry and fish, butter, vegetable fats in balanced proportions and form of varied menu and appropriate meals (diet №4 -gluten-free). Some medicines, nutritional supplements, beverages - beer and oth. contained gluten and should be avoided.

Syndrome "short bowel" includes loss of intestinal function and a reduction of the intestinal tract, which occur most frequently during resection, Crohn's disease, mesenteric thrombosis and necrosis, radiation enteritis, traumatic lesions. Eating disorders vary depending on the degree of intestinal disorders. In therapy normally involves parenteral nutrition - below 100 cm intestine with yeyunostoma - infusions of electrolytes and fluids, below 75 cm intestine with yeyunostoma - parenteral nutrition, less than 50 cm intestine to the colon intact - parenteral nutrition. Intestinal residue gradually adapt and increase the absorption capacity during the next three years after surgery. These patients require systematic monitoring and building individual diet.

In short bowel with continuity intact jejunum-colon include carbohydrates to 60 en.% and reduced fat to 20 en.%. Thus reducing steatorrhea, through which lose a lot of nutrients accepted. Suitably, and the use of medium chain triglycerides. If necessary, the diet is supplemented with fat-soluble vitamins. Dietary oxalate (tea, spinach, peanuts, beets, sorrel, cocoa and the like.) should be minimized, since it increases the risk of forming oxalate kidney stones due to increased intestinal absorption.

In patients with jejunostomy there is no need to reduce the fat, as the proportion of absorbed fat is not altered by increasing the amount of fat adopted. Hypotonic beverages containing less than 90 mmol sodium/l, causing the extraction of sodium in the intestinal lumen and increase in fluid loss. It is relevant the inclusion of an increased intake of salt and rehydration drinks with 90 mmol of sodium/l, since there is a loss of salt in the jejunum.

In patients with disorders primarily in the column also need adequate dietary therapy. Chronic constipation is a common disorder that requires diagnostic clarification. Diet is balanced and includes increased intake of dietary fiber and adequate fluid intake. It is recommended to increase the daily intake of fruits and vegetables to 400 g in five portions, whole grain bread to 200 g, whole grain rice and whole grain pasta, nuts, legumes (diet № 3). Liquids must be at least 2,5 l per day, so they can be absorbed and contribute to an increase in faecal mass. Adding wheat bran may be of additional benefit in the early below 10 g per day with gradual increase in the good tolerance. Particularly suitable are prunes, as they are rich in sorbitol, and phenols. When hemorrhoids and diverticulosis of the colon also recommended increased intake of roughage and fluids. In colorectal carcinoma dietary intake is determined by the patient's nutritional status and disease stage.

Irritable bowel syndrome is associated with experienced stress, post-infectious dysfunction and impaired nutrition, excessive intake of caffeine, development of food intolerance to wheat and dairy foods, lactose intolerance. Dietary recommendations should be individual and to comply with specific symptoms. The condition can be significantly improved by conducting strict elimination diet and nutrition survey of tolerance, for example. patients who consume a lot of milk - more than 300 g per day, can be improved with the use of low-lactose diet. Overcoming obstipation or diarrhea may be achieved by increasing or decreasing the ballast substances.

Diet in liver diseases (diets № 5, 5-A)

Hepatitis means inflammation of the liver cells caused by viral infection, alcohol, autoimmune reactions, exogenous toxins. Acute hepatitis occurs

with nausea and poor appetite, therefore patients should be encouraged to take enough food through frequent small food intake and fortified drinks. Diet is transient and is characterized by reduced protein and lipid in imports slightly increased carbohydrate intake (diet № 5-A). Excluded are extractive substances (meat soups, sauces, broths, etc.), alcoholic beverages, crude cellulose and irritating foods. Medical nutrition is made of easily digested sugar foods and starch-dairy creams, cereals, fruit and vegetables and meat (poultry, beef and fish fragile lean meats), purée, cottage cheese, egg whites, milk and dairy products with low fats, rice, potatoes, meal, starch. Diet is five regimen.

Patients with chronic hepatitis vary from state of malnutrition in protracted illness and reduced food intake to a state of obesity due to increased food intake and intake of corticosteroids. Diet contains an adequate amount of animal protein, especially milk, sufficient import of carbohydrates, fresh fruits and vegetables and moderate restriction of animal fats and cholesterol contained foods. Limited roughly cellulosic grains, legumes, nuts. The feed is a five-time and apply the aforementioned friendly culinary technology. In most patients with cirrhosis of the liver there is malnutrition, and they require an increased intake of energy 35-40 kcal/kg and protein 1,5 g/kg daily.

Diet with biliary diseases (diets № 5, 5-A)

Gallstone disease is fairly common, usually 2/3 of cases are asymptomatic. Gallstones are advantageously composed of cholesterol and much less than bilirubin, calcium, and pigments. In over saturation of bile and delayed its elimination creating conditions for precipitation of cholesterol stones. For nutritional prevention of cholelithiasis is necessary to avoid drastic body reductions and very low energy diets, to realize regular diet, not to be missed breakfast, to overcome bile stasis and concentration. In cholecystitis need low lipid sparing diet to reduce bile contractions and pain. In the obstruction and the occurrence of steatorrhea, nausea and heartburn, require surgical treatment. After overcoming the mechanical brake, is applied dietary regimen with reduction of fat, irritating and spicy foods and moderate import fiber to prevent bile contractions and gall stones.

Diet in pancreatic diseases (diets № 6, № 6-A)

Pancreatitis is a autolysis pancreatic tissue caused by activated pancreatic enzymes. Risk factors for development of pancreatitis are alcohol use, biliary diseases and abdominal trauma and/or surgery. Acute pancreatitis is characterized by acute abdominal pain, nausea, vomiting associated with pseudocysts, fistulas, shock, renal failure.

Chronic pancreatitis is accompanied by chronic pain, injury reduction, secondary malabsorption, lack of pancreatic enzymes. Malnutrition due to the worsening food intake due to lack of appetite and abdominal pain, malabsorption of nutrients accepted, frequent episodes of nausea and vomiting, increased nutritional needs due to catabolic states.

Moderate pancreatitis do not require dietary restrictions and adequate diet is not appointed enteral nutrition. Acute pancreatitis enteral nutrition is preferred to parenteral for the preservation of the mucosal structure and function, that are violated in the inflammatory process. Diet (diet №6-A) is moderately hypoprotein (70-80 g protein), hypolipidemic (40 g fat) and hypocarbohydrate (200-250 g carbohydrates, of which 25 g of sugar). In about 80% of patients have a gastric feeding tube. Parenteral nutrition is included failing enteral nutrition.

Today it is considered that low lipid diet is important in chronic pancreatitis, as always includes enzyme substitute therapy and need enough food energy. The pancreatic enzyme preparations are taken before and/or during the feeding in the intake of protein and lipid food and should not be mixed with hot foods or liquids as are inactivated at high temperatures and in an acid medium. About 1/3 of patients develop diabetes and this requires optimal control of blood sugar. It is vital to stop alcohol intake. The diet is characterized by a slight restriction of fat, particularly animals to 50-60 g per day and with an adequate amount of protein 1-1,5 g/kg. The daily amount of carbohydrates 350-400 g were primarily provided by foods containing polysaccharides - bread, rice, potatoes, fruit and vegetable purees and sauces. Co-existing diabetes excludes sugar (diet № 6).

In pancreatic cancer and conditions after pancreatic operations dietary intake is consistent with available primarily malnutrition and malabsorption, requiring supplementation and enzyme replacement therapy.

Diet in kidney disease (diets № 7 7-I, 7-II, 7-III, 7-H, 14)

Diet for patients with compensated renal function with normal creatinine clearance and normal serum creatinine and urea, contains optimal protein imports from 0,8 to 1,0 g/kg. The carbohydrates in the normal amount of 300-400 g per day, and the lipids are 80-90 g daily. The amount of salt is 4-6 g

per day, in the presence of hypertension should not exceed 4 g. The intake of liquids is considered optimal in accordance with urine output plus 500 ml. Accepted complete dairy and meat protein foods, salt-free bread, lots of fruit and vegetables, sweets and pasta. The meat is pre-cooked and the broth is removed for sodium chloride and purin containing extractive substances (diet №7).

In developing chronic renal failure in glomerulonephritis, pyelonephritis, uric acid nephropathy, etc., with a decrease in creatinine clearance from 80 to 50-25-10 ml/min. and increases in serum urea and creatinine from 133 to 700-1000 μmol/l, dietary intake changes by progressively reducing protein intake /diets №7 - I, II, III /. In the low-protein diet he is 0, 6 g/kg, and in very low protein diet dropped to the protein minimum 0,3 g/kg, or about 25 g per day. The diet is largely vegetarian, during 3-4 days are included dishes with milk or egg constituents. In this protein restriction is require additional supplementation of the diet with essential amino acids and their ketoanalogues, to support protein synthesis in the body. Because of risk of protein-energy malnutrition is required increasing the energy volume of 35 kcal/kg. It is necessary to reduce the intake of phosphorus because of growing hyperphosphatemia and increase calcium intake because of existing hypocalcemia, abnormal bone metabolism and risk of bone fractures. Maximum should be limited and intake of sodium and potassium due to progression of swollen and hypertonic syndrome and hyperkalemia. In the most restrictive embodiment diet consists mainly of fruits, vegetables with a lower protein content, nutritional fat - cream, olive oil, sugar, honey.

In the presence of nephrotic syndrome which occurs with high-grade proteinuria, edema, hypoproteinaemia, dyslipoproteinemia is necessary to provide a high protein intake to 1,5 g/kg, and to reduce the intake of saturated fat. Diet is hyposodium (2-3 g salt per day) and fluid intake is consistent with diuresis (diet № 7-H).

In the etiology of nephrolithiasis have a place nutritional factors - reduced fluid intake, dehydration and increased intake of saturated, primarily animal fats. Medical nutrition in kidney stone disease include increased fluid intake 2-2,5 l per day - water, herbal tea, soups, juices, compotes, mineral waters - alkaline or acidic, as pH of the urine and type of urolithiasis. When uric acid and oxalate lithiasis appointed alkaline, while phosphate lithiasis - acidic mineral waters. Suitable are so-called water hit with the intake of 1,5-2 l mineral water. The amount of salt is reduced to 5-6 g per day. In uraturia and oxalaturia appointed alkalizing diet, composed mainly of fruits, vegetables, milk and dairy foods to limit meat, meat products and fish. Today cosidered that, the nutritional oxalates (spinach, sorrel, cocoa, rhubarb, eggplant, tomatoes, etc.) are not absorbed and are not relevant to the diet. In phosphaturia apply acidifying diet, composed mainly of meat, fish, eggs, bread and pasta, butter and limited alkalising and calcium-rich foods.

Diet for overweight and obesity (diet №8)

A fundamental requirement of dietary regimen in obesity is moderate hypoenergy 1200-1400 kcal per day. The ratio of the major macronutrients is optimal and balanced as in healthy eating. Reduced energy of diet is achieved by switching off the energyndense, concentrated foods rich in fats and sugars and include more low-calorie foods - fiber, whole grain foods, raw fruits and vegetables. The feed is a five-time and requires equal distribution of food throughout the day, to not feel hunger. Important is adequate intake of fluids - 2-2,5 l per day in the form of mineral water, herbal teas, fresh fruit and vegetable juices, vegetable soups, to ensure proper metabolism in terms of increased energy expense and increased catabolism. Salt should be limited to 5 g per day and replaced with dietary salt. It is appropriate to use non-caloric sweeteners. Proper treatment is culinary grilling, boiling, steaming, without the use of extra fat. Preferred lean meats - chicken, beef and fish, nonfat or low-fat dairy products, dietary cottage cheese, oatmeal and cereal products, fortified with fiber, brown rice, whole grain bread diet, natural fruit and vegetable dishes and more. Low energy diet should be combined with increased individualized physical activity. The rate of weight loss should be moderate - 2 to 4 kg per month. Successful diet treatment leading to 5-10% reduction durable body.

Recommended are so-called unloading days 1-2 times a week with very low daily energy - about 600 kcal per day. Eg. they may include of 500 g low-fat yogurt and raw vegetables and/or fruit of choice. Starvation is not a method for reducing body and is associated with increased cardiovascular risk and a number of adverse metabolic, cardiovascular, hepatic, respiratory, neurological and psychiatric disorders. Clinical practice has proved that the effect of very low energy diets is not durable and is aligned with that of moderately low energy diets. Moreover in most cases they are not tolerated well by patients and have an increased metabolic and cardiovascular risk.

Diet in diabetes (diet № 9)

Diet is an essential element of diabetic therapy. Patients with type 2 diabetes and overweight need a

low-energy diet and a successful reduction of body, through which can fully improve their glycemic and cardiovascular control. At normal body mass forms normoenergic, while underweight body mass in children and adolescents - hyperenergic diet.

In the past it was thought that the diabetic diet should be hyperprotein and low-carb. The modern concept is that the structure of the diet in diabetes is fully covered by the current recommendations for optimal health nutrition. That include no more than 30 en.% fat, required ratio of saturated, monounsaturated, polyunsaturated fatty acids 1: 1: 1 - i.e. by 10 en.%, such as at accompanying dyslipoproteinemia they can be reduced to 20 en.%. Proteins are limited to 15-20 en.% or 0,8 g/kg, by reducing in renal insufficiency or increase in underweight and malnutrition. Carbohydrates take 50-60 en.% and are composed primarily of polysaccharides rich of fibres. Recommended intake of dietary fiber is 20-40 g daily. Preferred are carbohydrate foods with a low glycemic index, almost completely excluded mono- and disaccharides, with the exception of fructose to 50 g per day. It is extremely important even distribution of carbohydrate intake throughout the day, as with insulin therapy and in oral therapy. For the purposes of diet training and good diabetic control patients has been introduced for bread units. 1 BU conform to 12 g carbohydrate.

Diet in cardiovascular disease (diets № 10, 10-A)

Diet in coronary heart disease, hypertension I and II stage, cardiomyopathies and others with compensated cardiac function or initial decompensation, requiring restriction of salt to 2-3 g per day and moderately limiting the intake of fluids up to 1-1,5 l per day. The diet includes adequate amount of alkalizing plant foods - fruits and vegetables, digestible and complete protein and foods rich in potassium, magnesium, lipotropic substances, antioxidants and vitamins. Animal fats have moderately reduced, while in overweight forms low-energy diet in order of body reduction. Rough cellulose, spicy and hard-assimilate foods are limited and removed (diet №10). Suitable foods include low-fat milk and milk products, cheese, fish, lean poultry and veal, dietary salt, honey, strawberries, oatmeal, potatoes, apricots, starch, fresh fruit and vegetable juices and purees, whole grain foods and more.

In recent myocardial infarction and stroke, hypertension stage III and expressed heart failure apply a more restrictive version of the dietary regimen, which is an energy reduced from 1500 to 1800 kcal per day (diet №10-A). Protein is lowered to 60 g per day, fat to 50-60 g daily, and in dyslipoproteinemia to 30-40 g per day, to 250 g carbohydrate per day. This mode is salt-free and free fluid intake should not exceed 0,5 l per day. The food is slightly absorbable, mostly mushy, no soups, compotes are passion, fruits baked or in the form of puree. Removed are spicy, exciting and rude cellulosic foods, that can cause meteorism.

Diet in under body weight and malnutrition (diet № 11)

Curative nutrition in weak and exhausted chronically ill underweight after infectious diseases, heavily operations, burns, trauma, anorexia and others requires increasing the energy of an balanced with optimal ratio of individual macronutrients. Hyperenergy diet includes 40-50 kcal/kg and an total energy of 3500 to 4000 kcal per day, with a daily import of proteins 120-130 g, fat 100-120 g, carbohydrates 500-600 g. The food must be biologicaly wholesome, easily digestible and absorbable. Eliminated are spicy, hard-irritating and rude cellulosic foods. Suitable foods include lean meats, fish, whole milk and dairy products, cream, honey and bee products, nuts, pastry and confectionery, cocoa, chocolate, fruits and vegetables and more. In some cases it is necessary feeding to a transitional diet with normal or below an energy, wich according to the tolerance of the patients gradually expands and moves to hyperenergy meal.

In addition to the main dietary regimens in clinical conditions also apply a number of variants and combinations as well as special diets - milk diet Karel, rice - fruit of Kempner, magnesium diet, trial provocative and elimination diets, vegetarian, raw eating, healing hunger, fruit and others.

REFERENCES

1. **Balabanski ,. L.** Nutrition and Dietetics. S., Med. and phys., 1988. (in bul.)

2. **Balabanski L.** Nutrition and metabolic diseases. S., Med. and phys., 1990. (in bul.)

3. **Basdevant, A., M. Le Barzic, B.Guy-Grand.** Eating patterns from Normal to Pathological.Paris, PIL, 1993, 95 p.

4. Diet nutrition, ed. **Balabanski. L.,** S., Med. and phys., 1992, 322. (in bul.)

5. **Escott-Stump, S.** Nutrition and Diagnosis-related Care.3-td edition.Philadelphia, London, Lea & Febiger, 1992, 660 p.

6. Handbook on dietology. ed. **M.A. Samsonova and AA Pokrovskji. M.,** Medicine, 1992. (in russ.)

7. **Jinks, M. and M.Garrison.** Obesity and Eating disorders In: Textbook of Therapeutics: drug and disease management. 6th edition. Ed. by E.Hefindal, D.Gourley. Baltimore, Philadelphia, London, USA, Williams and Wilkins, 1996, 1165-1178.

8. **Konjishev, W.A.** Nutrition and body regulating systems. M., Medicine, 1985. (in russ.)

9. Krause's Food & Nutriton Therapy, Intern.edition. **L.Kathleen, S.Escott-Stum.** 12th edition.Saunders Elsevier, 2008, 1352 p.

10. **Markova M.** Guide for preventive nutrition. S., Med. and phys., 1990, (in bul.)

11. **Nikolova, P., P. Boyadjieva.** Heavy metal poisoning. ed. **Vl. Boyadzhiev and Ts. Aleksieva.** Med. and phys.ult., 1990, p. 133-148. (in bul.)

12. **Nikolova, M.,**Study of serum levels of 25 (OH) vitamin D in overweight and obese subjects and association with dietary intake, anthropometric and metabolic indices. Dis. 2018, 198 p. (in bul.)

13. Oxford handbook of Nutrition and Ditetics. Ed.by **J.Webster-Gandy, A.Madden, M.Holdsworth.** Oxford University Press, Inc., New York, 2006, 730.

14. **Page, A.** Alimentation et maladies coronariennes. Paris, Masson, 1993.

15. **Petrovskiy, K. S., V.D. Vanhanen.** Food hygiene. M., Medicine, 1982. (in russ.)

16. Regime alimentaire, nutrition et prevention des maladies chroniques. Rapport d'une groupe de l'etude de i'OMS. Serie de Rapporte techniques 797. Geneve, 1990.

17. Regulation N 8/24.04. 1987 free prophylactic food for workers employed in industries associated with adverse health effects. SG. 43/1987; SG 58/1993. (in bul.)

18. Regulation N 23 on physiological norms of feeding the population. SG. 63/2005. (in bul.)

19. **Tashev, T.** Clinical dietetics. Sofia Med. and phys., 1966, 409 p. (in bul.)

20. **Tashev, T., Zh.Stoyanova, Ya.Dzhambazova.** Diet nutrition. Sofia Med. and in phys., 1976, 394 (in bul.)

21. **Vanhanen, V.V., N.V. Vanhanen, E. T. Dorohova.** Nutrition: health and disease. Donetsk, 1994. (in russ.)

9.3.2. FEEDING OF VARIOUS POPULATION GROUPS. P.Nikolova

9.3.2.1. FOOD DURING PREGNANCY AND LACTATION

Pregnancy is characterized by a predominance of the processes of synthesis in the mother's body. Increase in certain organs and tissues, increases the volume of blood and parallel reduces the number of erythrocytes, develops so called "physiologic anemia of pregnancy." In connection with the change, needs of energy and nutrients are larger than in other periods of a woman's life; increase in different patterns nutrients.

In I quarter energy needs increase slightly - by 0,3 MJ (68 kcal)/d, compared to those before the pregnancy. During the quarter the growth in energy demand mainly related to the increase in mothers tissue, forming alternate depot of fat and in III-it - the growth of the fetus and placenta. For II and III quarter energy imports should grow by 1-2 MJ/d (260-500 kcal/d). For women between 18 and 50 years of age, low physical activity are needed daily average of about 9.2 to 10.5 MJ (2100-2500 kcal) If there is insufficient energy imports - less than 6,3 MJ/d (<1500 kcal/d) during the second half of pregnancy may be a delay of fetal growth.

◆ ***Proteins***

In the normal course of pregnancy protein catabolism is normal and nitrogen balance - positive. The shortage of proteins can lead to substantial disturbances in fetal development, but excess protein could have negative consequences for the pregnant woman and the fetus. Demand for protein increases in the I quarter of 7 g/d, while in II-III-it - 40 g/d to the needs of non-pregnant women. They should deliver about 15% of energy and 1/2 - to be complete. Since energy needs are increasing less than nutrients pregnant women need to choose products with high nutritional density - milk, low-fat dairy products, liver, eggs, legumes, vegetables, wholemeal bread. Especially useful due easily adopted complete protein are milk and dairy products. At the same time they provide a balanced procurement of easily assimilated calcium and phosphorous salts necessary for bone formation of the fetus. When the meat and fish on the menu, especially in the second half of pregnancy, it should be borne in mind that liver and kidney of pregnant women are overloaded, due to the increased release of products from metabolism (own and fetus). To avoid the agitating action of the extract substances from meat and fish, it is recommended that such a culinary preparation, by which they can be reduced in the finished plates.

◆ **Fats**

Fats are needed to replenish the fat depot of the mother, for the procurement of essential bioactive ingredients for fetus - especially PUFA and vitamin E. In I quarter supplement of fat 3 g/d, and in II-III - 8 g/d. Recommended salads with vegetable oil, and for the procurement of vitamin A and D - lactic butter, fish.

◆ **Carbohydrates**

Carbohydrates are necessary for fetal tissues and pregnant metabolism. The increase is hormonally determined to ensure the addition of glucose to the fetus. Along with deaminated protein carbohydrates protect pregnant by ketosis. The specifics of carbohydrate metabolism requires the adoption easily destructive as are fruit and milk sugar, honey. Carbohydrates must provide no less than 55% of the energy import. Sugary foods and drinks should be avoided. The minimum recommended dietary intake is 175 g/d.

◆ **Vitamins**

Vitamins are required in large numbers, given the enhanced protein synthesis and intensive processes of growth of the fetus. For the whole period of pregnancy should be take with 15 mg/d more vitamin C. It is recommended to increase the products natural sources of vitamin C - vegetables and fruits, which improves the absorption of iron. The needs for vitamin B_6 are increasing in parallel with those of the proteins to 0,4 mg/day. For the procurement of other B vitamins is recommended that consumption of whole wheat bread, oatmeal, beans. Needs folacin increase much because of the increased blood volume, rapid growth of the fetus and the amplified protein anabolism. For the whole period of pregnancy is necessary to import by food 600 µg/d folacin, i.e. three times increase. Vitamin B_{12}, which is obtained exclusively from animal products is also required in larger quantities, as assist folacin in the construction of the erythrocytes, and with it, and the iron, which prevents the occurrence of "physiologic anemia" at pregnant. Should by food be adopted 2,6 µg/d vitamin B_{12}. The needs for vitamins A, E and D are also larger and must be obtained from natural sources **(Table 9.9)**.

◆ **Minerals**

Mineral substances needed for forming the skeleton, normal blood formation and development of the fetus. This is particularly important for minerals involved in the construction of the skeleton - calci-

um, phosphorus, magnesium. Poor of calcium food results in a reduction in bone density of the newborn. In early pregnancy, intestinal calcium absorption doubles and calcium is deposited in the bones of the pregnant woman. Later, when the bones of fetal start calcify, calcium from the bones is derived maternal placenta and passes into the fetus. During the whole period of pregnancy should be ensured 1000-1300 mg/d calcium and so much phosphorus.

The body stores of iron improve, as there is no menstruation and iron is not lost. Recommendations are iron in the diet of pregnant be increased by 10 mg, ie daily intake to adopt 27 mg of iron. Best absorbed iron from red meats. The absorption of nohemic iron boost of vitamin C, so need to consume plenty of fruits and vegetables. With them, as well as whole-grain bread, are supply fibers which contribute to the normalization of impaired often function of the colon. Increasing the main exchange, in parallel with the increase in the activity of the thyroid gland and secretion of thyroid hormones, leading to an increased demand of iodine during pregnancy with 70 µg/d. The most important sources of iodine are iodized salt and seafood. Another nutrient vital during pregnancy is zinc. Many zinc are in protein foods, but absorption may be reduced when taking large amounts of fiber. Daily with food pregnant woman should take 11-13 mg zinc.

In normal pregnancy diet must be 4-fold in the I quarter and 5 times in II and III quarter.

◆ Nutrition in nursing

Adequate energy imports needed to satisfy the power consumption of the nurse and for lactogenesis and meet the energy needs of the infant through breast milk. Energy requirements are increased in proportion to the amount of milk that is separated from the mammary glands of the mother. In I - II quarter, they increased by about 3 MJ/d (700 kcal/d), and in III-it when the child is fed - 2 MJ/d (460 kcal/d). The qualitative and quantitative composition of breast milk depends on the composition of the food. Maternal diet affects most pronounced on the content of fat and water soluble vitamins. General malnutrition of the mother during lactation leads to protein malnutrition and reduce its calcium in the bones. The requirements for protein imports are very high. Protein be more by about 20-25 g/d compared to norms for age. They should be provided mainly from milk and dairy products, meat, fish, eggs, pulses. Daily supplements of fat is 17-20 g.

The increased needs of maternal's body by energy and restored tolerance to carbohydrates, require the adoption of more carbohydrates, with a preponderance of the complex. The minimum dietary intake of carbohydrates is 210 g/d. The processes of growth and development of the infant require large amounts of vitamins and bioelements, which come exclusively with breast milk. So the needs of the mother's body from these substances increased (**Table. 9.9**, **9.35** and **9.36**).

The increased needs should be satisfy from natural sources - foods. The needs for vitamin C was increased daily by 30 mg **(Table 9.35)** and on the bioelements - a significantly increased demand for iron **(Tab. 9.36)**.

Table 9.35. Recommended average daily intake of water soluble vitamins nursing

Vitamin	Recommended average daily intake
C (mg)	100
B_1 (mg)	1,5
B_2 (mg)	1,6
PP (mg NE)	17
B_6 (mg)	2,0
Folate (µg)	500
B_{12} (µg)	2,8

Table 9.36. Recommended average daily intake of minerals for nursing mothers

Minerals	Age – years	
	≤18	≥19
Calcium (mg)	1300	1000
Phosphorus (mg)	1250	700
Magnesium (mg)	320	320
Iron (mg)	10	10
Zink (mg)	13	12
Iodine (µg)	290	290

To stimulate lactogenesis is very important to observe a diet regimen. It should be like in the last months of pregnancy - i.e. 5 times. Fluid intake should precede breast feeding about 15 min.

9.3.2.2. FEEDING CHILDREN AND STUDENTS

Exchange processes in children are characterized by intensity. After the first year the main exchange and power consumption per kg of body weight, depending on age, are 2 to 1.5 times greater than adults. Increase in muscle mass, bone density and fat depot, especially during the two periods of accelerated growth – 4-6 and after 10 years.

In early childhood, energy and nutritional needs vary individually, depending on growth, sex, previous nutrition, health and many other factors. In insufficient import of plastic substances (proteins, calcium) and energy worsen bone mineralization, growth processes, reduce physical activity and resistance to infections. Therefore it is very important to ensure adequate import of protein and energy.

The average daily energy needs increase slightly with age. For children 1 to 3 years they have from 850 to 1600 kcal, for children between 6th age 10 - 1500-2200 kcal. In the adolescent period (after 10 years) exhibit sex differences in the skeleton, muscle mass, fat depot that affect energy demand. Development and maintenance of muscle mass for boys between 10 and 14 years require about 2000-2600 kcal), and from 14 to 18 - 2700-2800 kcal. Girls need less energy because their body mass is fewer, then after 15 growth processes almost stopped. To not develop obesity for girls of the same age are required 1700-2000 kcal.

The predominance of plastic processes increases the need of the child from plastic and catalytic substances.

◆ **Protein**

Protein needs increase with age, more sensitive to the boys. Deficiency of protein, especially in early childhood leads to significant distortions in the processes of growth and development, immunological reactivity, utilization of valuable micronutrients. But excess protein is harmful and can lead to adverse changes in the central nervous system, liver, acid-base status. To ensure adequate import of protein and amino acids - growth factors, and to balance the amino acid composition, for daily menu, paramount importance have milk and dairy. Milk proteins, however, are low in tryptophan, arginine and histidine. So every day should include foods that are their main sources - meat, fish, eggs.

◆ **Fats**

Shortage and surplus they may have adverse effects, lead to changes in the absorption of protein in immunological reactivity, digestive and others. To ensure sufficient polyunsaturated fatty acids and bioactive nutrients is an important qualitative composition of fats. Of animal fats is essential dairy butter, thereby obtain vitamins A, E, phospholipids (lecithin).

Fat needs are quantified as those of proteins. Therefore, the weight ratio between them is 1:1. They should provide 32-30% of the energy of the day.

◆ **Carbohydrates**

Needs per kg body weight are larger than adults due to the higher energy consumption per kg of body mass and intensive process of glycolysis. It is recommended that from an early age to establish correct eating habits and selection of food supplying carbohydrates, giving preference to containing complex carbohydrates and fiber, fruits and natural fruit juices, supplying fructose and glucose and other valuable nutrients. Excess sugar and confectionery products can lead to changes in resistance, exacerbation of allergic reactions, increasing the risk of tooth caries and obesity.

Given the intense ongoing metabolic processes, necessary food to import adequate amounts of vitamins, especially growth A, D, B_r B_6, B_{12}, pantothenic acid. Very important is the mobilization of vitamin D, which is essential for the absorption and deposition of calcium in the bones (**Table. 9.9** and **9.27**).

◆ **Minerals**

Mineral nutrients are required for normal growth and development of bone tissue and teeth, and for the maintenance of the teeth. Recommended daily be delivered from 0.5 to 4 mg fluoride (mainly food and drinking water).

Calcium and phosphorus **(Table. 9.23)** must be obtained from milk and dairy products, egg yolks, legumes, nuts. For normal blood formation, growth, development and the functions of the endocrine glands are required in sufficient quantities and bio-microelements - iron, copper, manganese, cobalt, zinc, iodine, fluorine and others. In particular attention, especially in prepubertal girls, is iron. Iron needs are greatest for ages 14-18 years. Very important is the daily ration to include foods rich in iron (meat, pulses, fruits), of which it is easily absorbed. In childhood and school age, and especially in early childhood, should be careful with the consumption of foods and beverages containing caffeine - cola, chocolate, cocoa, etc., which have little nutritional density, but increased energy imports and excitability of nerve system.

◆ **Diet**

Diets of early childhood and preschool is 4-5-fold, and for students - should be aligned with the regime of school classes (morning or afternoon), with breakfast one morning and snacks in the big break. Irregular eating, especially the lack of breakfast, affects children's behaviour. Concentration of attention is worse, they are distracted and irritable.

Eating habits obtained in children, especially school age, can affect the health both - positively and negatively, incl. and in the following age periods.

9.3.2.3. FEEDING PEOPLE ENGAGED IN MENTAL LABOUR

Intensive mental work, combined with high neuro-emotional tension, hypokinesia and failure of motor-visceral reflexes, leading to a number of unfavourable changes in metabolism and increases the risk of a number of modern diseases. As a result of endogenous synthesis of fat and cholesterol in the liver, increased total serum cholesterol and HDL cholesterol decreased. Intense and frequent emotional stress lead to increased blood sugar levels and reduce glucose tolerance. High neuro-psychological stress causes changes in metabolism of many vitamins, with a reduction of vitamins C and group B in the tissues, which, along with high cholesterol and wrong nutrition increases the risk of atherosclerosis. Negative emotions and emotional stress activate the peroxidation of lipids in the cells and tissues, especially in heart muscle, resulting in functional and morphological changes. More common, are due to hypokinesia and insufficient consumption of fiber, irregularities in motor function of intestines, hemorrhoids.

The energy value of the daily ration must not exceed the daily energy expense. For the people of intellectual labour is beneficial energy balance is slightly negative, given that with age the energy consumption gradually decreases.

Nutrition should be full, regardless of the limitation of the energy value. Daily to obtain the essential biologically active food ingredients, some of which - and in increased amounts. It is necessary to select products with high nutritional density and a maximum limit of refined and canned and importing "empty calories."

◆ Proteins

Proteins must be present in quantities providing no less than 10% of the energy required.

◆ Carbohydrates

Carbohydrates, mostly easily digested, should be limited due to the high energy value. People of intellectual labour must choose complex carbohydrates, mainly from whole grain (rye) bread, pulses, potatoes. Starch from legumes less stringent raises blood sugar levels. Needs of saccharides to satisfy from fruit, milk, honey (less). Easily adopted, especially combined with fats (pastries), should be avoided. Sugar does not exceed 10 percent energy.

◆ Fibre

Fiber are essential significance for preventive nutrition and normalization of motor activity of the digestive system. To ensure the necessary amounts - 25-40 g/day, daily diet should include whole wheat bread, bulur, oatmeal, wheat bran, fruits and vegetables (200-300 g/day).

◆ Vitamins

Vitamins should be supplied exclusively from natural sources - daily to consume raw vegetables and fruits. Important is the prevention of hidden forms of hypovitaminoses which occur first with reduced capacity and fatigue. When difficulties in getting enough vitamins from natural sources, requires the adoption of multivitamin preparations for prophylactic purposes.

Given that food sources of animal protein are usually rich in saturated fatty acids, in composing the menu should prefer foods with low atherogenic potential - fish, poultry **(Table. 9.37)**.

Table 9.37. Atherogenic potential of some food products, calculated index cholesterol/saturated fat (in Kreisberg, R.A.)

Food product	Cholesterol (mg/100g)	Atherogenic potential
Fish	50-100	4
Chicken meat (skinless)	67	6
Meat beef pork, lamb with 10% fat with 20% fat with 30% fat	 65 65 65	 9 13 18

Poultry meat is rich in glutamic acid, which is very important for the brain. Milk and dairy products must be one of the main sources of full proteins. At the same time they provide calcium - important for the prevention of osteoporosis. The presence of orotic acid with hypocholesterolemic action in milk also makes it necessary product. Part of the protein must be of pulses (beans, lentils, soya beans), nuts (walnuts, almonds), oatmeal, foods with hypocholesterolemic effect. Protein from cereals imported and glutamic acid.

◆ Fats

Fats should be limited - they have to deliver no more than 25% of the energy for the day. It is important combination of fats of vegetable and animal origin. To meet the needs of PUFA in the range 3-7 percent of energy, necessary to combine dietary vegetable and fish oils. Exogenous cholesterol should not be more than 300 mg/day.

Importance in the diet of persons engaged in mental work, have substances with antisclerotic and

lipotropic action (methionine, choline, inositol, lecithin, polyunsaturated fatty acids, folic acid, vitamins B_6, B_{12}, B_{15}). With daily food must be imported and enough natural antioxidants - vitamins E, A, C, carotenoids, selenium.

◆ **Minerals**

Bio-elements are necessary nutrients for persons engaged in mental work. To ensure them is necessary right combination of food products of animal and vegetable origin. Selenium is an antioxidant, chromium improve glucose tolerance, fluoride and calcium are necessary for prevention of osteoporosis, magnesium and potassium - the activities of the cardiovascular system. Salt should be moderately limited, especially in the presence of "salt sensitivity" for hypertension.

Essential requirement for people of intellectual labour is not abusing alcohol, coffee, strong tea, cola and other refreshing drinks rich in caffeine.

◆ **Diet**

Diet is properly to be 4-fold: first breakfast - 20-25%, lunch - 35%, snack -15% and dinner - 25-30% of the energy value of daily rations. When formed a diet must respect the need to provide 6-10 h rest a day for digestive glands. So dinner, mostly dairy-vegetarian, should be taken no later than 3 h prior night's sleep.

9.3.2.4. NUTRITION FOR INDUSTRIAL WORKERS

Feeding of industrial workers satisfy meet the needs of energy and nutrients, to strengthen health and their resistance to unfavourable impact of some factors in the work environment, help to increase their working capacity. It is based on the general principles of health (rational) and safety professional nutrition. When drawing up the menus should be kept in mind that the needs of nutrients and energy are increasing with the intensity of physical load, and in conjunction with neuro-sensory tension and hypokinesia, accompanying some professions, are required changes in qualitative composition of food. Normes of energy and nutrients, depending on the age and intensity of physical labour, are presented in **Table. 9.7., 9.15., 9.18., 9.19.**

◆ **Proteins**

To maintain high performance and durable in daily ration should include enough protein, providing 10.5 to 12% of the required energy, ie from 81 to 100 g/day. It is recommended that 50% of the protein to be full.

◆ **Fats**

Fats must not be more than 30% of total energy intake in the balance between animal and plant, considering that the vegetable fats introduced into the body, and substrates for peroxide oxidation of lipids, which can be stimulated by a number of work factors. Depending on the intensity of physical labour, daily intake should be adopted 90-127 g fat.

◆ **Carbohydrates**

The quantity of carbohydrate, primarily complex must be in accordance with the power consumption and provides about 60% of the energy required. Recommended carbohydrates in the daily ration to 392-564 g.

◆ **Vitamins**

Food should provide enough vitamins. Increased amounts required to work with significant physical load or neuro-sensory stress, presence of hazards, extreme conditions, especially in the adaptation process. In some industries (work in conditions of hazards high percentage of colds, etc.), advisable is provision of synthetic multivitamin complexes or complexes of minerals and vitamins.

◆ **Diet**

Diet is closely related to the operation mode. Recommended 4x nutrition where, depending on the shift,is appropriate in the canteen on enterprise to provide at least two receptions.

When working in night shifts to nutrition requirements are dictated by circadian periodicity of physiological functions and metabolism. Normalization of acid-base status, amending to metabolic acidosis, in nighttime snacks should be included mainly products alkalizing effect (dairy, fruits, vegetables). To improve psychomotor performance and maintain operability - enough protein, and the reduced utilization of glucose by tissues and tendency to hyperglycaemia - mainly hard resobed carbohydrates (bread). Animal fats, butter, margarine should be limited as the most acidogenic and lipidogenic. To maintain the tone of the nervous system and high-performance advised refreshing drinks (tea, coffee, cola). It is appropriate following distribution of food: light breakfast before daily sleep - 20%, lunch 25-35%, 35-40% dinner and night snacks - about 15% of the energy value of the daily ration. It should be served in appropriate packaging, close to the workplace, depending on specific conditions. In the presence of harmful factors in the work environment is organized safety professional catering, while establishing certain chronic diseases with unprofessional genesis and preserved working capacity (ulcer disease, diabetes, etc.) - dietary therapeutic feeding.

REFERENCES

1. **Balabanski L.** Nutrition and metabolic diseases. S. Med. and phys., 1990. (in bul.)
2. **Berger, H.** Vitamins and minerals in pregnancy and lactation. Raven Press, New York, 1988.
3. **Bournr, E.** Energy nutrition of women. Kargar Bale, 1987.
4. Food Hygiene. ed. **Vl. Boyadzhiev and M. Markova.** S., Med. and phys., 1987, p. 151-181. (in bul.)
5. **Gong E.J., Heald F.P.** Diet, Nutrition and Adolescence, in Modern nutrition in health and disease, ed. Shils M. E., Olson J. A., Shike M., 8-th, Williams & Wilkins, 1994, 759-770
6. **Hamilton, E., M. Whitney, F. S. Sizer.** Nutrition: concepts and controversies. West Publishmg Company. IV es., St. Paul, New York, Los Angeles, San Francisco. 1988.
7. **Heird W.C.** Nutritional Requirments during Infancy and childhood, in Modern nutrition in health and disease, ed. Shils M. E., Olson J. A., Shike M., 8-th, Williams & Wilkins, 1994, 740-759
8. **Ladodo, K., V. Ott, E. Fateeva.** Fundamentals of children nutrition. Kiev., 1987. (in russ.)
9. La prevention des le jeune age des maladies cardio-vasculaires de l'aduite; il est tempe d'agir. Rapport d'une groupe de L'OMS. Serie de Rappotts techniques 792, Geneve. 1990.
10. Les differents groupes d'individus, leurs besoins particuliers, in Alimentation et nutrition humains. Coord. **H. Dupin.** ESF editers, Paris. 1992, p. 445-507.
11. **Luke, B.** Principles of nutrition and diet therapy. Little Brown and company, 1984, p. 389-475.
12. **Markova M.** Feeding of students. S., Med. and phys., 1986. (in bul.)
13. **Mc. Ganity WJ, Dawson E.B., Fogelman A.** Embryonic Developmant, Pregnancy, and Lactation, in Modern nutrition in health and disease, ed. Shils M. E., Olson J. A., Shike M., 8-th, Williams & Wilkins 1994, 705-728
14. Regulation 23 of physiological norms of feeding the population. SG. 63/2005. (in bul.)
15. **Rosco, P.** Nutrition and metabolism in pregnancy. Oxford University Press, 1991.
16. **Trifonova, L.** Feeding children in nurseries. S., Med. and phys., 1983. (in bul.)

9.3.3. "NON-TRADITIONAL (ALTERNATIVE)" NUTRITION. B. Popov, D. Tsvetkov

Term "alternative diet" involves the application of diets with varying lengths, differing significantly from the principal requirements for healthy feeding. The motivation for their application has a different character:

• *Religious and philosophical:* the scientist and religious sects, preaching non aggression (and also for animals), spiritualism, ascetic lifestyle and restricted feeding.

• *Medical:* altered taste in cancer, kidney failure, dyslipidaemia.

• *Personality:* family traditions, changes in lifestyles, taste preferences, economic problems.

The most common forms of this unusual diet currently:

1. Reduced feeding.
2. Intermittent feeding.
3. Vegetalism.
4. Vegetarism.
5. Separate feeding.

◆ Reduced feeding

Reduced diet meal includes various forms of limited intake of nutrients and energy with different motivations. Most often reason for the application is reducing overweight. If it is administered under medical supervision for short periods, usually poses no risk to human health. The diet in these cases is to limit energy nutrients (fats and carbohydrates), combined with increased physical activity. If a diet however excluded for a long time imports of proteins, this leads to a number of disturbances in the body associated with protein deficiency. Implementing arrangements to complete fasting for more than 7 days constitutes a serious interference in the food homeostasis of the body, with disturbances in cellular metabolism and development of disease processes.

Fasting body mass is reduced, depending on its duration, but it depends and on initial body weight, sex and age. It is important to note, that besides the significant decrease mainly of subcutaneous fat and muscle mass, occurs and a reduction in weight of parenchymal organs - liver, kidney, spleen, heart. Fasting occurred and significant changes in biochemical status of the organism. Above all, it is reducing the total serum protein, especially albumin. Study about elimination of creatine in urine is very indicative of fasting. In healthy people with normal eating creatinuriaty is relatively constant and is proportional to muscle mass. When a moderate reduction of the latter is clear separation of creatine normally 70-80% of its normal value.

Consequently, the deficit in protein, vit. B_{12}, folic acid, iron and zinc, often in starving and reduced feeding finds anemia. Moreover, registering changes in immune processes and enzyme disorders and endocrine functions.

Especially indicative are the changes in digestive functions on starving and half-starving. It was found that in these cases to induce a sharp activation of enzymatic and transport processes in the small intestine. This is to ensure a faster and more efficient use of the nutrient substrates in terms of their deficiency. Renew feeding after starvation and reduced feeding again characterized by amplification activity of intestinal enzymes.

◆ Intermittent feeding

Intermittent feeding could be considered a variant of reduced nutrition and food intake includes only 2-3 times a week. From a physiological point of view, the application of fast, continuous, intermittent or reduced feeding is not appropriate. In all cases, the deficiency of nutrients or irregular acceptance induce the activity of the respective systems related to their absorption. Limited acceptance of a nutrient is a major incentive, leading to the adaptation of the systems associated with assimilation and storage of nutrients. Particularly ineffective for the body is that in these cases usually significantly enhanced the absorption of energy of food components, at the expense of plastic, which is especially true when resuming normal diet.

As a good version of reduced nutrition could accept the application of the so-called *discharge days*. In those days may be accepted or only fruits, or fruits and vegetables, or milk added to them. Fruits and vegetables are distributed in small portions throughout the day, and between their intake drink milk or herbal teas sweetened with a little honey. It is believed that mixed feeding the implementation of such a mode 1 time per week is especially helpful, because the body is saturated with alkaline radicals and facilitates the elimination of toxic substances and metabolites.

◆ Vegetalism

Vegetalism is a diet only plant products, completely off animal foods. These are the so-called strict vegetarians. The absence of animal products in the diet for such people is the cause of insufficient imports into the body of essential nutrients, especially essential amino acids and lipotropic factors. This is the reason why they are more vulnerable to

the chemical effects of the environment and with an increased risk of toxic liver damage. The significant deficiency of lysine, as well as histidine, methionine and tryptophan in the cereals, strict vegetarians compensate to some degree to the consumption of legumes and nuts, which have a better amino acid balance. Vegetalists have good mineral status, except Ca, which, although it deals with plant food, has low digestibility. Characteristic for them is the deficit of vitamins B_{12} and iron.

Studies have shown that vegetarians are less exposed to the risk of cardiovascular diseases, have a low level of serum total cholesterol, in a similar percentage of HDL cholesterol, and lower levels of blood pressure from people of mixed diet. Furthermore, the risk of gallstones in them is two times smaller and less frequently suffer from cancer when compared to populations of no smoking and no consuming alcohol.

This group includes vegetarians and people who eat only plant products in raw form - *so called raw food*. The advantage for them is that they accept products naturally with reserved primarily vitamin content, but the risk of some bacterial and mycotoxical diseases is higher. For the modern professional engaged person, subjected to the stress and toxic effects, both forms of vegetalizam are physiologically no relevant.

◆ **Vegetarianism**

Vegetarianism other type of vegetarian that does not eat meat, meat products and fish. This group includes also people who do not consume meat only from mammals, but consume meat of fish and poultry. Although they eat mostly plant products in their diet includes milk, eggs and their products, so called ovolactovegetalianism, while the second group - and meat from poultry and fish, so called moderate vegetarians. This type of eating according to most nutritionists could be used for a long time without much risk to health. Even vegetarianism could be considered as an option of rational nutrition, as with the inclusion of eggs, respectively meat of fish and poultry, products actually present and the 7 food groups. The intake of folate, vitamin E and vitamin B_2 is higher than that of healthy nutrition. The absence of fish in the diet in the typical vegetarians, reason for deficiency of arachidonic and clupanodonic fatty acid and linolenic acid and its derivatives, which are mainly imported of this product. The lack of meat does deprive the body of supplementation with essential amino acids and of extractive substances, which are specific essential ingredients of the meat. Therefore, the continued exclusion of meat and fish from the diet is physiologically unjustified.

◆ **Separated feeding**

Separate feeding, whose principles were formulated by Herbert Shelton (i.e. so called by him "hygienisme") is based on the recommendations of separate adoption of certain products, since by the concomitant consumption their absorption is significantly reduced. In this respect, he advised not to consume both carbohydrates and proteins, and sour foods along with sweet foods. According to him, the use of fat with protein slows the absorption of protein. Eggs should be eaten separately from milk because it violates the absorption of protein components. According to Shelton harmful foods for the body are meat, meat products, cereals, sugar, salt, spices and alcohol.

Now there are various schemes for compatible and incompatible foods and recommend various combinations of foods and combinations that must be avoided, but usually does not specify chemical or enzymatic incompatibility case. As in natural, chemical incompatibility between foods in the normal diet is not observed, it when we talk about incompatibility between them, it concerns to enzymatic incompatibility. In actual digestion in the cavity of the alimentary canal external environment is represented by food products with varied composition. In most cases, individual nutrients enter the competitive relationship for possession catalytic site of enzymes, most of which implement the hydrolysis of a large number of substrates.

As a result, some nutrients will prevail in its enzymatic hydrolysis, while others will remain intact and unused respectively. It depends on the particular composition of food intake at the moment. Especially expressed should be competition between nutrients stage suction. It could be reduced or possession plug on stage of vectors, or competition for common energy source. These relationships between nutrients, enzymes and transporters are dependent on the stage and location of hydrolysis and transport. Decoding these interactions, ultimately determines the degree of absorption of various nutrients. It is complicated by their dependence on the concentration of nutrients, pH of the intestinal mucosa, intestinal peristalsis, the available enzymes and transport capacities, individual metabolic characteristics and needs.

So far, it has been found that:

1. The fatty acids decreased glucose transport, and that the sugars in turn inhibit the absorption of fatty acids.

2. Proteins and peptides stimulate the uptake of fatty acids.

3. In the co-introduction of the two sugars in the small intestine, the speed of transport of one of them or both is reduced.

4. In monosaccharides and amino acids shown that competition between them a place primarily to the common entrance of the transport system.

5. In most cases, between suction amino acids are observed interactions expressed by the competitive type.

6. When protein deficiency reduces the enzymatic degradation and transport of nutrients, since the enzymes and transporters are proteinic bodies. To this, however, it should be indicated that:

Slow feeding, lasting more than 30 minutes, usually favours the optimal absorption of nutrients, even in unfavourable combinations and plenty of food.

Three- especially four-time diet is also a factor adjusting for optimal absorption of nutrients, according to the specific metabolic needs of the body. In this aspect is best principal amount of food to be adopted before dinner (no later than 3-4 h before bedtime), so the body best utilizes it.

◆ **Other forms of non-standard feeding**

Macrobiotics. Macrobiotics or art for a long life, according to Eastern and Western medieval texts is diet (introduced in Europe in the XX century by japanese Oshava), similar to that of Zen buddhists monks. According to Zen world is built from two complementary energetic polarity - Yin (cold) and Yang (warm), and nutrition is one means of achieving a balance between them. The combination of foods in your daily regime depends on their belonging to them (eg. rice is "very Yang", corn "balanced Yin/Yang", soybeans - "very Yin"). The ideal combination in the diet according macrobiotes can be achieved exclusively by the consumption of "balanced" (Yin and Yang) cereals - rice, corn, barley, rye, oats, millet; legumes - soybeans, chickpeas, red japanese beans; mixed food - muesli (cereal, nuts, dried fruit); algae (rich in Vit. B_{12}). Animal products are very limited - includes only fish. Restricting the intake of raw and dried fruits and vegetables. Fats are plant - olive oil, same oil. It is recommended that separate meals. In culinary treatment is recommended lightly fried with vegetable fats and cooking at low heat. Recommended and good chewing of food ("chew each bite 50 times").

Instinct therapy. This is a new trend in alternative feeding (established in Switzerland by J. R. Burger). Palatability (taste, smell) of food determine the "originality" of animal and plant foods, included in the diet.

Anthroposophy. It was founded by R. Steiner (Germany) at the beginning of XX century. Builds on the concept of unity between man and the environment. Using environmentally-pure (natural) food, vegetarian diet and once a week the adoption of a meat diet is the basis of this kind of nutrition.

REFERENCES

1. **Dupin, H.** Les etats de denutrition. In: Alimentation et nutrition humane • Coord. H. Dupin, ESF edit, Paris, 1992, 655-669.

2. **Helman, A.** et al. Vitamin and Iron status in new vegetarians, Am. J. Clin. Nutr., 1987,45, 758-9

3. **Krichevsky, K., A. Tepper, M. Goodman.** Diet nutrition intake, and metabolism in population at high and low risk for colon cancer - relation of diet to serum lipids. Am. J. Clin. Nutr. 1984, 40, 921-926.

4. **Popov, B.** The influence of experimental diets on some enzymes and transport systems in the small intestine. D. thesis, Sofia, 1977. (in bul.)

5. **Popov, B.** Separate nutrition and starvation - they were appropriate in terms of modern physiology of digestion? Hyg. and Pub. Health, 1995,6,30-32. (in bul.)

6. **Popov, B.** Effect of protein lipids, carbohydrate and free ration on amylase activity and glucose transport in the small intestine, Folia medica, XXIV, 4,1982,14-18.

7. **Walker, P.** Les modes alimentaires particuliers. In: Alimentation et nutrition humaines, Coord. H. Dupin,

9.4 FOOD AND DRINKS

ESF edit., Paris, 1992, 533-545.

Food products are multicomponent systems of chemical compounds with different character and complexity, nutrition and biological value **(Fig. 9.9)**.

Besides essential nutrients, contained different amounts of other compounds (alcohols, ketones, organic acids, pigments, aromatic substances), that form the biological and organoleptic qualities. Under natural conditions in food products meet a number of toxic factors: mycotoxins, hemagglutinins, enzyme inhibitors, demineralised substances.

The organic acids in plant products - acetic, lactic, oxalic, citric, malic, enhance the intestinal motility, secretion of digestive juices, imported mineral substances with an alkaline action (calcium, sodium, potassium).

Alkaloids - in plants, such as salts of organic acids with a strong and specific biological effect - caffeine, piperine, ergotamine, ergotoxin, berberine.

• *Glycosides* - in the bark of citrus plants contain hesperidin (with effects similar to routine). Some of them are highly poisonous - amygdalin (bitter almonds), solanine (potatoes).

• *Flavonoids* - defined yellow-orange color of plants. Quercetin is the composition of the glycoside rutin. Flavonoids are contained in hesperidin.

• *Anthocyanins* - glycosides similar to flavonoids.

• *Tanning substances* - anti-inflammatory, astringent taste, constipating, with P-vitamin properties.

• *Ethereal oils* - with specific smell, antimicrobial action, soothe pain, have antitussive effect. These are: aniol (parsley), terpineol (citrus), salven (sage).

• *Resins* - similar in composition to ethereal oils. Specific action - antimicrobial, laxative.

• *Enzymes* - lipase - legumes and cereals; nuclease, cellulase, amylase, pectinase - in all plant products.

Also immune bodies, phytoncides, hormones, pigments (carotene, xanthophyll).

All these ingredients have their great importance for food use in safety - professional and clinical nutrition, nutrition of children and adults, technological processing in the preparation of food and storage.

In the yield, processing or storage in food may fall substances with harmful or toxic effect - ie impurities. They include: pesticide residues, heavy metals, constituents of plastics, residues from detergents and disinfectants, of growth stimulants and biological preparations, antibiotics, enzymes, radioactive substances nitrosamines, microorganisms, mold, mycotoxins and more. Essential for their increase have chemical and biological factors in agriculture and the environment pollution from industry and transport.

◆ Hygienic assessment of the food

Made on the basis of nutritional, biological and

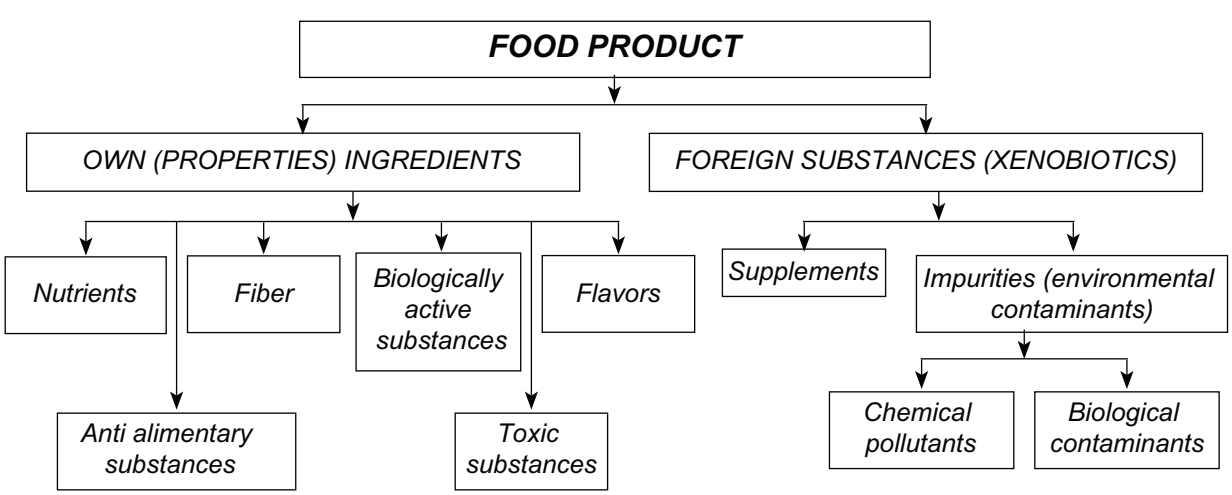


Fig 9.9.

energy value.

Nutritional value. It depends on the chemical composition, energy value and organoleptic qualities of the product. The product has a high nutritional value contains in optimal ratios essential nutrients.

Biological value. Determined by the content and the ratio of essential biologically active ingredients (essential amino acids, polyunsaturated fatty acids, vitamins, biomicroelements).

Energy value. Determine the amount of energy that is released upon oxidative degradation of nutrients in the body. In assessing the food into account the relationship between plastic nutrients and energy value.

Products, rich in nutrients compared with their energy value, are high ***nutritional density*** (eg. fruit and vegetables).

◆ Classification

Depending on the composition, biological value and its role in the body, the food products are divided into groups. In our country has adopted the classification of Acad. Tashev under which food products are divided into 7 groups **(Table. 9.38)**.

Most foods have different properties and can therefore be considered as products mixed use. But in each group prevail in one degree or another substance that satisfy certain needs of the body. Plastic importance are: meat, fish, eggs, milk and dairy produce, and energy - bread, legumes, pasta, confectionery, honey, fat and high-fat products. For biological stimulation and regulation of complex processes in the body are necessary fruits, vegetables, refreshing drinks. For a taste of food are important various spices.

In hygienic attitude, significant is the classification of foods depending on their stability during storage and time for the occurrence of spoiling.

• *Spoiling* are milk, cream, meat and other meat preparations, cooked meat and poultry, confectionery and others. Especially spoiling are those whose shelf life is up to 72 h from the time of production.

• *Durable (steady)* are dry products with humidity below 15% (flour, sugar, rice, pasta, etc.).

The food must meet the following requirements:

1. To provide the body with nutrients, satisfying its plastic and energy needs and facilitating normal metabolic processes.

2. Do not contain chemical, biological or mechanical factors that may impair his health.

3. To meet the established customs and traditions in the socio-psychological and aesthetic needs of the population in feeding him.

◆ *Indicators for assessing food*

Main groups of indicators in accordance with requirements are:

1. Indicators of nutritional and biological value (organoleptic and physico-chemical properties, chemical composition, digestibility).

2. Indicators of suitability for consumption (for

Table 9.38. Basic food groups

Group	Food	Introduced into the body	Role in the body
I	Milk and milk products	The most valuable animal protein, easily digestible phosphorus and potassium salts	Construction of tissue, alkalosis effect
II	Meat, fish, eggs	Complete animal protein, fats, vitamins B, iron, phosphorus, extract substances, lipoids	Construction and restoration of tissue, acidifying effect
III	Bread, pasta, sugar	Carbohydrates, vegetable protein, vitamins B, E, magnesium, potassium, dietary fiber	Providing energy, heat
IV	Legumes, nuts	Valuable plant proteins, fats, vitamins B, E, iron, sulfur, phosphorus, PUFA, magnesium, potassium	Providing heat, energy; building tissue, lipotropic action
V	Fats (animal, vegetable)	Fatty, lipids, fat-soluble vitamin, unsaturated fatty acids	Providing energy and heat; construction of cellular membranes
VI	Vegetables	Vitamins, mineral salts, cellulose, water, phytoncides, pectin	Protection and regulation of intestinal features, alkalosis effect, biological stimulation
VII	Fruits and fruit juices	Fruit sugar, fruit acids, mineral salts, vitamins, cellulose, dyes, water, pectins	Protection and regulation of intestinal features, alkalosis effect, biological stimulation

safety) - indicators of spoiling - changes in organoleptic and physical properties and chemical composition, impurities and additives, degree of bacterial contamination, type and nature of harmful microflora, foreign bodies and others.

3. User-trade indicators (appearance, packaging, labeling) with a view to informing consumers and the impact that may have on biological value and suitability of the product for consumption.

Hygiene requirements for food and biological value and suitability for consumption, are regulated in standards and other regulations that must be complied necessarily in the manufacture and marketing of food products and in conducting manufacturing and hygienic control.

9.4.1. FOOD OF ANIMAL ORIGIN

9.4.1.1. MILK AND DAIRY PRODUCTS

Milk is indispensable food for all ages. Nutritional and biological value is determined by the optimal balance of ingredients (complete proteins, easily digested fats and carbohydrates, minerals, vitamins), easy digestibility and high usability of plastic needs. According to the nature of the milk proteins contained, various domestic animals separate the casein (cow, sheep, goat and buffalo) and albumin (mare donkey). Albumin is breast milk. Albumin formulas are more nutritional and biological value. They are characterized by optimum balance of amino acids, higher sugar content and ability crossing to form a soft, small flocs. **Table 9.39** presents the essential composition of albumin and casein milk.

The most important for feeding people at home and globally has cow's milk.

◆ Food ingredients

Proteins. The proteins in cow milk are full around 3.2%. They contain essential amino acids and are characterized by high biological value and digestibility 98%. Milk contains 3 types of protein: casein (about 80%), lactoalbumin (12.1%) and lactoglobulin (6%) of the total protein. Casein is a complex protein-phosphoprotein - complexed with calcium to form the active casein-calcium - phosphate complex (calcium caseinate). Under the action of acids or rennet, casein coagulates and precipitates out and the milk is interrupted. Lactoalbumin is a simple protein, rich in sulfur, tryptophan, lysine and phenylalanine, with high digestibility. Not coagulate under the influence of rennet and goes into the whey. Lactoglobulin is in a minimum amount, more in colostrum. Do not be crossed by rennet. Dairy globulins possess antibacterial properties. To dairy globulins refer euglobulin and pseudoglobulin who are carriers of immune properties.

Table 9.39. Composition of some types of milk (in%)

Type of milk	Proteins	Fats	Carbohydrates	Mineral salts
Cow's	3,50	3,80	4,80	0,75
Sheep's	5,50	7,20	4,30	0,82
Goat's	3,00	4,20	4,50	0,70
Buffalo's	4,00	7,50	4,50	0,80
Mother's	1,25	3,60	7,50	0,20

Fat. Fat (3.5-5%) are finely emulsified, with a low melting point and absorption 98% .They are a mixture of triglycerides, phospholipids, sterines, fat soluble vitamins, essential fatty acids (linoleic and arachidonic). Basic fatty acids are oleic, palmitic and stearic. Low molecular weight short-chain fatty acids, mainly caproic, caprylic and butyric, give specific flavor of milk butter and have high biological activity. Milk contains phospholipids (lecithin) and sterines. Of sterines in milk are important cholesterol and ergosterol. Other fat-soluble substances are fat-soluble vitamins, carotene and xanthophyll. Milk fat content varies, depending on the breed of animals, food, lactation and others.

Carbohydrates. In milk contains mainly lactose (4.5 to 7%) and minimal amounts of glucose, galactose and other sugars. Lactose improves the use of protein and minerals, has a normalizing effect on the intestinal microflora, reduces the pH in the intestines and facilitates the absorption of calcium. There is a slight diuretic effect. In the digestive system breaks down under the influence of the enzyme lactase and galactase to lactic acid.

Mineral salts. Mineral salt (7-10 g/l) include chlorides, sulphates, bicarbonates of sodium, potassium, calcium and magnesium. Milk is a major source of easily assimilated calcium and phosphorus salts - over 50% of the salts in the milk. It contains a number of trace elements: manganese, copper, iron, iodine, fluorine and the like. The milk is poor in iron and copper, and can not fully meet the needs of the growing organism of iron, copper, zinc and manganese.

Vitamins. Depending on the season, breed, feed and lactation of dairy animals, the milk contains small amounts of vitamins, but his daily consumption can to some extent to satisfy the body with a number of vitamins. Whole milk and butter milk are a good source of vitamin A, and in summer - and carotene. The content of vitamin D depends on the type of food and the season. Milk is an excellent source of riboflavin (0,18-0,24 mg%). Other vitamins

(B_1, B_{12}, PP, C) in small quantities. Vitamin C is unstable and the process of processing and storage of milk fell sharply.

Organic acids. In milk contains certain organic acids such as pyruvate, citrate, phosphopiruvat etc. Hypocholesterolic action is associated with the presence of orotic acid and hydroxymethylglutaric.

Enzymes, hormones. The enzymes relevant to health expertise have peroxidase, reductase and catalase.

In milk has **hormones**, **immune bodies** and **pigments** (lactoflavine, carotene).

Impurities. In the extraction and processing of milk can enter various contaminants: pesticides, heavy metals, mycotoxins, detergents, antibiotics, disinfectants, harmful ingredients of forage and grass.

◆ Microflora in the milk. Epidemiological importance

Along with valuable qualities as food for human milk is an excellent environment for many saprophytic and pathogenic microbes. In the extraction it can be contaminated with microorganisms of animal or milker. Additional sources of pollution are automatic milking machines, containers, milk tankers (with poor washing and disinfection).

Microflora in milk depends on its initial amount and the temperature of storage. Hygiene importance are the following 3 phases of its development in milk:

1. Bactericides.

2. Phase of the mixed microflora.

3. Lactic acid phase.

Even under sterile conditions milking number of microorganisms into the udder is 500/cm^3. In milk may fall causing of many zoonoses and zooantroponoses: brucellosis, anthrax, tuberculosis, salmonellosis. Milk may be the cause of mass disease, the source of which is man. These are primarily intestinal infections, typhoid, paratyphoid, dysentery, cholera. Sources are mostly healthy carriers of intestinal infections, involved in milk production and dairy. Milk obtained from sick cows with mastitis, contains large amounts of pathogenic staphylococci. Its consumption is associated with a risk of staphylococcus intoxication.

To reduce the risk of occurrence of these diseases is necessary to observe hygiene during milking and storage of milk, to exercise systematic and rigorous hygiene control, incl. on workers. Milking systems, containers, vehicles, inventory must be washed and disinfected regularly. In order to keep the development of microflora immediately after milking the milk must be cooled, and prior to commercialization - pasteurized.

Raw milk. Represents a homogeneous liquid with a white color with yellowish or bluish tint, with a specific smell and taste. Raw whole milk is richer in vitamins, but is not eligible for direct consumption unpasteurized or unsterilized due to a risk of infection.

Fresh pasteurized milk. Obtained after heating the raw milk at a temperature of 86 ° C for 15 s and subsequent cooling. By pasteurization destroy vegetative forms of pathogenic microorganisms, sharply reduced microflora, is extended shelf life. Organoleptic qualities, vitamins and minerals is changing slightly, physico-chemical properties are retained. Peroxidase is destroyed and serves to evaluate the effect of pasteurisation.

Fresh pasteurized milk may be fat 0.1% (skimmed) to 6%, density - 1027-1034 and acidity - 15-21° Thorner. Microbial count should not be more than 150,000, and the content of aflatoxin M_1 (milk) - up to 0,5 μg/l.

Milk powder (dry milk). Obtained by drying the condensed pasteurized cow's milk or other in a spray dryers. It may be full-fat (25%), semi (15%), skim (not more than 1.5%) and moisture content to 4%, protein - 32%. The dry milk is highly hygroscopic and must be stored in suitable containers. Unpressurised packaged lasts to 3 months and hermetically packaged - up to 8 months.

For feeding infants and young children produce special powdered milk, enriched with vitamins, iron with whey protein product, milk sugar, biologically acidified. They are not permitted preservatives, inhibitors, pesticide residues, mycotoxins.

◆ *Dairy Products*

Dairy products are produced by lactic fermentation or coagulation of milk.

• ***Yogurt***

Lactic products with the highest popularity enjoyed yoghurt (sourdough) milk. It is obtained by lactic acid fermentation caused by Lactobacilus Bulgaricus and Streptococcus thermophilus. In composition yoghurt like fresh, from which it derives, but differs in some respects - reduces the lactose content, urea, certain vitamins (C, B_{12}, biotin, choline), a hippuric and orotic acid, and increases the content of lactic acid, galactose, peptides, free amino acids, free fatty acids, folic acid, vitamin PP, organic acids and flavor components. Its value as food is largely determined by the presence and amount of free amino acids, which are formed on standing. The most important ingredient is a lactic acid which is obtained by destruction of lactose. It has significant biological activity, creates optimal conditions for the

development of lactic acid bacteria and inhibits the development of putrefactive and pathogenic microflora in the large intestine. Lactic acid improves the digestibility of the proteins, the usability of calcium, phosphorus and iron. Yoghurt improves gastric secretion, normalizes bowel, reduces gasification, improves defecation. By lactic acid and its salts, it has a diuretic effect, calming effect on the smooth muscle of the vascular walls and helps to moderate lowering of increased blood pressure. Yogurt is a rich source of calcium, especially for people suffering from lactose intolerance.

The yogurt should have a temperature up to 10°C, acidity - 100-160 ° T, coli-titre - 0.1.

• Cream

It is a product of high biological and energy value. Prepared from pasteurized milk. Depending on how processed it is: nosour (sweet), sour (acidic) and wheyly. It contains protein about 2.2%, fat 15-45%, mineral salts. It is rich in vitamin A and E, lecithin. Its durability is up to 72 h at a temperature of 2-6°C.

• Cottage cheese

Obtained by coagulation of proteins in milk, whey or buttermilk. Different types of cheese is 4-17% protein, contained in concentrated form almost all amino acids.

Especially valuable are the sulfur-containing - methionine, cysteine, donators of SH groups in the synthesis of choline (a lipotropic factor). Cottage cheese whey, contains only lactoalbumin and lactoglobulin, has high absorption and highlighted protective and healing properties. The fat content of various types ranging from 9 to 18%. Curd is rich in easily assimilated calcium (70-140 mg%) and phosphate salts (130-190 mg%) and is recommended for bone and lung tuberculosis, osteomyelitis, rickets, bone fractures. It is rich in lipotropic factors and helps lower cholesterol and diuretic. Valuable food for obesity and atherosclerosis, cardiac decompensation, hypertension, hepatic, renal diseases without disturbances in the separation of fatty substances from the body. Its durability is up to 7 days at 0 ° C.

• Cheeses

Obtained by curdling milk with rennet or lactic ferment. Different types of cheese contain 16-25% protein, 23-32% fat, 500-890 mg% calcium, 550 mg% phosphorus. In the whey remain some of the salts, of lactoalbumin and lactoglobulin, nitrous substances and some vitamins.

Most used in the country is *white brined cheese*. When ripe cheese protein peptonised, small part becomes soluble nitrogen compounds and amino acids, that give flavor and increase the digestibility and absorption of cheese. The specific organoleptic qualities arouse the appetite, gastric and intestinal secretion. It is suitable food for people with anorexia, hypoacidic gastritis. The high content of sodium chloride in cheese (3-5%) imposes its desalination, especially for dietary nutrition. In the matured white cheese contains a number of biogenic amines (tyramine, phenylethylamine, cadaverine, tryptophan, etc.), that are obtained by free amino acids under the influence of bacterial decarboxylases. A large amount of biogenic amines are formed in cheeses made from raw milk with high microbial number.

• Yellow cheese (Kashkaval)

Produced from raw cow's or sheep's milk by curdling with rennet and starter culture of lactic acid bacteria. In the process of ripening (about 60 days), there partial degradation of the proteins; possible available microflora destroyed. The cheese contains of 100 g about 25 g of protein, 27-35 g of fat, 680-1100 mg of calcium, 860 mg phosphorus. Processed cheese have a high fat content (40-50%), proteins from 6.5 to 21% and salt 2.5%.

9.4.1.2. MEAT AND MEAT PRODUCTS

Meat and meat products are major sources of complete protein for humans, they supply valuable minerals (iron, copper, zinc, phosphorus) and vitamins. The composition, resp., nutritional and biological value of the meat depends on the kind, age, breed, feed of the animal; the type of food **(Table. 9.40)**.

In the meat as food containing: muscle (muscle fibers), connective (fascia, tendons), fat, cartilage,

Table 9.40. Composition of different types of meat (g/100 g product)

Product	Water	Proteins	Fats	Carbohydrates	Calories
Lean lamb	70,0	17,5	11,7	0	181
Lean beef	66,0	18,8	13,7	0	204
Lean sheep	69,0	18,2	12,5	0	191
Pork without bacon	50,0	14,1	35,0	0	383
Lean veal	72,7	20,5	5,4	0	134

bone tissue.

◆ **Food ingredients**

Composition of muscle tissue varies depending on the above factors. Approximately 75% of water, 10-20% protein, 4-30% fat, 1.6% non-protein nitrogen components, 1.2% carbohydrates and their metabolites, 0.7% inorganic salts, trace elements, vitamins and other ingredients.

Proteins. Protein in muscle tissue contain all the essential amino acids (about 10-12 g per 100 g of product) and have a high biological value. The greatest value are: myosin, miogen, globulin, actin. Characterized by rich in amino acids - growth factors (tryptophan, lysine, arginine). Less valuable, due to lack of tryptophan and cysteine, are the connective tissue proteins collagen and elastin (12.3% of muscle tissue). To assess the nutritional value of meat is proposed rate ratio between tryptophan and oxyproline, as tryptophan characterized content of complete protein and oxiproline - of no complete.

Fat. Fat (adipose tissue) ranging from 4 to 30%. The composition predominant are saturated (long chain) fatty acids which increase with age of the animal and determine the highest melting point. Beef fat contains relatively larger amounts of Vitamin A and carotene, and lard - more PUFA (20 times more arachidonic acid than beef). In the fat to muscle fibers (intracellular structural fat) having known amounts of phospholipids, lipoproteins, cholesterol.

Carbohydrates. The content varies depending on the animal feedstuff and previous activity of the muscles. They are represented by glycogen - more in the liver and glucose - more in the blood. The intermediate product of carbohydrate metabolism - lactic acid contained in the muscles and increases after postmortal numbness.

Mineral salts. About 1.5%, is represented by a well digestible phosphoric compounds of potassium (240 mg%), magnesium (16 mg%), calcium, sodium chloride (50 mg% Na). The main microelements are copper, iodine, iron, zinc.

Vitamins. The vitamin complex including vitamins B_1, B_2, B_6, PP, folic acid, choline, is well balanced. Larger quantities are contained in the liver. In some organs contained traces of vitamins A, C, D.

Extract substances. They are nitrogen (creatine, carnosine, hypoxanthine and others.), and nitrogen-free (glycogen and lactic acid). They form the specific taste and smell of meat broth, fried and roasted meats and amplified secretion of digestive glands. More extract substances contained in meat from older animals and game.

Pigments. The meat color is due to the heme pigments myoglobin and hemoglobin.

Impurities. In modern conditions of production in meat may fall veterinary preparations, antibiotics, residues of pesticides and growth stimulants.

◆ **Microflora. Epidemiological significance. Saprophytic and pathogenic microorganisms.**

Meat can be contaminated endogenous and exogenous. Meat may fall causes of tuberculosis, brucellosis, salmonella and others. Endogenously insemination may occur in intestinal infestation of animals if before slaughter the permeability of the intestinal barrier is lowered due to improper care of animals (fatigue, stay in the sun, keeping in inappropriate conditions, etc.), and the slaughter of sick animals. Exogenous contamination can occur at all stages of production, processing, transport or storage, especially in disturbances in technology and sanitary regime. This necessarily involves the implementation of certain preventive measures: strict health checks on slaughterhouses and meat packing plants, including the examination of animals to be slaughtered and laboratory testing of meat, tight control over their health and personal hygiene of staff and observing the sanitary regime. Criteria for exogenous contamination is the presence of sanitary-indicative microflora.

Infestations. The most important parasites transmitted to humans through meat are Trichinella, beef tapeworm, pork tapeworm. (Tenia saginata, Tenia solium)

◆ **Changes in meat during storage and spoilage**

Meat of freshly killed animals is hard, hard boiled, hard to digest in the stomach and not tasty. When storing 12-24 h at a temperature of 2-5 ° C under the influence of the contained therein enzymes, undergo auto hydrolysis of protein, as a result of which receive low-molecular proteins, free amino acids. Muscle fibers swell, the meat becomes soft, pleasant taste and smell, so called "maturing". In long-term storage, depending on conditions, occurs destruction of the amino acids to amines, ammonia, hydrogen sulfide, and rancid fat. Increase of microorganisms, leading to organoleptic changes in the form and color, appears smells of "musty".

◆ **Internal organs (sub-products)**

For food use liver, brain, kidneys, intestines, endocrine glands. They have fewer proteins of skeletal muscles, but more lipids (cholesterol, lecithin), fat and water soluble vitamins, iron, copper, zinc. They are rich in nucleoproteins, loaded the body with their breakdown products (uric acid and its salts) cholesterol and should therefore be limited in the diet of adults, persons with impaired purine metabolism and others.

◆ **Meat products**

These are semi-manufactured meat, sausages, canned meat. Semi-manufactured meat, packing and minced meat are perishable products. Commercially should be stored at 0 to 6 ° C no more than 48 h for minced and 2-3 days for packing meat.

• **Sausages**

They are produced from no minced (ham, sirloin, bacon) and minced meat (sausages, wurst, flat sausages, etc.). Different types contain 13-28% protein, 70% fat, flavoring agents, preservatives. Salt should not be more than 2.5 to 3%. According to technology and thermal processing sausages are: raw, boiled, raw - smoked, boil-smoked (perishable, semi-permanent and permanent).

In manufacturing as a supplement used nitrites and nitrates. Demonstrated is the ability to bind nitrite with secondary amines to form nitrosamines, some of which are carcinogenic effect. Nitrosamin reactions are accelerated by the fall in meat phosphates or heavy metals. Sources of formation of nitrosamines may be residual pesticides and pepper. Therefore, there is a tendency to reduce nitrite and nitrate in the manufacture of sausages. Nitrites are allowed to 4,5 mg%.

Sausages should be stored at a certain temperature, perishable - raw and boiled -1-2 days at 1 to 5 ° C, as they contain significant amounts of water and protein and are a favourable environment for the propagation of the microflora. Sausages with less water content and can be stored in the refrigerator 2-6 months.

Benign sausages have a dry, clean surface, close-fitting to the filling. Cut surface is evenly colored, and the aroma and taste are specific to each species.

◆ **Poultry meat**

Poultry meat in the nutritional and biological value is not inferior to meat from mammals. It has a soft texture because of less fine and uniformly distributed connective tissue. Meat of different poultry differ in chemical composition and color. The meat of chickens and turkeys is lighter, contains more protein and extract substances. The meat of waterfowl (ducks, geese) is darker and richer in fat.

Proteins. At lower levels of connective tissue proteins (up to 8% of the total amount), they are relatively more (24%) compared to meat from mammals. The poultry proteins are distinguished by optimum balance of amino acids. They are rich in glutamic acid, which gives a specific flavor of poultry.

Fat. The fats contain a high percentage of unsaturated fatty acids, and therefore have a softer consistency, low melting point and high digestibility. Cholesterol content is lower than in the fat of mammals.

Extract substances. Muscle tissue (more white meat) contains a lot of nitrogen extract substances (carnosine, anserine, creatine). The white meat is rich in minerals, particularly sulfur, phosphorus and iron. Poultry meat is recommended product in the diet of elderly, people with mental work, in dietary. Poultry broths are irreplaceable dietary dish in some diseases (atrophic gastritis, tuberculosis - Diets 2, 11 by Pevzner).

Impurities and contaminants. Small amounts of antibiotics are used to speed up growth and increase muscle mass of poultry. Therefore, the known antibiotic residues can be found in liver and adipose tissue. Pesticides may fall from the environment (mostly from feed) in breeding the poultry. It is possible that they may be contaminated with salmonella (very common in waterfowl) and infected with poultry leukosis.

9.4.1.3. EGGS AND EGG PRODUCTS

Eggs contain almost all necessary for the growth and development of human substances. Characterized by high nutritional and biological value. The egg protein represents 58% of whole egg. It is composed of 87.6% water, 10.9% protein, 1.1% carbohydrates and traces of fat.

Proteins. They (12.9% of the total mass of the egg) have high biological value, contains all the essential amino acids necessary for growth, development and repair of tissues, have been adopted as a reference for the evaluation of other food proteins. They are represented by ovalbumin (phosphoglucoprotein - 64%) containing the sulfhydryl groups of egg white, conalbumin (12%), ovomucin (2%). Ovomucoid glucoprotein (12%) is thermostable. It inhibits the proteolytic enzyme trypsin. Globulins are 8%, of which the most important is lysozyme (3%). In raw eggs contain small amounts (0.5%) avidin which inactivates biotin. The nutritional and biological value of egg protein is determined by the contents in optimal ratios of the most important amino acids. It is particularly favourable ratio of tryptophan, histidine and arginine, providing optimal conditions for

the synthesis of proteins, tissues and growth of the young organism. For that eggs are an indispensable product in infant feeding.

Absorption and the use of egg-white depend on the type and degree of heat treatment. Crude egg-white is mutcilaginous mass, difficult to access for the active ingredients of gastric juice. Contains ovomucoid - trypsin inhibitor and avidin, which inactivates the eggs biotin and other food products, coming along with them in the digestive system. In short boiling ovomucoid destroyed, avidin coagulate and absorption of egg-white increases. During prolonged boiling or frying egg-white denatured and digested more difficult.

Egg yolk. It constitutes about 32% of the mass of the egg. It contains less water (49%), more protein, fat (32%) of the protein, traces of carbohydrates. Yolk protein-fat concentrate. Most of the proteins are lipoproteins - lipovitelin, livetin, lipovitelinin.

Fat. Fat of the egg most of which are related to complex with proteins - lipoproteins, are concentrated in the egg yolk. They are 12% of the total mass of the egg. In the egg yolk has 3 types of lipids: triglycerides, phospholipids (lecithin, sphingomyelin kefalin), cholesterol (about 1600 mg%). It is in colloidal state. The ratio of phospholipids/cholesterol is very favourable - 6:1. 70% of the fatty acids in the yolk fat is unsaturated (oleic, linoleic, palmitoleic). Absorption of fat is 96%.

Mineral content. It depends on the mineral composition of the diet of poultry. Calcium is the most, but is concentrated in the shell. The mineral substances in egg white in high amounts are: sulfur, sodium, potassium, chlorine, into smaller quantities of phosphorus, calcium, magnesium, iron. In the yolk prevail phosphorus (540 mg%), sulfur (170 mg%), iron (6700 µg%), zinc (3100 µg%).

Vitamins. In eggs contain fat-soluble vitamins - A, E, carotenoids; B vitamins (PP, B_2, B_{12}, folic acid).

Impurities. In eggs sometimes found antibiotics, pesticide residues, falling from the environment in breeding the poultry.

• Epidemiological significance

When poultry are suffering from salmonellosis, tuberculosis, ornithosis, eggs can be contaminated endogenous by causes of these diseases. Feeding poultry with waste products or feed with forage made from them (meat, bone or fish meal), often contaminated with different types of salmonella and other microflora increases the risk of endogenous contamination of eggs. Contamination can also be exogenous, since the eggshell surface is varied microflora - saprophytic and pathogenic. It penetrates into the interior up to 5 days post laying the eggs, but at high temperature and humidity the process accelerates. With the use of eggs are most commonly associated occurrence of food toxinfections. Epidemiological danger imposes restrictions in the use of raw or inadequately cooked eggs. It is forbidden the sale of goose and duck eggs in shops and markets, as well as the preparation of meals and desserts from them in catering. They are used only for the production of small, well-baked bakery products (biscuits, cookies, etc.), as high temperature (180°C) at baking destroys salmonella.

Prior to use eggs candled, washed, if necessary, are soaked for 30 min with 2% sodium hydrocarbonate solution and disinfected with a 2% solution of chloramine (200-250 mg/l of active chlorine) for 10 min. The thermal treatment, which is subjected to the egg mass in the preparation of creams, is not sufficient to destroy the salmonella, which is why the preparation of creams with eggs is limited. It is necessary eggs for immediate consumption be boiled 13 min.

When stored in inappropriate conditions (high temperature and low humidity), eggs lose moisture and their air camera increases. Under the action of the permeated microflora and the own enzymes during prolonged storage starts degradation of the proteins of the skin, separating the egg white from the yolk, and the two parts are mixed. Often to autolytic processes to add and putrefactive.

To prevent spoilage of eggs must be kept at -2 to 0 ° C of not more than 6 months. According BSS fresh eggs are stored at a temperature of 2-16 ° C and relative humidity 60-80% not more than 1 month. For long preservation, after washing, disinfection and drying, the eggs are covered with a protective cover, processing eggs with 6% solution of sodium carboxymethylcellulose.

◆ Egg products

• Egg melange

Prepared from homogenized egg mass, pasteurized at a temperature of 65 ° C. Frozen egg mass to store up to eight months at temperatures up to -18 ° C. Used for cooking and products which must be subjected to sufficient heat treatment.

• Egg powder

Prepared by drying egg mass strict thermal regime. It is an amorphous powder with good solubility. Store at 2-10 ° C in non air-tight packaging to eight months and sealed - up to 12 months.

9.4.1.4. FISH

Fish is extremely valuable food because of its high protein and mineral content, fewer calories and

Table 9.41. Composition of different types of fish (g/100 g product)

Product	Water	Proteins	Fats	Carbo-hyd-rates	Calo-ries
Turbot	35,4	6,8	0,3	0	31
Shad	37,7	9,3	12,2	0	152
Mullet	38,9	10,3	1,3	0	53
Gobies	43,9	13,2	1,2	0	65
Sardine	43,5	11,5	3,1	0	76
Scad autumn	51,9	13,5	10,1	0	149
Mackerel ocean	43,7	14,6	1,9	0	78
Herring	45,8	13,0	3,1	0	82

waste, and generally less fat. Chemical composition and digestibility of meat fish does not differ significantly from the flesh of mammals and in some ways surpasses it. It contains 66-84% water, 15-24% protein, 0.3 to 28% fat, 0.8 to 2% minerals **(Table. 9.41)**.

◆ ***Food ingredients***

Proteins. They are a major constituent of muscle tissue. They are myoalbumin, myosin, actin, myogen, globulin X, myoglobulin and a small amount of nucleoproteins. Relatively rich in amino acids, growth factors (tryptophan, threonine, histidine, lysine). Due to the significant amount of methionine have lipotropic action.

Fat. Grease vary within wide limits (from 0.3 to 28%). They have a low melting point and easy digestibility. Fish oils have a high biological value and low atherogenic potential due to the long and medium-PUFAs (eicosapentaenoic, docosapentaenoic), vitamins A and D and iodine. Especially rich in polyunsaturated fatty acids are fats from scad autumn (5.44%) and ocean mackerel (4.93%). Clupanodonic acid (docosapentaenoic) gives them a specific smell.

Mineral substances. The fish is relatively rich in macro- (phosphorus, sulfur, calcium, potassium, magnesium) and trace elements (iodine, cobalt, manganese, fluorine, copper, zinc).

Vitamins. Besides fat-soluble vitamins A, D_2, E, K contains B_1, B_2, B_6, B_{12}, PP.

Extract substances. They (creatine, creatinine, hypoxanthine, free amino acids, volatile amines, ammonia) is less than in the meat of mammals, but are readily soluble and rapidly undergo heat treatment in the broth and sauces. The characteristic smell of raw fish due to the aromatic substance trimethylaminoxid. Marine fish contain more minerals and extract substances and therefore their meat is tastier compared to freshwater. Connective tissue (0,6-3,5%) is five times less than in the flesh of mammals, gentle and positioned evenly among the muscle and does not contain elastin. It consists primarily of collagen, which when cooked gelled, and is converted into gelatin. The fish is digested and absorbed more quickly than meat. The high biological value and low content of connective tissue identify the fish as a necessary product for the feeding of all ages, prophylactic and dietary feeding.

Impurities. From contaminated ponds in fish may fall heavy metals, pesticides, radioactive substances. Caught ocean fish are monitored for radioactive substances and mercury compounds.

◆ **Microflora. Epidemiological significance**

Because of the high water content of the fish is perishable product, a good environment for the development of various microorganisms. Microflora reflects the nature and extent of pollution of the basin. The normal microflora is psychrophilic, which is why fish spoils easily and refrigerated. Rapid spoilage during storage due to some peculiarities in the chemical constituted. So after catching the fish should be cooled quickly and transported to the consumer in refrigerated conditions.

Hygienic assessment is made by organoleptic, microbiological and parasitological indicators. Spoiled fish loses its luster, body covered with mucus, eyes sunk, belly buling, gills acquire a brownish color appears saprogenic odor.

Parasitosis. The fish may give rise to some parasites, of which the most important are diphylobothrium and opisthorchis felineus.

◆ **Fishery products**

Fish used for food and as salty, smoked (warmth- and coldly-), preserved in airtight containers, marinated. In salting and smoking water content decreases, the consistency changes, the fish acquires a pleasant smell and spicy taste.

Warmth smoked fish with significant moisture is perishable product. Commercially must be stored at a temperature not exceeding 8 ° C to 72 h.

Coldly smoked fish is more durable than warmth smoked due to low humidity and a significant amount of salt.

• ***Caviar***

In biological properties and chemical composition refers to delicatessen products. It contains a specific protein - phosphoprotein (ihtulin) and albumin. Fat is rich in polyunsaturated fatty acids incl. arachidonic, lecithin and much cholesterol. In the mineral composition is dominated by acidic ions of sulfur and phosphorous, there is also a significant

amount of iron.

◆ **Clams**

Meat of mussels is a complete protein product. It contains 13-19% protein, 5% lipids, rich in polyunsaturated fatty acids and 1-4% carbohydrate. Trace elements are about 10 times more than in the flesh of fish. It has been proven positive impact on meat from clams on lipid metabolism, removal of cholesterol and permeability of capillaries. Therefore, it is seen as a promising source for creating special products for therapeutic and preventive nutrition.

9.4.2. VEGETABLE FOOD PRODUCTS. B.Popov, P. Nikolova

9.4.2.1. CEREALS AND PRODUCTS OF THEIR TREATMENT

In most countries of the world cereal products occupy over 50% of total energy intake in the daily diet.

◆ **Cereals**

The composition of each grain are included envelope -14%, germ -1% and endosperm - 85%.

Proteins there are on average 10-12%, the deficit of lysine makes them incomplete. Are insufficient and the quantities of methionine, tryptophan, valine, leucine.

Fat is relatively small but high biological value - contain phospholipids, polyunsaturated fatty acids (linoleic and α-linoleic) and vitamin E.

The carbohydrates in grains are about 70%. These are mainly in the endosperm and some quantity of pectin and cellulose in the casing.

Of ***minerals*** is significant content of P, K and Mg. Cereals are low in Ca, and the small amount contained is difficult digestible. **Trace elements** importance are iron, cobalt, copper and zinc. Furthermore, vitamin E and P well are presented almost all vitamins of group B. The various assortments grains are similar in composition, except for the rice, characterized by the highest carbohydrate content (above 75%) and with a lower protein content and corn and oats, which are rich in fat **(Table. 9.42)**.

• ***Oatmeal***

Table 9.42. Composition of cereals in g per 100 g net product

Products	Proteins	Fats	Carbo-hydrates	Cellulose
Wheat	12,1	1,7	69,1	2,0
Rye	10,1	1,8	72,1	2,1
Oats	12,6	7,1	59,0	5,5
Corn	11,8	4,9	67,7	2,6
Rice	7,4	2,2	75,4	0,7

They are a valuable food product. They are rich in unsaturated fatty acids (linoleic), lecithin, choline, vitamins, fiber-homopolysaccharides-beta-glucans. The mineral substances are represented by potassium, phosphorus, magnesium, fewer calcium and iron. On lipid metabolism beta-glucans, have a similar effect as pectins.

Impurities. The most important are pesticide residues in relation of which any systematic control. Improper extraction and storage of grain (high temperature and humidity) are developing a variety of micro- and macro- organisms - fungi, microscopic fungi, some weed impurities and storage pests. They destroyed part of the grains, deteriorated organoleptic qualities and some excrete toxic substances. Prevention - requires proper storage and adoption of non contaminated batches of grains.

• **Flour**

Flour obtained from whole grain are called whole- flours. They contain all valuable components of grain and therefore have a high biological value. Refined flours, in which are separated to varying degrees of grain husks, are obtained predominantly from the endosperm. They are characterized by high carbohydrate content and better digestibility. In such flours almost no B vitamins, mineral salts are reduced by about 50%, cellulose 90% are allocated a certain amount of grain protein. In the flour contained albuminous substances with water to form an elastic mass called gluten, which largely determines the quality of the bread. Flour stored in dry, ventilated rooms with durability up to 1 year.

◆ ***Bread and pasta***

They occupy a significant place in the diet of the Bulgarian people.

Bread is the most commonly consumed food product. The composition and nutritional value depends on the type of flour, respectively the type of cereal, the nature of the additives and rising, the quality of baking.

Nutrients. Bread is a source of essential nutrients. The average daily consumption of 300-400 g of bread provides 25-30 g protein, 150-200 g carbohydrates and 3130-4180 kJ (750-1000 kcal).

Protein - 7-8%, are characterized by lacking in lysine but rich in glutamic acid.

Carbohydrates - 45-55%, are presented primarily of starch, small dextrins, simple sugars (maltose, sucrose, fructose, raffinose, stachyose).

The ***fat*** content is negligible, but they are carriers of PUFA.

Bread contains varying amounts of ***fiber***: cellulose, hemicellulose, mucus and gumatous substanc-

es, pectin and others.

The ***mineral substances*** are represented by phosphorus, magnesium, potassium, calcium, low in trace elements - iron, copper, zinc, manganese.

Calcium, phosphorus and iron are hard assimilated. With bread supplied ***vitamins*** B_1, B_2, PP, B_6, biotin, pantothenic acid. Absorption of nutrients depends on the type of bread. Carbohydrates are utilized about 95%, and protein - 75 to 90%.

Breads. In commercially available several basic types of bread: wheat, rye, rye-wheat.

1. Whole wheat bread "Graham". Prepared from flour obtained from the milling of whole grains, incl. husks and germ. It contains more vitamins, minerals, fibers, amino acids, especially lysine. The content of cellulose is 5 times greater, and magnesium - 3 times as compared to the white bread. It is pasty medium has a higher acidity and stimulate gastric secretion.

2. Coarse bread. It contains a certain percentage of bran, but was stripped of the germ of the grain and no contains vitamin E.

3. Rye bread. This bread is rich in lysine and tyrosine, minerals, vitamins and fiber than wheat, but there are more phytates, which hinder the absorption of calcium. Rye bread is dense media and higher acidity than wheat. The consumption of rye bread glycemic increases slowly, even at low blood sugar, low maximum and steady decline.

4. Dietetic bread. Produced and special types of dietary bread: salt-free, enriched with vitamins and lecithin, with the addition of milk, eggs, soy protein, wheat bran or germ (containing more vitamin E and polyunsaturated fatty acids, mainly linoleic acid) enriched with various seeds (sunflower, flax, corn, oatmeal). Supplements reduced carbohydrate content. These types of bread with a greater nutrient density.

Hygienic assessment of bread. Performed on organoleptic characteristics, moisture (up to 47%), porosity (over 60%) and acidity (down to 5 ° N by Neumann). Upon storage the bread is hardened, due to changes in the colloidal state of the starch (the migration of water in gluten). Upon heating it to 70 ° C the gluten gives the water back to the starch, which makes it more fresh. When stored in damp and poorly ventilated premises, bread quickly grow due to development of fungus of the genus Penicillium and Aspergillus. Extending storage surest way is freezing him at minus 30-40 ° C. The bread to be offered in packaging (cellophane, waxed paper, aluminum foil) which, in addition to prolong durability, and protect it from external contamination, including pathogenic microorganisms.

Potato disease. Represents changes in bread caused by Bacillus subtilis var. mesentericus, widespread in nature. Spores are resistant to high temperatures and baking of the bread does not destroy them. Conditions conducive to the emergence of the potato disease are low acidity of the flour and the inappropriate storage conditions of grain and flour (high temperature and humidity). Bacillus grows well in a neutral environment and therefore affects mainly wheat bread.

Due to hydrolysis of protein and starch bread medium becomes sticky, brownish color and odor of rotten fruit. Such bread irritate the mucosa of the digestive system and can cause nausea, vomiting, diarrhea.

In establishing the potato disease bread be destroyed. The acidity of the wheat bread can be increased while kneading the dough was added lactic acid or calcium lactate. After baking the bread must quickly cool and shorten the duration of storage. In parallel, is need to make a thorough disinfection of the warehouses for flour and cereals.

9.4.2.2. VEGETABLES AND FRUITS. MUSHROOMS

◆ **Vegetables and fruits**

For the body, they are a major source of vitamins, mineral elements with alkaline valences, cellulose, pectin substances, carbohydrates, organic acids, phytoncides, aromatic and dye substances.

They have diverse and versatile action of metabolism in the body:

- *Raising secretory activity of digestive glands and improve absorption of food.*
- *Stimulates appetite.*
- *Increased motility of the stomach and intestines.*
- *Suppressed putrid intestinal microflora.*
- *Stimulate bile secretion.*
- *Have a diuretic effect.*
- *Participate in maintaining the acid-alkaline state in the body.*
- *Possess anticholesterol action.*
- *Facilitate the elimination of some poisons from the body.*
- *Inhibit the metabolism of carbohydrates into fat and prevent their deposition in landfills.*

Nutrients. The composition of vegetables and fruits contain about 1% protein and a negligible amount of fat. The carbohydrates in vegetables are an average of 5% and fruits - 10%, primarily as oligosaccharides. Of vegetables richest of sugar are beet and carrots, and in some fruits, such as grapes, figs, dates and bananas, its content reaches 20-25%. Together with cereals, fruit and vegetables are a major contributor in organism to dietary fiber. Their metabolism is well known, in fruit and vegetables, they are present primarily as a cellulose and pectinous

substances. The energy value of vegetables averaged 167 kJ (40 kcal), and the fruits - 230 kJ (55 kcal) per 100 g product. Vitamins - ensuring the body with vitamin C, P and carotene almost exclusively of fruits and vegetables. They deliver a significant amount of vitamin B_1, B_2, PP, inositol, choline, folic acid. Fruits and vegetables introduced into the body minerals mainly from the alkali salts of weak organic acids, and therefore alkalised. Particularly important is their role as an importer of potassium and iron. Significant is also the amount of calcium, magnesium and phosphorus. Organic acids, as in addition to a flavoring matter, involved in the digestion and metabolism. Fruits contain mainly malic, citric and tartaric acid. Some fruits and vegetables contain oxalic acid, which under certain conditions violate salt metabolism. High is its content in vegetables dock, sorrel, spinach and fruits - in blueberries, blackberries and plums. Ethereal oils contained therein phytoncides favourably affect the digestive and nervous system. Rich of them are garlic, dill, savory, parsley, and the fruit - citrus and melon.

Impurities. The most commonly detected pesticide residues with different chemical composition. Improper fertilizing with nitrogen fertilizers in leafy and root vegetables are detected elevated concentrations of nitrates. In some areas around industrial enterprises, as well as near the road motorways in vegetables is detected elevated levels of heavy metals - lead, mercury, cadmium.

Microflora. They may be contaminated with pathogenic microflora in their crop, transportation and storage. When watering with sewage, leafy and root vegetables and fruits can be infested with eggs of geo- and biohelminths. Vegetables and fruits are best stored at 0-3 ° C and relative humidity of 80-90%. Their decay is mainly due to rot and mildew caused by mold and some bacteria. Besides fresh, they are used in processed form as:

- dried;
- frozen;
- pickles;
- sterilized canned;
- fruit and vegetable juices;
- products with a significant amount of sugar - jams, marmalades.

• Potatoes

Contain about 2% protein, lots of carbohydrates - 16-20% and insignificant - fat. Proteins are insufficient methionine and cysteine, but with relatively much lysine. Carbohydrates are presented by starch and small (1-2%) simple sugars. When storing and freezing under the action of amylase degrades starch, sugars and increases the potatoes are sweeter. Potatoes are a major source of potassium (500 mg%), but are low in sodium and respond favourably water-salt balance in the body. The phosphorus content was relatively high (about 50 mg%) and only a small part is connected in the form of phytin. Vitamin C is about 25 mg%, but in boiling almost entirely destroyed. Cellulose is less, delicate and has absorbed almost completely. When standing in water and boil peeled potatoes lose part of starch, simple sugars, minerals, vitamin C. In potatoes (husk) may contain glycoside solanine, which has a bitter taste and can cause digestive disorders.

◆ Mushrooms

Chemically mushrooms are close to vegetables and pulses, but some ingredients (glycogen, chitin, amino acids, uric acid) have a similarity with animal products. It is therefore also called "vegetable meat." Proteins are 2-4%, with a balanced amino acid composition, but with low solubility, (70%) - containing chitin in cell walls. Fat 0.52% contain lecithin, ergosterin, unsaturated fatty acids and high digestibility. Carbohydrates are presented by glycogen, inulin, dextrin, mannitol. The mushrooms contain vitamins, mainly from group B (B_1, B_2, PP, etc.).. The mineral substances are represented by potassium, phosphorus, trace elements (manganese, copper, zinc, iron). Iron is in an easily absorbable form. The water content is 82.5 to 95.4%. Energy value is low 92-143 kJ (23-34 kcal). The pleasant taste of the mushrooms are determined by the content of the extract and aromatic compounds. Nitrogenous substances - ammonia nitrogen, uric acid, purine compounds amplified gastric secretion.

Suitable for cooked are hard and above all fresh mushrooms. They are perishable goods and for longer storage should be preserved appropriately. Most mushrooms are poisonous counterparts.

Mushrooms are difficult digestible and absorbable food. They are considered as a supplement to the diet of healthy people. Are contraindicated in many diseases: liver, kidney, cardiovascular, gout, arthritis, arthrosis, gastritis, enterocolitis and others.

9.4.2.3. PULSES AND NUTS. SPICES

◆ Pulses

These include beans, lentils, peas, chickpeas, soybeans.

With the exception of soy, they are characterized as a protein-carbohydrate foods.

• Beans

In mature beans and lentils proteins are about 23% similar in amino acid composition to milk casein. Carbohydrates, about 55% are represented by starch and small quantities of sugars raffinose and

stachyose. Fats are negligible (1-2%), but are biologically valuable because of the relatively high content of polyunsaturated fatty acids, oleic acid, beta-sitosterols, phospholipids, vitamin E. These minerals are primarily potassium, magnesium, calcium, phosphorus, sulfur, iron. Vitamins are preferably represented by the group B.

Pulses and particularly mature beans contain significant amounts of purines and should be avoided by individuals with gout, hyperuricemia, arthritis. The mature beans is excellent food for healthy people, but it is difficult digestible. Proteins are water soluble, but with little rise and impose prolonged boiling. Swelling of starch in cooking is greatly hampered by the hard cell cellulose husk. The utilization of the starch is slower and in the consumption of pulses (mature beans) glucose in the blood increases to two times less than the consumption of bread. Cellulose husk was digested by intestinal bacteria difficult and causes fermentation with excessive gas.

• Lentils

The lentils has a composition similar to that of mature beans, but it is more rich in iron. Cellulose it is relatively soft, so that the lentils is easier to digest and causes less fermentation in the gut.

• Soya

Is defined as protein-lipid concentrate. It contains 37-40% protein of high biological value, similar to egg on amino acid composition. It contains significant amounts of lysine, histidine, arginine, methionine, phenylalanine, tryptophan. Fat, about 20%, are rich in unsaturated fatty acids - linoleic (43-59%), and oleic (22-35%), of phosphatides but less cholesterol. Soy protein isolates and concentrates containing 65-90% protein, was used as a protein enrichment in the production of various food products (meat, bakery, dairy - curd etc.), are widely used in clinical nutrition.

◆ Nuts

Meaning for nutrition have walnuts, peanuts, hazelnuts and almonds. The protein content of these products is significant, as in peanuts reached 26%, while for the rest is between 14 and 15%. Their proteins are composed of essential amino acids in a balanced form. The protein composition of walnuts is close to that of milk, and if needed to reduce animal foods walnuts are an excellent source of complete protein. The amino acid composition of nuts makes them suitable for diets with reduced animal protein. Typical of nuts is high in fat (47-65%). They are carriers of significant amounts of essential substances (PUFA, phospholipids and vitamin E). Another feature is the significantly lower content of carbohydrates in comparison with pulses (12-19%), represented mainly by starch. Because of the high fat, energy value is almost two times higher than in pulses - 2592 - 2976 kJ (620-712 kcal) for 100 g. Of mineral substances in nuts significantly the content of K and P, and less of Mg, Ca and Fe. Vitamins highest content of vitamin E, and less on the B_1, B_2 and PP. Improper storage of nuts (hot and humid rooms) they quickly deteriorate, as most often they develop microscopic fungi, some of which, such as Aspergillus Flavus, emit dangerous (carcinogenic) mycotoxin.

◆ Spices

Improve the taste and aroma of the finished dishes, due to the content of certain essential oils, alkaloids and glycosides. The most commonly used spices are red and black pepper, cumin, mustard, cinnamon and others. As spices are used and some vegetables: dill, parsley, chervil, garlic, etc., which except flavors contain also vitamins and phytoncides. The use of food spices should be moderate, as abuse of them adversely irritating the digestive system.

9.4.2.4. SUGAR AND CONFECTIONERY. HONEY

◆ Sugar

Sugar produced from sugar beet or sugar cane. The proposed sugar commercially represents almost pure sucrose (over 99%). Sugar is most often consumed with milk, soft drinks, coffee, tea, pastries and more. For our country is characterized by its increased consumption by about 33% from accepted norms.

◆ Confectionery

Sugar enters as the main ingredient of many food products that can be classified into three groups:

1. Sugar confectionery - candies, halva, chocolate and more.

2. Pastry confectionery - biscuits, waffles and more.

3. Confectionery - fancy, cakes, oriental sweets and more.

They are characterized by good taste and high power density,. Confectionery contain easily digested carbohydrates and in some assortments - and a significant amount of fat. Confectionery are a common cause of food poisoning from microbial origin, especially in the summer months. Due to its high sugar content and energy value of these products must be confined in mental work, with hypokinesia and older. In some countries of beet sugar is recovered powder, which contains sucrose in a set of cellulose, organic acids and minerals (brown sugar). Such a sugar degrades more slowly and has a positive effect on lipid and carbohydrate metabolism in

the body.

◆ **Honey**

It is a natural sugar product made up almost entirely of a mixture of glucose to fructose. It contains many enzymes necessary for vital activity of every cell and tissue. It contains micro- and macroelements such as Ca, Na, K, Mg, P, Fe, S, J and others. The honey contained organic acid and a minimal amount of protein and vitamins (B_2, B_6, pantothenic and folic acid). The honey contained no well explored biogenic stimulators that increase the life of the organism. It has proven antibacterial and antifungal properties, causing never get mouldy. The presence of royal jelly in honey complements its composition valuable constituents, having a total revitalizing, immunoregulatory and antisclerosis effect.

9.4.3. DIETARY FAT.
P. Nikolova, R. Tsanev, M. Nikolova

They are adopted by people as pure fat or in food. In our country there is a tendency to increase their share in feeding an average of 5-7% more than the physiological norms. Subdivided on animal and plant. Animal are dairy butter, sheep and beef tallow, lard, poultry fat and fish oil. Of vegetable oils with essential role for nutrition are sunflower, corn, soybean and olive. The contents of the most commonly used fats with respect to the fatty acid in g per 100 g of the product are given in **Table. 9.43.**

◆ **Milk fat**

They most often consumed butter. It contains about 80% fat, 16-18% water, 1% protein, 0.7% lactose. There is a minor amount of polyunsaturated fatty acids (less than 1%) and a high content of saturated fatty acids (about 50%). Phospholipids are almost two times more than cholesterol. Butter is an important source of vitamin A, D_2, E, carotene.

Table. 9.43. Fatty acids in fat (g per 100 g of product)

Fatty acids / Fats	PUFA	Saturated	Oleic acid
Cow butter	0,9	50,2	22,7
Lard	10,6	39,6	45,5
Sunflower oil	59,8	11,3	23,7

◆ **Animal fats**

Characterized by a diverse staff and diverse biological value. The latter is mainly determined by the amount of PUFA, content of lipoids and vitamins. Most incomplete are sheep and beef tallow, which are composed mainly of saturated fatty acids. In pig and poultry fat prevail monoenic (oleic) fatty acids and fish oil are typically unsaturated, with high in PUFA. Lard is almost 3 times more PUFA than tallow, which determines the higher its biological value. Its durability is 3 months refrigerated.

◆ **Vegetable fats (oils)**

Obtained from oil seeds and nuts by special technology, including extraction or pressing, filtration and refining. To vegetable oils include: sunflower, corn, rape, olive, sesame, cotton, walnut, almond, peanut, coconut, cocoa and others. The biological value of raw and norefined vegetable oils due to the high content of polyunsaturated fatty acids, phospholipids, vitamin E, sitosterol. In the process of refining vegetable oils are clarified, acquire a pleasant smell and taste, but phospholipids are removed and much of sterols and vitamin E reduces twice.

• ***Sunflower oil***

It is the main vegetable oil, which is used in nutrition at home. Refined sunflower oil is light to golden yellow, clear, without sediments. It is characterized by a high content of unsaturated fatty acids, mainly oleic and linoleic, and relatively little saturated fatty acids. Durability in bottles of dark glass is 12 months.

• ***Corn oil***

It is valuable salad oil, concentrate of linoleic acid. Crude and unrefined corn oil contains 40-60% of polyunsaturated fatty acids, up to 1500 mg% phosphatides, vitamin E

• ***Olive oil***

Obtained or from the edible parts (60% fat), or of the kernel (12% fat) of the olive fruit without refining and is one of the highest quality vegetable oils. It has a low content of PUFA, but is rich in oleic acid (80%) and sitosterols. It is used most frequently as a salad.

• ***Cottonseed refined oil***

Used for the production of hydrogenated vegetable oils.

• ***Solid vegetable oils (coconut and cocoa)***

Coconut used for producing margarines and cocoa - chocolate.

◆ **Margarine. Trans-fatty acids**

Margarine was invented in 1869 by french pharmacist Hippolyte Mege-Mourice at the time of Napoleon III, with the aim of creating lasting and cheaper product with the characteristics of butter. Originally manufactured from animal fats, emulsified in water or milk.

The main raw material for there production are hydrogenated vegetable oils, alone or in combination with animal fats. By partial hydrolytic hydroge-

nation of the double bonds of the unsaturated fatty acids was added hydrogen. The fatty acids are saturated, and the consistency of the fat - firmer. Depending on the type and purpose in the formulation of margarines include: vegetable oil, emulsifiers, vitamins (A, D, E), essential phospholipids, native linoleic acid. In physical and organoleptic qualities and energy value margarines have resemblance with butter.

Differ table, dairy, dietary, culinary, confectionery, energy-reduced and more margarines. Total fat on average 82%, saturated fatty acids - 17-22% and PUFA - 8-17%.

• *Dining margarines* are high in water content, less (40%) fat, fortified with vitamins, phosphatides. Consumed raw.

• *Culinary margarines* have an oil content to 99% and solid consistency. Containing additives, facilitating culinary processing of products.

• *Dietary margarines*, low fat and salt content and substantially - on native linoleic acid.

• *In the low energy margarines* part of the fat phase was replaced with water (up to 60%) by increasing the emulsifiers. Higher water content favours more rapid deterioration and requires compliance with certain terms and conditions of storage.

Important to assess the biological value of margarines have ratios between saturated and unsaturated fatty acids - between cis- and trans-isomers of unsaturated fatty acids; content of native linoleic acid.

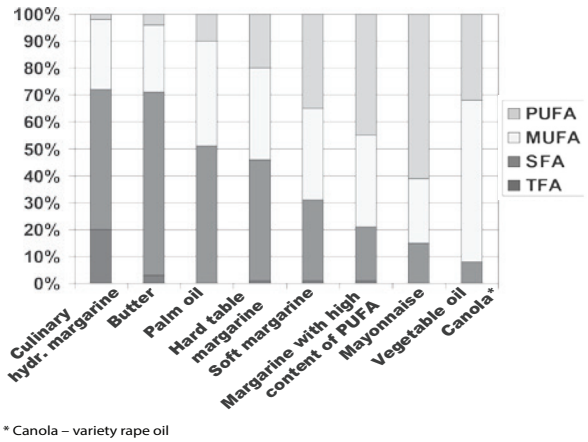
In control of margarines paying attention to the content of nickel and copper (catalyst) and indicators of hydrolytic and oxidative processes (peroxide value, acid number).

The nutritional quality of a fat are determined by the fatty acid constituted - quantitative content and ratio of saturated fatty acids (SFA), trans fatty acids (TFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), vitamins, lecithin, cholesterol. For practical purposes, current recommendations for fat intake to divide them "healthy" fat containing mainly MUFA and PUFA and "unhealthy" fats rich in SFA and TFA. **(Fig. 9.10)**.

The presence of double bonds in the molecule of higher fatty acids (C> 12) allows for the geometric isomerization of cis- and trans- configuration of hydrogen atoms relative to the double bond **(Fig. 9.11)**. In the natural fat is distributed mainly cis-configuration. The exceptions are milk fats and tallow of ruminants naturally contain trans- acids up to 5%.

Liquid vegetable oils are unstable when heated and is easily oxidized. By hydrogenating the double bonds of polyunsaturated fatty acids are saturated with hydrogen atoms, changing their consistency

Fig. 9.10. Fatty acid composition in some fat-rich products



* Canola – variety rape oil

(hard) and increases their stability. A major disadvantage of this process is the production of trans-fatty acids.

In terms of partial hydrogenation: highpressure, high temperature, and metal, powdered catalysts, energetically optimum trans-forms are thermodynamically more stable and compact. Since natural cis- PUFA received saturated fatty acids (SFA) with a trans- configuration.

Trans- fatty acids can be found in vegetable oils - after hydrogenation, roasting or refining, in some

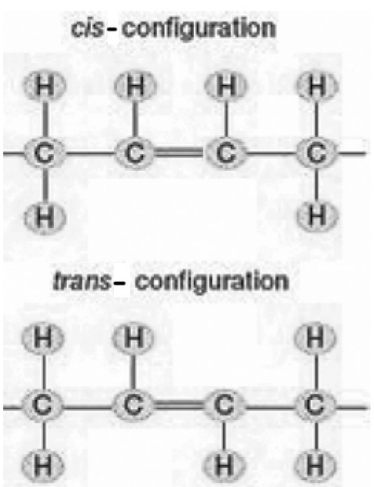


Fig. 9.11. Cis- and trans-configuration of the fatty acids

margarines, dry crackers, crackers, pretzels, baked pastries, snacks and other foods made or fried in partially hydrogenated oils.

Of particular interest are SFA and TFA and thus containing them edible oils, due to their unfavourable effects on serum lipid levels in humans **(Fig. 9.12)**. TFA and SFA are identical effect of increasing concentrations of total cholesterol (TCh) and LDL - cholesterol, but also TFA decreased levels of HDL - cholesterol. Furthermore, TMA have additional adverse effects on the human body by inhibiting the biosynthesis of essential fatty acids (EFAs), difficult

their β-oxidation and metabolism, reduced insulin sensitivity (IS) in diabetics, altering membrane fluidity in incorporation into membrane phospholipids.

With improving technology and composition of margarines, produced from the mid-20th century

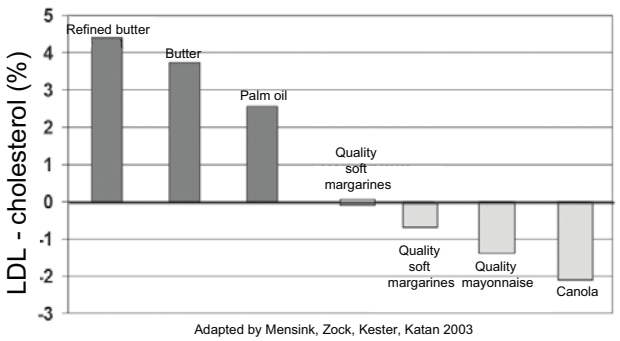


Fig. 9.12. Assessment of the influence of dietary fat on serum LDL-cholesterol in the blood

were replacing saturated fats with polyunsaturated fats and the creation of the first cholesterol-lowering margarine (Becel) - in 1960, the development of low-energy, "light" margarines with reduced SFA in the late 70s. Currently margarines are produced by a new technology for hardening of vegetable oils, called "interesterification" in which hardly form a trans-FA (<1%), concentrates additional with essentials n-6 polyunsaturated fatty acid - linoleic and n-3 PUFA - α-linoleic.

The new generation of table margarines are emulsion of quality vegetable oils in water. Have a semisolid consistency thanks to the structure of the crystals of the deposited solid fat - palm kernel fat. This is a vegetable fat, solid at room temperature, contains mainly saturated fatty acids, and no contains free cholesterol and TFA. Put in the new generation of margarine in order to structure the oils - in the amount up to 30% of total fat. In order to use the lowest possible amount of palm fat, at the same time maintain product consistency and organoleptic properties, it is modified with the processes of fractionation and interesterification.

Studies show that interesterified fat did not affect cholesterol or glucose levels in the blood. Interesterified palm oil is widely used in the food industry for many years, including dairy products for newborns.

Milk fat and fat of ruminants (cattle, goats, sheep) have a natural content of trans-fatty acids to 4%, which are formed by the action of micro-organisms in animals. Recent studies indicate, however, that its effect is different in comparison with that of trans-FA in hydrogenated vegetable oils. Natural TFA raise LDL cholesterol in women, but also significantly increase and HDL cholesterol; in men natural trans-FA not increase cholesterol. These formulas also include conjugated linoleic acid, which is reported to exhibit anti-cancer properties.

Denmark is the first country in the world that a legislative limit the content of trans-FA in food to 2% of the total fat content in products. Switzerland introduced the same ban on trans-FA in food in 2008. England oblige manufacturers to disclose on food labels the content of trans-FA, by carry out a policy of encouraging voluntary preclude the use of partially hydrogenated vegetable oils. USA (2003) and Canada (2005) also introduced mandatory labeling of trans-FA. The US Agency for Food and Drug Administration has estimated that the legislation introduced, would lead by 2009 y. to prevent yearly by 600-1200 cases of coronary heart disease and 250-500 deaths associated with it.

In Bulgaria TFA content in foods for infants (up to and over 4 months) is allowed up to 4% of the total fat content.

Usefulness of the fat component of the diet depends mainly on the ratio of polyunsaturated to saturated fatty acids, which should be 0,2-0,4. When storing fat hydrolyzed, thereby increasing the free fatty acids which are oxidized to peroxides, aldehydes and ketones. Prepared so-called rancidity of fats. When heated the oils above 200 °C to form primary and secondary oxygenated products, similar to those observed in their decay. Furthermore overheating, the most common in frying, disrupted PUFA (more than 40%), available phosphatides and vitamins, such as are formed, and compounds (acrolein), damaging the gastric mucosa, and having a carcinogenic effect. Therefore it is not allowed reusing (refried) sunflower oil. Subject to the control and frying products - potatoes, fish, meatballs, pastries and more.

9.4.4. BEVERAGES, SPIRITS. B.Popov

◆ Soft Drinks

Soft drinks contain no more than 0.5% ethyl alcohol. They can be classified into several groups:

1. Carbonated mineral waters.

2. Natural carbonated fruit juices - various assortments "Schweppes", apple, raspberry, strawberry and others.

3. Flavoured drinks - lemonade and more.

4. Tonic drinks - Coke, Pepsi and others.

5. Milk drinks and boza (millet-ale).

Some of these drinks (sets "Schweppes" Pepsi cola, apple, raspberry, strawberry, etc.) are high in refined sugar (10-12%), which means 25-30 g in each bottle 200-250 ml. This requires attention to their consumption in hypokinesy, children, elderly,

obesity, diabetes.

In soft drinks may fall contaminants from water, raw materials and additives to them. Often in poor washing bottles in them remain residues from detergents and disinfectants or may fall pathogenic microorganisms, that usually die within 1-2 days. The allowable coli-titer of soft drinks is the same as in drinking water. Molds and yeasts in them are not allowed.

Boza. Boza is a fermentation product obtained from cereals, mostly rye. Its sugar content is 8-10%, acidity 0.3-0.6%. It is a good medium for the development of some pathogens (known are dysentery epidemics after consumption of boza).

◆ Alcoholic drinks

Alcoholic drinks have different content of ethyl alcohol. Especially harmful to health are those that contain other harmful ingredients - methyl alcohol, furfural, higher alcohols. In some drinks containing a significant amount of sugar, making them high-energy, considering that itself ethyl alcohol has a high-energy performance (1 g absolute alcohol contains 29,72 kJ or 7,11 kcal). Alcoholic drinks divided into 3 groups:

1. Wines.

2. Distillation drinks.

3. Water-alcoholic beverages.

• ***Wines***

Obtained mostly as a result of the alcoholic fermentation of grape juice. Dry wines are prepared without added accessory ingredients. They contain about 10% alcohol and sugar less than 0.1%. Dessert wines are obtained by the addition of ethyl alcohol and sugar. These contain 16-18% alcohol and 10-15% sugar.

• ***Rakiya*** (brandy)

Obtained by distilling fermented fruit. Alcohol is a significant amount (30-45%). They are most commonly found side harmful substances that are normalized: methyl alcohol - up to 4 g/l, furfural - up to 4 mg/l and higher alcohols - 300 mg/l. Of ethyl alcohol by special technologies produce vodka, mastic, liqueurs and others. Vodka contains 40-50% alcohol, mastic - 47-55%, liqueurs -17-26% alcohol and 30-40% sugar.

• ***Cognac***

This is a distillate of wine stored in oak barrels, the age of growing in years is indicated by asterisks on the label.

• ***Beer***

Prepared from water, hops and malt fermented. Malt constitutes adherent, dried and milled barley. The alcohol content of beer is 2.5 to 6%. The labeled rates reflect dry matter in beer, ranging from 10 to 14 percent or more. In its chemical composition includes protein, carbohydrates, vitamins B, A, D, E, PP. The energy value of 1 l beer, depending on the type, is 1672-3344 kJ (400-800 kcal).

◆ Alcohol

Currently, according to most nutritionists, consumption of small amounts of alcohol during meals is not harmful and it could be considered a nutrient energy in the overall balance of nutrients accepted. In the opinion of researchers from different schools this amount varies from 20 g to 80 g of pure ethanol per day. Most nutritionists are inclined to accept alcohol as no toxic if its amount does not exceed 10% of the energy volume of daily ration.

Epidemiological studies have shown that low alcohol consumption associated with reduced risk of coronary events, compared with people non consuming alcohol. It is registered that small doses of alcohol leads to an increase the level of cholesterol in high density lipoprotein (HDL), which, as is known, has anti sclerosis effect. These data should be interpreted with caution, as it should be borne in mind, that alkoholdehydrogenase is an enzyme present genetically different in individuals and in some people and lower administered doses of alcohol can raise levels of total cholesterol and cholesterol in lipoprotein low density (LDL), and to provoke also hypoglycemia. Therefore, in individuals with abnormalities in the glycaemia and dyslipidemias alcohol is undesirable.

Alkoholemy studies in various ways on ethanol drinking shown that taking his fasting was most unfavourable, since sharply increases the amount in the blood. When consumed along with the protein, fat or carbohydrate food, its level is considerably lower, with the best effect in this aspect have carbohydrates. On the other hand has been proven, however, that the protein diet promotes more rapid metabolism of alcohol in the body. It was found, moreover, that the same amount of ethanol consumed, causes different alkoholemiya if passed once, twice or several times.

With moderate alcohol consumption, exceeding 40 g of pure ethanol per day, increases the risk of steatosis and later fibrosis and cirrhosis of the liver. It has been shown that, when the same alcohol consumption risk of cirrhosis in women is much higher than in males. It is unclear whether fermented drinks (wine, beer) or strong-water drinks (vodka, whiskey) have a higher cirrhosogenic effect at the same quantity imported ethanol.

According to some authors moderate alcohol consumption increases the risk of certain cancers in the digestive tract. The risk increases significantly

with the combination of alcohol with smoking.

High doses of alcohol in alcoholism undoubtedly be regarded as chronic intoxication. It has been shown that alcoholics immune system is significantly reduced because they more often and more severely ill. Chronic alcoholism is a common *disease affecting almost all organ and systems*, especially the liver and nervous system. The diet in alcoholics is most often unbalanced with deficiency in proteins and particularly of essential amino acids. The protein deficiency in one is often the cause of damage to the pancreas, with development of chronic pancreatitis. High doses of ethanol generally provoke hypertriglyceridemia, with the corresponding atherogenic risk. Moreover disturbed metabolism of the amino acids in the liver, while inhibits oxidative deamination them. Alcohol reduces serum tryptophan, leading to disturbance in the behavioural reactions. Alcohol abuse usually leads to a disturbance in the metabolism of water soluble vitamins such as reducing their content in the blood. Of fat-soluble vitamins are reduced depots of vitamin A. Notes are often deficient in certain minerals and trace elements.

◆ **Tonic drink**

Tonic drink beverages contain substances that tone the central nervous system and cardiovascular system. To some extent they stimulate secretion and motor function of the digestive system. These include tea, coffee and tonic noalcohol drinks.

• ***Tea***

Tea is a specially processed leaves the tea plant. The quality influencing compounds, which are easily extracted from the dried tea - tannin, caffeine, essential oils and certain vitamins - C, P, B_1, B_2. Tannins are tanning extract that determine the taste properties of tea - the average content is 8-15%. The caffeine content in different varieties is 1.5-3%.

• ***Coffee***

Coffee is the most popular snack. Key ingredients that determine the properties of coffee have caffeine (0.6 to 2.4%) and chlorogenic acid (7%). Caffeine causes insomnia, palpitations and pain sensations at abuse - more than 3-4 cups of coffee a day. Chlorogenic acid determines the bitter taste of coffee. Currently, a special technology produces coffee with total or partial separation of caffeine, but it is significantly inferior in taste from natural.

• ***Tonic soft drinks*** (no alcocholic)

Most widely used are Coca-Cola and Pepsi. They received their names from the nuts of the cola, containing a number of substances with tonic properties. Their tonic effect is proven, but their main disadvantage is their high sugar content.

9.4.5. FUNCTIONAL FOODS. K. Angelova

Development of the concept relating to the name "functional foods" rooted more in the minds and recommendations of Hippocrates and Celsus (Aulus Cornelius Celsus, ~ 25 BC - 50 AD) and traditional Chinese medicine, with a strong rise in interest her in Japan in the 80th of XX c., 90th - years in the US and later in Europe. This is due both to the accumulated scientific evidence on the relationship between nutrition and chronic non-infectious diseases and the demographic trend of an increase in the proportion of old people in the world have an impact on the health status of the community and increase healthcare costs.

In the European Health Strategy emphasizes that six of the seven most important risk factors for premature death (high blood pressure, abnormal cholesterol, risk body mass index, low intake of fruits and vegetables, physical inactivity and excessive alcohol consumption) relate and to nutrition. The Ministry of Health of the United States,indicate that five of the ten leading causes of mortality - ischemic heart disease, certain cancers, cerebrovascular disease, type 2 diabetes and atherosclerosis, are associated with nutrition. The implementation of a preventive strategy, one of the main purposes of which is to reduce the level of exposure to risk factors, induce the concept of functional foods as a major factor in reducing the risk of chronic diseases and health promotion.

There is no universally accepted definition of functional foods. One of the main reasons for this is due to the difficulty of proving the functional/ health claim and, accordingly, building the scientific basis of biomarkers as sensitive and specific indicators for reducing the risk of diseases or to stimulate a function of the body. Untenable is that there are "non-functional" foods, but also the categorization of "good" and "bad" can refer only to specific diets, but no foods at all.

The European Commission has adopted a working definition of functional foods, "a type of food can be classified as functional, provided that convincingly proves its beneficial effect on one or more functions in the body in excess of adequate nutritive effects in a way that demonstrates achievement of improved health and welfare of the body or reducing the risk of disease. "

Functional foods should form part of the normal dietary pattern to consume in the form of food and not in the form of tablets or capsules and to show its effects at normal dosage intake diet.

They are differentiated from drugs and apart from food supplements and so-called nutriceuticals, that provide in concentrated form bioactive substances

and in dosages exceeding their usual dietary intake.

The functional foods intended for the general population and thus differ from dietary foods, targeted at certain populations, for example dietary foods for special medical purposes and special purpose foods - foods for infants and young children, food for energy-restricted diets in order to weight reduction, food for sportsmen, foods for diabetics.

From a technological standpoint, the functional food may represent natural foods, foods - fortified with specific nutrients (fortified food) or no nutrition bioactive substances produced by extraction and separation technologies (eg. extracted beta-glucan of cereal, added to different foods) , modified by removal of the food ingredients exhibiting negative health effects (eg. saturated fatty acids), by chemical modification (eg. hydrolysis of protein in infant formulas for reducing the allergenicity), by enzymatic treatment to reduce the specified ingredients (eg. treatment with phytase to reduce phytates - chelators of essential minerals).

Scientific proof and validate the health and micronutrient claim for specific bioactivity of functional foods is a complex and lengthy process with the use of sensitive and specific biomarkers for reduction of health risk or to stimulate physiological functions. Valid biomarkers of health risk, for example in relation to cardiovascular diseases include blood pressure, levels of LDL-cholesterol and HDL-cholesterol (but apply and other potential markers, such as intercellular adhesion molecule 1, vascular cell adhesion molecule 1, P-selectin, homocysteine et al., although that evidence of correlation between changes in the levels and reduction of health risks are limited). In assessing functional foods applied for the reduction of the risk of diabetes, biomarkers are applied as an oral glucose tolerance, fasting blood glucose, insulin levels and insulin sensitivity. In osteoporosis, biomarkers- incidence of fractures and bone mineral density, requires a long period of research to reach statistical significance, while the markers based on the kinetics of calcium belong to the short-term indicators. Biomarkers, indicators that appear to stimulate physiological functions affecting the gastrointestinal physiology, immune system, physical loading and behavioural/psychological function. With the exception of physical potential, in other areas the identification of specific and valid biomarkers is a difficult task - especially in terms of demonstrating a functional effect on psychological function and cognitive abilities.

The promotion of "functional" attributes of functional foods is carried out and approved under a special procedure, based on scientific criteria, by regulatory institutions - eg. Agency for Food and Drug Administration (FDA) in the United States, the European Commission and the Authority for Food Safety (EFSA) in the European Union, the Ministry of Health in Japan, etc.

Some studied functional foods with bioactive ingredients and their potential role in health promotion and risk reduction of disease are listed in **Table. 9.44**.

• Oxidative stress and antioxidant defense

Generation of reactive oxygen species (ROS) in the body occurs under normal physiological conditions and is also part of the primary immune defense. The synthesis of ROS (superoxide anion radical, singlet oxygen, hydroxyl radical, peroxyl radical, nitroxide radical, etc.), however, is enhanced under the influence of stress, trauma, infections and adverse environmental factors (cigarette smoke, air pollution, increased levels ozone, radiation, etc.). Protecting the body from pro-oxidant states action of ROS is performed by enzymatic and non-enzymatic mechanisms (superoxide dismutase, glutathione peroxidase and catalase, via glutathione reductase and glutathione-S-transferase, respectively. vitamins C and E, reduced glutathione, ubiquinone, uric acid, bilirubin and enzyme cofactors Se, Cu, Zn). Imbalance of counteracted mechanisms, to develop oxidative stress, which occurred DNA damage, mutations, carcinogenic transformation, formation of DNA adducts, lipid peroxidation, protein changes. This speeds up the aging process, induces degenerative diseases of the nervous system, carcinogenesis and atherogenesis. Modulation of oxidative stress with food is promoted by three large groups of antioxidants - essential nutrients, carotenoids and flavonoids. To essential antioxidant nutrients decreased the water-soluble vitamin C (ascorbate), lipophilic tocopherols and tocotrienols (vitamin E) with bioactivity of alpha-tocopherol, and the minerals - primarily of selenium. Identified carotenoids exceed 600, of which food found about 50 species. More important species are beta-carotene in yellow-orange fruits and vegetables, alpha-carotene in carrots, lycopene in tomatoes, lutein in spinach, broccoli, zeaxanthin in corn betacryptoxanthin in citrus. Flavonoids are a heterogeneous group of more than 4,000 types of 6 subgroups - flavanols in black and green tea, cocoa, apples, grapes, red wine (catechin, epicatechin), flavanols in onions, grapes, apples, tea (quercetin, myricetin, kemferol), flavanones in citrus (naringenin, hesperetin), flavanones in parsley, citrus (apigenin), isoflavones in soy (genistein, daidzein) and anthocyanes in blueberries, black currants and dark blue pigments of grapes and other fruits. To flavonoids includes other phenolic compounds such as ortho-diphenol in olive oil and rozmanol

Table 9.44. Tested functional foods to improve the potential health claims - Agency for Food and Drug Administration (FDA, USA)

Food	Bioactive substances	Potential physiological beneficial effect
Alliums spp. (garlic, onions, etc.).	Organic sulfur-containing compounds	Reduction of - blood lipids, carcinogenic risk and blood pressure
Brassica spp. (broccoli, cabbage, etc.).	Isothiocyanates, indoles	Reduction of the risk of certain cancers
Almonds	Arginine, vitamin E	Reduction in the risk of CHD
Grapes	Polyphenols, resveratrol	Improving the health of the cardiovascular system, reduction of carcinogenic risk
Tomatoes	Lycopene	Reduction of the risk of certain cancers
Jerusalem artichoke	Fructo-oligosaccharides	Improving the health of the gastrointestinal system
Cocoa, chocolate	Polyphenol compounds	Antioxidants
Saltwater fish (oily)	Long chain n-3 polyunsaturated fatty acids (EPA, DHA)	Reduction of cardiovascular risk
Flax seed	Lignans	Reduction of carcinogenic risk
Soy	Isoflavones	Reduction of menopausal symptoms and possibly improve bone health
Fermented dairy products	Probiotics	Improving the health of the gastrointestinal system, immune function, reduction in the risk of certain cancers
Citrus fruits	Lemonoids	Reduction of the risk of certain cancers
Tea, green and black	Catechins	Reduction of carcinogenic risk and likely risk CHD

* Under C.M. Hasler

and carvacrol in rosemary, peppermint, etc. Outside antioxidant effect, soy isoflavones interact with the estrogen receptors and inhibit bone resorption in postmenopausal women.

• Gastrointestinal function, probiotics and prebiotics

Functional foods aimed at modulating the activity of the gastrointestinal tract comprise the administration of probiotics, prebiotics and synbiotics in their combination. **Probiotics** are defined as live microbial food ingredients with beneficial health effect. **Prebiotics** are defined as non-digestible food ingredients with potential beneficial health effects by the selective stimulation of the growth and/or activity of one or a limited number of bacterial species in the colon. **Prebiotics** are non-digestible galactooligosaccharides and fructooligosaccharides, which fermentable column with production of short-chain fatty acids, acetate, proprionate and butyrate. The bacteria most commonly used as probiotics are Lactobacillus spp. and Bifidobacterium spp., taken with milk products. Probiotics facilitated lactose intolerance in the presence of beta-galactosidase activity deficiency, stimulate immunity by causing an increase in circulating IgA, decreased fecal microbial enzyme beta-glucuronidase, urease and nitroreductase, activated mutagens and carcinogens. From prebiotics most studied are fructans inulin type, which include native inulin, enzyme-hydrolyzed inulin or oligofructose and synthetic fructooligosaccharides - categorized as a new type of food (inulin fructans are used as substitutes for sugar and fat and have a beneficial effect on the intestinal microflora) .

• Cardiovascular system and functional foods

Functional foods aimed at the reduction of cardiovascular risk affect the lipoprotein profile, thrombogenic potential, hyperhomocysteinemia, hypertension. Fish and fish oils rich in long-chain n-3 polyunsaturated fatty acids - eicosapentaenoic (EPA) and docosahexaenoic (DHA) decreased plasma triacylglycerols, blood pressure, platelet aggregation, inflammation, improve vascular reactivity - i.e. reduce cardiovascular risk. Foods rich in soluble fiber and fortified foods with phytosterols and especially esterified sitostanol exhibit lowering effect on LDL-cholesterol. Antioxidants inhibit lipid peroxidation and oxidation of LDL and thus reduces atherogenic potential. Due to the multifactorial etiology and pathogenesis of cardiovascular disease, the reduction of the risk require a total change of diet, and not only the application of the some individual functional foods. This is reflected in both health advice approved by the FDA - "Diets rich in whole grain

foods and other plant foods and low in fat, saturated fat and cholesterol may reduce the risk of cardiovascular disease and certain cancers" and "Diets containing foods sources of potassium and low sodium content can reduce the risk of high blood pressure and cerebral insult. "

• Reduction of carcinogenic risk and functional foods

So far is known from experimental models and epidemiological observations that some bioactive ingredients in plant foods can reduce the carcinogenic risk. Such data exist for lycopene in tomatoes and their products, for polyphenols catechins (epigallocatechin, epigallocatechin-3-gallate, epicatechin and epicatechin-3-gallate) in green tea, alilsulfidites in Allium sativum (garlic), genistein in soy, the hydrolysis products of glucosinolates - isothiocyanates (sulforaphane) and indole-3-carbinol in the species of the family Brassicaceae (cabbage, broccoli, etc.)., limonene in citrus. The mechanisms of inhibition of carcinogenesis include inhibition of angiogenesis, induction of apoptosis, destruction of free radicals.

In terms of stimulating **physical activity** make special foods rich in carbohydrates as a quick source of energy, carbohydrate-electrolyte solutions for maintaining fluid and electrolyte balance and foods rich in protein to build muscle mass. There is a legal ordinance harmonized with EU directive 2006 for the specific requirements for these foods for physical loading and especially for athletes.

On stimulation of **psychological and cognitive functions**, it should be in mind that in addition to biological factors have a strong influence sociocultured determinants, on the other hand, the difficulty in developing a valid and specific biomarkers and underlined individual reactivity with such effects, place the formulation of functional foods in this area in the very early stages of development.

While in the US raise questions about the establishment of functional foods, in Japan, functional foods called "foods for special medical purposes" (FOSHU), reaching in 2011 a level of 955 food products. In Europe, the European Commission and EFSA, in 2012, based on Regulation (EU) No 1924/2006 and Regulation (EU) No 432/2012, approved and submitted a list of 222 authorized health claims for nutrients, substances and foods.

REFERENCES

1. **Ashwell M.** Concepts of Functional Foods. ILSI Europe, Washington DC, pp 1-39, 2002.

2. **Balabanski L.** Nutrition and Dietetics. S., Med and phys., 1988. p. 33-87. (in bul.)

3. **Berry S.E.E, Woodward R., Yeoh C., Miller G.J., Sanders T.A.B.** Effect of interesterification of palmitic-acid rich triacylglycerol on postprandial lipid and factor VII response. Lipids 2007; 42: 315-323.

4. Chemical composition of foods. ed. **I.M. Skrihina and M. N.Volgareva. M.** Agropromizdat., 1987. (in russ.)

5. **Chomakov Hr.** Bulgarian yoghurt - health and longevity. S., Zemizdat, 1987. (in bul.)

6. Dietary Polyphenols and Health. Proc 1st Int Conf, Vichy France, Amer J Clin Nutr 81 (1) Suppl: 215S-335S, 2005.

7. Food hygiene. ed. **V.I. Boyadzhiev and M. Markova.** S., Med and phys., 1987. p. 83-108. (in bul.)

8. Functional Foods: Scientific and Global Perspectives. (Eds) **W.H.M. Saris, P.M. Verschuren, S. Harris.** Brit J Nutr vol.88 Suppl 2: S123-S235, 2002.

9. **Hamano H.** Regulation/Guidelines relating to functional foods in Japan. ILSI Japan, 2011.

10. **Hasler C.M.** Functional foods. In: Present Knowledge in Nutrition. 8th ed. (Eds) B.A. Bowman & R.M. Russell, ILSI Press, Washington DC, pp 740-749, 2001.

11. **Korver, O., M. Katan.** The elimination of Trans Fats from Spreads: How Science Helped to turn an Industry Around: Nutrition Reviews, 2006, 64, 6, 257-279

12. Les Aliments, in Alimentation et nutrition humains. Coord. **H. Dupin** ESF editor, Paris, 1992. 733-1182.

13. **Luke, B.** Principies of nutrition and diet therapy. Little, Brown an company, Boston/Toronto, 1984, p. 211-277.

14. **Markova M.** Milk and health. S., Med. and phys., 1988. (in bul.)

15. **Meijer GW, Weststrate J.A.** Interesterification of fats in margarine: effect on blood lipids, blood enzymes and hemostasis parameters. Eur J Clin Nutr 1997; 51; 527-34

16. **Petrovskiy, C.S., V.D. Vanhanen.** Food hygiene, M. Medicine, 1982. p. 159-260. (in russ.)

17. Physiologically Active Food Components. Proc17th Ross ResConf medIssues San Diego (ed) **A.E. Harper.** Amer J Clin Nutr 71 No 6, (S): 1647S-1743S, 2000.

18. **Pravst I.** Functional foods in Europe: A focus on health claims. In: Scientific, Health, and Social Aspects of the Food Industry. (Ed) B.Valdez, INTECH, 165-208, 2012.

19. Probioticss and Prebiotics. (Eds) **J. Schrezenmeir, M. de Vrese, K. Heller.** Amer J Clin Nutr 73 No 2 (S): 361S-486S, 2001.

20. Tables for composition of the Bulgarian foodstuffs. ed. **Tashev T. and G. Shishkov.** S. , Med and phys., 1975. (in bul.)

21. **Tsanev R. Ruseva A. Bosev A.** Trans-fatty acids, their effect on the human body options for lowering their content through new technological approach and experience to their legal limit., in Functional foods, food additives, food technologies. ed. **B. Popov**, Filvest, Sofia, 2006, 150-157. (in bul.)

22. **Tsanev, R., A. Ruseva. M. Pesevska.** Imported table margarines. Food Industry, 1993, 2, 19-20. (in bul.)

23. **Upritchard, J. E., M. J. Zeelenberg, H. Huizinga, P. M. Verschuren, E. A. Trautwein.** Modern fat technology: what is the potential for heart health ?: Proceedings of Nutrition Society (2005), 64, 379-386

24. **Visioli F., Rise P., Bosisio R., Sirtori C., Galli C.** Omega 3 - fortified milk. Modulation of cholesterol in dyslipidemic patients. NUTRAfoods 6 (2): 15-19, 2007.

25. **Yli-Jokipii K, Kallio H, Schwab U.** et al. Effects of palm oil and transesterified palm oil on chylomicron and VLDL triacylglycerol structures and postprandial lipid response. J Lip Res 2001; 42; 1618-25.

26. **Zampelas A, Williams C.M, Morgan L.M** et al. The effect of triacylglycerol fatty acids positional distribution on postprandial plasma metabolite and hormone responses in normal adult men. Brit J Nutr 1994; 71; 401-10.

27. **Hristov D.,** Traditional foods and their importance for healthy nutrition, 2017, Diss., 129 p. (in bul.)

9.5 CULINARY TECHNOLOGY

Basic hygiene requirements for culinary technology are: ***storing biological value in the preparation and ensuring chemical and biological safety of food.***

In order to maintain maximum biological value in food preparation technology of culinary preparation must be connected with minimal loss of nutrients.

The processing of food is: preliminary - mechanical and includes a good cleaning, washing and subsequent *cutting, grinding, grating*. The objective is - to break the cell walls of plant foods and insoluble fiber connective muscle tissue. Facilitates the effects of digestive juices. It is recommended to avoid prolonged contact of sliced food products with air, in order to prevent oxidation of the vitamins. It is recommended that fruit and vegetables be eaten mostly raw, in natural state - no chopped or in the form of salads (the goal is - to prevent loss of nutrients). In preparation for consumption, avoid prolonged stay in the water as some nutrients - vitamins, minerals, carbohydrates, are water soluble and can be extracted from the products. For this reason, the liquid part of the sterilized canned not be released because it contains much of the water soluble vitamins and minerals. The same applies to the brine of pickles, unless excessive salty. Frozen vegetable preparations were placed directly in the hot water, without pre-defrosted. Meat and fish are defrost slowly at room temperature, but not in hot water or in an oven.

Heat treatment of food aims to increase the assimilation of nutrients. Denature the protein molecule and increases the assimilation of protein food. Collagen connective tissue during heat treatment swells and turns into a water-soluble gluten - accessible to digestive juices. Starch cooked absorbs water and swells, i.e. - sizing, and easily breaks down into di- and monosaccharides. Sugar is converted to invert sugar. Upon heat treatment the insoluble protopectin of cell membranes is degraded to soluble pectin and cellulose, and the cell wall becomes permeable to digestive juices. During prolonged cooking fat emulsify and break down to glycerol and fatty acids, which gives an unpleasant taste of the dish.

Methods for heating treatment of cooking food must be friendly and most retain nutrients and biologically active substances. For this purpose, the most commonly recommended culinary method is boiling. ***Boiling*** can be *usually* when products are in liquid (water, milk), *steam boilling*, *pressure boiling* - in airtight containers, *stewing*. The temperature generally does not exceed in usually boiling 100 ° C (at high temperature are destroyed biologically valuable substances - vitamins, aromatic compounds, etc., and is aggravated organoleptic). It recommended for cooking vegetables to put in hot, lightly salted water. In cold water, the enzymes destroyed much of vitamins, especially vitamin C. It is better the water to cover the vegetables completely, and the court is covered with a lid. To retain maximum nutrients from oxidation and destruction, it is preferable vegetables for garnish be served whole, unpeeled if possible. *Steamed* takes place in special containers with double bottoms with a tightly fitting lid. The products are placed on a grid bottom, under which boiling the water. Of products or dishes are derived extractive substances and they are suitable for people with gastrointestinal inflammatory problems. *Pressure boiling* is carried out in special airtight containers at a temperature of 125 ° C. So cook time is shortened. *Stewing* is a thermal mode of culinary preparation - at moderate temperature in the presence of water and a little added fat. Stewing is suitable for vegetable products with delicate fibrous tissue - leafy vegetables, potatoes, broccoli, cauliflower, peas, and some animal foods - fish, poultry meat and young animals. If the target is stewing products with a solid consistency they need to be subjected to boiling. Boiling and stewing are the most recommended in infant feeding. Is used and the sauce because the extracted and found it water-soluble nutrients (vitamins, minerals, sugars, etc.). Upon heating of products, the content of fat-soluble vitamins A, D and K are retained, but vitamin C is destroyed to 50%, vitamin B_1 to 30%, vitamin B_2 and carotene - up to 20%. To reduce vitamin loss up to 10-20%, vegetables cooked unpeeled, in a closed utensil with the addition of starch, sugar, vinegar and others. ***Roasting*** can be grilled (electric or solid fuel - wood, coal), grilled in the open or covered pan with foil or lid - in oven and roasting in a water bath. When *grilling* (150 °C) the products are

dried, (meat, fish, sausages, etc.). Expire and remove some of the fat and their oxidation products. Expire and extractive substances. Food becomes low energy and non-irritating gastrointestinal mucosa and in the surface layer are formed to their specific aromatic and flavoring substances. The absence of water at a high temperature in a baking makes it impossible for the conversion of collagen - hard assimilated protein fraction of the connective tissue in the meat, of water-soluble glutin and absorption is difficult. When baking in an *oven* the temperature of heat treatment is moderately high, and the amount of oxidized substances - minimum. ***Frying*** is avoided because when frying to form oxidation products of fat (acrolein, peroxides, aldehydes), which are toxic and irritating to the mucous membrane of the digestive tract. Fried foods absorb a large amount of frying fat and significantly increased energy cost.

In recent years, households and the public sector entered ***microwave*** ovens (ovens, cameras) for cooked food. At this stage the convenience of a shorter time for heating and preparation of food is the leading reason for their use, but no less important is sparing effect on nutritional value - reduced protein denaturation, up to 50% lower vitamin losses (not yet passed enough long period to take account of possible health risks from consumption of foods subjected to high frequency microwave impact).

Besides improving the assimilation of food, with culinary treatment goals and achieve **microbiological safety**. With pre-treatment product (washing, peeling, cutting, etc.), to remove any impurities, contaminants or inedible parts. To avoid the spread of microorganisms washing is done with clean running water /in doubt - boiled/ and separate for different food sorts.

The thermal treatment of animal products - meat, poultry, fish, eggs, must be sufficiently long at a temperature above 70 °C. In order to ensure maximum microbiological safety, **freezing** food should be performed for all food - fast. Defrosting meat and fish - slowly at room temperature, until thawing of vegetables and fruits - is carried out quickly in boiling water.

If possible, **prepared meals are eaten** as soon as possible after culinary processing, as reproduction (proliferation) of bacteria begins with a cooling them.

A prerequisite for achieving the microbiological safety observance of **proper storage temperature** of cooked food - to 6 ° C. The remaining unused food is kept **covered and separately**;

Warming of prepared food before consumption is carried out at least 70 ° C. Cooked meals (stew, hash, hotch-potch, etc.) can be **kept refrigerated** only until the end of the day. For roasted and boiled meats allow cold storage to 30 hours.

MODEL OF FEEDING IN DIFFERENT NATIONALITY

Bulgarian cuisine

Eating pattern of every nation is linked to its history and climatic and geographical features of the territories inhabited. So for proto- bularians source of livelihood was livestock, and for the Slavs - agriculture. And in livelihoods and food Bulgarians throughout the centuries leading position are cereals and their products - bread. The bread is synonymous with livelihood, food - "I earn my bread." National epidemiological studies food consumption/food groups 1997, 1998, 2004 establishes traditionally high consumption of bread, which is a major source of complex carbohydrates in the diet of Bulgarians. Unfavourable is high intake of pastry (pies, cheese cakes, buns, etc.), in addition to carbohydrates, are a significant source of hidden fats in the diet of almost all population groups. Relatively high consumption of pulses. They are chemically complex plant food containing both proteins (23%), starch (55%), fat (1-2%), minerals and vitamins. In poor and crisis years Bulgarians have experienced precisely with cheese, beans, bread, vegetables and fruits. Consumption of meat and meat products varies widely, but is mostly at the expense of fatty meats (pork, beef, mutton) and sausages. Establish very low average consumption of fish. The intake of vegetables approaching the recommended amounts, but this of fruit is beneath them. A characteristic feature of Bulgarian cuisine is to have breakfast component - basic breakfast (combined sandwich, pastry, some kind of cereal - cornflakes, oatmeal or their derivatives - muesli, macaroni - the so called "Pasta") plus a snack - coffee, tea, juice. Traditional bularian lunch includes **soup** - vegetable, meat or milk (tarator), **main course** - meat, fish or egg-milk-based with vegetables - included with the dish and/or in the form of salad (or side dish) and **dessert** - most often with fruit and/or starch ingredient (fresh fruit, compote, cream, pastries). Dinner consists of a main dish (alaminute on a meat or sausage, milk product with vegetables) and dessert - fruit base. Specific is the **seasonal patterns** of the Bulgarians. In the so-called. risk seasons (winter and early spring) prevail animal protein foods with high fat content - mainly pork. Vegetables and fruits in winter and early spring are accepted mostly in preserved condition - vegetables like pickles, sauerkraut, sterilized canned, dried or frozen, chutney (typical bularian tomato-pepper mixture - a concentrate of vitamin C and lycopenes - antioxidants with

a strong anti-atherogenic and anti-cancer activity), and fruit - in the form of compotes, jams, dried fruit. On the table during the colder months of the year and attend various bakery products - cheese, cakes, round loafs, baklava, leak astys and others. Early spring green leafy vegetables include typical bularian dock, nettles, sorrel - with rich content in addition to vitamin C, folic acid and iron, as well - in antioxidants from the group of flavonoids and carotenoids. In the summer and fall, pattern of eating is richer for regional climatic and geographic conditions fresh vegetables and fruits, more yogurt and lactic acid foods and drinks, more poultry and fish. All yearly in soups and dishes from the bularian national kitchen includes onions, garlic is a common spice flavor. Used cooking technologies are different and almost all used in modern gastronomy, but typical of bularian cuisine is boiling "slow fire" a combination of meat with various vegetables, yielding a bouquet of taste and aromatic qualities of dishes known as " hotch-potch ". Sprinkling of parsley or other green leaf seasoning (mint, dill, savory, basil, lovage and oth.) further enriches the nutritional and organoleptic qualities. With the globalization of the world and the transition to an open market economy in our country we have brought new foods and culinary products - from national cuisine of other nations. They entered the so-called chains. "Fast" meal - offering high-energy foods and culinary products and low in biologically active substances (because of meager presence of fresh vegetables and fruits), pizzas, spaghetti, "snacks", "chips" and oth.Traditional drinks are lactic acid - butter milk (ayran), herbal teas, coffee, boza (millet-ale). In recent years, a very high consumption of soft drinks. Usual bularian alcoholic beverages are brandy (rakiya) and wine. Widely consumed beer.

Trends in modern nutrition naturally affect biochemical nutritional status of the population in Bulgaria and related chronic diseases.

Arab cuisine

Exotic scenery and climate have given their stamp on the traditional dietary pattern of Arab nations.

Sheep and camels inhabit these climatic-latitudes. So sheepmeat and meals thereof, eggs and dairy products (yogurt, cheese) are the main animal feed in arab cuisine. Bread is usually in form of flat bread - "Samus." Often them fried stuffed with spinach, onions, meat. Cereals and theirs culinary products are widely - messes, baking flour, farina, bulur and others. Breads are many types: fried falafel, traditional bureks stuffed with spinach, meat, cheese. Traditional are and messes of pulses - of red lentils, brown beans - seasoning with lemon and olive oil, chickpeas with garlic and more. Arab cuisine is rich in vegetables and fruits. Frying, grilling and boiling are the main culinary technology in the preparation of food.

Spices are saturated with flavor. Usually used mixtures of spices (containing coriander, mint, allspice, pepper and sweet pepper types - black, red, white, etc.). Specific spice is cardamom extracted from seeds of ginger. Add to coffee. Cardamom gives the coffee beverage characteristic flavor and so called "Arabic coffee" can not be unrecognized. Arab nations traditionally consume different types of tea - black, green and others. Cardamom added to stews, yogurt to food and drinks, different sauces.

Arab cuisine is rich and varied desserts. Typical are flooded with sugar syrup baklava, schreded wheat (kadaif), syroped sponge cake (revane) to which plenty add any nuts (pine-nuts, walnuts, hazelnuts, almonds). Of medical and biological perspective arab cuisine is rich in carbohydrates, fat and moderate protein. Eating a variety of fruits and vegetables and using different black, green and aromatic teas enrich the diet with vitamins, minerals, antioxidants, dietary fiber, biostimulators.

Arab food is tasty, spicy and preferred by lovers of exotic flavors.

Mediterranean cuisine

In recent years the mediterranean diet has become synonymous with "healthy food". Scientific observations have found that the people of southern Europe suffer less from cardiovascular disease than those living in northern European countries and the USA.

Analyze the specifics of the mediterranean diet, which makes an impression of wealth:

Fruits and vegetables - both in terms of quantity and in terms of variety of citrus fruits, all vegetables and olives, ie high intake of vitamin C and other vitamins from the group of water-soluble, minerals, organic acids and antioxidants - activators of metabolic processes, immunomodulators and imunostimulator protectors of cardiovascular risk.

Grains - macaroni (ie. "Pasta"), rice, oatmeal, who daily attend the table of mediterranean peoples - containing complex carbohydrates and dietary fiber - activators of peristalsis, absorbing and putting the faeces excess cholesterol and part of fat and toxic agents, that help to control blood-sugar levels and more.

Dried fruits - included 2-3 times weekly menu. Dominant in their composition content of magnesium, potassium, vitamin C and simple sugars -activators of cardiovascular activity;

Fish and seafood (shrimp, crab, squid, octopus), prepared with olive oil and consumed no less than

3 times a week. Undisputed is the beneficial health effects of long-chain omega-3 fatty acids on controlling blood levels of triglycerides and cholesterol, reducing the risk of clumping of platelets and blood thrombuses.

Red wine - "ricin" brewed from local grape varieties in specific technology - rich in antioxidants from the group of flavonoids that help reduce cardiovascular risk;

Olive oil as a supplement to meals and salads in mediterranean cuisine is of the most nutritious vegetable fats in the human diet, because of its unique composition - rich in alpha-tocopherols - powerful antioxidants; monounsaturated fatty acids - strong oxidizing changes; beta-sitosterol - a powerful lipotropic substance protecting the hepatic parenchyma of fatty infiltration and exercising effective control of cholesterol levels in the blood, with effective cholagogic action.

There are nuances in mediterranean cuisine in different regions. So in the Greek Mediterranean traditionally eaten bread - white, wheat, rye, corn and in South Italy (Sicily) - traditional is pizza with tomatoes and mozzarella (pizza "Margarita") and "risotto" - a dish with rice and vegetables, and preferred are local white wine. In areas of the Greek Mediterranean eaten cheese "Feta" and in Italian regions - "Mozzarella". Refreshments in the Greek regions are "frappe" - coffee with milk, yogurt and fresh-citrus juices, and strong black coffee - for the Italian. Overdose however, salt and added fats, alcoholic beverages, including concentrated (ouzo). Because of the high temperatures, style of work, sleep and relaxation is specific - a diet typically includes double intake of food - lunch (14-16 hrs.) and dinner (after 21h.). During the rest adopt fruit juice (more than water) and other refreshments. A high proportion of people with overweight and obesity, but lower the morbidity and mortality from cardiovascular disease.

French cuisine

Diet is threefold. Breakfast includes a hot drink - coffee, tea or chocolate and taken with "French roll", "French bun" croissant, spread with butter and jam. Lunch and dinner usually consist of an entrée (meal-starter), main warm dish - based on meat or fish, garnished with various sauces and vegetables, and for after dish - cheese. Dessert is fruit, pastries, cakes, dessert creams, ice cream, chocolate. The drinks are bottled water, wine - red, rosé, sparkling. The specifics of french culinary dishes lies in a combination meats and fish with sauces, in theirs preparation of traditionally attend butter, cream and various cheeses. As fertilizer to taste of dishes using mushrooms - truffles. Delicacy are seafood, including - live mussels with lemon juice. Extremely great is the variety of sausages, dessert bakery and confectionery products - cakes, pastries, creams (including the famous French cream "brulee"). Over 300 species are local cheeses, some are so varieties wines. Amid the shared characteristic french cuisine in each region has its own specific peculiaritis. Food is rich in complete protein sources (meat, fish, seafood, dairy, eggs), of complex and simple carbohydrates, fats (dairy, animal, plant). Consumption of sufficient amount and variety of vegetables and fruits, and red wine import enriched food with vitamins, minerals, organic acids and antioxidants - activators of metabolism and reduce the risk of chronic non-infectious diseases.

It is believed that it is the wealth of vegetables and fruits, as well as the traditional red wine in french cuisine due to lower morbidity and mortality from cardiovascular incidents. Problem remains, however, a relatively high proportion of people with liver problems, which are associated with high use of wine, dairy products with high fat and chocolate.

Chinese cuisine

Chinese kitchen offers world uncounted number of diverse, original, exotic products of the culinary arts and has a rich history. Each region in China, even each family has its own traditional dishes, among which unites beauty color exterior, sophisticated and unique taste, flavor and diversity.

The climate, geography and ethnic differences in the culture of China's population impart color and appearance of traditional dishes in different provinces. In northern China produced salt and there prevail salty dishes.

In southern China obtained sugar and meals are often a sweet taste. Near the rivers consume fish, crabs, molluscs, etc., and in coastal provinces - other fish, gifts of sea, scallops, oysters, shrimps. Typical for areas with developed poultry and livestock are meat dishes. With unique spicy Sichuan cuisine is famous - chilli, white pepper, wild pepper, ginger, pungent puree of broad beans and others. In the culinary traditions of certain regions of China dominated by light and delicious soups - clear, aromatic and milky white.

Uniting in chinese culinary culture is the structure of meals in the complex menu consisting of 5 courses: the first is the broth (liquid), the second - a thick soup (semi fluid), third - omelette or porridge (soft) and the fourth and fifth - hard consistency.

The main ingredient in the menu is food - a source of starch (complex carbohydrates) - rice, noodles, breads steam (mantau) and topped or accompanying ingredient is meat, fish, eggs (animal protein),

and also - vegetables and fruit (sources of biologically active substances). Visible is the difference between traditional chinese cuisine and the cuisine of European and American nations, where meat (source of complete protein) is a key component and starches (complex carbohydrates from bread, corn, rice, pasta, couscous, potatoes) and vegetables accompanying and decoration main protein dish.

Rice is unchangeable and essential part of most chinese dishes or after dishes. Serve in individual bowls, unlike other culinary dishes and products that are available in the common vessels. Typical for chinese cuisine is cheese of soy milk - "tofu". Veal is not popular and preferred are *duck, chicken, pork meats*. Widely used *exotic spices* - soy sauce, various combinations of ginger, anise, sesame, turmeric, cinnamon, curry, different types of mushrooms and more.

Typical flavors of Chinese cuisine are also sodium glutamate, garlic and leeks. By cleverly combining spices, food becomes strange and specific aroma, and taste of basic prescription ingredients in the finished dish disguise and alter (such as pork or chicken strips acquired taste fish or duck, etc.).

Soup is served at the beginning and end of a meal (South China).

As a *kind of dessert* at the end of a meal are served sliced fruit or hot sweet soup.

In traditional chinese culture cold fluids (water or aerated (soda) soft drinks) are considered "harmful" when taking hot food, so drink at mealtimes is most often *hot green tea* without sugar and without additives (served in bowls) or hot water. Tea, according to the Chinese, purifies the body, prepares the palate for the perception of tastes, aids digestion and therefore is served at the beginning and end of the meal.

Special attention is paid chinese cuisine for *breakfast*. In each area snacks are distinguished by their originality and diversity. Filling most of mince, onion, eggs, chinese cabbage and other vegetables (spinach, vegetable marrow, fennel, green beans), and seasonings are soy sauce, salt, cooking oil, chinese vegetable, sugar, etc. Dumplings are a favourite culinary products in the northern chinese provinces.

Basic utensils for consumption in China are chopsticks (wood, plastic, bamboo). For the soup does have designed *wide ceramic spoons* with a flat bottom. The knife and fork on the table are considered inappropriate. Therefore, the products in most chinese dishes are prepared as *bites* - and vegetables and tofu and meat, to facilitate their consumption. Only fish traditionally prepared and served whole, and with chopsticks detach and consume soft fish pieces.

Chinese culinary culture pays great attention to the *color*, *aroma* and *appearance* of food. The quality and type of raw materials are carefully selected. Important details in the process is thoroughly cleaning them, washing, slicing.

Preconditioning represents about 70% of the overall culinary processing of products, and *cooking* is done by conventional methods (browning, frying, boiling, steaming, baking, etc.), paying special attention to the power of fire and the duration of the thermal process . Typical of Chinese cuisine is subjecting the products of s*eparate heat treatment* - in a frying pan (usually a round-bottomed - "walk") is fried meat, in another - vegetables and finally combined. *Specific and individual culinary operation* is the combination and composition of meals.

With the globalization of the world, chinese cuisine tolerate the influence of various western culinary cultures. In preparations enter "new" products - inherent in other nations (beef, unknown to the Chinese until recently varieties of leafy and root fruit vegetables, vegetable oil, dairy butter and cheese, beer and soft drinks, etc.). Enriched and modernize techniques for preparation of traditional chinese dishes.

In all parts of the planet, the national chinese dishes accept elements of customs in the diet of the population in the region. It is achieved astonishing variety of stored key features of chinese cuisine.

REFERENCES

1. **Baikova D., Bl. Jordanov, S. Petrova, K. Angelova, V. Duleva, L. Ivanova, Kr. Vatralova** - National Nutrition Monitoring in Bulgaria - Food Intake - Second Balkan Congress on Obesity, 19-21 May, 2006, Albena, Bulgaria, BASORD - 106

2. **Balabanski L.** - Nutrition and Dietetics, Med. and phys., S. 358, 1988 (in bul.)

3. **Botzov, D., M. Markova** - Food hygiene, S., Med. and phys., 269.1984 (in bul.)

4. Food in the Arab world - www.al-bab.com/arab/food .htm-38k

5. French Food - www.aftouch-cusine.com/-14k

6. French Food Culture - www.france-property-and-information.com/french_food.htm-31k

7. **Hristov D.,** Traditional foods and their importance for healthy nutrition, dis., 2017, 129 p. (in bul.)

8. Mediterranean diet - the key to health and beauty - www.tialoto.bg/article. php? id = 2680-22k

9. Modern Aspects of Nutrition. Present Knowledge and Future Perspectives 2003, Ed. **I. Elmadfa, E. Anklam, J.S. Konig**, IUNS, Joint Research Center, EC, Karger, Basel - NY

10. **Obretenov Ts** - Thermal transformations of vitamins, 52-56 - Food Industry, No. 3, p. 52-56, 2007 (in bul.)

11. **Petrova S., K. Angelova, L. Ivanova, C. Duleva D. Baykova, Bl. Yordanov, Kr.Vatralova D. Ovcharov M.Vukov, H. Duneva.** National survey of dietary and nutritional status of the population in Bulgaria, 1998 - Food consumption. Hyg. and Publ. Health. 2000 XLIII, 3-4, 55-62 (in bul.)

12. **Popov, B.** - Culinary processing of food - in. Hygiene V. I - ed. **D. Tsvetkov,** S. Clement of Ohrid, 200-201.2005 (in bul.)

13. The traditional Bulgarian cuisine - menumag.bg/articles/view/16-19 k

14. **Todorov, D., M. Sharlandzhieva** - Food Bulgarians through the ages - S. Slavic Library/11, 96, 1999 (in bul.)

15. **Tsvetkova E., R. Nikolova, D. Miteva** - Providing safe meat products through the application of specific technologies: The science of nutrition in human health protection ed. **B. Popov,** Blenda, 79-83 S. 2004 (in bul.)

16. WHO Regional Office for Europe 2000 - CINDI Dietary Guide (EUR/OO/5,018,028)

17. WHO Regional Office for Europe 2004. Global Strategy on Diet, Physical Activity and Health. 57th World Health Assembley 2004. WHA 57.17

18. WHO - Food and health in Europe - a new basis for action - ISBN 92 890 1364 8, Denmark, 30, 2002

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9.6 PRESERVING FOOD PRODUCTS

Through canning food products are stored for longer . This is achieved either by destruction of microorganisms and destruction of the enzymes that cause deterioration of the products, or by creating conditions under which the microorganisms do not develop, and the enzymatic action is inhibited. In the first case the products are stored for a longer period, but the biological value is reduced, and the second - the durability of products is small, but the biological value is almost completely preserved. Preservation of the products is important in order to ensure a variety of seasonal products year round, and also the possibility of eating them regardless of distance and weather conditions.

Preservation methods can be classified into 4 groups: physical, chemical, physico-chemical and biological.

◆ **Physical preservation methods.**

1. Preservation at low temperatures:

Preservation by cooling. Performed by storage at a temperature close to zero. In these conditions remained development of nospore microorganisms and slow autolysis and oxidative processes in products. The period of storage at chilled products from a few days to 2-3 weeks.

Preservation by freezing. Was performed in freezing chambers at a temperature of about minus 18 ° C. At this temperature microflora does not develop, and oxidation processes are minimized. The spoiling of frozen products mainly comes from the oxidation of fat. The period of storage, depending on the fat content is from 6 to 12 months. Hygienic cooling and freezing are recognized as the best methods of preservation because the food and biological value of foods are preserved almost completely.

2. Preservation at high temperatures.

Preservation by pasteurization. It is performed by heating the product at a temperature below 100 ° C. The advantage of this method are minor changes in the natural properties of the products. Its duration from a few days to several months.

Preservation by sterilization. Is performed at temperatures above 100 ° C with varying duration. The advantage of this method is that it destroys harmful microflora, including spores, and provides storage under ambient conditions for prolonged periods. A disadvantage of this method is that the high temperature leads to structural changes in the product - change in the organoleptic properties and chemical composition as well as the destruction of most of the enzymes and vitamins. The storage period is usually 18-24 months.

Preservation by drying. It is based on the principle that at a water content in the product below 15% arise unfavourable conditions for the development of most microorganisms. We use several methods for drying: under natural conditions outdoors, hot air or by contact with a hot surface, vacuum drying, freeze drying (lyophilization). Sublimation is considered one of the best ways. Its essence consists in freezing the product under vacuum conditions with subsequent evaporation of the ice, at which the product was dried. This method retain the best biological and organoleptic properties, but it preserved microflora of product. Therefore, lyophilization should be subjected only for products nocontaminated with pathogenic microorganisms.

1. Preservation of UHF currents. Thus sterilized fruit and vegetable juices, wherein heated to boil for 30-40 s.

2. Preservation of ionizing radiation.

Obtained sterilization effect without an increase in temperature, and therefore it is also referred to as cold sterilization. This method is limited due to the lack of conclusive evidence against possible mutagenic action of irradiated products. In Bulgaria it is only allowed to dry herbs, spices and vegetable seasonings with a maximum mean absorbed dose to 10,0 kGy. *

◆ ***Chemical preservation methods***

1. Changes in osmolality

By salting. For contents of salt more than 10% pathogenic bacteria do not grow in food. Disadvantages of the process are in addition to the high content of salt and a decreased amount of extractable

* Decree № 6/2002, the Ministry of Health.

** Summary of Ordinance № 8/2002, the Ministry of Health

substances in the salt product, as well as most completely destroyed vitamins.

Preservation through sugar. Prepared in sugar concentration in the product over 60%. The preservative effect can be enhanced by pre-cooked. Thus prepared jams, marmalades, etc.

2. The change in the pH of the product

Marinade. It is performed by pouring of the product with 1.5 to 2% acetic acid with addition of salt and spices, wherein the pH of the product decreases less than 4 and most development of pathogens is retained.

By lactic acid fermentation. This is a combined method in which in addition to the low pH is primarily bactericidal action upon the putrefactive microflora of lactic acid and combining with the salting. In vegetable pickles (cabbage, tomatoes, carrots, mixed) lactic acid is 0,7-2,4%, pH - below 4%, salt -1,5-5.

3. Preservation by antiseptic substances. Currently in our country as additives, permitted to be used as preservatives are 5 groups of substances, as defined food which is permitted to invest as well as their maximum-permitted levels.

The first group includes sorbates, benzoates and p-hydroxybenzoates (E 200-E 219) - in all 13 substances - **Table. 9.45 and 9.46**.

In the second group are sulfur dioxide and sulphites (E 220 - E 228) - a total of 8 substances.

Table 9.45. Additives permitted to be used as preservatives **

Section A1: sorbates, benzoates, p-hydroxybenzoates

E №	Name	Abbreviation
E 200	Sorbic acid	Co
E 202	Potassium sorbate	
E 203	Calcium sorbate	
E 210	Benzoic acid	Be(¹)
E 211	Sodium benzoate	
E 212	Potassium benzoate	
E 213	Calcium benzoate	
E 214	Ethyl p-hydroxybenzoate	r – HB
E 215	Sodium ethyl p-hydroxybenzoate	
E 216	Propyl p-hydroxybenzoate	
E 217	Sodium propyl p-hydroxybenzoate	
E 218	Methyl p-hydroxybenzoate	
E 219	Sodium methyl p-hydroxybenzoate	

Third group - propionic acide and its salts (E 280 - E 283) - 4 substances.

Fourth group - other preservatives, including antibiotics and Nisin, Natamycin and boron acide and Lysozyme (E 230 - E 1105) - a total of 10 substances.

Table 9.46. Section A2: Food, which allowed to put strict preservatives of Section A1 and their maximum levels **

Food	Maximum level (mg/kg or mg/l)					
	Co	Be	r-HB	Co+Be	Co + r-HB	Co + Be + r-HB
Flavored wine, flavored wine-based drinks, flavored cocktails	200					
Non-alcoholic flavored drinks, without milk drinks	300	150		250 Co + 150 Be		
Liquid tea concentrates and liquid fruit and herbal infusion concentrates				600		
Unfermented grape juice				2000		
Wines, fortified wines, non-alcoholic wines; fruit wines. Made wine; cider and perry (incl. non-alcoholic)	200					
Sod…Saft or Sodet Saft	500	200				
Alcohol-free beer in keg		200				
Mead	200					
Alcoholic beverages with an alcohol content less than 15% vol.	200	200				
Filling for ravioli and similar products	1000					
Jams, jellies, marmalades and similar products, low-calorie or sugar-free (low sugar) and other mixtures of fruit-based spreads		500		1000		
…….						

Fifth group - Nitrates and nitrites (E 249 - E 252) - a total of 4 substances.

4. By antioxidant

Additives permitted to be used as antioxidants - delaying oxidation processes in food such as fats, mixes for cakes, soups and broths, dry milk, sauces, dehydrated meat, canned meat products, fish, etc., are permitted : gallates, butylhydroxy anisol, butylhydroxytoluol, erythorbic acide and sodium erythorbate (E 310 - E 321) - a total of 7 substances. With antioxidant action (antioxidant) is ascorbic acide (Vit C) and its compounds (E 300 - E 304) and Vit E (tocopherols - E 306 - E 309), but they are not always regarded as supplements and as food substances (as and mineral salts), added to food to support and strengthen the physiological functions of the body.

◆ ***Physicochemical methods for preserving***

Fumigation - a method for preserving, which uses the combined action of the drying, salting, heating and antiseptic effect of the smoke. According to the technology of processing differ cold- and warmfumigated assortments. The composition of the smoke has the substances (formaldehyde, etc.)., exerting microbicidal action, but the presence of resinous substances making it dangerous due to their carcinogenic action. Currently recommended the use of smoke gases with no resinous substances.

◆ ***Biological preservation methods***

They are based on the antagonism of microorganisms. A widely used process is the fermentation at the base of which stands development of specific saprophytic micro flora in the product. It decomposes the sugar substances with the formation of lactic acid, which changes the pH of the medium in an unfavourable for pathogenic microflora direction. This principle is based on the preparation of vegetable pickles. These vitamin C is retained more than 50% in storage stability of 6 months.

REFERENCES

1. Basics of Nutrition, ed. **T. Tashev**. Med. and phys. Sofia, 1981. (in bul.)

2. **Cuq Jean-Louis, St. Guilbert.** Cuisson, conservation, technologies, 1183-1266, In Alimentation et nutrition humaines, Coord, H, Dupin, ESF editor, Paris, 1992.

3. Decree № 8/SG. 44 of 29.04.2002 (in bul.)

4. Decree № 6/SG. 38 on 04/12/2002 (in bul.)

5. Food hygiene, ed. **Vl. Boyadzhiev, M. Markova**. Med. and phys., Sofia, 1987. (in bul.)

6. **Jurukov, X., I. Yanachkov B. Tsvetkova.** Common dietary and technology of food for patient. Med. and phys., Sofia, 1992. (in bul.)

7. **Petrovskiy, K., D. Vanhanen.** Food hygiene. M., Medicine, 1982. (in russ.)

9.7 FEEDING - DISEASES AND POISONING

Diseases regarding food and nutrition are classified as:

1. Diseases caused by biologically contaminated foods.

2. Diseases caused by chemically contaminated foods.

3. Diseases of hypersensitivity to food.

4. Diseases of intolerance to food.

5. Diseases of wrong nutrition and eating behaviour disorders.

9.7.1. DISEASES BY WRONG NUTRITION. B. Popov

Today, a number of modern diseases are defined as typical diseases resulting malnutrition. WHO defines 4 main pathologies caused by repeated deviation of healthy eating:

1. Malnutrition.

2. Partial malnutrition.

3. Overfeeding.

4. imbalance of nutrients. To these can be added and disease caused by improper diet.

◆ ***Malnutrition***

Systematically malnutrition develop common protein-energy deficiency that leads to the alimentary dystrophy and marasmus. According to UNESCO, about 66% of the inhabitants of our planet systematically starve. Every year millions of people, mostly children, die due to direct and indirect effects of starvation.

◆ ***Diseases of partly malnutrition***

• *At deficiency of protein in the diet* decreased body's defense mechanisms, which becomes less resistant to adverse environmental factors. Typically hypoprotein state is kwashiorkor disease. It is common in developing countries, affecting children fed mainly by plant foods, low in protein. It is characterized by a general retardation of growth, body weight, body swelling, delayed mental development and worsening function of all organs and systems. The protein deficiency, mainly of animal origin is the cause of so-called nutritional anemias. They insufficient protein intake is combined primarily with lack of iron, folic acid and vitamin B_{12}. Patients usually develop orthochromic normocytic anemia.

Protein deficiency is common in chronic alcoholism, in which people abuse alcohol, take 30-60% of the daily amount of energy as alcohol.

Insufficiently protein diet is seen as a possible etiologic factor in the development of chronic pancreatitis. Furthermore, it is shown that a low-protein diet with deficiency of choline and methionine, leads to the development of hepatic steatosis, which can evolve in cirrhosis.

• *Insufficient intake of fat* is important mainly for deficient import of essential polyunsaturated fatty acids and phospholipids, which favours the occurrence of atherosclerosis.

The negative impact of insufficient amounts of *carbohydrates* is mainly related to compensatory increase in protein catabolism. This leads to the use of adopted proteins for energy, rather than plastic purposes.

• *Insufficient vitamin intake (hypovitaminosis)* or due to a general lack of food and malnutrition, or excessive consumption of canned, refined and culinary processed foods.

Classical diseases in deficit of bioelements are: goiter in iodine deficiency, tooth decay in shortage of fluorine, rickets in calcium deficiency. Characteristic of modern man's is lack of potassium, magnesium and iron. One of the essential reasons for the scarcity of mineral substances and chronic alcohol abuse.

◆ **Diseases of overfeeding**

1. Overfeeding with protein. Specific disease by overfeeding with proteins is gout. Key factors for the emergence of this disease than are excessive intake of purine-rich protein diet and chronic alcohol abuse and hypokinesia.

2. Overfeeding with fat. It is infavourable for the organism and generally leading to obesity. Due to overload of ketone bodies occurs acidosis. Adipose tissue accumulates all poisons entering the body, and slows elimination, to a higher expression of the chronic poisoning. Recently highlighted the role of diet and hyperlipidemia in liver and pancreatic carcinogenesis.

3. Overfeeding with carbohydrates. Abuse of the carbohydrates are most commonly associated with diabetes mellitus. Currently a controversial question is whether food rich in sugar may directly cause the occurrence of diabetes in adulthood by way of direct stress on the system, producing insulin, or it is a consequence of induced obesity. Overfeeding with carbohydrates and alcohol abuse cause the most common forms of hyperlipoproteinemias type IIa, IIb and IV. These two types (IIb and IV) is most often combined with diabetes mellitus.

Diseases of the increased import of vitamins (hypervitaminoses) and the excess of some bioelements are discussed in the relevant chapters.

9.7.2. DISEASES BY IMBALANCE OF NUTRIENTS. B. Popov, M. Nikolova, L. Rangelova

Clean overfeeding occurs naturally rare. Most often overfeeding with some nutrient is combined with simultaneous deficiency of others. Thus arise and most common diseases of our time - obesity, atherosclerosis and cancer related to imbalance of nutrients.

◆ ***Obesity***

Obesity is considered when the men is established body fat over 20%, while women - over 30% of total body weight. There are numerous indices, formulas and tables for comparison of body weight. Normal is considered the ideal body weight with variations of ± 10%. They distinguish four levels of obesity:

Stage I - Overweight is 10 to 30%.

Stage II - from 31 to 50%.

Stage III - from 51 to 100%.

Stage IV - over 100%.

According to the WHO 30 to 40 percent of the population in developed countries are overweight.

Etiology. In over 90% of obesity develops as a result of the fact that the energy input to food in the body exceeds its power consumption. According to some authors, obesity is due to defective exchange as a result of which the body loses the ability to use the surplus of food. Allowed the existence of individual coefficient of utilization of ingested food. Obesity is more common in people abusing carbohydrates and foods high in fat. Irregular meals, with food intake mainly evening and alcohol abuse should also be borne in mind in etiopathogenesis of obesity. Obesity develops in people whose appetite is not easily enhance and vice versa - is stimulated by carbohydrate food. Overweight is often coupled with adverse changes in lipids status, carbohydrate metabolism and hyperuricemia. Consequently, at obesity is significant damage to the cardiovascular system, liver, pancreas and kidneys, which is expressed with reverence incidence of atherosclerosis, hypertension, kidney disease and diabetes. It was found that in obese people are violated and respiratory function due to reduced pulmonary ventilation, which predisposes to bronchopulmonary infection. Epidemiological studies register that people with overweight, live on average 10 years less.

It is now considered that obesity, is due to unbalanced diet with excess carbohydrates and protein deficiency, leading to a disorder of lipid metabolism. The role of carbohydrates is considered that it is complex: increased fat accumulation (lipogenesis) and reduce fat mobilization (lipolysis).

Treatment. When treating obesity diet includes adequate amount of protein, with varying degrees of restriction of carbohydrates and fats. Apply different diets: significantly low energy (2500 kJ), low energy (from 2500 to 5000 kJ) and moderately hypoenergy (from 5000 to 7500 kJ).

Prevention. It aims to provide a balanced diet in which energy imports corresponds to the energy losses. Recommended limits of sweet carbohydrates, pasta, high fat foods and increase physical activity.

◆ ***Atherosclerosis***

Etiology. Currently for early occurrence of atherosclerosis accepted the following risks:

- *Genetic factors.*
- *Alimentaria factors.*
- *Obesity.*
- *Hypertension.*
- *Smoking.*
- *Diabetes.*
- *Hypokinesia.*
- *Hyperlipoproteinemia.*
- *Hyperuricemia.*

For occurrence of atherosclerosis is essential cholesterol. Endogenous its synthesis takes place mainly in the liver and less in the intestinal mucosa. Endogenous production of cholesterol may exceed about 10 times the cholesterol, maximum taken with food, and therefore it is considered that the exogenous cholesterol is less important for atherogenesis.

Undoubtedly hypercholesterolemia is an important risk factor for atherosclerosis and especially for coronarysclerosis. No less important is, however, high levels of triglycerides and low density lipoproteins (LDL-chol.), which are also a risk factor, independent of serum total cholesterol (norm - <5,2 mmol/l).

In recent years, the spread of atherosclerosis in the world increased significantly. It is believed that

atherosclerosis affects about 25% of people between 40 and 50 years age, 48% at the age between 50 and '60, over 60% in people of 60 to '70 and 90% above 70 years of age.

Due to low fat consumption in Asian nations (Japanese, Korean) atherosclerosis occurs significantly rarely than in Europeans. It is interesting to note that in some nations as Eskimos, Mongols, consumption of animal fat is very high and yet they practically no suffer from atherosclerosis. It is assumed that they have an exchange adaptation to the increased use of fat as an energy source instead of carbohydrates ,as in most people.

In our country the level of serum lipids and cholesterol in people engaged in physical labour, especially in rural areas, are lower compared to people of the city, although they adopt energy food and a large amount of animal fats.

Currently, it is considered that by alimentary factors essential for the occurrence of atherosclerosis is overfeeding with sweet carbohydrates (oligosaccharides) and animal fats rich in saturated fatty acids. Simultaneously, its development is crucial prolonged diet low in polyunsaturated fatty acids, phospholipids, vitamins and dietary fiber. It has been found that saturated fatty acids and hyperglycemia induced by oligosaccharides, stimulate endogenous cholesterol synthesis, maintain its high level in the serum and slow elimination from the body. In contrast is effect of polyunsaturated fatty acids and lecithin. The action of vitamins (mainly vit. C) is to stabilize the physiological balance between the biosynthesis of cholesterol and its utilization in tissues. The role of fiber (cellulose, pectin, hemicellulose, and lignin resins) is mainly determined by their ability to more quickly eliminate cholesterol from the body.

Ultimately critical of alimentary factors for atherogenesis is the imbalance between saturated and polyunsaturated fatty acids. Evidenced by the numerous studies that have proven that with an increase in the energy share of saturated fatty acids in the diet (especially over 12%), significantly increases the risk of cardiovascular pathology. Conversely, increase energy share of PUFA reduces this risk significantly.

It should be borne in mind that the strong decrease in fat and cholesterol intake is also a cause for the development of atherosclerosis, due to the rapid induction in the synthesis of endogenous cholesterol. However, with food especially rich in cholesterol, such as brain, caviar etc., should not be abused. In some foods, such as eggs, fresh oil, etc., the cholesterol content is significantly, but they predominate quantitatively lecithin, which is the most potent physiological antagonist of cholesterol. With the anti-atherogenic effect are foods rich in addition to polyunsaturated fatty acids and lecithin, but also of choline, methionine, vitamins (A, C, E, P, B_{12}, B_{15}) and magnesium.

Hormonal factors are also important in the etiopathogenesis of atherosclerosis. For prostaglandins, such as tissue hormones are considered to have influence on lipolytic processes in adipose tissue and the processes of atherogenesis. Arachidonic fatty acid in fish oil is the most important metabolic precursor of prostaglandins and optimal its import by food indirectly also has anti-atherogenic effect.

Prevention. It should start from an early age, with a limit of foods rich in saturated fatty acids and oligosaccharides. The diet should include foods rich in polyunsaturated fatty acids, phospholipids, vitamins (especially vitamin C, A, carotenes, P, B_{12}, B_{15}), minerals and salts (especially magnesium) and fiber. Favourite foods should be poultry, fish, dairy products, vegetable oils, whole wheat bread, fresh fruit and vegetables. Simultaneously limited pork, beef and sheep meat, confectionery, cream, alcohol, coffee. It is also necessary total abstinence from nicotine, increased physical activity and avoidance of nervous tension and regulation of energy intake in order to prevent obesity.

◆ *Coronary disease*

Ischemic heart disease as a consequence of coronarysclerosis is one of the most common diseases of modern man.

Etiology

1. Consumption of fat. High-fat diet and an increased proportion of saturated fatty acids increased coronary fatal events. In Canada, an average consumption of fat around 38% of total energy intake and proportion of saturated fat 15.2%, mortality from coronary ischemia is 446 of 100 thousand. In Japan, where the proportion of fat is only 9 en.%, and saturated fat are only 3% mortality of 100,000 people is 86.

On the other hand the higher fat consumption, with an increased proportion of saturated fatty acids directly correlates with an increase in serum cholesterol. It has been found that there is a direct relationship between the level of serum total cholesterol and coronary events. Thus, in total cholesterol below 2 g/l, they are 2.5 to 1000, and if its content exceeding 2,6 g/l, they are 9.8 to 1,000.

It registered that serum cholesterol was significantly lower in vegetarians, compared to people of mixed feeding. Furthermore, in vegetarians are not usually found overweight. In the enrichment of food with alimentary fiber and reduced fluctuations in hypercholesterolemia.

2. Consumption of carbohydrates and alcohol. Interesting is the data and the relationship between carbohydrate intake and mortality from ischemic heart disease. In this aspect, studies show that in Japan, where the average consumption of carbohydrates include 278 g polysaccharides and 61 g oligosaccharides, in energy share of alcohol consumption average of 8.7 percent, the death rate per 1,000 people was 1.3. In the US, where the share of the polysaccharides is 155 g, and the oligosaccharides of 96 g, although the energy share of alcohol intake is 2.5%, mortality from coronary ischemia was 3.7 per 1,000 people.

In this direction are interesting and studies on the relationship between the consumption of alcohol (wine) and ischemic heart disease. It was found that in Finland where the consumption of wine is three times lower than in France, mortality from coronary heart disease is 4 times higher.

3. Drinking coffee. It has been found that increased consumption of coffee also adversely affects the serum cholesterol level and frequency of incidents of coronary heart disease.

So where no smoking has been found that no consuming coffee incidence of coronary heart disease are only 1.6%, while consumption of 1-2 cups per day are now 5.1%, while accepting more than 5 cups per day, the accidents increase an average of 10.7%. The number of drinked cafes correlated with increased levels of serum total cholesterol, this increase was more significant in men than in women.

Prevention. For prevention of coronarysclerosis WHO recommends the following consumption of nutrients, that have direct relevance to its occurrence:

- *total fat - up to 30 en.%;*
- *saturated fatty acids - up to 10 en %;*
- *PUFA to 10 en.%;*
- *alimentary cholesterol - up to 300 mg daily;*
- *added sucrose - up to 10 en %.*

◆ *Essential hypertension*

Etiology. Currently, it is considered that an imbalance between sodium and potassium, characterized by excessive intakes of the first and the second deficiency, is the basis of essential hypertension. Addition salt, overfeeding with carbohydrate also leads to the activation of the sympathetic system, followed by arterial hypertension. Recently reported a higher incidence of hypertension in abuse of animal fats. Established a close link between obesity and hypertension, such as the degree of obesity and increased risk of complications of hypertension. Hyperinsulinemia, very common in obesity due to sodium retention, also increases the incidence of hypertension.

Prevention. Alimentaria prevention includes primarily increased consumption of foods rich in potassium (vegetables, fruits, legumes, nuts, milk), limiting intake of salt - up to 3-5 g per day. Reduce consumption of products rich in sugar and saturated fatty acids with an increased share of polysaccharides and essential fatty acids. Obesity - reduction of energy intake, to optimize body weight. It is also important and limiting alcohol consumption, especially in genetically burdened persons.

◆ Cancer

Etiology. Increased frequency of cancer is associated with altered diet, characterized by the adoption of more concentrated, more refined and low in fiber foods. WHO statistics show that the food has a higher energy value and rich in saturated fatty acids and cholesterol, the higher the mortality from arteriosclerosis and cancer. In this aspect of risk factors for atherosclerosis alimentary origin are at risk for cancer.

1. Consumption of fat. So far, the most convincing evidence are of a direct correlation between overfeeding fat and a higher incidence of cancer. Saturated fats, mainly supplied by animal products, connects the growing incidence of cancer of the colon, liver and prostate in men and breast cancer, female genital organs and gall bladder in women. The role of protein for the occurrence of cancer has been less studied.

2. Consumption of carbohydrates and fiber. The importance of carbohydrates and dietary fiber in the diet for the etiopathogenesis of cancer are the subject of numerous studies. Establish data of right correlation between mortality from pancreatic cancer and breast by abuse of refined sugar. Carcinoma of the colon and rectum are far more common in nations with low consumption of fibrous ingredients in the diet and high consumption of refined foods. With a low-fiber diet is associated and ever-growing incidence of liver cancer, diverticulosis and intestinal polyposis, chronic constipation, hemorrhoids and gallstones.

3. Drinking alcohol. Increasingly, as a risk factor for the occurrence of certain cancers states and the alcohol. It was found that in alcoholics are more often observed oral cancer, pharynx, tongue, esophagus, liver and lung. Upon consumption of more than 100 g of absolute ethanol daily risk of esophageal cancer increased 20 times.

4. Spices. Eating a lot of salt and spices to food in some nations, as Japan, has reason to suffer more often from cancer of the stomach and liver. Interesting is the data that the emigration of Japanese people in the US, with utilization of new eating habits, the

incidence of stomach cancer and liver significantly decreased, but increases the incidence of cancer of the colon and prostate. These cancers are typical of Americans because of the abuse of animal fats and dietary fiber deficit.

5. Vitamins. The known data indicates that the main role in carcinogenesis of most of the vitamins is protecting. In particular for vitamin C than anti-cancer, and discuss its possible antimutagenic action. Recently, particularly active discussed anticancer effect of beta-carotene and vitamin A. It was shown that they have such protective effects, without clear precise mechanisms of action. Therefore widely recommended consumption of products rich in carotenes such as carrots, tomatoes, peppers and others. Vitamin E is also considered to reduce the risk of cancer.

6. Minerals. Intensive studies are and the role of some minerals in carcinogenesis. For arsenic is considered to have a mutagenic effect. Selenium, according to most authors, has protective qualities against the development of cancer. Established inverse relationship between its level in the blood serum and cancer. Under discussion is the fact that selenium is a component of some enzymes, which are essential in the process of detoxication of the body. In some localization of the cancer - stomach, intestine, mammary gland, prostate, as well as leucosis zinc level in the blood serum and in the tissues is very low.

Prevention. Alimentary cancer prevention requires: do not overeat and be taken daily varied diet; to increase the share of raw, unprocessed fresh foods; to consume foods rich in dietary fiber - whole grain products, fruits and vegetables; to limit the total intake of fat, particularly saturated; reducing the consumption of sugar and salt; to avoid consumption of fried foods.

Carcinogens. At this time, it is assumed that about 50% of cases of human cancer due to alimentary carcinogenic chemical contaminants and additives, mycotoxins and those obtained by culinary processing and storage of the products.

More important carcinogens entering from food are as follows:

1. Nitrates, nitrites, nitrosamines. In plant products contain mostly nitrates which are reduced to nitrite by enzymes in plants or in the human body under the influence of saprophytic flora, particularly in the oral cavity and intestines. The reaction of nitrites with some components of food (amino compounds) are synthesized in an alkaline environment nitrosamines. At present are examining more than 120 nitrosamines, most of them are considered to be carcinogenic. Experimentally it has been shown that they induce tumors of the liver, esophagus, lung, urinary bladder.

The synthesis of nitrosamines catalyze in the body: under the influence of bacterial flora in hypo-and anacidity; of the compounds of iodine and bromine; formaldehyde, chlorogenic acid (coffee), analgin, ephedrine, aminopyrine, tetracycline. Other factors such as thioproline, vitamins - thiamine, riboflavin, nicotinamide, tocopherols, ascorbic acid, retinol, retinol precursors - carotenoids, reverse - inhibit the synthesis of nitrosamines. In the enrichment of meat for sausages with nicotinamide, thiamine and riboflavin establishes inhibiting synthesis of nitrosamines from 30 to 70%.

2. Some mycotoxins produced by microscopic fungi. Firstly it is aflatoxin of fungus Aspergillus flavus, causing primary liver cancer.

3. Anabolic hormones. Apply in intensive farming to boost growth and immune function in animals. While natural estrogens have a carcinogenic effect, some of their synthetic derivatives haven't it. Therefore, the European Community prohibits the sale of meat from animals treated with anabolic hormones.

4. Benzo-3-4-pyrene contained in the smoke in smoking of meat and fish. It was found that people who eat more frequently smoked foods, sick 3 times more from cancer of the gastrointestinal tract.

5. In the fried products subjected to high temperature, with greater duration are formed from a number of fat oxidation products, as some of them, such acrolein are carcinogenic.

6. When grilling at high temperature, due to the pyrolysis of protein and amino acids, to form compounds with increased mutagenic risk.

7. Some synthetic sweeteners. For cyclamate has been shown to have carcinogenic effects in experimental animals, but for people no epidemiological data. However, its increased consumption of soft drinks and sweets is not desirable.

8. Some synthetic colourents from the group of azo-compounds have a carcinogenic effect, which is why health legislation prohibits the use of insufficiently studied colourents.

9. On the polymers, used for packaging and storage of food, toxicological problem is polyvinyl chloride. It has been shown that the constituent monomer vinyl chloride is mutagenic, teratogenic and embryotoxic action.

10. In products of marine origin are often found carcinogenic polycyclic aromatic hydrocarbons, due to water pollution by oil and oil products.

◆ ***Food anemia.*** **M. Nikolova, L. Rangelova**

Nutritional anemia is a serious medical problem affecting both developing and developed countries.

Iron-deficient conditions associated with impaired function of the major enzyme systems **(Table. 9.47)** are the most common causes of nutritional anemia, but lately paying attention to other micronutrients such as folate, Vit A, Vit B_2, Vit B_{12} , Vit C, copper, zinc.

Nutritional anemia significantly increase morbidity and mortality among children and pregnant women in many developing countries.

According to WHO, about two billion people of the total population suffer from nutritional anemia. On average 40-50% of children under 14 and women of childbearing age in developing countries are affected.

Distribution of nutritional anemia is highest in Asia, Africa and Latin America. The incidence of nutritional anemia in Europe is three times lower compared with that in South America **(Tab. 9.48)**.

There are various causes of nutritional anemia. These include insufficient import of nutrients due to poor diet or a general shortage of micronutrients intake. A number of physiological factors could contribute to the development of nutritional anemia (such as age decreases gastric acidity, which is related to bio availability of Vit B_{12} from food).

Adverse environmental factors associated with increased risk of many infections, including parasitosis and can be cause of anemia among persons primarily from developing countries. It is known that the inflammatory response of the organism to infectious diseases triggers a series of changes in the metabolism of iron associated with redistribution of iron deposits in the body. Nurselings most vulnerable group due to the immaturity of the immune system.

Table 9.47. Key enzyme systems involving iron

Types of iron	Subcellular localization	Major organs	Functions
Heme iron			
Hemoglobin		Erythrocytes	Oxygen transport
Myoglobin		Heart, skeletal muscles	
Cytochromes a-a3	Mitochondria	Skeletal muscle, heart, liver, brain	Final oxidases of electronic chains
b	Mitochondria	Heart	Electron transport
c1	Mitochondria	Heart, brain	Electron transport
c	Mitochondria	Liver, skeletal muscle, heart, brain	Electron transport
b5	Mitochondria	Brain, liver	Electron transport chain in microsomal
P450	Mitochondria	Liver, intestinal muscles, adrenal glands	Oxidation
Catalase	Peroxisomes		
Lactoperoxidase		Brain, liver, erythrocytes	Peroxidase destruction
Tryptophan pyrolysis	Cytosol	Milk exocrine secretions, neutrophils	Peroxidase destruction
		Liver	L-tryptophan - formil kynurenine
Nonheme iron			
NADPH cytochrome with reductase	Mitochondria		
Succinate cytochrome with reductase	Mitochondria	Liver, heart	Respiratory chain in mitochondria
Succinate dehydrogenase	Mitochondria	Liver, heart	Respiratory chain in mitochondria
NADH ferrocyanide oxidoreductase	Mitochondria	Heart	Respiratory chain in mitochondria
	Microsomes	Heart, liver	Respiratory chain in mitochondria
Aldehyde oxidase	Mitochondria		
Phenylalanine - hydroxylase		Brain, liver	Metabolism of serotonin
Aconitase	Mitochondria	Liver	Phenylalanine - tyrosine
Adrenodoxin	Mitochondria	Heart, kidney	Krebs cycle
Fe-S protein complex III	Mitochondria	Adrenal	Hydroxylation of steroids
Fe-S protein succinate dehydrogenase	Mitochondria	Heart	Electron transport
succinate dehydrogenase Flavoprotein	Mitochondria	Heart	Electron transport
NADH dehydrogenase	Mitochondria	Heart	Electron transport
Xanthine oxidase	Mitochondria	Liver, kidney, heart muscle	Electron transport
Transferrin	Mitochondria	Liver, intestinal muscles	Hypoxanthine
Lactoferrin	–	Plasma	Transportation of iron
Ferritin	–	Exocrine secretions	Transportation of iron
Hemosiderin	–	All tissues	Storage of iron
Monoamine oxidase	–	Liver, red bone marrow	Storage of iron
Ribonucleotide reductase	Mitochondria	Brain, liver, platelets	Metabolism of catecholamines
	Ribosomes	Lymphocytes, hematopoietic tissue	Synthesis of I'AND

Table 9.48. Frequency of anemia and iron deficiency among the population

REGION	Anemia		Iron deficiency anemia		Iron-deficient statuses	
	Millions	%	Millions	%	Millions	%
Africa	237	39	175	29	438	73
America	142	18	106	14	266	34
Southeast Asia	765	53	574	39	1435	99
Europe	80	9	60	7	150	17
Eastern Mediterranean	179	38	135	29	337	72
Western Pacific	578	38	434	29	1084	72
TOTAL	1981	34	1484	26	3710	64

Anemia is defined as a state with low hemoglobin and/or hematocrit low. Usually anemia is iron deficiency. It should be noted that iron deficiency is often to accumulate on other micronutrient deficiencies. Vit A deficiency is a common cause of abnormal hemoglobin synthesis and contributes to the deepening of the existing iron deficiency anemia. Riboflavin deficiency also leads to disruption of the iron metabolism and hemoglobin synthesis. A deficiency of folate, Vit C, Vit B_{12} also relate to the emergence and development of anemia **(Table. 9.49)**.

Forms of nutritional anemia

1. Iron deficiency

Incidence of iron-deficiency states are much more due to the fact that anemia develops only when fully depleted iron stores in the body. Iron deficiency is 2-2.5 times more often than itself iron deficiency anemia. There are about four billion individuals of varying severity pronounced iron deficiency.

Increased demand for iron - iron needs vary according to the age, sex and physiological status and are within the 7-27 mg per day for the different population groups. Pregnant women have the highest requirements of iron as iron from the mother is transported to the fetus and the placenta, iron also be used for the synthesis of larger quantities of hemoglobin.

Pregnant women have the highest incidence of anemia among all risk groups. Iron supplementation during the third trimester of pregnancy in the form of dietary supplements reduced the risk of developing iron deficiency anemia in pregnant women. In the US it is recommended that all pregnant women daily intake of 30 mg of iron in the form of supplements and 60 mg if proven anemia. Particularly at risk of developing iron deficiency anemia pregnant women under 18 years of age, those with multiple pregnancy and women with a short interval under 2 years between 2 consecutive pregnancies.

Breastfeeding postponed the resumption of menstruation, which supports the preservation of iron stores in the body.

Approximately ½ of the needs of every woman of iron used to cover the losses of iron with menstrual bleeding. Menstruation is the reason why women have a 2-fold higher demand for iron than men and thus are much more at risk of developing iron deficiency anemia.

Early childhood (0-2 years) - The needs of newborns and iron during the first, and less during the second year are very high, due to the extremely fast growth. Infant has a relatively constant levels of serum iron during the first four months of life, as ½ of the accumulated reserves are mobilized and used for the synthesis of hemoglobin, myoglobin and enzymes.

Breast milk is low in iron, but has a very good bioavailability. It was found that the stock of newborn iron at birth reduced to four months and limited to 6 months of age. So the US recommended fortified with iron of all feeding foods for infants. Most often giving iron supplement is necessary between

Table 9.49. Forms of nutritional anemia.

Nutritional anemia	Reason
I. Iron deficiency anemia	Increased physiological needs - pregnancy, menstruation, children and adolescents
	Low intake or low absorption of iron from food
	Infections and infestations - malaria, HIV infection, helminthoses
II. Nutritional anemia due to other micronutrient deficiencies	A deficiency of Vit A
	A deficiency of Vit B_2
	Folate deficiency
	A deficiency of Vit B_{12}

6 months and 2 years. After 2 years of age the incidence of anemia decreases, first due to the decreased demand for iron, and secondly because of expanding diet of children.

The amount of iron stores in the infant depends on the iron status of the mother, the weight of the infant at birth. Premature infants are at higher risk for developing anemia, as they are depleted iron stores not at 4-6 months of age, but at 3 months.

Adolescence - The frequency of iron deficiency and iron deficiency anemia are increased in early adolescence and in both sexes associated with an increase in the demand for iron, due to rapid growth. In girls, an additional factor is the emergence of menstrual bleeding and boys is the rapid increase in muscle mass.

Insufficient iron intake and/or low absorption of iron from food.

The best sources of iron are red meat, fish, poultry, liver, because they are rich in heme iron, whose absorption rate reaches 20% - 25%. In developing countries the intake of iron at the expense of consumption mainly non heme iron from plant foods - corn, whole wheat flour, beans, brown rice, whose absorption is very small - 2 to 5%. In plant foods iron is associated with phytates in no assimilated compounds. Inhibitors of iron absorption are also polyphenols in beans, tea, coffee, nuts, and oxalates in spinach and other leafy vegetables. Calcium of food also may deteriorate the absorption of iron from food.

Souring of bread leads to release of the iron-bound by phytates and improves absorption of iron from some cereals. Absorption of non heme iron is improved in the presence of activators, as Vit C in the diet, so the low intake of Vit C is also a risk factor for the development of iron deficiency anemia **(Fig. 9.13)**.

Infections and infestations contribute to the development of anemia by increasing the iron losses. The most common infections and infestations, leading to anemia - malaria, HIV - infection, helminthiasis caused by Ankilostoma duodenale, schistosomiasis (Schistosoma haematobium /mansoni/ japonicum), ascaridosis (Ascaris lumbricoides) and Trichuriasis (Trichocephlus trichiurus/dispar). Key areas where these are common infections and infestations are Africa and the Middle East. Mechanisms for developing anemia are different for different infectious agents. In malaria has haemolysis of red blood cells, haematopoietic suppression and possible secondary folate deficiency. In AIDS, anemia is the result of chronic underlying diseases, nutritional deficiencies, anti - erythrocyte antibodies, overdose with medicaments and so on. In helminth infection has constant bleeding from the gastrointestinal tract, as it is affected intestinal mucosa. In trichiuriasis and ascaridosis there are stomach and intestinal ulceration and corresponding blood loss.

2. Anaemia due to other micronutrient deficiencies.

Iron deficiency is often associated with other micronutrient deficiencies. Diet low in animal products is poor in easily absorbed heme iron, and also of Vit A, Vit B_2, folate, Vit B_{12} and other micronutrients.

Vit A deficiency. The subclinical Vit A deficiency affects about 256 million children under 5 years of age. Pregnant and nursing mothers Vit A deficit reached 20 percent in some areas of East Africa. Vitamin A deficiency results in anemia, as it affects transferrin receptor and disrupting the mobilization of iron from landfills, and thus the synthesis of hemoglobin. Induced anemia is effected only in combination with suplimentirane of Vit A and iron.

Deficiency of Vit B_2 (riboflavin). An insufficient intake of animal products, including milk, observe low intake of Vit B_2 and heme iron. The distribution of this deficit is supposed to be significant in areas with low consumption of animal products. Most at risk are pregnant and lactating women, because of their high demand, as well as adolescents and adults. Vit B_2 deficiency may exacerbate an existing iron deficiency, by increasing the loss of iron in the intestine due to a reduction in iron absorption, or by disrupting the mobilization of intracellular iron. This anemia also have to be treated by a combination of iron preparations and Vit B_2.

Folate deficiency gives rise to megaloblastic macrocytic anemia due to impaired synthesis of erythrocytes. There is no accurate data on the prevalence of folate deficiency. In the United States before fortified flour with folic acid about 15% of women have a bad status for vitamin. In new data indicate that folic acid has no this manifest effect on hemoglobin concentrations, as was thought until recently. Malabsorption of folate was observed secondary at infections.

Vit B_{12} deficiency. Pernicious (megaloblastic) anemia is an autoimmune disease involving a defect in the synthesis of the internal gastro- intestinal factor required for the absorption of Vit B_{12}. Since the vitamin is found only in animal products and is actively reabsorbed from bile, deficit has traditionally been associated with prolonged application of a strict vegetarian diet. A deficiency of Vit B_{12} in developed countries is typical in older people over 65, while in developing countries this deficit occurs in all age groups due to lower consumption of animal products. Most endangered groups of deficiency of Vit B_{12} are vegetarian mothers and their children,

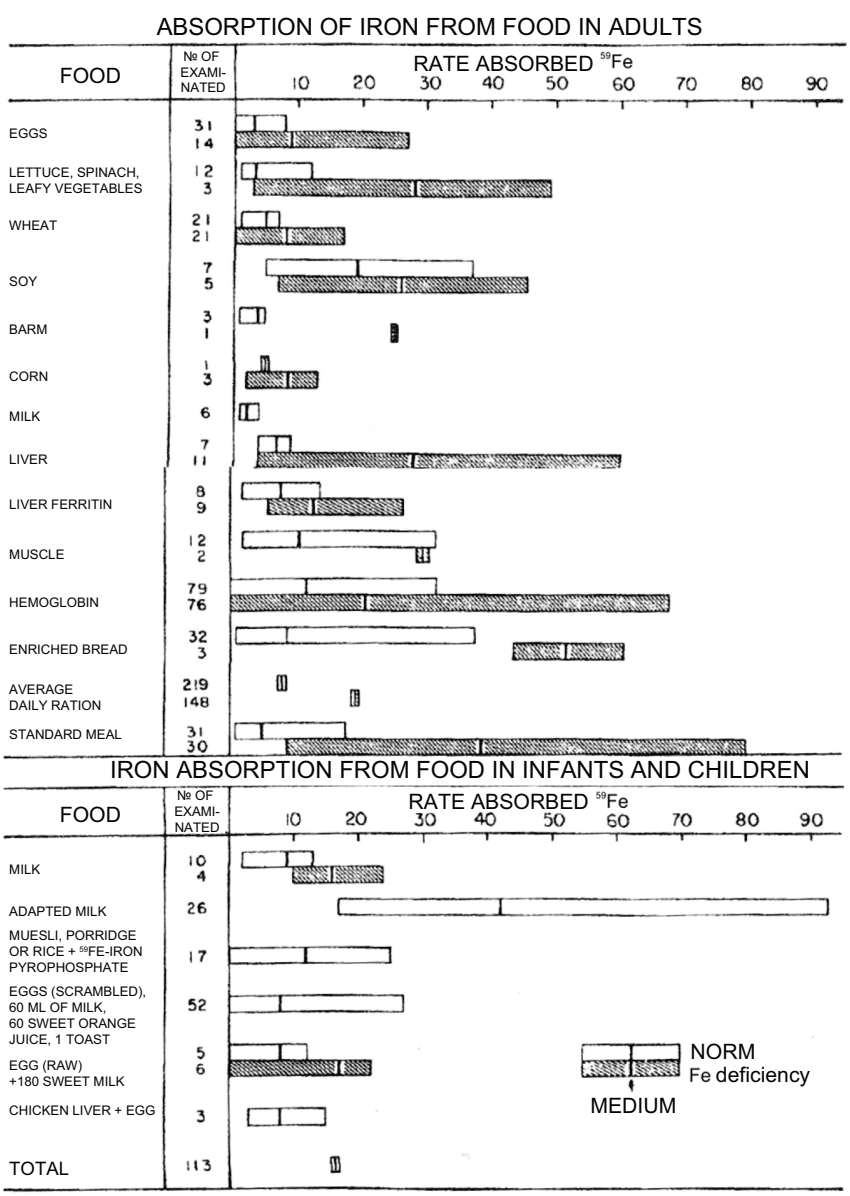
nursing mothers and children under school age, as well as seniors over 65, where the reason is atrophic gastritis leading to reduced secretion of hydrochloric acid and thus reduced absorption of Vit B_{12} from food. The risk of Vit B_{12} deficiency is highest in combining low intake of vitamin with food and violated its absorption as a result of infections (most commonly caused by Helicobacter pylori).

◆ ***Diseases by improper diet***

These diseases are associated most often with irregular submission, processing, improper absorption and utilization of ingested food. Besides metabolic, here are frequent and diseases of the digestive system. Irregular eating supports hyperphagia and leads to adaptive storage of more nutrients in reserve (lipid pool). Abundant food produced in one or two doses is the cause of poor absorption of protein. Well digested fats and carbohydrates, which the body fails to metabolize and they set aside as a reserve fat. Particularly harmful is abundant evening meal just before bedtime with food rich in fat. It has been found that after such a meal, beta-lipoproteins (Apo B - chol.) was significantly increased in the blood, such as during sleep are more intensive processes of deposition of cholesterol on the vessel wall.

It was found that overfeeding night leads to a more pronounced weight increase, than when the breakfast was amplified and dinner lighter. It is also found that the intake of more food before bedtime disrupts the total metabolism of nutrients and their effective utilization in the body. Is increased and the risk of lithiasis, as the night the formation of gallstones in the gallbladder and kidneys is accelerated.

Fig. 9.13. Radioisotope determining the absorption of iron from food in adults, children and newborns



9.7.3. VIOLATIONS OF EATING BEHAVIOUR.

D. Popova

From a physiological standpoint anomalies in nutrition are prandial (related to nutrition) and extraprandial (outside of feeding).

Anomalies in food imports are hypophagia, hyperphagia and others. Hypophagia include anorexia (lack of appetite and desire for food at the usual hours), denial of food (for normal perception of food signals) and suppress the feeling of hunger. Hyperphagia include exacerbation of hunger and appetite, shortening of satiety or lack of satiety and over threshold reception for satiety. Other anomalies are systematically avoiding certain foods, no chewed or quickly swallow, secretly disposing of food, ingestion of non-food substances.

Extraprandial anomalies in nutrition include hyperactivity to food stimuli (which is a metabolic or psychological predisposition), often eating, "addiction" to certain foods eg. sugars, qualitative modifications, so-called night eating syndrome, paroxysmal overeating so-called binge eating syndrome, vomiting. Deviations of eating behaviour may develop from the norm to pathology, going on adaptive response to feeding disorders, disease symptoms and systemic disease.

In the International Classification of Diseases - 10th Revision: mental and behavioural disorders, under "disorders feedings" (F-50) are presented: **anorexia neurosis and bulimia neurosis**.

In psychiatric clinical vocabulary anorexia and bulimia are clarified as follows: "Anorexia (greek prefix an - not, orexis - desire): lack of appetite, loss of appetite; lack of desire to eat in the presence of a physiological need for nutrition. "

"Bulimia (greek bus - ox, buffalo and limos - hunger) pathological increased food urge; pathological sharp hard sensation of hunger, often accompanied by general weakness and stomach pains. "

What connects these two disorders are some anxieties concerns shape and weight of the body. These anxieties and obsessive (compulsive) thoughts are specific to anorexia and bulimia and are of great diagnostic significance.

Main prerequisite for diagnosis - anorexia neurosis and bulimia neurosis, is the fact that the infringement represents a **vital threat,** is demonstrated serious somatic and psychiatric disorders, impairs social functioning of the affected person.

According to the World Health Organization in anorexia mortality rate 15% -20% is the highest among all psychiatric and psychosomatic diseases.

By anorexia neurosis are affected 0.5% to 1% of the female population. Mortality in patients enrolled in university hospitals is more than 10%. Bulimia neurosis affects 1% to 3% of young women and 0.1% to 0.3% of men. Five to ten years after the onset of bulimia neurosis, 20% of women corresponde to the diagnostic criteria for bulimia neurosis; 50% of women recover completely.

In Bulgaria a total of 150,000 girls suffer from anorexia and bulimia. The riskiest group is between 12 years and 18 years.

In the past decade, mortality was reduced by improving treatment. In anorexia the risk of death is greater. Recent statistics show **mortality 0.5% annually**. This means that after twenty years of illness 10% of sufferers are lethal.

Statistics indicate leading performance in feeding disorders:

- From diseased 95 percent are women.
- Feeding disorders predominantly occur during puberty (teenage years) and young women;
- Anorexia and bulimia highest numbers are common in highly industrialized countries.
- These diseases are observed in recent decades, as the number of affected increases. (In the 19th century there are medical reports of disease refusing food, but much later in the 20th century observed patients with characteristics corresponding to anorexia nervosa).
- Anorexia and bulimia are "diseases of modern society."

Anorexia neurosis most commonly affects girls during or shortly after puberty, but can occur at an earlier or later ages, and also in boys.

Anorexia is characterized with low birth weight (at least 15% lower than the lower limit of normal weight for the height and age), which is self-provoked with deliberate restriction of nutrition or starvation, taking diuretic or laxative drugs, self-provoked vomiting, excessive exercise. There is a strong fear of weight gain and unawareness of the need for food. Patients efforts to overcome the feeling of hunger, calculated daily food intake of calories and keep hypoenergic nutritional modes. Most people have no idea about the pathological behaviour and are satisfied with the weight loss. They lack critical of the changes occurred unaesthetic. Develops striking severe cachexia, subcutaneous adipose tissue is strongly reduced, but the volume and parenchyma of breast is preserved. Missing somatic and organic disease. Women develop amenorrhea. Lacking spontaneous menstruation and this occurs only after taking hormone therapy. The disease is classified as psy-

chiatric and diagnosis is based on the above criteria.

Etiopathogenetic discuss whether it is a primary hypothalamic lesion, causing a change in eating behaviour and psycho-emotional disorders, or more likely it is a person burdened with impaired adaptation and neurotic disorder, which is deposited on eating disorders.

Clinical manifestations of anorexia neurosis are psychiatric and somatic.

Required somatic symptoms are pronounced weight loss 25-40% and amenorrhea, and optional - hypotension, obstipation, dry, scaly skin, lanugo, thinning hair, bradycardia, increased parotid gland. Mental symptoms include:

1. Impaired feeding behaviour with reduced intake and peculiar selection of food intake, avoiding high-energy carbohydrate foods, meat and liquids.

2. Controlling body weight by avoiding eating in public places, pathological increased physical activity/exercise, aerobics, jogging, etc./, actions and movements of spending power and weighing several times a day.

3. Other abnormal features of behaviour - strange views about food and nutrition, morbid fear of obesity, conviction for subsequent drastic weight gain in "breakthrough" on appetite control, underestimation of pathological character of behaviour, hyperdealization the weak figure.

4. Disorders in perception - a sense of clumsiness and "swell"and "increase" in the abdomen after a meal.

5. Other disorders - isolation from family backlog from previous interests, rejection behaviour of the same- aged and privacy, extraneous interest in cuisine, biology, medicine.

As a result of malnutrition develop multiple food and energy deficiencies that cause anemia, lymphopenia, immune deficiency, hormonal disorders. The latter can lead to anovulation, cessation of menstruation and infertility. Amenorrhea is associated with hypothalamic hypogonadism. Anorexia can cause disturbances and delays in growth and development during puberty, osteoporosis, muscle weakness and reduced muscle mass inactive hypertrophy of the salivary glands, hypoproteinemic edema, trophic skin changes, progressive parenchymal damage to the heart, kidneys, liver, atrophy of brain cortex. Gastric emptying is slowed, and the allocation of the intestine can lead to paralytic ileus. Be established hypotension, bradycardia and heart rhythm disorders. Glomerular filtration progressively reduces, develops azotemia and edema. Gradually develops apathy, decreased interest in social contact, depression. In the absence and treatment failure , can lead to death.

Bulimia neurosis is characterized by frequent consumption of large quantities of food, followed by self-provoked vomiting, taking laxatives and diuretics. Strong uncontrolled hunger is often a reaction from chronic half-fasting.

Bulimia affects mostly women between 16 and 40 years and is most often caused by depression. In a potential risk groups, in the 20% - presence of bulimic symptoms. It is assumed that under the influence of stress in susceptible individuals lose control over food intake, develop bouts of overeating and subsequent feelings of guilt and depression with a phobia of obesity. Overweight and obesity in the past, especially in childhood, can create dominant for a special "over-control" on the weight.

Clinical manifestations of bulimia neurosis include recurrent episodes of food over eating with food intake in less than 2 hours, or lack of control of the receive and the amount of food. Overeating is associated with recurrent compensatory behaviour to prevent weight gain by self-vomiting, intake of laxatives and diuretics, fasting or excessive exercise. These behavioural abnormalities are repeated at least twice a week for a period of 3 months. Self-control is excessively influenced by body type and weight.

Bulimia can lead to overweight, but due to the application of different ways of disposing of food eaten, usually weight did not change noticeably. The adoption of large quantities of food, alternating with prolonged fasting and vomiting over time leads to serious health disabilities, similar to anorexia. In bulimia also experienced menstrual disorders, hypokaliemia in about 10% of cases in relation to the frequent intake of diuretics, acute gastric dilatation and sometimes rupture, constipation, hypertrophy of the parotid gland, parodontitis and tooth decay due to an increased intake of sugars, esophageal rupture, aspiration pneumonia.

As a result of ever-increasing attention in terms of healthy eating is a new offense in eating behaviour - **ortorexia neurosis**. While anorexia and bulimia are directed to the amount of food consumed, ortorexia is obsessed with the quality of food intake. Affected by this eating disorder are fixed in whealthiness of nutrition and too limited assortment of food they consume. There is a fear of the contained substances harmful to health in food such as salt, sugar, fat, preservatives, colorings, contaminants, etc. Such individuals for hours thinking about nutrition and planning healthy menu. They feel guilty if violate own's health principles of nutrition and most often fall into social isolation.

Treatment of eating disorders is difficult, inadequate and ineffective. Usually, individuals with these disorders have no awareness of illness and/

or conceal their anomalies. Often there is a misunderstanding on the part of relatives. Therefore, patients are moving away from the proper medical and psychiatric care. Treatment includes psychotherapy (individual, group and family) and behavioural therapy, which should be realized by a clinical psychologist. It is a leading therapeutic method that aims to restore proper self-identity, self-confidence and self-control. Often, a consultation with a psychiatrist is needed. In practice apply antidepressants that are more successful in bulimia, as well as medicaments, modifying various neurotransmitters in noradrenergic, serotonin and opioid systems. Drug treatment is not yet leading. A major is interdisciplinary therapeutic approach to restore proper weight and dietary behaviour correction of existing deficits. When malnutrition is expressed apply's individual hyperenergic dietary supplementation with enzymes, vitamins, minerals and probiotics combined with diet training. If necessary, include courses on partial parenteral nutrition in clinical conditions.

9.7.4. DISEASES OF BIOLOGICAL CONTAMINATED FOOD

Concept biological pollutants (contaminants) includes a variety of living organisms widely distributed in the environment. The most important of them are: bacteria and bacterial spores, microscopic fungi, viruses, rickettsiae, yeast, a unicellular protozoa, biotoxins, some biological forms of helminths.

They may fall in food endogenous (primary), most often by foods of animal origin and exogenous (secondary) in all stages of producing, processing, packaging, transportation, storage and marketing of food. Accepted from products, they can cause disease in humans directly by submitting a large number of them in the digestive tract or indirectly - through metabolic products in the process of development and breeding.

In some cases, they change organoleptic of products, but in most cases such changes lack, which is their primary danger. The most common cause of changes in organoleptic and spoilage of products are microbial enzymes, as bacterial toxins usually accumulate in products without visible external changes in them.

Diseases of biologically contaminated foods are classified as:

Infectious diseases transmitted through food:

1. Zoonoses.

2. Antroponoses.

3. Helminthoses.

Foodborne diseases from biological contaminants:

1. Microbial origin:

- *Toxico infections.*
- *Intoxications.*
- *With insufficiently understood pathogenesis.*

2. From microscopic fungi.

9.7.4.1. INFECTIOUS DISEASES TRANSMITTED THROUGH FOOD.

R. Jenikova, M. Nikolova

Bacterial food infections

To food infections related diseases that food is passive, mechanical factor in the transmission of an obligate for human pathogenic bacteria. These are typhoid, paratyphoid A and B, bacterial dysentery, cholera, tuberculosis, brucellosis, listeriosis, anthrax. Infectious doses are small, the agents normally do not multiply in food. The incubation period and clinical disease indistinguishable from those when the infection is by non-food route of transmission. Treatment is specific to each of these nosological units. Prevention is to not allow contamination of food.

Causes of bacterial dysentery are germs like Shigella, the most prevalent today are S.flexneri, S.sonnei. These are Gram-negative, non-sporulating bacteria from the family Enterobacteriaceae, pathogenic for humans and reproduce in his gastrointestinal tract. The most common are water epidemics. As a rule, dysentery bacteria do not multiply in food. Food infected with Shigella are only mechanical factor for transmission. Animal products - meat, milk, eggs no risk of contamination primary, since carriers of Shigella in animals is not observed. No die of freezing and drying, but in conventional methods of heat treatment of foods are killed. The infection is transmitted by "contact-bit" way and factors in the transmission are waters, unclean hands and foods contaminated by them, articles of life. Risk represent and raw fruits and vegetables irrigated with waste water and poorly washed before consumption, seafood - clams, oysters consumed raw or almost raw state and harvested from contaminated with feces waters. Very active carriers of dysentery bacteria are flies. Infectious doses are small - about infection requires not more than 10-100 viable cells. Can occur with severe clinical picture of the characteristics of infectious colitis.

Listeria - Gram-positive bacteria with a wide range of distribution (carriers are wild animals, birds, insects, man). Not all microbes like Listeria are pathogenic to humans. Very sensitive to virulent Listeria are immunocompromised individuals as virulent and cause listeriosis are usually hemolytic strains of the genus - L.monocytogenes and much less L.ivanovii or L.seeligeri. Interest in Listerias increased in

the last 30 years, when dates intensive monitoring of food listeriosis and reveals unexpectedly high prevalence of infection. Listeria are cold resistant, ordinary refrigerator does not stop their growth, killing at deep freezing or drying, high temperatures - above 70 ° C and at elevated concentrations of acids. Infection occurs by feeding, breathing, contact way, after a tick bite. Epidemic risks of foodborne illness of Listeria carry many types of food, unpasteurized milk dairy products made from raw or low-pasteurized milk - soft and hard cheeses, cottage cheese, etc.; meat and poultry products - raw and undercooked, with no serious heat treatment; combined sandwiches and appetizers, frozen prepared foods and cooked, raw salads, fruits and vegetables, seafood and more. In products with effective heat treatment does not contain Listeria. Listeriosis is a very serious infectious disease for adults and children, often fatal. The clinical picture is variegated, polymorph, proceeds differently depending on the place of entry of the infection, the infectious dose, age, condition of the immune system. Can occur asymptomatically, with gastrointestinal damage, but with severe angina, cutaneous form, and in severe forms are disseminated in all internal organs to septic conditions. Customary accompanying most forms of the disease symptoms are fever, nonspecific fatigue, enterocolitis. Mortality rates of up to 50-80% in immunocompromised individuals.

Viral food infections

Caused by food contaminated with viruses by fecal-oral mechanism of transmission. These are hepatitis A, Norwalk and Norwalk - like, polioviruses, ECHO viruses, intestinal adenoviruses, astroviruses, caliciviruses, parvoviruses, rotaviruses. Nutritional way of transmission does not affect the clinic, the severity and complications of the disease. Anti-epidemic measures require high culture and hygiene to prevent contamination in food.

The frequency of viruses in food products is known much less than for the bacteria, which is due to the inperfect diagnostic virology. It is known that as intracellular parasites they do not reproduce in food - they serve only as a factor in the transmission at antisanitary conditions. The most common sources of gastroenteritis caused by viruses are sea products, particularly molluscs - clams, oysters. Theoretically, the mechanism of transmission can participate variety of food contaminated with feces of virus carrier.

The most important representatives of enteropathogenic viruses are:

Hepatitis A. The documented cases of outbreaks of foodborne illness from hepatitis A are far more than in other viral infections. The mechanism of transmission is fecal-oral, most often in the consumption of raw or insufficiently processed seafood from contaminated waters, as well as salads, sandwiches, pastries and other products contaminated by unclean water from carriers, etc. The incubation period of infection was 15 to 45 days, after relapse establishes lifelong immunity. The disease occurs with general weakness, intestinal dysfunction, icterus, liver damage.

Norwalk - viruses are infectious for older children and adults. Considered as too frequent cause of viral food gastroenteritis and are transmitted by the faecal-oral route. The incubation period is from 18 to 48 hours. Start with nausea followed by vomiting, no blood diarrhea, painful abdominal cramps, and symptoms last 2-3 days and disappear without serious consequences.

Rotaviruses are responsible for 1/3 of diarrheal diseases in children under 5 years of age (most susceptible are children 0 t 6 months to 2 years), as peak in season of the winter months. By rotavirus infections sick and elderly, the mechanism of transmission is fecal-oral and therefore is possible and food-borne contamination. The incubation period of rotaviruses is 2 days. Leading are vomiting and watery diarrhea for 3-8 days, often accompanied by abdominal pain and fever. It is possible that chronic course, which deepens the digestive damage and intestinal enzymopathy.

Parasitic diseases

Unlike bacteria, parasites do not multiply in food. Each parasite has a complex biology and route of penetration in the human body, overcoming sanitary barriers surrounding civilization. Parasites in food are unicellular and multicellular. Protozoan parasites are one of the simplest species. Multicellular parasites of interest are some geohelminthes, the most typical of which is ascariasis and agents of taeniasis: Taenia saginata and Taenia solium and trichinosis (Trichinella spiralis) - zoonotic infections transmitted through animal foods - meat and fish.

Transmission of food-borne protozoan parasites such as Entamoeba histolytica, Lamblia and Giardia and geohelminthes - Ascaris lumbricoides, Oxiuris vermicularis, Trichocephalus dispar, likely through fruits and vegetables irrigated with contaminated water. Nutritional time of transmission does not matter to gravity and clinic of disease.

Ascaris lumbricoides (ascariasis) belongs to the family of roundworms (Nematoda) and is one of the most widespread parasites. It is believed that the world is annually observed around 1.5 billion cases. Main host is the man - in his thin intestines live viripotent form, where feed of intestinal contents and mucosal membrane and thus absorbs and blood, plasma

and tissue fluids. The female releases to 2 million eggs a day, excreted with the feces fall in soil. There for about two weeks under appropriate conditions develop primary forms of larvae that are very resistant to various physical and chemical adverse effects and survive there for years. Fall orally in the body, most often with bad wash fruits and vegetables, penetrate the walls of the small intestine in blood vessels and spread throughout the body to lung and liver, heart, etc., Then infiltrate back into the intestinal canal from them develop sexually mature forms. The most common symptoms include indigestion, stomach discomfort, nausea, cramping abdominal pain. In severe forms of infestation can be achieved by blocking the functions of the intestine, appendicitis, ileus, peritonitis, migration of helminth in the trachea.

In unfinished thermally meat of pigs - domestic and wild, larvae of **Trichinella** become the cause of outbreaks of varying severity, depending on the intensity of the invasion. The incubation period is 5 to 30 days. The disease begins with swelling of the face, neck, develop painful myalgias, fever and a worsen general status. An important symptom is eosinophilia. In severe cases are possible myocarditis, pneumonia, meningoencephalitis. Treatment is specific.

More limited is the meaning of **taeniasis** where contamination is from undercooked infected with cysticercus meat, mainly pork.

Indicator microorganisms in food products are those micro organisms or group of micro organisms, that the presence and quantity to provide information on hygiene of production of raw materials, technology of processing and efficiency, conditions of storage, transport and sale. They are an indirect indicator of the risk of pathogens of foodborne diseases. Pathogenic microbes are rarely distributed and are in small quantities and their methods of determination are slow and expensive. Therefore, current practice uses mostly the indicator microbiological indicators and normalized them to ensure their acceptable levels, achievable under good manufacturing practices.

EU Regulation 2073/2005 on microbiological criteria for foodstuffs (operating in Bulgaria from January 1, 2007) is the first ever international document in the field of microbiological standardization of food. It is used in the daily practice of hygienic food control, giving primary legislation for ensuring biosafety food (bacteria and biotoxins) **(Table. 9.50)**.

9.7.4.2. FOODBORNE DISEASES OF MICROBIAL ORIGIN. B. Popov

In these diseases the food is good ***environment for the development*** of certain pathogenic and relative pathogenic microorganisms and fungi. Under appropriate conditions (temperature and humidity) they rapidly multiply in products and can cause illness or food poisoning.

◆ ***Food toxicinfections***

Food toxicinfections occur by eating foods contaminated with large doses of live microorganisms. The most frequent causes of these diseases are representatives of the genus Salmonella and some relative pathogenic microorganisms.

- **Toxicinfections caused such Salmonella ***

They are currently the most popular in the world - isolated more than 2000 serological types of salmonella, but diseases caused only 10-15 types, of which most often S. typhi murium, S. cholerae suis, S. enteritidis and others. Their natural habitat is the intestinal canal of warm-blooded and cold-blooded animals, including humans. Salmonella resistant to the external environment - experience from several days to 5-6 months or more. At a temperature below 5 ° C do not develop. Upon heating to 75 ° C withstand 5 min, and at 100 ° C killed instantaneously. Salmonella multiply at room temperature, but rapidly at 35-37 ° C without altering the organoleptic qualities of the products. Optimal environment for their development is slightly alkaline pH 7,2-7,4, but are viable at pH 4-9. Source of the disease are animals and man.

Roads of falling into food. They are numerous. Furthermore endogenous contamination of meat with sick animals and transovarian contamination of eggs, (poultry), salmonella commonly found in milk at milking. Exogenous contamination can happen all the way through the product from production to consumption. The most common factors for transmission of salmonella here are meat and meat products first, eggs and egg products - in the second.

Clinical picture. The disease begins most frequently sudden, at an incubation period of 6 to 24 h, then the consumption of contaminated food. It begins with vomiting, abdominal pain, diarrhea. The temperature was raised to 38-40 ° C. Appear and symptoms of intoxication - muscle aches, headache, disturbance in cardiovascular activity and more. In severe cases arise exsiccosis, adinamiya, collapse. Lethality does not exceed 1% Duration of the disease is usually 2-3 days. Crucial for the diagnosis besides clinical and epidemiological data are microbiological studies of residues consumed food, vomit and faeces.

* According to ICD - ninth revision, salmonellosis include the group of intestinal infectious diseases - 003.0

Table 9.50. Indicator organisms (excerpt)

MICROORGANISMS (GROUPS OF MICROORGANISMS)	METHODS OF DIAGNOSIS	SHORT NOTES ON INDICATOR MEANING	FOOD GROUPS WHERE INDICATOR IS USED
1. Total number of mesophilic aerobic and facultative anaerobic microorganisms	ISO 4883	Group heterogeneous microorganisms united on the basis of physiology-biochemical signs - growth in universal nutrient medium at 37 °C - 72 hours. Universal, direct sensitive indicator of the general level of microbial contamination, technological indicators for pasteurization or sterilization modes of heat treatment and other technological methods.	Raw and pasteurized milk, minced meat, surface of carcasses, dry spray dried products - milk, egg powder; baby foods for early age of milk, cereal, soy and other basis; dry meal for baby food and food for direct consumption of milk, cereal and other basis; food additives; spice plant; ready meals, heat-treated; other foods for direct consumption and so on.
2. Psychrotrophic microorganisms	ISO 17410	Group heterogeneous microorganisms united on the basis of physiology-biochemical signs - growth in 6,5 °C - 10 days. Indicator for chilled products (from -1°C to +10°C), carry the risk of spoilage during storage in cold conditions.	Meat, poultry, dairy, fish, meat, vegetable, vegetable products and meals stored at temperatures from 0 to 10 °
3. Coliform (coliforms)	ISO 4831 ISO 4832	Indicators of fecal and biogenic pollution, poor hygiene; indicators of insufficient heat treatment risk of intestinal infections.	Virtually all nosterilized products, food and beverages.
4. Lactic acid bacteria	ISO 15214	Indicators for biogenic pollution; risk of spoilage of food.	Sterilized and pasteurized vegetable cans; Tomato products; Fruit and vegetable purees and pulps * No indicator for lactic acid and other foods produced with lactic fermentation - raw dried sausages, pickles and so on.
5. Yeast	ISO 7954	Indicators for biogenic pollution; risk of spoilage of food.	Baby food; Dairy products; no sterilized food for direct consumption of animal origin; Vegetable preserves; Soft drinks; Other non-sterile products for direct consumption.

Prevention. Prevention is based on the key factors for the occurrence of salmonella illnesses:

1. Contamination of the product with salmonella.

2. Improper storage and compliance deadlines for selling products and prepared meals.

3. Insufficient heat treatment.

Prevention includes:

1. Activities on prevention of contamination of food products - veterinary controls on animal health, sanitary regime in the extraction of meat and milk, sanitary regime in catering, personal hygiene of workers in contact with food products.

2. Appointments excluding the possibility of propagation of salmonella in food products - storage refrigerated.

3. Destruction of microorganisms by means of sufficient heat treatment of products.

◆ ***Food poisoning (toxicosis)***

Cause of food containing bacterial toxins formed as a result of vital activity of some microorganisms. Illness can occur without necessarily oral administration of live microorganisms. To food poisoning related staphylococcus poisoning and botulism.

- ***Staphylococcus intoxication***

They, along with salmonellosis are the most common food poisoning. Leading pathogenetic point of the disease are staphylococcus enterotoxins secreted by some strains at St. aureus. 6 are described serological staphylococcus enterotoxins: A, B, C, D, E, F, and all types have the same degree of biological activity. The major source of contamination of the products is the man carrier at St. aureus in the upper respiratory tract and skin in inflammatory diseases. Another source are sick animals of mastitis that contaminate raw milk.

Optimal conditions for development, reproduction and toxin formation in Staphylococcus is temperature 30-37 ° C, pH 7.5 and about the absence of antagonistic saprophytic microflora. At a temperature

below 6 ° C are not propagated, and at a temperature of - 80 ° C were killed for 10 min. Staphylococcus are osmophilic - they cease to proliferate when the sugar in the middle is more than 60%, and sodium chloride is over 12%. Enterotoxin produced by staphylococcus, is characterized by high thermal stability. Heat treatment at ordinary culinary processing of products not usually destroys it. Complete inactivation occurs upon heating above 100 ° C over 2 h.

Clinical picture. The incubation period in staphylococcus intoxication is generally short - from 30 min to 6 h. The disease begins as an acute gastritis - numerous vomiting, epigastric pain, sometimes collapse phenomena. The body temperature does not rise, dyspeptic disorder usually not observed. Healing occurs quickly, usually after the first day. Diagnosis is by epidemiological data and clinical and bacteriological tests.

As *factors of staphylococcus intoxications* in our ,main role play confectionery, dairy products and meat products. The decisive condition for the occurrence of poisoning is improper storage of food under normal non-refrigerated conditions. Sufficient are 4-5 h aging the contaminated product at a temperature of 30-35 ° C in order to produce therein enterotoxin. Even if then followed by heat treatment product, it will destroy staphilococci, but not the released already toxin. It is noted that staphilococci, and produced enterotoxin no affect organoleptic of products.

Prevention. It is aimed in two directions:

1. Preventing contamination of the products with the St. aureus - suspension from work of working in catering and businesses in the food industry, suffering from acute catarrh of the upper respiratory tract or purulent skin diseases; non-edible milk of mastitis infected animals.

2. Cold storage products and ready meals - in fact this is a decisive moment in the prevention of staphylococcus toxicosis.

- ***Botulism***

It is a most serious food poisoning caused by Cl. botulinum, which is strictly anaerobic, spore-forming microorganism. It is widely distributed in nature, and is found in soil, especially in the natural fertilization. Contamination of products is mainly driven by it. In the products may fall as vegetative forms and spores. As a typical anaerobic he intensely propagated by separating exotoxin in hermetically sealed glass or metal cans and inside the sausage, fish, ham. Spores of Cl. botulinum are extremely resistant. They withstand at 100 ° C for a few hours, lower temperatures did not influence them, they are resistant to acids, salts, disinfectants.

Botulinum toxin is produced by the 7 types of Cl. botulinum. By their chemical nature toxin is a protein, and toxicity is considered the most powerful natural toxin. It is produced active at 22-30 ° C. Toxin formation is terminated completely in a medium containing more than 11% sodium chloride, 55% sugar and pH below 4.5. Formed is toxin is retained for a long time in food products, but relatively quickly destroyed by heating at 100 ° C for 15 min. Products containing botulinum toxin are usually signs of decay - have an unpleasant odor, bitter taste and preserves are blistering. However, there were many cases where the organoleptic properties of the products have not changed. Currently one of the most common causes of illness from botulism are improperly sterilized canned at home.

Clinical picture. It is different from that of other bacterial food poisoning. The incubation period is most often 6-30 h. After absorption from the gut toxin is fixed in the CNS, which explains the clinical manifestations. The first symptoms are non-specific and limited to general weakness, headache, sometimes vomiting and diarrhea. The first specific symptoms include changes in vision - weight loss, diplopia, eyelid ptosis. Later disorder occurs in speech, difficulty swallowing, paralysis of facial muscles. Temperature is usually normal or below normal (hypothermia) in slow pulse (bradicardia) and low blood pressure (hypotonia). Death usually occurs from paralysis of the respiratory center or cardiac. If no specific therapy, lethality is over 50%. Upon timely diagnosis and application of polyvalent anti botulinum serum he is reduced to 10-15%.

Prevention. Currently botulism occurs most often by eating home-made preserves. This requires prevention include:

- *A broad health education among the population.*
- *Use of preserving fresh, healthy and well-washed products and packaging.*
- *Properly conducted sterilization.*
- *At home do not have to produce canned meat, fish and mushrooms.*
- *Before use the cans to look carefully, while the smallest suspicion of corruption be discarded.*
- ***Other foodborne illnesses by microbial origin***

These are diseases in which has not yet been elucidated the role of micro-organisms living on the one hand, and the role of toxins - of the other, in the whole pathological process. In some of relative pathogenic microorganisms are proven enterotoxin (Esch. Coli, Bac. Cereus, Cl. Perfringens, etc.), But is not correct to believe that it causes intoxication, since for the occurrence of poisoning is necessary oral administration of massive doses of live cells.

1. Escherichia coli. Contamination of food with bacteria became almost exclusively by men. Diseases occur after eating and cooked meat, fish and egg products, stored under normal (no-cold) conditions. There are more common in infants and children in infancy. Disease occur as typical toxic infection.

2. Proteus. The source of contamination of food are both animals and humans. Among the products most common cause of the disease are minced meat, some sausages, fish. Sometimes the disease is characterized by continuous course and hundred percent recurrent nature.

3. Cl. perfringens. The main reason for the disease are meat and meat products, as the main source of contamination are animals.

4. Bac. cereus. Caused by the food poisoning are common in summer and autumn after eating egg creams, canned meat and others. It is characterized by gently symptoms.

The described causes of foodborne illnesses are regarded as sanitary-indicatory as marked contamination of the environment with intestinal bacteria. For their diagnosis prevailed bacteriological and serological methods. Prevention them as salmonella toxic infection.

◆ ***Food poisoning from microscopic fungi (mycotoxicosis)***

In developing on different substrates some of microscopic fungi (molds) produce toxic substances (mycotoxins) that can cause disease called mycotoxicosis. They normally do not occur acute and diseases are chronic, resulting in extended periods of minimal amounts of mycotoxins. The latter are resistant to high temperatures (not to destroyed when heated and above 200 ° C). This is the main reason currently no reliable methods for disposal of products contaminated with toxic microscopic fungi. From mycotoxicosis more important are the following:

1. Aflatoxins. Cause of aflatoxin produced by microscopic fungi from the group of Aspergillus flavus. Currently, there are 12 isolated aflatoxin, the most toxic is aflatoxin B_1. It is believed that aflatoxins are among the most powerful ever known carcinogen. In acute aflatoxicosis, which occurs rarely, grow and fatty dystrophy and liver necrosis, in chronic form - cirrhosis and primary liver carcinoma.

Development of fungus and formation of aflatoxin is most often observed on groundnuts and cereals. Aflatoxins are produced most actively at a temperature of 20-30°C and 85-90% humidity. Besides aflatoxin fungi of the genus Aspergillus release and other toxins, of which the most common are ochratoxin.

Prevention of aflatoxicosis requires proper storage of grains and nuts in a dry ventilated area and system control for aflatoxin B1 (in foodstuffs is allowed to 2,5-5 μg/kg product). For larger concentrations products are destroyed.

2. Fusariotoxicosis. Caused by microscopic fungi of the genus Fusarium.

Alimentary-toxic leucopenia. Serious illness caused by toxins produced by the fungus Fusarium sporotrichoides. The disease occurs when consuming products made from stored outdoors cereals, most bread. Toxins the fungus strike myeloid and lymphoid tissue and cause necrotic bone marrow. Some authors believe that endemic nephropathy affecting our country, due to some strains of the same fungus that produce nephrotropic toxin.

Poisoning of "drunk" bread. It is caused by eating bread made from grains, struck by the fungus Fusarium graminearum. It develops by improper storage of grain in wet areas. The toxin it is neurotropic action. The clinical picture resembles of alcoholic drunk, with euphoria, dizziness, incoordination of movements.

Fungi by genus Fusarium produce and other mycotoxins, more important of them are trichotecenic mycotoxins and Zearalenone. *Prevention* fusariotoxicosis mostly limited to proper storage of cereals in dry and ventilated warehouses.

3. Ergotism. Disease occurring after use of food products of plant origin, contaminated with ergot (Secale cornutum), which is mycelium of the fungus Claviceps purpurea. The disease occurs more sharply in three forms: nervous, gangrenous and mixed. The toxicity is due to the available alkaloids, ergotamine, ergotoxin et al., having adrenalinsimilar action. Prevention is aimed at cleansing the grains of spores of the ergot.

4. Micotoxicosiss caused by genus Penicillium. Fungi of this group produce a number of toxins, some of which cause disease in humans. More important are icelanditoxin and patulin.

• *Icelanditoxin* has hepatotropic effect, which causes atrophy of the liver and tumors. Produced by Penicillium icelandicum on cereals,

• *Patulin* causes "brown" rot in apples. Establishment in the fruit and vegetable juices is proof that they are made of decayed materials. Patulin is normalized in products to 50 μg/kg products. In our country introduced a system of food control to avoid exceeding the levels of mycotoxins.

When an outbreak of food poisoning physician should:

1. Place the initial diagnosis of the disease.

2. To provide first aid to sick and hospitalized urgently need.

3. To call into foreclosure dubious products and dishes.

4. To take samples from the suspected foods and materials removed from the injureds and the staff of catering for laboratory tests.

5. To inform quickly about these disease RHI.

9.7.5. POISONING OF CHEMICALLY CONTAMINATED FOOD. FOOD ADDITIVE

Chemical contaminants are understood unusual composition of food substances falling from the external environment or form them in the processes of producing, processing and storage. Some of the contaminants fall in producing of plant and animal products (pesticides), others pass the apparatus, equipment and packaging of production and processing them (constituents of polymeric materials), third come from the environment (pollution of the air environment), and the fourth is formed by culinary processing of products (oxidized substances of overheating fat).

In some cases governed add some substance to products to improve their quality (additives), in others under certain conditions accumulate harmful substances, and the third primary, the product has in its composition natural toxins. Upon consumption of the product by the presence therein of chemical contaminants, depending on the nature of the substance, respectively, substances, and the amount thereof, can occur various diseases - by subtle variations in the state of health to various poisoning and to remote effects of the impact of contaminants.

Diseases caused by chemical contaminants of food and dietary supplements are classified as follows:

Adverse health effects from dietary supplements.

Diseases of contaminants in food (exogenous toxicants) - pesticides, heavy metals, nitrates - nitrites - nitosamines, constituents of polymeric materials, veterinary medicines, feed additives, components of industrial and household water pollutants from the air environment, radioactive substances, oil and petroleum products, residues of detergents and disinfectants, mechanical impurities.

Non microbial food poisoning (natural toxicants).

1. Poisoning of products toxic in nature:

- *From vegetable origin.*
- *From animal origin.*

2. Poisoning of products toxic under certain conditions:

- *From vegetable origin.*
- *From animal origin.*

9.7.5.1. FOOD ADDITIVES.

P.Nikolova, B.Popov, D.Tsvetkov

Food additives are substances that are not normally used as food or as a component, regardless of whether they have nutritional properties, and which, in addition to technological considerations to food production, processing packaging, transport or storage remain its integral part, even in altered form.

The use of food additives in food is only permitted to:

- *Sustain the natural qualities and nutritional value of the product.*
- *Reduce or replace targeted some nutrients in the preparation of dietary and special foods.*
- *Improve organoleptic properties of food without this leading to changes in its nutritional value and quality.*
- *Improving the quality and stability of food in storage.*
- *Improve the conditions of the manufacturing process for preparing, processing, packing of foodstuff.*

Food additives may only be used in amounts that do not exceed the maximum levels of additive ready for consumption or in compliance with good manufacturing practice.

Classification of food additives according to their technological purpose:

1. Preservatives and antibiotics.

2. Antioxidants.

3. Acids.

4. Acidity regulators.

5. Anti-foaming agents.

6. Anti-caking agents.

7. Fillers.

8. Emulsifiers.

9. Emulsifying salts.

10. Hardeners.

11. Flavor enhancers.

12. Foaming agents.

13. Gelling agents.

14. Glazing agents.

15. Humectants.

16. Carriers.

17. "Modified starches".

18. "Packaging gases".
19. Raising Agents
20. Complexing agent.
21. Stabilizers.
22. Thickeners.
23. Agents for the treatment of flour.
24. Aromatic substances.
25. Enzyme preparations.
26. Dyes.
27. Sweeteners.

Since 2000 the European Community and in Bulgaria are authorized and used a total of 322 additives (E100-E1521). 80-ies of the XX century. Bulgaria were allowed to use a total of about 150 supple-

Table 9.51. Additives permitted to be added to all foodstuffs in accordance with the principle "As much as necessary" *

E №	Name
E 170	Calcium carbonates
	(i) Calcium carbonate
	(ii) Calcium hydrogen carbonate
E 260	Acetic acid
E 261	Potassium acetate
E 262	Sodium acetate
	(i) Sodium acetate
	(ii) Sodium hydrogen acetate (sodium acetate)
E 263	Calcium acetate
E 270	Lactic acid
E 290	Carbon dioxide
E 296	Malic acid
E 300	Ascorbic acid
E 301	Sodium ascorbate
E 302	Calcium ascorbate
E 304	Esters of ascorbic acid with fatty acids
	(i) Ascorbyl palmitate
	(ii) Ascorbyl stearate
E 306	Tocopherol
E 307	Alpha - tocopherol
E 308	Gamma - tocopherol
E 309	Delta - tocopherol
E 322	Lecithin
E 325	Sodium lactate
E 326	Potassium lactate
.....	
.....	
E 942	Nitrogen oxide
E 948	Oxygen
E 949	Hydrogen
E 1103	Invertase
E 1200	Polydextrose
E 1404	Oxidized starch
E 1410	Monostarch Phosphate
E 1412	Distarch phosphate
E 1413	Phosphated distarch phosphate
E 1414	Acetylated distarch phosphate
E 1420	Acetylated starch
E 1422	Acetylated distarch adipate
E 1440	Hydroxypropyl starch
E 1442	Hydroxypropyl distarch phosphate
E 1450	Octenylsuccinate sodium starch
E 1451	Acetylated oxidized starch

* Extract from Section A: list of additives ... Ordinance № 8/2002, the Ministry of Health - requirements for use of food additives.

ments. Part of authorized now - a total of about 112 (E170-E1451) may be used in all foods - **Table. 9.51**, but there are restrictions - can be added to honey, unprocessed foods, butter, coffee, natural mineral and spring waters, sugars, foods for nurseling and children up to 3 years.

To additives has certain specific criteria and requirements for cleanliness them, as specified and relevant methods of analysis in carrying out state control of the quality of additives.

Not considered additives substances used for: plant protection; flavorings; food solids (mineral salts, vitamins, etc.)., added in order to support the physiological function of the body; edible gelatin, milk protein and gluten; amino acids (without glutamic acid, glycine, cysteine and salts thereof); casein; inulin; substances used for treatment of drinking water.

◆ ***Additives that improve the organoleptic qualities in the composition of food.***

Colorings. A total of 42 (E100-E180). Use natural; put in carotene, chlorophyll and caramel. Synthetic most commonly used are: indigotine (blue) tartrazin (yellow), patent blue, sunset yellow, azorubine and erythroxine (red paint). Allowed for coloring confectionery, soft and alcoholic drinks, farina, ice cream, strawberry compote.

Flavorings. These are different essences that enhance the flavor of some foods. Use natural aromatic substances - ethereal oils, extracts of spices and fruits, and synthetic (vanillin), monosodium glutamate.

Sweeteners. They are used as substitutes for sugar. They are natural (dextrose, fructose syrups) and synthetic. From toxicohygienic viewpoint interest are synthetic sweeteners - are allowed 11 (E420-E959), sorbitol, mannitol, maltitol, lactitol, isomalt, xylitol, acesulfame K, aspartame, cyclamic acid and its derived sodium and calcium salts, saccharin, thaumatin, neohesperidin DS.

- Aspartame (E951).

New generation sweetener composed of amino acids (L-aspartyl, L-phenylalanine). It is 200 times sweeter than sugar. It enhances the taste of sucrose, glucose, cyclamates and saccharin, suppresses the unpleasant aftertaste of saccharin. There are many low energy (4 kcal/g), but as it is used in small amounts, virtually no effect on the energy value of food. As a standard adult dosage is indicated 1-3% of the daily dietary incoming aspartic acid and phenylalanine.

- Acesulfame (E950).

Acesulfame tradename "Zunet" is 200 times sweeter than sugar. It is recommended at a dose of 15 mg/kg body weight. In sweetness this corresponds to 210 g sugar.

- Saccharin (E954).

Saccharin is 300-350 times sweeter than sucrose. On thermal effect changes flavor and imparts a bitter taste to the food. It considered safe when taken daily in small doses.

- Sorbitol and xylitol (E420, E967)

does not change the content of sugar in the blood and are completely harmless to the body.

- Cyclamate (E952).

The International Agency for Research on Cancer concluded that there is no evidence of carcinogenicity in humans when it accepted the oral route.

Acids and bases. Used to acidification of certain products - applying acetic, citric, tartaric, lactic and malic acid. From basics like supplements are permitted sodium and ammonium bicarbonate.

Flavors. It is believed that the improved taste of fresh products due to glutamic acid (E620), which decreases during storage. Therefore, she and sodium glutamate (E621) are used as additives to prepared and preserved foods to enhance their natural taste. There is evidence for an adverse effect in children, they are not allowed in baby foods.

Dressings. Put in a lot of products to improve their composition - vitamins (most often A and C), polyunsaturated fatty acids, lecithin and others.

◆ ***Food additives accelerating technology of food production***

Enzyme preparations. Used animal, vegetable and enzymes derived from microorganisms. In bread factories to speed up the process of proving the dough using enzyme preparations from some strains of the fungus Aspergillus, which cause rising bread for 2-2,5 h, instead of 7-8 h.

Clamps of myoglobin. These are substances that give lasting pink sausage. As such, the most commonly used nitrites. Due to the risk of methemoglobinemia, the permissible content of nitrite in these products is 5 mg/100 g product.

◆ ***Additives that are consumed in order to extend the terms of storage (antimicrobials, antioxidants)***

Discussed in section Canning food.

9.7.5.2. CONTAMINANTS IN FOOD (EXOGENOUS TOXICANT). B.Popov

With few exceptions, these are substances that come from the external environment in products and therefore are called exogenous toxicants. Hygiene assessment of contaminants is carried out on

a number of indicators on which the more significant are:

• *The acceptable daily intake for man (ADI)* - represents the maximum amount of a substance in mg/kg body weight, which can be taken up daily over a lifetime without risk to health.

• *Acceptable level (AL)* - this is the maximum allowable concentration in mg/kg product.

◆ **Pesticides**

Intensive pesticides contaminate the environment and within the human body mainly through food. Harmful to human health are pesticides with high toxicity, persistence in the environment, with pronounced cumulative properties and detachable from the body through milk.

Chlorine organic pesticides. Chlorine organic pesticides - DDT, hexachlorine, aldrin, lindane, etc., Are characterized by stability in the external environment, expressed cumulative capacity, low toxicity, separated by milk. These qualities make them dangerous, so use them narrows.

Organo-phosphorous pesticides. Organophosphorus pesticides - metafos, karbofos, chlorofos etc., are the most widely used group of pesticides that are characterized by high acute toxicity, perishability in the external environment, slight accumulation.

Carbamates and dithiocarbamates. Carbamates of the most used in the country is sevine - preparation with high insecticidal activity, relatively weak resistance in the external environment and weak accumulation. By dithiocarbamates country used zineb and maneb. They have pronounced fungicidal activity, as their characteristics are similar to those of sevine.

Mercury organic compounds. Due to its high toxicity, over accumulation and considerable resistance in the environment, they are only permitted in processing of seeds.

In the presence of pesticide residues above permissible levels in the products they can be realized: after storage in sufficient time for the disintegration of pesticides; after mechanical and thermal treatment; by descent butter content of milk and milk products.

◆ **Heavy metals**

Food products containing traces of heavy metals. In additional contamination quantity increases, in which adversely affect the body. Main sources of contamination of food are pollutants from industry and transport caught up in the air, water and soil, or by surfaces with which food is in contact (machinery, containers, packaging). The most important as contaminants are lead, mercury and cadmium, mainly because its toxicity and cumulative ability. With less hygienic importance are zinc, copper and tin.

Lead. Essential for the emergence of chronic lead poisoning have glazes on pottery, tinning vessels with increased content of lead in tin, lead-contains enamel for vessels, receptacles of tin packaging - metal cans and tins. In a study of grains, vegetables and fruits in the vicinity of metallurgical enterprises and roadside stretches of highways, has increased contents of lead in them fallen by industrial contaminants before and of transport (TEL).

Mercury. Fish and fish products have dominant importance of the receipt of mercury intake. Mercury-organic pesticides are another important source of contamination of cereals, which enters the body.

Cadmium. It is an industrial pollutant, but is also found in fertilizers. In the food comes from soil and water. Particularly high content in some cereals such as wheat and rice, which it extracted and concentrated from the soil, and some marine organisms accumulate it from the aquatic environment in very high concentrations.

Copper and zinc. Compounds their cause in person only acute poisoning. Falling into the organism is usually done by eating food stored in copper and zinc containers. It is therefore forbidden preparation and storage of food in galvanized containers. Copper vessels are only allowed in the confectionery industry for brewing syrups.

Tin. Used for tinning copper and iron vessels, for soldering tin cans and others. Normalization in food products is based on the fact that tin is always a certain amount of lead.

◆ **Polymeric materials used for containers and packaging**

Polymers are harmless, but are dangerous if they contain non-polymerized residual monomers or other additives incorporated into the plastic to improve its qualities (stabilizers, plasticizers, pigments, antioxidants). When storing food of them can penetrate from the plastic in the product. To avoid side effects is necessary containers and plastic packaging to be used for storage only those products for which they are intended. As a packaging material for food products currently most important are polyethylene, polystyrene and polyvinyl chloride.

Polyethylene. It is widely used for packaging of dry products, fruits, vegetables, fresh pasteurized milk and others. It produces various cans, trays, crates, barrels, intended for the food industry. Due to its high chemical resistance is virtually harmless.

At elevated temperatures it emits smell, and therefore is not suitable for long term storage at ambient temperature.

Polystyrene. It is used for packing and storage of yogurt, cottage cheese, toe, cream, ice cream and more. Polystyrene is non-toxic, but piped styrene is hepatotoxic and violates hematopoiesis.

Polyvinyl chloride. Polyvinyl chloride due to the proven carcinogenic, teratogenic and mutagenic effect of constituent vinyl chloride is used as a limited seal of corks from the caps of beer and soft drinks and metal lids for glass jars.

◆ **Nitrates and nitrites**

Nitrates and nitrites accumulate significantly in the environment in intensive fertilization with nitrogen fertilizers. In plant products, mainly vegetable, contained predominantly nitrates, but they are easily reduced in the human body to nitrite under the influence of intestinal microflora. The latter are associated with hemoglobin to methemoglobin in the blood.

One of the recent problems in nutrition are *nitrosamines*, which are formed by reaction of nitrite with certain components of the food (amine compounds). Prevention is aimed at limiting nitrogen fertilization, especially for vegetables, reduced their use as additives in sausages and demand means for their destruction in products.

◆ **Other contaminants**

Interest are the *antibiotics*, which are used in agriculture as a medicament or for stimulating the growth of animals. Proceeding with human food, they can cause allergic reactions, disbacteriosis and others.

In the products of marine origin are often found *polycyclic aromatic hydrocarbons* (carcinogenic) due to water pollution by oil and oil products.

Radiation contamination of products, possible by pollution of the air environment with radioactive substances that accumulate in organisms, inhabiting the seas and oceans. Acceptance of products contaminated with radioactive substances poses a health risk due to their radiotoxicity.

9.7.6. NOMICROBIAL FOOD POISONING. B.Popov, D.Tsvetkov

◆ ***Poisoning products, toxic by nature (natural toxicants)***

- ***From herbal***

Poisoning with mushrooms. In our country grow more than 200 species of fungi, of which over 20 are poisonous. They are divided into three groups: faloidinic, muscarinic and resinoids.

Faloidinic mushrooms. These include green agaric mushroom Amanita phaloides (double of field mushroom), white fly agaric and sticky white fly agaric. Main toxic substances in them amanitins, faloidine and helvolic acid. They are potent cellular poisons with hepatotropic and neurotropic action. The disease begins after an average incubation period of 12 h, with a strong abdominal pain, continuous vomiting and diarrhea. Develops collapse state with jaundice and rapid hepatic impairment (toxic hepatitis, hepatic coma) and kidneys. This led to fatal in about 50% of the victims.

Muscarinic mushrooms. Includes agaricus muscarius (Amanita muscaria), spotted fly agaric and wolf tooth. They contain substances muscarine and muscaridine which affect the central nervous system. The events occurred rapidly after 1-2 h, with course of saliva, chills, vomiting and diarrhea. These poisonings most often pass for 1-2 days, usually victims recover.

Resinoids mushrooms (Boletus satanas. Poisonous jelly, false field - mushroom and diplenka). Poisoning by these mushrooms are the most common but less dangerous. Resinoids contain substances that cause abdominal pain, vomiting, diarrhea. Signs of poisoning appear rapidly, from 1/2 to 2 h after eating mushrooms. In severe poisonings are diplenka that contains toxic substances gyromitrine and helvolic acid having expressed haemolytic and hepatotropic action.

Prevention of poisoning with mushrooms is aimed at strict control over the collection and sale of wild mushrooms. Industrial cultivated mushrooms do not pose a danger. For prophylaxis it matters and health education among the population.

Poisoning with poisonous plants. More prevalent of these are wild vine, agorian poppy, elder, oleander, belladonna and others. Commonly for all poisoning is the short incubation period, in some cases, the clinical picture is dominated phenomena of acute gastroenteritis, while in others - the phenomena of total intoxication.

Weed toxicosis. Cause of the seeds of weeds caught in cereals. Their toxic effect due to some alkaloids, saponins and glycosides. Cockle seeds contain saponin gitagin, which irritates the mucosa of the stomach and intestines. The seeds of wild oats contain alkaloids temuline causing nausea, vomiting, disturbance in gait. In the seeds of wild vetch and peas contain glycosides that by degradation to give hydrogen cyanide. Prevention bring to the cleansing of grains and seeds of weed seeds.

- ***From animal***

Most important of poisoning by toxic products,

constantly contained in animal species have fish. There are known more than 400 species of fish, the meat, liver or gonads contain toxic substances that can cause poisoning. Interest are poisonings by some endocrine glands of domestic animals. Proven are substances with high biological activity in the adrenal glands and the pancreas, the consumption of which can be toxic.

◆ ***Poisoning products, toxic under certain conditions***

- ***From herbal***

Poisoning by sprouted potatoes. Causes of contained therein solanine, which is glycoalkaloid and has hemolytic activity. In a long and improper storage of potatoes is increasing its quantity repeatedly. Tender, green and especially sprouted potatoes are a sure sign that solanine in them has increased. Poisoning occurs within an hour after eating - nausea, vomiting, diarrhea which resolved quickly. Because of the concentration of solanine in the surface layer of potatoes, is recommended stayed longer to peel deeper, but relented and sprouted be scrapped.

Poisoning bitter apricot and almond nuts. They contain glycosidic amygdalin, which on hydrolysis releases hydrogen cyanide. The poisoning occurs by headache, dizziness, nausea, and in severe cases with cyanosis to unconsciousness. For prevention is important to prevent consumption of bitter nuts.

Poisoning of raw beans. It contains toxalbumin phasine that the heat treatment is destroyed and inactivated. Food poisoning can occur by eating bean flour in its insufficient heat treatment. The disease is manifested after 1-2 h with dyspeptic phenomena in varying degrees. Bean flour is not allowed for human consumption.

- ***From animal***

Poisoning fish. These fish under certain conditions form biotoxins such as during the rest are absolutely edible. Most often some fish biotoxins produced during spawning, in which he accumulates them. In our dangerous caviar of barbel and sheatfish. The fish suddenly acquire toxic properties after develop toxic plankton fed to them. In some fish, such as belted bonito, muscle histidine by microorganisms transformed into histamin-like substances. Upon consumption of such fish poisoning occurs, like histaminic intoxication. Fish can acquire toxic properties and contamination of any water with heavy metals, radioactive, organochlorine and other toxic substances.

Shellfish poisoning. Observed during the summer months when unicellular plankton, which feed on mussels, multiply rapidly. In the plankton containing toxin that has neurotoxic effects. Typical in the development of toxic plankton that colours in red sea water. In such cases, prohibit the harvesting and consumption of mussels in these places.

Poisoning of honey. It acquires toxic properties when bees gather nectar from the flowers of some poisonous plants. The disease occurs acutely as symptoms depend on the nature of the toxic substances.

◆ ***No microbial food poisoning in tropical conditions***

Specific intoxications with poisonous plants

Poisoning plants with hypoglycemic action

Fruit of tree Bighia sapida, called "akee" contains in its shell hypoglicine A and B blocking gluconeogenesis in the liver, common in undernourished children in Latin America - vomiting, hypoglycaemia, tachycardia, mortality of 80-90%.

Poisoning plants with cyanogenic glycosides. Manioc contains manitoxine, which with water forms cyanic acid. If eaten raw - nausea, vomiting, shortness of breath, the smell of bitter almonds, coma. Such glycosides exist in Phaseolus lunatus (beans in Madagascar, Java, Lima). Be used for food after several days of soaking in water.

Disease Mac Leod. This is due to the grains of Mexican cloves (Argemone mexicana), additions - accidentally or deliberately to food. It is found in India, South Africa, Mauritius. Causing damage to the carbohydrate metabolism, similar to those of beri-beri - edema, hemangiomas, diarrhea, heart failure.

Poisoning the fruit of senecio and crotolaria. These are weeds containing pyrrolizidine alkaloid that causes acute necrosis in hepaticlobule. It occurs commonly in children in Iraq, Egypt, Jamaica, South Africa, consuming contaminated food or fruits used for unconventional treatments.

Poisonings with tropical fish

Ihtiohemotoxicosis. These fish contain in their blood strong (deadly) acting toxins - river and sea eels, Moorea, fish-torpedo.

Ihtiootoxicosis. General and with the countries of the temperate climate zone poisoning of toxins contained in the gonads, caviare, milky liquid of sturgeon, salmon, carp, tench and others (meat is not poisonous).

Ihtiosarcotoxicosis. Toxins in the skin, meat, internal organs.

Tsigotera poisoning. It is found in Polynesia, the Antilles islands in the Indian Ocean. Caused by a variety of fish - Meru, Napoleon, fish-surgeon containing toxin, which inhibits cholinesterase. The toxin falls into fish feeding them with microscopic algae (biological chain), so these fish are not always tox-

ic. Gastroenteritic syndrome, bradycardia, extrasystoles, pain in joints and muscles, asthenia, oliguria. Mortality is rare (1-2%).

Other fish poisoning are those of some species of sharks, sardines, mackerel, tuna, fish-moon: cardiovascular and respiratory disorders, gastroenteritic syndrome histamin-like poisoning, jaundice, neuro-psychiatric disorders - ataxia, hallucinations and others.

Poisonings with other marine animals. Often it occurs poisoning by molluscs, Murex, oysters, Mediterranean mussel (palurd). Cause various poisoning - histamin-like; staphylococcal poisoning; severe paralysis caused by mitilotoxin (plankton); haemolytic anemia; muscle contractures and others.

Some *tropical species of sea turtles* cause stomatitis and hepatonephritis in consumption.

9.7.7. DISEASES DUE BY HYPERSENSITIVITY, INTOLERANCES AND BY EATING INCOMPATIBLE FOODS

9.7.7.1. FOOD ALLERGY AND PSEUDOALLERGY. A.Krasteva

Approximately 50% of allergic reactions due to hypersensitivity to foods or their ingredients. Diseases of the digestive organs increase the possibility of allergysation of the organism to food. The manifestations of food intolerance, however, only 25% of cases are due to food allergy. Others relate to food pseudoallergy.

Food pseudoallergy is a collection of pathological processes that do not participate immunological mechanisms to foods and dietary supplements. The term "food pseudoallergy" includes food idiosyncrasy, food intolerance, food toxicity, anaphylactoid reactions to foods and food pharmacological effects.

Any food can be an allergen, but given the complex chemical composition of food can be considered that each separately collected food is a complex of protein, lipid, carbohydrate and other antigens. Protein food ingredients usually play the role of full or true antigens.

Lipids, carbohydrates and food additives and contaminants (preservatives, coloring agents, corrective substances, flavors and the like.) act primarily as incomplete antigens or haptens.

Allergenic potential of food depends on several factors:

1. An antigenic composition of the food allergen.

2. Consumed amount.

3. The frequency of consumption of a food.

4. Culinary treatment and enzymatic effect.

Cooking food and enzymatic hydrolysis practically no changed allergenic potential of foods. Ripening of fruit and vegetables increases their allergenicity.

◆ Causes of food allergy

These are most commonly used, mostly rich in protein ingredients foods: cow's milk, eggs, fish, various meats and their products, but also gluten containing cereals, legumes, celery, strawberries, raspberries, cocoa , tomatoes, potatoes, citrus fruits, apples, coffee and more. Depending on the eating habits of a nation and the list of food allergens is arranged differently.

Milk. Cow's milk is the most common allergenic food. It contains about 25 protein agents, 4/5 of which are caseins and the remaining 1/5 is contained in lactoserum. Most powerful allergen of cow milk is beta-lactoglobulin. The heat treatment of milk decreases sharply anaphylactic activity.

Eggs. The major allergens of egg protein are egg albumin and ovomucoid. Lysozyme, konalbumin and a dozen other proteins belong to the so-called. minor allergens. Because of antigenic similarity of lysozyme with alfa-lactoalbumin of cow's milk are possible cross allergic reactions.

Allergy to egg yolk is rare.

Fish. It is more common in northern and consuming more fish nations. Fish can also cause pseudoallergy by rich histamine content and direct histamine- liberalisatoion. Allergy observe and from other representatives of marine fauna: crabs, mussels, shrimp, squid, lobster and more.

Meat. Flesh most allergenicity is pork, but allergy to it is rare. Events like allergy was observed following consumption of sausages, but some of them are pseudoallergic and are due to histamine in these foods.

Cereals. Cereals contain more than 40 protein antigen.

Prominent among the wheat allergens takes gliadin, which is considered to be involved in the development of hypersensitivity in celiac disease (gluten enteropathy).

Allergy to flour wheat is accompanied by a large number of cross-reactions and is more common in the Nordic countries and the USA. Allergens from cereals can penetrate and by inhalation /bronchial asthma in bakers/. They can pass and alcoholic drinks produced from cereals.

Legumes. From legumes allergens are most commonly soybeans, mature beans and peas. Some digestive disturbances observed after the consumption of legumes, refer to pseudoallergy and due to non-immune mediated actions of lectins contained therein.

Powerful allergenic action have *celery*, as well as *peanuts, strawberries, raspberries, chocolate, tomatoes, citrus fruits, apples, coffee* and other foods.

Food additives. They also participate in the development of allergic reactions, particularly of the skin (urticaria, eczema) and respiratory (asthma).

◆ **Causes of food pseudoallergy**

They can be grouped into the following 4 groups:

1. Foods rich in histamine: tomatoes, beef and veal, pork liver, some fish (tuna); canned food (fermented cheeses, fermented beverages, dried herring, etc.).

2. Foods that cause histamine release (histamine-liberators): fish, pork, tomatoes, egg whites, strawberries, raspberries, chocolate, alcohol and others.

3. Foods rich in tyramine: chocolate, French cheeses, pickled herring, yeast and others.

4. Food, causing pseudoallergy by more than one mechanism: artichokes, dried vegetables.

Certain foods can act as immunological and non-immunological pathway, such as fish.

9.7.7.2. FOOD INTOLERANCE. CONGENITAL AND ACQUIRED ENZYME DEFICIENCY. A.Krasteva

Food intolerance in about 1/4 of cases are due to allergic reactions. In other cases, the causes can be various - digestive disorders in diseases of the digestive organs: individual differences in taste preferences and eating habits; purely psychological factors; racial features and more. Chronic and acute diseases sharply lower tolerance to some food products.

A common cause of food intolerance is *a congenital or acquired enzyme deficiency* that causes disturbances in the absorption of nutrients in the intestines.

When it comes to *congenital complete or partial absence of disaccharidases intestinal enzymes (lactase, sucrase, maltase)*, this intolerance is apparent in nurseling. In light cases, with age and with progressive food load, amount of intestinal enzymes increases and decreases intolerance or disappears completely.

- ***Acquired intolerance to disaccharides in food (lactose, sucrose and maltose)***

Is observed most often in patients with acute and chronic bowel diseases, gastric ulcer and atrophic gastritis, stomach with surgery, with hepatobiliary diseases and others.

Intolerance to lactose (milk sugar). This is due to complete or partial lack the intestinal enzyme beta-galactosidase /lactase/. In a part of the black and yellow population of our planet this intolerance are diarrhea, intestinal colic and bloating after consuming milk.

Intolerance to sucrose and isomaltulose. Due to lack of complex sucrase-isomaltase in microvilli layer of intestinal epithelial cells. Embarrassed the hydrolysis of all the alpha-glucosides (starch, dextrin and sucrose). It is characterized by fermentative diarrhea include these carbohydrates in the diet and its disappearance after their removal. In children after the third year tolerability improves. The need for glucose is compensated by giving glucose, fructose, and starchy foods, rice, potatoes. Enables non-sweet fruit - sour apples, raspberries, strawberries, cherries, non-sweet grapes and various vegetables.

- ***Intolerance to monosaccharides (fructose, galactose)***

Can also be congenital or acquired.

Hereditary fructose intolerance. Due to lack or deficient activity of the enzyme fructose-1-phosphataldolase mainly in the liver but also in kidney and intestinal mucosa. Reduced activity is fructose-1,6-diphosphate aldolase,. Excludes fructose, contained in fruits and fruit juices, nectars and puree in a number of vegetables (carrots, beets, green peas, onions, dry vegetables) in cane- and beet- sugar and sweetened foods with them. Sweetening can be carried out with glucose.

Galactose intolerance /galactosemia/. It refers to inborn enzimopathia with autonomous - recessive transmission. It occurs rarely and remains for life. Besides milk and all dairy products from the diet is switched off and the brain, which is rich in galactocerebroside.

Intolerance to milk (though rarely) may be due to congenital absence of *galactokinase*. To prevent early clouding of the lens of the eye (cataract), the main is to be excluded from the milk diet.

- ***Intolerance beans /favizam/***

Due to inherited deficiency of the enzyme glucose 6-phosphate dehydrogenase in erythrocytes.

- ***Intolerant to gluten (protein component of cereals)***

Clinically manifested by severe morphological and functional changes in the small intestine.

Use gluten-free foods.

9.7.7.3. INCOMPATIBLE FOODS AND INCOMPATIBILITIES BETWEEN FOOD AND DRUGS.
B.Popov, A.Krasteva, D.Popova

Excluding some rare combinations of concomitant consumption of lard and milk, fresh milk and raw vegetables, milk and some fruit, incompatibility

between foods in the normal diet is not observed. It is assumed that in the near future will achieve targeted process control (inhibition or stimulation of constituents of food), whereby when the right combination of diet will achieve maximum absorption of essential ingredients of the food, while the side and unwanted ingredients will separated out. In this aspect interesting are recommendations of Shelton formulated as principles for separate meals:

1. Acidic foods should not be co-administered with products containing starch (bread, potatoes, pasta) because the acid destroys ptyalin of saliva necessary for digestion starch.

2. Different proteins require a different set of digestive enzymes, so eggs should be eaten separately from milk.

3. The use of fat with protein slows the absorption of protein. In these cases is useful adoption of fresh raw vegetables that counteract the suppressing effect of fat.

◆ Interaction between food and drugs

It's possible that inhibiting the healing effect of certain medications from certain foods and strengthen the side toxic effects of certain drugs in relevant foods and diets. Still argue about when to take medication - before or after a meal. It was found that cardiac glycosides, many antibiotics, most sulfonamide preparations and tranquilizers are sucked faster and better if taken on an empty stomach. The effect of drugs taken largely depends on the composition of food consumed. When concomitant administration of tetracycline antibiotics in milk and dairy products rich in calcium salts in the small intestine to form insoluble complexes that are hardly utilized. High fat meal may inhibit the absorption of some sensitive sulfonamides and diuretics. In overfeeding with proteins occurring decay suppress intestinal absorption of cardiac glycosides and antibiotics. Carbohydrate diet, due to acceleration of intestinal passage, usually violates the absorption of certain antibiotics, sulfonamides and tranquilizers. There is some antagonism between hypotensive agents and sodium contained foods, while potassium-rich foods potentiate their effect and the effect of diuretics. Essential for the activity of the drug is acid-base status of the organism, which largely depends on the composition of ingested food. It has been shown that the acidifying effect of food suppress most saluretics, but potentiate the effect of the sulphonamide and antidiabetic agents. Contraindicated is adoption of small doses of alcohol when taking hypnotics, soothing and anti- pain means. Concomitant use of alcohol and aspirin increases detrimental effects on the stomach lining and can cause bleeding. Described are also cases of group allergy of similar ingredients of foods and medicines: between antibiotics and food, salicylates in food cans and appropriate medication ,Schweppes 'Tonic' and quinine and others.

Some interactions between food, nutrients, and medications are illustrated in **Table. 9.52.**

Table 9.52. Interactions between foods, nutrients and drugs

Medicaments	Food and nutrients	Possible synergies
Ampicillin, erythromycin	Received food	Reduces the absorption and bioavailability of antibiotics with risk of ineffective treatment
Lovastatin	Adopted by a diet rich in fiber	Reduces absorption
Penicillamine	Milk, minerals, such as Ca, Mg, Fe, Zn	Reduces the effect of the drug. Be taken on an empty stomach.
Nifedipine	Adopted by food	In capsules or tablets, reduces the peak plasma concentration without affecting the bioavailability, with reduced risk of adverse effects
Griseofulvin	A diet high in fat	Enhances its effect
Theophylline	Foods high in protein and low in carbohydrates	Increases hepatic clearance of theophylline and a lower level in the blood
Warfarin	Foods containing vitamin K	Reduces its effect
Antihistaminic and antidepressant medications	Accepted alcohol	Increases the sedative effect, can cause respiratory depression
Cephalosporins	Potassium, magnesium	Hyperkalemia, hypermagnesemia
Levothyroxine	Calcium carbonicum	Reduces absorption
Thiazide diuretics	Na, Cl, K, Mg, Ca	Increases the excretion of Na, Cl, K and Mg, and Ca-reduced excretion
ACE inhibitors	Increased imports of foods rich in potassium	Hyperkaliemia, cardiac arrhythmia
Isoniazid	Vitamin B_6	Vitamin B_6 - deficit
Acetylsalicylic acid	High doses of Vit C	Decreased renal clearance of acidic drugs

REFERENCES

1. **Berkow, R., A.Y. Fletcher.,** The Merck Manual of diagnosis and therapy, xv edit., Rahway, N. Y., 1987,2696.
2. **Causeret, J.** Toxicologie alimentaire. In: Alimentation et nutrition humaines. Coord. H. Dupin, ESF editor, Paris, 1992, 1342 - 1367.
3. Decree № 23 of MH on physiological norms of feeding the population. SG № 63/2005. (in bul.)
4. Decree № 27 of the Ministry of Health on hygiene requirements for catering. SG. 107/1996. (in bul.)
5. Decree № 31/2003, the Ministry of Health for norms and maximum residue levels of pesticides in food. (in bul.)
6. Decree № 31/2004, the Ministry of Health for maximum levels for contaminants in food. (in bul.)
7. **Dupin, H.** Aliments, alimentation et risqué de survenue de certains cancers. In: Alimentation et nutrition humains. Coord. H. Dupin, ESF editor, Paris, 1992, 701-718.
8. Food Hygiene, (ed. **V. Boyadzhiev** and **M. Markova**). Med. and phys., Sofia, 1987. (in bul.)
9. **Gentilini, M.** Medecine Tropicale: Intoxications, ed. Flamarion, 1991,635-638.
10. **Hercberg S, Galan P.** Nutritional anaemias. Baillieres Clin Haematol 1992; 5: 143-468
11. **Jenikova R.** Biological hazards in foods, edition of NCPHP, 2007 (in bul.)
12. **Jenikova R.** EU Regulation 2073/2005 on microbiological criteria for foodstuffs, edition of NCPHP, 2007 (in bul.)
13. **Krasteva A.** Food Allergy and pseudoallergy. In: "Gastroenterology", ed. **Z. Krastev and K. Chernev**. "Tilia", Sofia, 1997, 170-185. (in bul.)
14. **Lucas A.R., Huse D.M.,** Behavioral Disorders Affecting Food Intake: Anorexia nervosa and Bulimia nervosa, 977-983., In Modern nutrition in health and disease, ed. Shils M.E., Olson J.A., Shike M., Will/Wilkins, 8-th ed. V.2, 1994.
15. **Mitrov, G., I. Chernozemski.** Nutrition and cancer. Med. and phys., Sofia, 1985. (in bul.)
16. New data on nutrition and epidemiology of major metabolic diseases (ed. **L. Balabanski**). Sofia, 1991. (in bul.)
17. **Nikolova M.** Nutrigenomics in the prevention of metabolic diseases. GP News; 2008, 6: 7-9 (in bul.)
18. Ordinance № 1/2002 of MH, ME and MEW on materials and articles of plastics intended for food contact. (in bul.)
19. Ordinance № 21/2002 on specific criteria and requirements for purity of additives for use in food. (in bul.)
20. Ordinance № 8/2002, the Ministry of Health on requirements for use of food additives. (in bul.)
21. **Page, A.** Alimentation et maladies coronariennes, ed. Masson, Paris, 1993, p. 201.
22. **Petrovskiy, Ks., V.P. Vanhanen.** Food hygiene. Moscow, "Medicine" 1982. (in russ.)
23. **Rangelova L.,** Nutrition and dietary risk factors in infants and young children up to age 5 in Sofia. Doct.dis., Sofia, 2009 (in bul.)
24. **Rangelova L, M Nikolova.** Eco-nutrition: healthy way of eating and protecting the planet. Science Dietetics 2012, 1 (un print) (in bul.)
25. **Rangelova L., S. Petrova, K. Tsachev B. Atanasova.** Iron deficiency and iron deficiency anemia in children 1 to 5 years in Sofia (Biochemical markers of dietary intake of iron). Bulg. J. Publ Hlth. (In press)
26. **Ramakrishnan U** (Edit). Nutritional Anemias, CRC Pess LLC, Florida, 2001.
27. Residual quantitiesof pesticides in food. Report FAO/VOD, Geneva, 1980. (in russ.)
28. **Roe D. A.** Diet, Nutrition, and Drug Reactions, in Modern Nutrition in Health and Disease, ed. Shils M. E., Olson J. A., Shike M., 8 - th ed. V.2,1399-1416, Will/Wilkins, 1994, p. 1657.
29. **Savova H.**, Anorexia and Bulimia - diseases of modern times., "Mont" Ltd., Sofia, 2005, 105 p. (in bul.)
30. **Shils ME, Shike M, Ross AC, Caballero B, Cousins RJ**, Modern nutrition in health and disease, 10-th ed., 2006:
31. **Slepenkov, Y.,** Nutrition and atherosclerosis. Question of nutrition. 3, 1983. (in russ.)
32. **Smolyanskiy B.,** Feeding deseases. L., Medicine, 1979. (in russ.
33. **Stopler T.** Medical Nutrition Therapy for Anemia. In: Krause's Food, Nutrition & Diet Therapy. Yvonne Alexopoulos (Edit). USA, Elsevier, 2005: 838-847.)
34. **Tsvetkov D., M. Radeva, A. Penkov.** Studies on some biological effects of magnetically treated water and food (embriotropic and carcinogenic), Bul. Med. VII, 3-4, 1999, 53-58. (in bul.)
35. **Vanhanen, E. Dorohova.** Nutrition: Health and disease, 1994. (in russ.)
36. **WHO.** Assessment, Prevention and Control. A guide for programme managers. In: Iron Deficiency Anaemia. Ross Hempstead (Edit). Geneva: WHO; 2001: 97-100.

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D. Baykova

9.8 HYGIENE REQUIREMENTS FOR PRODUCTION, TRADE AND IMPLEMENTATION OF FOOD

Hygiene requirements of objects for the manufacturing, trade (wholesale and retail) of food are strictly regulated by regulatory documents and periodically updated. The goal is the production of so-called. "Primary products" (natural products) from agriculture, livestock, fishing and hunting with guaranteed protection from pollution and health safety. Hygienic requirements regulated in normative documents, include **measures to *control*** of potential contamination of food by: air, soil, water, feed, fertilizers, veterinary medicinal products, plant protection and control measures of waste, premises, personnel hygiene and others.

Producers of ***primary (natural) products of animal*** origin must be kept clean all the premises and equipment used in the primary production of food products. This clause includes disinfection of technological equipment, containers, cages for animals, vehicles and vessels. In food production using potable (clean) water. To work in primary food production are allowed only healthy persons trained to meet the requirements for personal hygiene. Control subject pollution of primary products from animals and pests, storage of waste and chemicals, precautions to prevent the emergence and spread of infectious animal diseases, that can be transmitted by food to people.

In the preparation of ***food products of plant origin*** is controlled purity, including - disinfection of buildings, equipment, containers, transport containers, vehicles and vessels. Observe the safety of plant protection products and biocides.

Producers of primary food of both animal and vegetable origin are obliged to keep records on measures applied on any specific activities to ensure food safety. The documentation shall be retained for at least one year after the sale of food to serve in an accident.

Objects for production and food **trade** are built in compliance with the requirements of the territorial provisions of spatial settlements and buildings to ensure noise levels in accordance with hygiene standards. For admission to the operation of such objects requires coordinated architectural design and technology plan, which indicate the location and size of the premises. They must allow effective maintenance of cleanliness and disinfection, as well as to minimize contamination of food by air. An important requirement is that there are conditions for the implementation of good manufacturing and hygienic practices to maintain and control the temperature during processing and storage of food, including conditions exist for pest control, for good hygiene toilet facilities, included in effective sewerage system. Special requirements to sinks - sinks for food and sinks for washing hands. They must be equipped with hot and cold water, washing and drying means, if necessary - the means to desinfection of hands. Ventilation systems are also subject to controls ensuring clean indoor air, lighting is guaranteed and complies with hygiene standards. To ensure food safety, locker room undressing staff are isolated from the rest and are subject to hygiene control.

There are some ***specific requirements for premises where they are prepared, treated or processed foods*** and they must take into account when drafting and technology plan. These requirements are aimed at creating conditions for the application of good hygiene practices, including protection of food from contamination between and during the various stages of the process. They are aimed at coverage of floors, walls, ceilings, windows, doors and panels on which food is handled. It should be smooth and made of non-corrosive, non-absorbent materials and allows for easy wet cleaning, if necessary - disinfection.

When selling food outlets are regulated relevant hygiene requirements, ensuring maximum protection of food from contamination and restricting access of animals and pests.

Vehicles, containers and other means of ***transport of food*** are kept clean and in good condition, used as intended, and if necessary reconciliation with other goods, providing conditions for their effective separation. Food in bulk, in the form of liquids, granules or powder form shall be transported in specially designed containers, tankers or tankers with indelible inscription that are intended for food. If necessary, the vehicles are provided with equipment for maintaining and monitoring the temperature required for storage of foodstuffs. In the sea

transport of food in bulk consisting requires containers or tankers are made of stainless steel or be coated with epoxy resin subject to special cleaning and replacement of cargo.

Hygiene requirements for the equipment - objects, devices, machines that come into contact with food include measures to maintain their purity, and if necessary - disinfecting them. Cleaned and disinfected surfaces of objects, instruments and equipment meet the following microbiological parameters:

1. Total number of mesophilic aerobic and facultative anaerobic microorganisms

• To surfaces of technological equipment - no more than 100 CFU*/cm^2;

• For table utensils - no more than 300 CFU*/cm^2 for the entire surface.

2. Coliforms - not in washaways and smears of technological equipment and table utensils.

3. Pathogenic microorganisms - not in washaways and smears of technological equipment and table utensils.

Hygiene requirements for food and other wastes and by-products not intended for human consumption are removed as quickly as possible from the premises where there is food. They are stored in containers or containers with tight lids and made of materials that allow easy and efficient cleaning. Their removal is regulated by special regulations.

The requirements for ***personnel hygiene*** are also subject to regulatory reglamentation. Person who work with food or food contact, subject to preliminary and subsequently - ongoing medical examinations, the results of which are registered in personal health care card. It is imperative to maintain a high level of personal hygiene, proper clean clothing, tools for harvesting hair and, where necessary protective clothing and gloves. When an infectious disease or carriers of infectious agent transmitted by food, which would be a risk for contamination are not allowed to work with food and /or to visit premises where food is handled while not heal effective. On connection of food safety in production facilities and food trade objects are determined premises or places for storage of personal belongings, meals and others.

At all stages of ***production, processing, distribution of food*** to ensure the provision of adequate ***safe storage and prevent spoilage***. In this regard, the production and food trade objects are only accepted primary products or processed foods marked and/or labeled in accordance with current regulations. Raw materials, food ingredients, intermediates and final products, which represent a favourable environment for the propagation of pathogenic microorganisms or the formation of their toxins are stored in temperature conditions which prevent the emergence of a risk to human health. The cold chain storage is not interrupted at all stages from production to processing, distribution and sale of food. It is important that the separate storage of dry raw and processed foods, including - separate refrigerated storage of fast-perishable products. Cooling and freezing, respectively - defrost, aims to minimize the potential for growth of pathogenic microorganisms or the formation of toxins in their food, so it is regulated.

Food ***packaging*** of materials that minimize contamination of food with harmful to the environment. Bottling of liquid food products, beverages and mineral waters is automated.

The thermal processing of food provides reaching the relevant temperature for a period of time in every part of the food product in order to ensure microbiological safety. International standards classify thermal processing such as pasteurization, sterilization or high-temperature processing.

Manufacturers and retailers of foods implement and maintain a system of procedures and programs for managing food safety ***system of hazard analysis and critical control points*** (***HACCP*** - Hazard Analysis Critical Control Points) or in other words it is the control system at critical points during production. The construction of HACCP requires identification of any hazards that must be prevented, eliminated or kept to acceptable levels, identifying critical points in the process, defining the range of acceptability of hazards. Required monitoring the supervision and registration of parameters in special journals. Are monitored microbiological indicators, temperature regime, maintaining the cold chain, sampling for laboratory analysis. Apply measures to prevent deviations from acceptable performance. Check the efficacy of these measures. Manufacturers and retailers of foods provide training to staff working with food, and then monitor compliance with the instructions.

Food manufacturers are required to have drawn up according to the legal requirements in the country's technological documentation produced foods. Technological documentation is a company document, guaranteeing standard indicators of chemical and microbiological product safety, standard recipe composition, nutritional and biological value, expiration date, specific conditions of storage and transport, packaging, labeling, marking, control of the production process.

* CFU - colony form units (micro organisms)

REFERENCES

1. **Botzov, D., M. Markova** - Food hygiene, S., Med. and in phys., 269, 1984 (in bul.)
2. Hygiene - Hygiene and Ecology V. I. ed. **Tsvetkov D.**, S., ed. Kl. Ochr., 217-218, 2005. (in bul.)
3. Ministry of Health - Food Law - SG. №90/15.10.1999, amended. and suppl., SG. 102/21.11.2003, amended. №70/10.08.2004, effective from 01.01.2005 (in bul.)
4. Ministry of Health, Ministry of Agriculture and Forestry - Decree № 5 SG. 55/2006. (in bul.)
5. Ministry of Health, Ministry of Agriculture and Forestry - Ordinance № 7, SG № 40/2002, amended. and suppl. SG. № 59/2003 (in bul.)

B. Miteva, Ts. Popivanova, V. Pisev, A. Alexandrova, Vl. Radulov, M. Tsvetkova, S. Sabeva A. Manolova, T. Popov

10 HYGIENE OF CHILDREN AND ADOLESCENTS

1. AGE MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERISTICS OF CHILDREN AND ADOLESCENTS. V. Pisev

The age, morphological and physiological characteristics of children and youth organism represent biomedical basis on which form requirements for the organization of learning and overcoming information and the rated load of students, of physical education, sport and tempering for employment and career training, for professional guidance of adolescents.

1.1. PERIODS OF GROWTH AND DEVELOPMENT, THE MAIN RELATIONSHIPS AND FACTORS

◆ **Periods of growth and development**

Children's body differs qualitatively and quantitatively from the body of the old man. Quantitative changes taking place in it are designated as growth and quality - as maturation. Growth is expressed in increasing the size and weight and maturation - to improve the morphological and functional organization. The development covers both the growth process and the process of maturation.

Ontogenetic development of the individual begins from fertilization of the ovum. Ontogenetic development is determined by the end of fetal development. Later this term includes the period after birth until the onset of puberty. Currently, this definition is considered to be generally accepted. Some authors define ontogenetic development and the death of the individual, and include in it the whole individual development.

F. Mueller and E. Haeckel formulated the so-called biogenetic law, according to which ontogenetic development is short repetition (recap) of phylogenetic. Human analogy between ontogenetic and phylogenetic development occurs during the fetal development. Postpartum an analogy exists only in the first few months of life.

Intrauterine period. Fetal development begins from fertilization of the ovum and ends with the birth of a child - 280 days (X lunar months or 40 weeks). If the birth occurs before 37 weeks gestation are considered premature, respectively after 42 weeks - late.

Germline period. It starts from fertilization of the ovum and ends with its implantation in the uterine lining. Continued from 7 to 10 days.

Embryonic period. Begins after implantation and continued until the end II lunar month.

Fetal (placental) period. Starting at beginning of III lunar month and ends normally at the end of X.

Extrauterine period. Extrauterine child development begins at birth and continues until the age of 18 years.

Neonatal period. It starts at birth and continues until the end of the 1st month. Divide by two sub-periods: early - from birth to 7 days, and later from the 7th day to the end of the 1st month.

Nursing period. Since the beginning of the 2nd month and finishes at the end of the 1st year. During this period, improved regulation of the respiratory, cardiovascular, digestive and urinary system and stabilize thermoregulation.

Period of early age. This is the age of 1 to 3 years old. The pace of growth and development slows down. Regulation of autonomic processes strengthens completely, which results in stability of thermoregulation, cardiovascular and urinary tract. Terminate the cutting of milk teeth. There is a rapid development of the motorial and the nervous system. At the end of the period the child walked steadily and perform fine motor manipulation. It spoke with long phrases. In thinking still dominates the first signal system.

Period of preschoolers. It covers ages 3 to 6 years old. During this period, improve mental and motor processes. Starts cutting of permanent teeth. Locomotion automate, second signal system begins to dominate the first, to develop the ability for real thinking. Increase in domestic and street accidents.

Peoiod school age. It covers ages 6 to 18 years old. It is divided into three periods: starting - from 6 to 10 years, an average of 10 to 14 years and upper school age - from 14 to 18 years.

• *In primary school age* child adapts to the training, which is accompanied by considerable tension of visual and nervous system and psyche of the child. In this period are common abnormalities of the musculoskeletal system (spinal curvature). Hypodynamia predisposes to obesity. Perform replacement of milk teeth with permanent.

• *In middle school age* begin pubertal - boys 12-13 years of age and in girls 1-2 years earlier. Pubertal had a strong impact on the morphological, functional and psychological development of the individual.

• *In the upper school age* ending sexual development of children and sexual maturity occurs. The processes of growth, especially in girls begin to slow down. The increase in height is negligible, while more intensive increase the size of width and strength, physical development of boys and girls is close to that of older men and women. Considerably strengthens the differentiation of the nervous system, higher nervous activity improved, which is the basis for diverse intellectual activity.

◆ General regularities of growth and development

Each of the periods of childhood and adolescence is characterized by certain features of the anatomy-physiological development of the organism. Nevertheless, there are certain *common patterns of growth and development*, which characterize the entire period of maturation (0 to 21-22 years).

• *The first general pattern* is expressed in the fact that the rate of flow of the processes of growth and development is not the same in different periods of childhood and adolescence. This is best demonstrated by changes in the values of anthropometric indicators, increased significantly during the first and last two years of the child's birth, then their growth is gradually slowing. The same applies to the weight and the stroke volume of the heart, the weight of the brain, etc.

• *The second common pattern* refers to unevenness in development and mainly in the growth of organs, which leads to change in proportion to the body. In the first years of life growth of limbs lags behind that of the corpse. In creche and pre-school age child has a significantly longer body and relatively large head and to the 14-15 age proportions of individual body parts are similar to those of adult **(Fig. 10.1)**.

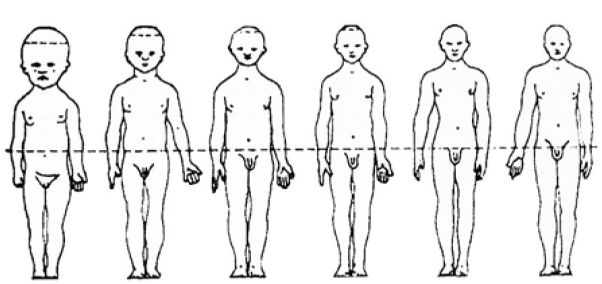


Fig. 10.1. Changes in body proportions with increasing age

Inequality has in the growth and development - usually in rapid growth slows differentiation and improvement and vice versa.

• *The third pattern* is expressed in gender differences of growth and development of the body. This is best expressed in puberty, which is characterized by uneven growth of the organism in both sexes - ie. "Crossing the age curves" for height, weight and chest circumference, which have higher values of 1-3 at the girls due to early onset of puberty.

◆ Endogenous and exogenous factors of growth and development

Endogenous factors. They are:

Genetic factors. The peculiarities of growth and development are encoded in DNA. It is assumed that the transmission of hereditary characteristics becomes the principle of polygenic system, ie growth are responsible for more than one type genes. So genotype, influenced and shaped by various exogenous factors, is becoming phenotype.

Hormonal factors. Stimulating growth are: growth hormone (somatropin), insulin, thyreoid hormones, androgens of adrenal cortex and gonads and inhibiting - glucocorticoids and estrogens.

Metabolism of substances. At the core of growth and development stands metabolism and energy, which is growing at an accelerated child.

Exogenous factors. They are:

Nutrition. The importance of nutrition for growth is linked primarily as a protein, mineral and vitamin component as well as energetic imports.

Socio-economic factors. These are living conditions and lifestyle, preventive and remedial measures, social legislation, health education of the family, the processes of urbanization and more.

Diseases and growth. The impact on growth as has the incidence of diseases and their severity and duration.

The influence of endogenous factors is more pronounced on the functions that occurred earlier in the phylogenetic development (unconditioned reflexes, instinctive behaviours). The influence of exogenous factors is more pronounced on the features that have appeared later (conditioned reflexes and higher mental processes).

1.2. PHYSICAL DEVELOPMENT AND ACTIVITY

◆ Physical Development

Physical development is an integral indicator of the health of children, total reflection on the processes of growth and development. The study enables him to identify deviations from normal development to assess the living conditions and education and the effectiveness of a number of socio-hygienic measures. Setpoints for the physical development and can be used in planning, furnishing of schools, in the manufacture of clothes, shoes, etc.

Growth in the right position. In tracing the curve of growth of the child found that the greatest acceleration of growth there and breastfeeding and later in puberty. At birth the child has a medium height 50-51 cm. In the first year of life the child grew on average by 25-27 cm. After the first year, increasing it slows down. The following period was characterized by a relative stabilization in the values of growth - 5-6 cm per year, so the growth of the infant triples in girls around '13 and boys - about '15.

Table 10.1. Height and weight of the Bulgarian population from 6 to 18 years of age

Year	Sex	Growth		Bodyweight	
		X	Sx	X	Sx
6	m.	117,4	5,3	22,3	3,4
	f.	116,8	6,1	21,9	3,6
7	m.	125,0	6,1	25,4	4,2
	f.	124,6	5,5	25,2	4,1
8	m.	130,6	7,3	28,0	5,0
	f.	129,4	6,3	27,7	5,4
9	m.	135,2	6,4	31,3	5,5
	f.	135,6	6,4	31,0	5,3
10	m.	140,9	6,4	35,2	6,5
	f.	141,4	7,5	35,6	7,5
11	m.	145,8	7,5	38,6	7,4
	f.	147,2	7,5	39,3	7,8
12	m.	151,0	8,0	43,3	8,7
	f.	153,1	6,9	45,4	8,6
13	m.	158,3	8,4	49,7	10,1
	f.	157,2	6,6	49,9	9,2
14	m.	165,6	8,1	56,2	10,5
	f.	159,2	5,8	53,8	8,4
15	m.	169,6	7,7	60,4	10,1
	f.	159,9	5,6	56,6	8,2
16	m.	172,3	7,1	64,5	9,4
	f.	160,7	6,1	57,3	7,7
17	m.	173,8	6,4	67,9	8,9
	f.	161,2	5,8	58,1	8,1
18	m.	172,3	6,3	69,6	7,9
	f.	161,4	6,0	58,4	8,3

The period of so-called. "first extension" is formed in age from 4 to 7 years of "second extension" of 11 to 15 years - ie. "puberty jump." Average annual rate of 8 cm for girls and 9,5 cm for boys. Approximately 1 year after this "jump" in the height of the average growth returns to its initial values - 5-6 cm per year, and then cut in half to become a minimum until completion of puberty period **(Table. 10.1)**.

Bodyweight. Body weight is a sensitive indicator that most strongly impact the external environment. The child was born with an average body mass 3400-3500 g, but individual differences are significant - the lower limit of normal was 2500 g, and the above - 4300 g. The most intensive bidding in the first year of life - an average of 6500-7000 g. After a period of relative stabilization in the body weight gain, which by the end of 6-7-year system is moved about 2 kg per year. In the harmonic progression of the growth period of the so-called. "first rounding 'is formed in early childhood, the second - between 7-11 th year and the third - after '15.

The existing relationship between height and weight requires a comparison of these two indicators, and for early childhood - and compliance with weight at birth. It establishes a certain seasonality in the increase of body mass, that is perceptible in the autumn-winter period.

Chest. At birth, the *chest* is barrel-shaped, due to approximately equal size front-to-rear and transverse diameter, ribs concluded almost a right angle to the sternum. Gradually chest gets tight, angle concluded between the ribs and chest - sharp.

It is accepted on the condition of the chest to judge by the chest measurement. In newborns it is about 33 cm, in the first year rising on average 14 cm long and at the end of the first year, reaching an average of 47 cm. Subsequently (at a minimum growth rate), at 14 years of age, reaching 74 cm. A large chest measurement, combined with a big difference in circumference at inhalation and exhalation, usu-

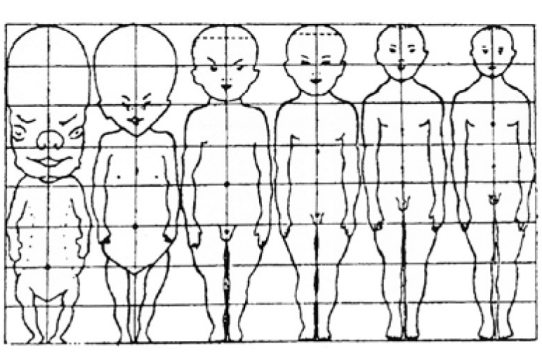


Fig. 10.2. Body proportions in different age groups:
1 - 2 months embryo; 2 - embryo at 6 months; 3 - newborn; 4 - a child of two years; 5 - child 6 years old; 6 - a child of 12 years

ally shows good functionality of the lungs. Respiratory diseases and deformities of the chest lead to a decrease in this indicator. Though unstable, chest circumference is an important indicator in assessing the health status of children and adolescents.

Other indicators. The child is born with a relatively large head. Its length in this period represents 1/4 of the total length of the body, while adult she is 1/8. Furthermore, neonatal facial portion of the skull is small of the brain. This ratio changes with age, due to a larger growth rate of the front part of the skull **(Fig. 10.2)**.

The child is born with an arched curve of the *spine*. During the first year of life form the physiological spinal curves. At 2-4 months appears first cervical lordosis, to 6-9 months - spinal kyphosis, and in standing and walking of child - lumbar lordosis. Within the limits of physiological norm these curvatures of the spine are less or more pronounced.

Of all the body parts *legs* grew most significantly. For the final height 3-4 times the body increases, the carcass - 3 times, the head height - less than 2 times, and lower extremities - more than 4 times.

◆ **Physical capacity**

For quality speed particularly significant is *running short distances*. A significant difference in the speed of running between boys and girls is observed after 10-11 years of age. While 11 years boys see running 60 m on average for 11 s, and the girls to 11,8 s, at age 18 the difference is much greater - 9,7 s for boys and 11,9 s for girls. Even more significant is that the highest rate - 11,3 s, girls develop for 14 years, while boys give their highest achievement - 9,3 s, 17 years **(Fig. 10.3)**.

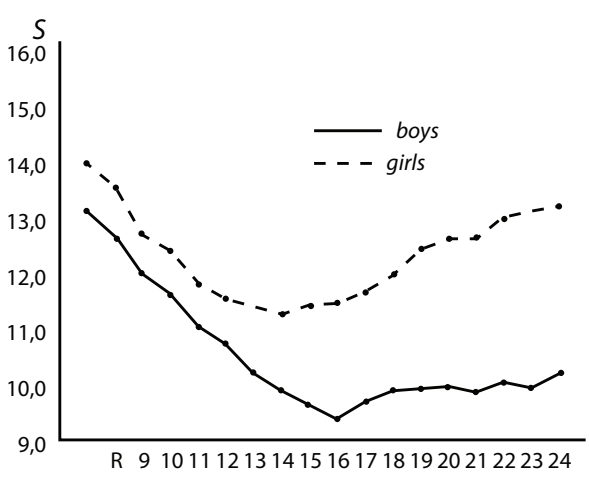


Fig. 10.3. Dynamics of speed when running 60 m in children, adolescents and young people aged 7 to 25 years

Long jump gives an idea of the quality speed and strength, especially in the lower extremities. Boys showed higher achievement than girls in the entire school period and the differences are more significant during puberty and the following age periods.

Throwing the ball 80 g - a strong hand. The achievements of girls increases with increasing age. The largest annual increase was observed between 9 and 11 years and after 13 years decreases. Boys achievements are increasing very intense until the end of school age.

Number of squats for 20 seconds. This test provides information about the peculiarities of the development of speed-strength endurance of the lower limbs.

The data show that boys and girls achievement improved to about 15 years of age. Opportunities to students of both sexes in the number of squats are very close. The difference is 1-2 squats for 20 s, in favour of boys.

Flexibility or depth of slope. By 8 to 11 years students have a slight retention in the development of its flexibility. After '11 starts improving, which not only continues until the end of school, but in the student age. 15 and older improvement is slower and is accepted as a period of stabilization.

The depth of the inclination is the only test in which girls outperform boys of all ages, the difference in individual cases up to 3 cm for girls.

• ***General type of physical development***

Also very important to establish a common type of physical development (constitution) by somatoscopy (visual inspection) of adolescents.

• *Normotonic type* is set average 60-80% at different ages. It is considered favourable and for capacity of students.

• *Athletic type* of development occurs in 25-30% in different school ages. It is especially beneficial for larger exercise and sports achievements.

• *Astenic type* meets from 4 to 12%. These are children and adolescents with poor physical qualities and abilities of the musculoskeletal system, cardiovascular and respiratory system.

• *Picnic type* - with a tendency to obesity, there is an average 5-12% among students of both sexes.

Somatoscopic research definitions and general view, of the child's skin condition, of the lymph nodes, thyroid, the degree of sexual development, spinal deformities.

In determining the physical development of children and adolescents are grouped usually calendar age. Several studies show that physical development occurs at different rates - in the same calendar age meet students whose somatic development meets the 11-year-olds, while others are closer to 15-16 year olds. This gives reason to pay attention not to the calendar age, but and biological age. It

represents that achieved by the individual level of the morphological and functional development, which corresponds to the average level of each individual of the calendar age. It is also called physiological, morphological, bone, teeth, etc., depending on what criteria reflect biological changes in the body and which ones are taken as a basis. The criterion "bone age" is Rö determining the period of occurrence of points of ossification of certain group of bones;"dental age" - the cutting of milk and permanent teeth. The criteria are used more somatic development of the child, the ratio of certain body size, sexual development. Established correlations between different criteria allow only some of them to determine biological age.

1.3. ACCELERATION

It occurs mainly in the fact that children and adolescents are developing at an earlier age in terms of height, weight, sexual maturation and others indicators.

XX century children are taller and heavier than their peers in the last century. Made over the last one hundred years anthropometric measurements in different countries of the world showed that average height and weight of adolescents are increasing. For example, during this period at 5-7 year olds every ten years growth has increased by 1,5 cm and weight is 0,5 kg, while in boys and girls - by 2,5 cm and 2,0 kg. Today, newborns are more severe with 100-500 g and longer with 1-2 cm compared to newborns half a century ago. Current infants double their body mass no for 5-6, but and 4-4,5 months. Teeth sprout modern children 6 months or more earlier than those of their peers in the past.

Besides growth, characteristic changes undergone and the skull. Paleoanthropologists show that its capacity is increasingly growing. Also pelvis of modern woman in recent decades, changing volume and its capacity due to increased core size. These changes create opportunities of more favourable biological development of the fruit for easy childbirth and so on.

All these facts and observations became the basis for the construction of the doctrine of acceleration, i.e. for the accelerated development of the human body. E. Koch first introduced this term in science to refer to him in haste physical growth and sexual maturation of adolescents. Today, under accelerated understand not only wipe the physical development and early stabilization of the growth of the body, but the earlier "start" and later "finale" of human development, the earlier puberty, accelerated mental development and intellectual maturation of young people. So often uses another concept - "secular trend" ("phenomenon of the century").

Theories and hypotheses for accelerated. There are many theories and hypotheses about the factors and causes that give rise accelerated.

1. Heliogenic theory. According to her, in recent decades clothing and lifestyle enable increasing access of sunlight to the body of children and adolescents. In connection with this theory some scientists bring data to support the fact that in the southern regions and geographical areas where sunshine is longer and stronger pace of accelerated growth and development of children are more pronounced.

2. Radio frequency theory. Its supporters have tried to explain accelerated processes by more intensive irradiation of our body with radio waves that might affect stimulating growth hormones. From more recent times it is considered that the accelerated development of adolescents is determined by the modified natural radioactive background of the Earth, citing data from animal experiments showing that certain small doses of ionizing radiation stimulating influence on the body.

3. Genetic theory. This theory explains accelerated with projected at human genetic code. Some researchers suggest that carriers of hereditary information - the genes that "manage" human growth are not "equal." If one parent is high, and the other - low, the child will haven't average growth but growth will inherit of the higher parent.

Although already a tendency to flare, still in cities is accelerated more pronounced than in the villages. This is one of the reasons some scientists to seek reasons for accelerated development in the ever-growing urbanization.

4. Alimentary theory. Some scientists are supporters of alimentary theory. It pointed out that a key role in accelerated development plays a radically changed diet of modern man.

All these theories and hypotheses explaining only some aspect of acceleration. The reasons for this phenomenon must be sought in the complex impact of multiple social factors and conditions on which they depend labour and customs, development and human health.

Accelerated processes continue, albeit at a slower pace. Along with the higher growth and higher weight compared to 20 years ago, chest circumference, shoulder diameter hardly changed, and skinfold thickness and waist circumference increased significantly. Hardly alter the values of muscle strength in the arms and the vital capacity of the lungs. These data give grounds to assert that although improving, the physical development of teenagers is not harmonious. There is a tendency to overweight, rela-

tively groovy and backwardness of some functional and physical activity indicators.

Prevention of adverse effects of acceleratioin and ensuring good health and harmonious development of children and adolescents nowadays require more effort and care from the school, family and society to educate proper health position and health behaviour, habits for healthy lifestyle among the younger generation still in their infancy.

1.4.FEATURES IN GROWTH AND DEVELOPMENT OF INDIVIDUAL SYSTEMS

1.4.1. MUSCULOSKELETAL SYSTEM

◆ Skeleton

Neonatal main part of the skeleton is cartilage. His gradual ossification and ends at 23-25 years of age. In children from earlier periods of development bones are fibrous structure, while in adults they are plastic construction, which determines their internal structure, best suited to the biomechanical functions.

The bones of the skeleton most important is the backbone whose growth and development continued until 22-25 years of age. In newborn spine without curves. With the growth and mainly to the development of muscles and movements of the child form the normal curvature of the spine. First to the third month, when the child begins to stand head arises cervical curvature with convexity forward. When the child begins to stand and walk are formed lumbar curve with convexity forward. Last form thoracic curvature with convexity backward. Although initiated, these curves for a long time, including during the preschool period are inconsistent. Only in adolescence spine becomes permanent form a double S-shaped curvature in the anteroposterior direction, characteristic of adult. Full ossification of the spine ends after 20 years.

Ossification of sternum and ribs fused with her finish at 20-25 years of age. Late ends ossification and pelvis - to 25 years of age, which sometimes causes a deformation of his, having important implications for girls.

◆ Muscle

Muscle mass in children is less pronounced. In the newborn it is 23.8% by weight, the child of eight years - 27.2%, with 15-year-old teenager - 44.2% with adults - 45%. The development of individual muscles and muscle groups is uneven. Earlier develop large muscles of the shoulder and pelvic girdle, shoulder and hip, forearm and lower leg. The latest develop the muscles of the wrist, foot and toes.

Skeletal muscles in the newborn are poorly differentiated, myofibres thin, with plenty of round cell nuclei. As we age the diameter of the fibers increases, the number of nuclei is reduced from 45 in the neonate to 5 in 17-18-year.

The normal development of the musculoskeletal system and its innervation depends on proper body frame. There are four types of stands.

• *Stand A is very good.* The head is erect, chin harvested, breasts are lifted and the sternum is the protruding body part. Lower abdomen is retracted and flat. The curvature of the spine is normal. Axes of head, body and legs merge in a straight line. It starts from the middle of the crown, passes through the eye directly behind the angle of the mandible, crosses the center line that connects the two hips and formed the quadrangle formed by the feet.

• *Stand B e good.* The head is slightly bent forward, chest slightly reduced. In her lower abdomen is retracted, but is not flat, a curvature of the spine are slightly increased. Three axes - the head, body and legs are slightly inclined towards each other - the axis of the head and the legs are slightly tilted forward and the axis of the body - back slightly.

• *Stand C is average, slack*. Her head is tilted forward, breasts are flat and depressed and belly - relax. It is the protruding body part. Spinal curvatures are increased. The three axes are more inclined to one another than in a stand B.

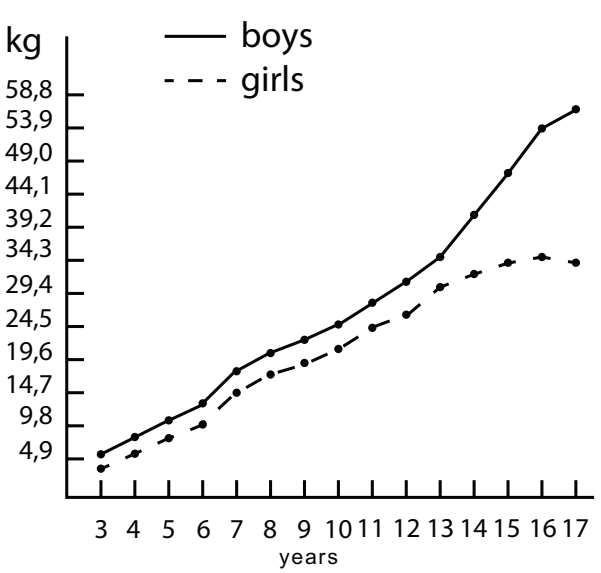


Fig. 10.4. Strength right hand

• *Stand D is bad.* The head is strongly leaning forward, sunken chest and the belly is quite relaxed and protruded. Curvature of the spine are greatly increased. The three axes are strongly inclined to one another.

Throughout the school period motility gradually improved. At 6-7 years of age the child control well their muscles, but the subtle movements of the peripheral musculature it difficult. To 8-10 years experience significant stability of motility and coordination.

Later, in the prepubertal period and early puberty, occur disturbances in motility, expressions of endocrine changes and increased excitability of the cerebral cortex.

Of particular interest is the development of motor skills: strength, endurance, speed of movement, accuracy and coordination of movements.

Strength and endurance increase with age. In prepubertal period power of the right hand is similar for boys and girls - unlike average 2-3 kg to 13 y. age **(Fig. 10.4)**, reaching up to 22 kg in the 17 years of age.

The strength of right hand in a 15-year-old boys averaged 47 kg - about 63% of the power in adults. The accuracy and coordination of movements also improve with age and are determined by the dynamics and nature of higher nervous activity. At 13-14 years age ends differentiation of peripheral nerve endings and cortical center of the motive analyser.

1.4.2. CARDIOVASCULAR SYSTEM

Changes experienced with increasing age, weight and shape of the heart, its location in the chest, structure of myocardium and breadth of aperture of the vessels.

Dimensions of heart. After birth increased proportionately in three dimensions: width, length and thickness. Most intense heart grew in the first three years, at the end of the third it triples its mass. The second impetus for growth is between 13 and 15 years, ie during puberty period.

Along with increasing the size and weight of the heart through school age amend its histological structure. In the process of growth increases the transverse diameter of the muscle fibers. Increasing

Table 10.2. Pulse rate and blood pressure of the Bulgarian population 6 to 18 years

Years	Sex	Pulse rate		Blood Pressure			
				max		min	
		$\bar{x}$	Sx	$\bar{x}$	Sx	$\bar{x}$	Sx
6	m.	91,0	15,0	92,2	11,1	56,9	10,4
	f.	92,7	14,0	90,9	11,6	57,2	10,9
7	m.	89,2	12,8	93,9	10,9	58,1	9,8
	f.	86,5	11,6	92,3	11,8	56,6	11,4
8	m.	86,3	11,6	97,1	11,4	60,0	10,0
	f.	86,7	12,1	96,2	11,3	59,7	10,4
9	m.	86,0	10,7	98,6	10,7	62,5	10,2
	f.	88,1	11,8	97,1	10,4	61,4	10,5
10	m.	86,4	10,6	100,4	10,7	62,9	9,9
	f.	86,7	11,4	100,2	13,3	63,1	11,2
11	m.	84,3	10,9	103,4	11,1	64,2	10,2
	f.	84,4	10,2	104,1	12,7	64,9	11,0
12	m.	83,3	11,2	106,6	12,0	65,7	10,6
	f.	85,5	11,6	107,4	13,2	66,4	10,4
13	m.	83,5	10,6	111,6	12,2	69,1	10,9
	f.	84,2	10,9	108,1	12,3	67,8	10,8
14	m.	84,6	11,0	114,0	12,3	70,4	10,4
	f.	82,9	10,5	111,4	13,3	69,4	9,3
15	m.	81,8	10,7	116,5	11,6	72,4	8,5
	f.	83,0	10,8	112,8	13,0	70,8	9,0
16	m.	80,1	10,4	118,3	12,2	72,8	9,0
	f.	82,2	9,4	113,6	12,4	71,8	9,0
17	m.	79,9	9,6	120,1	12,9	73,4	9,0
	f.	81,7	10,2	111,2	11,3	70,6	8,6
18	m.	76,1	8,5	116,6	11,1	73,4	7,8
	f.	78,2	8,6	113,3	10,8	71,0	8,5

size and nuclei of muscle cells and a gradual decline with age. Muscle fibers take on form, inherent of myocardium of adult man to 10-11 years of age.

Nervous tissue of the heart differentiate relatively faster than muscle tissue, such as the development of heart nerves ends at 7-8 years of age.

Heart rate. Heart rate continuously slows down after birth. This delay is due to changes in neural regulation of cardiovascular function - to overcome the influence of the vagus.

A characteristic feature of the pulse in childhood is its instability. At 7-8 years it is more sustainable, but during puberty again becomes labile. Heart rate is an important physiological mechanism for adjusting circulation to physical work. In girls, with the exception of 8-, 10- and 14-year-olds, the pulse rate is greater in comparison with that in boys **(Table. 10.2)**.

Arterial pressure. While the pulse rate decreases with age, blood pressure - diastolic and systolic, continuously increases. Throughout school age boys have higher values for systolic blood pressure. While childhood difference is negligible, with the onset of puberty in boys it begins to rise steadily, resulting in higher values increase the maximum pressure on them **(Table. 10.2)**.

Stroke and minute volume. Stroke volume and cardiac minute output increase with age. Increase in absolute terms, but relative values, ie per kilogram of body weight decreased.

Due to decrease pulse rate with age stroke volume is amended intensified by minute. The increase in cardiac minute output at rest at all ages at the expense of stroke volume. Upon exercise stroke volume increases at the expense of using the residual volume, which is an indicator of the functional reserve of the heart.

In the upper school age often observed disturbances in cardiac, accompanied by organic noises, increased blood pressure, irregular heart beat, etc., which are temporary in nature.

At the age of 18 the formation of the cardiovascular system basically ends. Nervous regulation of cardiac activity becomes perfected and therefore the cardiovascular system is resistant to physical exercise.

1.4.3. RESPIRATORY SYSTEM

Childhood respiratory organs are among the most vulnerable. During this period, the respiratory diseases occupy a leading position in the structure of infant morbidity and acute respiratory insufficiency is the most common life-threatening condition. This is due to a number of morphological and functional characteristics of the respiratory tract in children.

In connection with the growth and functional loading of the respiratory, circulatory system increased and reached its biggest development in 25 years. Lungs with age increase the mass and volume. Thus, compared to the infant, the mass of the lungs at the 7-year-olds is increased 8 times, and in the 14-15-year - 10 times. The volume of the lungs to 8-9 years is increased 7-8 times at 13-14 years -10 times, and in adult -15-20 times.

Mucosa of the upper respiratory tract in young children is gentle, richly vascularized, easily susceptible to external adverse factors, but gradually with age, develop its protective function.

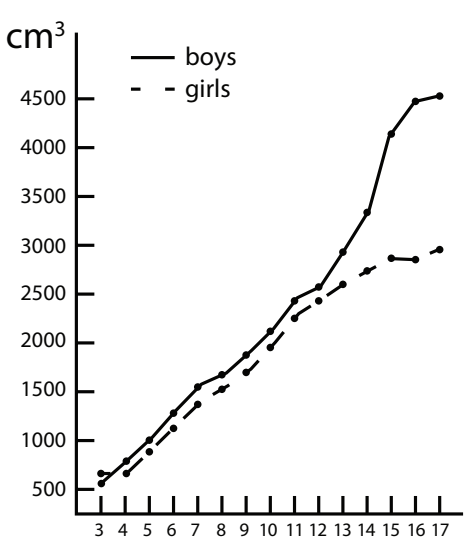
Vocal cords undergo more intensive development during puberty, when the voice of the boys began to mutate.

The trachea is short, narrow, with soft lining, a soft texture. The length of the trachea increases in accordance with the growth of the body. The greatest increase in length noted in the first six months and the second between 14 and 16 years. The diameter of the trachea also increases with age.

The chest is constantly formed - from cylindrical shape at birth, he gradually yields oval. In accordance with the morphological changes breathing gradually changed its type and becomes of diaphragmatic to chest. In the boys prevail diaphragm type (abdominal breathing), and the girls - chest type. Increased strength and endurance of the respiratory muscles, that girls ended development at 13-14 years and boys - to 17 years.

In the process of growing magnitude of the vital capacity is constantly growing. In all ages boys showed significant higher values. Particularly sharp difference between the sexes is increased after 13-14 years of age **(Fig. 10.5)**.

Fig. 10.5. Vital capacity of the lungs



One of the main indicators of pulmonary ventilation - minute volume, in absolute terms age increases. The limit of the pulmonary ventilation (maximum ventilation) increases with age, boys showed significant higher values at all ages. When athletes adolescents maximum ventilation can reach 150 - 200 percent above normal for age - an important indicator of fitness level.

Between the respiratory and cardiovascular system there is a close relationship. At the time of sexual maturation are marked increased excitability of the respiratory center, wherein the arterial hypoxemia occurs (eg. reducing oxygen in the inhaled air is poorly tolerated). After completion of the sexual maturation occurs resistance in the breathing process.

1.4.4. ENDOCRINE SYSTEM

◆ **Pituitary**

In the newborn pituitary mass oscillates between 0,10 and 0,15 g. During puberty its mass is doubled and reached 0,20-0,35 g, and 18-20 years to match the average rate - 0,50-0,60 g. The hormones of the anterior pituitary stimulate growth (STH), the formation of progesterone, the development of mammary glands (LH and prolactin - LTH), growth of the cortex of the adrenal and biosynthesis of corticosteroids (ACTH), entrance of T3 and T4 of thyroid (TSH). Follicle stimulating hormone (FSH) stimulate the development of ovary, and boys - spermatogenesis. Luteal hormone (LH) stimulates ovulation in mature follicle and release of estrogens.

◆ **Thyroid**

There are important for the growth of the body. Her hormones - T3 and T4 are major factors for the metabolism in the body. In primary school age, along with the pituitary gland, thyroid gland is essential. During puberty, when occurs deep reorganization of the endocrine system, thyroid activated its operations and doubles its mass - 4,5-3,0 g at 2 years of age, 18-20 g in 12-14 years age, 14-16 g - in 16-17 years. It affects the growth, somatic and mental development of the whole organism.

◆ **Parathyroid glands**

Produce their hormones - parathyroid hormone and calcitonin, together with vit. D_3 regulate the content of calcium in the blood. Their weight of 0,02 g at 1-10- years age reaches 0,05-0,07 g respectively on 17-20 and 61-70 years.

◆ **Thymus**

Thymus gland develops to puberty, then atrophy and in its place developed adipose tissue. The most perfect development it reaches for 8-10-year (mass 28-33 g). At 11-12 age begins its reverse involution (mass 21-23 g of 20 years). The thymus is involved in the processes of growth and also in immunological relationship of the organism with exogenous harmful environmental factors (cellular immunity).

◆ **Pancreas**

First impetus to the development of the *pancreas* is note at the end of the first year, when it increased 4 times compared to its size in the newborn, and the second - to 5 years of age. At 13-15 years of age in their dimensions and weight (80-90 g) the pancreas does not differ from that of adults. Final development he reached much later - 25-40 years.

1.4.5. MENTAL DEVELOPMENT

◆ **Brain**

Formation of the nervous system in the fetus starts from the third week of pregnancy. In the brain of a newborn are well expressed major grooves and gyrus, and small grooves are formed in the first years of life. In the cortex (pallium) are numbered from 14 to 17 billion nerve cells through their growths connect different parts of the cortex, and others - provide the connection of the cortex with a low lying sections of the brain. Particularly intensive develop after birth phylogenetically newer formations of the brain. Along with the development of brain tissue grow and nerve fibers.

The brain of the newborn has a relatively large mass which constitutes 1/8 of body weight against 1/40 in adults. The mass of the brain from birth until reaching adult are increased ~ 4 times. The increase is most intense during the first 2 years of life. At 7 years its mass up to 1280 g, 9 years -1350 g, 12 years - 1400 g.

◆ **Higher Nervous Activity**

• *In preschool age* higher nervous activity is characterized by persistent instability of neural processes. Notes are easy fatigue of cortical cells. Conditioned reflexes are easily formed, but easily broken. The predominant processes of excitation over these of retention, and also the processes of irradiation before those of the concentration.

• *In primary school age* continue to dominate the processes of excitation, but the processes of retention are stronger than those in preschool. The memory is also well developed but is mainly affective. The child remember better what he has made a strong impression. In the process of training, which is committed the second signal system, rapidly evolving and mental activity. Dominates specifically-shaped thinking, but there are also the beginnings of abstract- summarizing. He began to improve oral and written language. The vocabulary of a first grader encompassing an average of about 3000-4000

words. Vocabulary expands with age, and his speech improved.

• *The average school age* is characterized by the formation of the individual physically, mentally and sexually respect. And in this age excitatory processes continue to prevail over the retained, but unlike primary school age conditioned reflexes and differentiation form easily and quickly. Improves concentration of basic cortical processes, which helps to improve the coordination of movements, increases accuracy and agility. Endocrine changes associated with puberty, causing emotional instability.

Mechanical and concrete memory began to give way to logical. Develops and abstract thinking, the ability for analysis and synthesis. Perceptions of the environment are becoming more sophisticated and profound.

• *In the upper school age* occurs a significant increase in associative processes.

Involuntary memory, which is leading the previous age periods gradually replaced by random, semantic memory. A number of characteristics acquired and thinking. The nature of the training during this period, contributing to the development of theoretical thinking. A higher level of development reached moral qualities, intellectual ability and aesthetic needs.

Although for all ages characterize certain features of higher nervous activity, for each child are inherent individual typological traits. The combination of the three main properties of nerve processes - strength, balance and mobility, determine the following types of higher nervous activity:

1. Strong, balanced, movable type (sanguine). Children and adolescents of this type are characterized by strong, mobile and well-balanced nervous processes. They are alive, active, high-performance, easily switch from one to another kind of activity, have a variety of interests.

2. A strong, unbalanced type (choleric). Children and adolescents of this type are characterized by increased excitability of the cerebral cortex and imbalance of nerve processes. Such children are characterized by variability in the nature, difficult to cope with their affections and emotions.

3. Strong, balanced, stiff type (phlegmatic). It is characterized by strong, balanced, but slightly moving processes. Conditioned reflexes are formed slowly. Children of this type are calm but hard switch from one to another kind of activity.

4. Weak type (melancholic). It is characterized by poor processes of excitation and detention, poor mobility of nerve processes, difficult formation of conditional reflexes, lack of ability to adapt to environmental changes.

Depending on whether the predominant first or second signal system people are divided into artistic and intellectual type. The first type refer children and adolescents with better developed first signal system - the direct perception of the world through the senses. When thinking type is more highly developed second signal system, especially abstract thinking, handled mainly by words. Most people are represented and developed in approximately equal measure both signaling systems.

The types of higher nervous activity began to emerge as early as preschool. In school they are already well distinguished. Throughout this period, however, the types of higher nervous activity are in the process of formation and change in relation to changes that occur in conditioned reflex activities of different age groups.

1.4.6. SENSORY ORGANS

◆ ***Vision***

During the birth smell, taste and skin sensitivity are better developed than vision and hearing. At birth the child morphological development of the peripheral area of the retina has been completed, while the central region (yellow spot) is not yet sufficiently differentiated. At 3-4 months after birth ends myelination of the visual pathways.

Immediately after birth the child is light sensitivity. In directing strong light to it then closes his eyes (nictitating reflex). This reflex is innate and has a protective nature. In the newborn child there is photophobia, which is why it almost constantly with his eyes closed. Lacrimal glands start functioning in the second week after birth. About 3 months of age their activity is associated with emotional reactions of the child.

Visual acuity of the newborn child is too small - from 0.01 to 0.05. With age gradually improving. At the end of the first year visual acuity is from 0.1 to 0.3 and after 5 years of age became 1.0. The boundaries of the field in the newborn are 2 to 8 °. They gradually increased and 5-6 months of age reaching 30-40 °. Then it is assumed that peripheral vision function properly, although it continues to expand, reaching its maximum limits only 20 years old.

Differentiation of colors in nurseling is done within the first signal system. Knowing the colors and their proper naming takes place only in the third year of life.

The development of visual functions is connected directly with the development of the regulation of eye movements. In newborn eye movements are pointless, chaotic and not related to the effect of stimuli from the external environment. The move-

ments of both eyes are not coordinated. At the end of the 10th month to establish the first coordinated movements and the possibility of fixing the stationary objects. Coordination of eye movements improve in the second and third quarters, but became stable until the end of the first year. Between 1 and 3 years of age develop a mixed track - hopping movements combined with smooth. About 5 years of age can register good smooth tracking.

◆ **Hearing**

Adult perceives sounds with frequencies from 16 to 20,000 Hz. At the upper limit children could reach 22,000, and sometimes up to 32 000 Hz. Hearing sensitivity to sound is greatest for sounds from 1000 to 4000 Hz. The hearing organ of the nurseling and young child is particularly sensitive to strong auditory stimuli.

In the newborn child morphological development of the ear is basically complete. However, there are some peculiarities. The external auditory canal is very short at the expense of the poor development of the bone part. Eardrum almost reached dimensions that are at the adult, but is situated horizontally. Eustachian tube is short and broad. In the middle ear is still embryonic connective tissue, which is absorbed by the end of the 1st month. After birth, with the first breath and making swallowing movements, the middle ear fills with air. The morphological development of the inner ear is complete. Auditory pathways from the midbrain to the cortical centres are not myelinated. This is about the fourth year when he graduated and cytoarchitectonics differentiation of cortical part of the auditory organ.

◆ **Olfaction**

Immediately after birth the child's sense of smell is very well developed. Then gradually back development of olfactory sensitivity, which continues through early childhood. Therefore, the infant feels smells better than the older child and adult. Unlike the absolute olfactory sensitivity which decreases after birth, the ability to differentiate between olfactory stimuli is increased.

◆ **Taste**

Neonatal and infant taste cells (taste buds) are located on a broader surface that covers the majority of tongue, hard and soft palate, the rear part of the lining of the lips and cheeks. In terms of functionality in the newborn child is a developed flavor sensation. It can take and make out some basic taste stimuli. Substances with a sweet taste produce sucking movements and total calm. Substances with sour, bitter or salty taste provoke negative emotional reactions (frown, sometimes vomiting, etc.). Compared with adult, infant child has a higher threshold of palatability. Gradually with age improve the accuracy of differentiation and speed of its implementation. This process continues throughout early childhood.

◆ **Skin sensitivity**

Tactile sensation. In tactile irritation of any part of the skin of a newborn child can cause general and local reactions. The most sensitive is the skin of the hands, feet and face. Particularly sensitive eyes and skin around them.

Temperature sensation. Temperature fluctuations are perceived by two types of receptors: cold and warm.

1 cm^2 of skin accounts for an average of 6 to 23 receptor for cold and only 3 hot. Receptors are present in the lining of the mouth, nose, vagina, anus and the like. The most sensitive is the abdomen.

Painful sensation. The pain is perceived by special receptors scattered throughout the body in a significant amount - 1 cm^2 of skin are about 100 receptor. Pain occurs as a result of irritation, not only the skin, but also a number of internal organs. The pain is often the only signal that warns of ill success in the state of one or another organ.

1.5. FEATURES OF PUBERTY

One of the critical periods of ontogenesis of human development is the period of puberty - puberty (lat. pubertas - maturing). This is a difficult period in the development of the human body ("second birth" - J. J. Russo), which occupy an important place changes in reproductive and endocrine systems.

In fact sexual maturation is a continuous upward line from the antenatal period in which only menarche (first menstruation), ejaculation and pubertal surge in growth are clearly distinguished.

Depending on hormonal activity differ 4 stages:

1. First - from early fetal life until the second half-year after birth with remarkable for period reproductive hormone activity. Sex steroids (testosterone and progesterone) reach values that are found during puberty. By the end of the first year after the birth of their production decline.

2. Second - prepubertal (calm); from the end of the first year to 8-9 years of age. It is characterized by low levels of gonadotropic hormones, follicle stimulating high ratio of (FSH) and luteal hormone (LH), low secretion of sex steroids - testosterone, androsterone, progesterone, 17 - β-estradiol.

3. Third - puberty - greatly increase the secretion of gonadotropins, development of gonads and increased secretion of sex hormones.

4. Fourth - reaching sexual maturity and reorganize the overall personality of the adolescent - build their physiological, psychological, social characteris-

tics, qualities, habits and behaviour.

Various authors (N. Simonet, M Skorzhena, J. Tanner) give different classifications for actual puberty period (after 8-10 years of age):

• *The first stage* - prepubertal (pubescens), sets the stage for the onset of puberty. It features enhanced overall growth and development with primary external (secondary) sexual characteristics.

• *The second stage* is called puberty (adolescens). During this stage form the most characteristic of both sexes primary and secondary sexual characteristics.

• *The third stage* - postpubertal (maturitas), is characterized by a gradual strengthening, mature and completion of sexual development and reaching the characteristics of adulthood.

Onset and duration of pubertal development depend on a number of factors such as race, heredity, living conditions, nutrition, climate, health, physical activity, individual features and more.

Sexual development in boys. It shows that in the same age can meet guys who are not yet out of childhood and boys whose puberty has not been fully completed. The first sign of puberty is the appearance of hair around the genitals. Simultaneously, development and scrotal sac. Most often between 13 and 16 years old and enlarges the penis. The prostate gland develops and begins to secrete mucus, which does not differ from the secretions of mature men. A little later than other secondary sexual characteristics develop and hair under the arms and face. Hair on other parts of the body occurs simultaneously with underarm hair, but lasts a long time, even into adulthood.

When growing boys is increasing and developing larynx. This is manifested visibly enlarged adam's apple and a deepening of the voice.

Sexual development in girls. Start earlier - at the end of 10. The first signs of maturation are the development of mammary glands and rounding the pelvis and hips. The pigmented circle of mam-

Table 10.3. Development of puberty in girls and boys (by Tanner)

I. Pubertal development in girls	
A. Development of breasts (telarhe-M)	
1 grade (M1)	– prepubertal stage
2 grade (M2)	– palpate only "button"
3 grade (M3)	– chest rise and profile have relief
4 grade (M4)	– nipple and areola are cone-shaped, breasts are almost shaped
5 grade (M5)	– nipple stands out above the areola, breast is shaped
B. Pubic hair (Pubarhe - Po)	
1 grade (Po 1)	– prepubertal stage
2 grade (Po 2)	– single pubic hair and fluff
3 grade (Po 3)	– rare hair central part of the pubis, lacking shaped horizontal line
4 grade (Po 4)	– pubic hair is strong, has formed a horizontal line
5 grade (Po 5)	– pubic hair is both adults and little hair inside thighs
C. Axillary hair	
I grade (A1)	– single hair in axillae
II grade (A2)	– no full hair
III grade (A1)	– fully hair type as in adults
D. menarche - the date of first menses	
II. Pubertal development in boys	
A. Genital gonads + penis	
1 grade (Go 1)	– prepubertal stage
2 grade (Go 2)	– a slight relaxation of the scrotal sac
3 grade (Go 3)	– growth of gonads and penis
4 grade (Go 4)	– continuing the growth of the gonads and penis, more intense staining of the skin at the scrotum
5 grade (Go 5)	– completed development of the scrotum and penis
B. Pubic hair - as girls, but at 3 has hair on its belly and thighs	
C. Axillary hair - degrees of development are as girls	
D. Facial Hair	
1 grade	– initial (moss)
2 grade	– 1 grade < 2 grade < grade 3
3 grade	– type of adult
E. First night nocturnal pollution - date	

mary gland expands, darkens and becomes coarser. Below it is often palpable solid sometimes painful when pressure or slightly tense. At the same time, sometimes a few months later, the hair appears around the genitals. After a few months to 1 year appear underarm hair, sometimes thighs and forearms.

The most distinctive sign of puberty is ensuing onset of menstruation. The average age of onset is 12-13 years. Rarely after the first menstruation is established as a normal menstrual cycle. Typically, the first few menstruations occur in different time intervals (2-3 months or more).

Along with the development of the endocrine system, the sexual maturation are observed and substantial somatic changes **(Table. 10.3)**.

Changes in higher nervous activity. Particularly important are the changes in higher nervous activity. Badsed on morphological and functional development of the nervous system (regulatory mechanisms, the basic neural processes, particularly processes of internal, differential detention, second signal system), mental processes during the puberty period are turbulent, with increased excitability and lability. Adopting everything new becomes more and more perfect, abstract thinking develops. The logical thinking improve compared to the mechanical, the polarization of the interests in the fields of knowledge is perfected. The ability to predominate the volitional component, the consciousness, is increased. Emotionality gradually becomes more conscious. The adolescents during this period rehomed to romance, fantasies. This so-called age of spirits depends on the conditions of life in the family, the school, the society. Most young people are optimistic, looking to the future with hope, others have a sense of inferiority, negativity, grief - sometimes causes of unmotivated suicide. Erotic feelings develop earlier in girls. There is also a greater interest in clothes, hairstyles. The character of the individual is shaped, the intellect rises to the higher degree.

REFERENCES

1. **Bratanov. B.** Puberty, S., Medicine and phys., 1979, 19-23. (in bul.)

2. Children, family, school and society at the beginning of the XXI century realities, perspectives, solutions. ed. **Slavov Sl., G. Hristov, M. Nikolova, V. Vassilev, Y. Takeva,** ed. "Kamea Design", 2007, 502 p. (in bul.)

3. Decree № 2 of the MH, SG. 16, 2003 for the organization and conduct of preventive examinations in subjects from 0 to 18 and dispensary observation of mandatory health insured persons (Sections I, II and IV; Appendix № 1). (in bul.)

4. **Hadzhiolova, I., N. Tsaneva, E. Dincheva, V. Koycheva.** Performance and age. S., Med. and in phys., 1984, 10-28. (in bul.)

5. Hygiene problems of modern school ed. **Vl. Boyadzhiev.** S., Med. and phys., 1985, 17-70. (in bul.)

6. Hygiene of child and adolescent. **V.N. Kardashenko.** M., Medicine, 1980, 39-97. (in russ.)

7. **Kuzma C. R.,** Some features of physical developments of child and adolescent of modern stage, 2002, Health child mat. conf. pediat. Russ., 200-217. (in russ.)

8. **Milev, P.** What is acceleration? S., Med. and phys., 1987, 7-16. (in bul.)

9. **Mitova Z.** Age and sexual difference in some basic body circumferences throughout 9-15 years of age. Proc. of Balkan scient. conf. of Biolog., 2005, Plovd.

10. Morphological and physiological characteristics of the child, ed. **V. Gatev. S.,** Med. and phys., 1988, 19-22. (in bul.)

11. Physical development, physical ability and neuro-psychological reactivity of the population of Bulgaria ed. **Slunchev P.S.,** Med. and phys., 1992. (in bul.)

12. **Vasilev S.V.** Basic of age and constitutional anthropology. M. 1996 327. (in russ.)

13. **Zaimov, K., N. Kolev.** Anatomy and physiology of higher nervous activity. S., Science and Art, 1973, 207-221. (in bul.)

2. FEATURES OF HEALTH STATE OF CHILDREN AND ADOLESCENTS. Ts. Todorova-Popivanova

Significance of the problem of the health status of children and adolescents in our country is determined by the fact that the age contingent from 5 to '19 covers approximately 2 million people, ie about 22% of the population. In assessing the health status of children and adolescents are particularly important criterion for morbidity data. Over the past decade in children and adolescents reveals the beginning of a large number of chronic non-communicable diseases, constituting then a significant part of the pathology of the adult population. Moreover, increasingly found data for shifting the lower limit of these diseases to children. Simultaneously, from primary to higher grades chronic diseases increased about 1.5 times. It should be borne in mind that the diseases in school age have characteristic specificity, which is determined by morphological and psycho-physiological characteristics of the organism of children and adolescents.

2.1. STRUCTURE AND TRENDS IN MORBIDITY

Incidence in childhood and adolescence has been monitored at the beginning of the XX century. Kusitasev indicates that in 1902-1903 year 24% of students in the country have left school due to illness. Data on the health status of students found in the reports of doctors of established in 1905-1906 academic year "Teacher-medical institution" in the country. They inform about the widespread disease at the time of tuberculosis, typhoid and others. dangerous infections, mainly among the poor students and conditioned on dropout in schools, reaching 23% to 74%.

For the period until 1944 many authors indicate data on prevalence of many diseases such as otorhinolaryngologic - 40.8%, lung - 28.7%, anemia and poor feed - 68.6%, enlarged cervical lymph nodes - 69.4% reduced visual acuity - 20.3% and others. A topical issue for the youth pathology during this period still represents tuberculosis, malaria, rheumatism, heart damage, traditional school age infectious and parasitic diseases and others.

Scientific studies have found that over the period 1944-45 year, proportion of TB infected children and adolescents decreased within 3.2% -6%, but new patients registering children and adolescents from malaria -13%. A number of authors detected in school-age high rate of spinal curvature of all shapes and grades - from 37.2% to 58.3%; reduced visual acuity - from 11.9% to 27.2%; decreased hearing - 3.9%, speech disorders - 2.7% and others. The first favourable trends in incidence of students seen in 1956, according to which there is a reduction in the incidence of malaria and tuberculosis. It was found, although at a low rate, chronic gastrointestinal, renal and endocrine pathology.

There is a growing incidence of hypertension and allergic diseases. Statistics on the incidence of students during the period 1975-1981 was not show significant differences. Chronic diseases and anom-

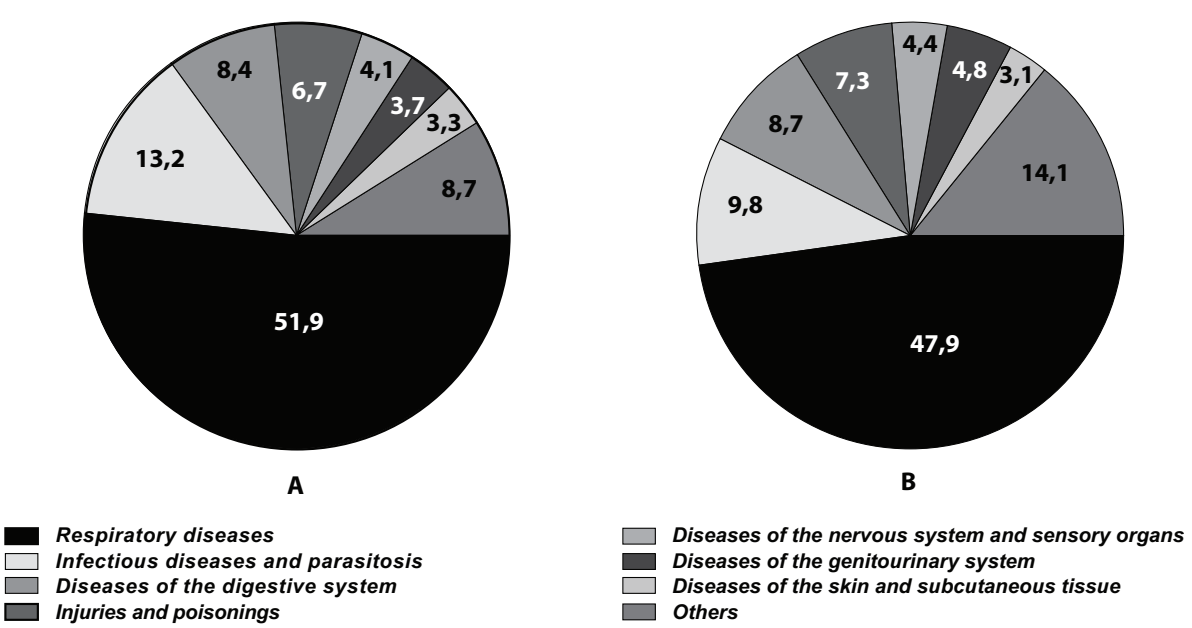


Fig. 10.6. Hospital morbidity per 100 inhabitants aged 0 to '14 at classes diseases. A - 1975-81 y.; B - 1981-93 years (average for the period)

alies fluctuated between 17.2% -21.2%. Continued reduction of desease as rheumatic and rheumatic cardiomyopathy and tuberculosis. Minor dynamics show speech abnormalities and reduced visual acuity, and neuroses tend to increase. Throughout this period the largest share in the structure of the current morbidity of students occupying lesions of the musculoskeletal system, followed by visual disturbances and chronic respiratory diseases. Hospital morbidity during almost did not show changes. The highest share was respiratory diseases, followed by infectious diseases and parasitosis, diseases of the digestive system, injuries and accidents, etc. In summary one can say that the data on morbidity during this period followed basically the trend typical of most developed countries in the world. The improved material living conditions, increased general and health culture of the population, preventive orientation of health and implement the achievements of medical science led to complete elimination or significant reduction of the number of severe and widespread in the past acute infectious and parasitic diseases affecting children and adolescents, such as poliomyelitis, diphtheria, typhus fever, typhoid, whooping cough and others. Most of the diseases vary favourable aspect and its pathomorphology as less severe and less often accompanied by complications. Of the chronic infections biggest achievements are again in relation to malaria, tuberculosis, whose active forms of this period are factual reduced to zero. The same goes for rheumatism and rheumatic cardiomyopathy. These same diseases in the past have led to severe disability and high mortality. In largely controlled disease conditions associated with malnutrition - alimentary dystrophy, avitaminosis, iron deficiency anemia.

The dynamics of morbidity in children and adolescents for the period 1981-1993 year shows that the structure of hospital morbidity highest relative share diseases of the respiratory system, but relatively low rate compared with the period 1975-81, the **(Fig. 10.6)**.

The rate of infectious diseases and parasitosis declined. Increasing the frequency of injuries and poisoning as well as diseases of the digestive system. In the structure of morbidity in turnover leading position have respiratory diseases, followed by the nervous system and sensory organs, diseases of the skin and subcutaneous tissue disorders, infectious diseases and parasitosis, traumas and poisoning and so on.

Studies over the past 10 years show growth in children and adolescents of hypertension, diabetes, cancer, obesity, neuroses and mental disorders, allergies, asthma and others. These diseases more clearly form a group so-called socioimportant diseases (SID), which are gaining in importance in childhood and adolescence. It turns out that at present chronic non-infectious pathology is diagnosed in children and adolescents average in 40-45% of cases.

The proportion of chronically ill students is high - 32.7 percent, and the risk threatened with a family history of children and adolescents was 26.7%. The incidence of chronic non-infectious diseases is growing in parallel with the age at which guys are relatively more often affected. The largest share was allergic diseases. Dominant are also elevated blood pressure and abnormal body mass respectively 16% and 7.9%. Between 14-18 years sharply increased incidence of chronic gastrointestinal diseases - 5.8%, neuroses and neurotic reactions - 6.5%. More than half of overweight students there is increased blood pressure.

Analysis of physical development and health of Bulgarian students according to data from prophylactic examinations for 2009 showed that reviewed 649 531 pupils aged 7-19 years (92.7%), abnormal health condition were found in 89 ‰ - 99 ‰. The highest incidence was reported at seventh graders - 146 ‰. Compared to 2008 there is a tendency to increase the number of children with abnormal health condition.

Leading the structure of the current morbidity prevalence in obesity students (18,4 ‰), diseases of the eye - 14,6 ‰, asthma - 7,4 ‰ and spinal deformities - 6 ‰. Compared to previous years, no significant differences in the incidence of these diseases, which gained the status of basic health problems in school age.

The summarized data for the country indicate that 15 749 children, ie 2.8% of students have a condition which requires dispansery system. The largest number of dispensary with respiratory diseases with allergic etiology, of epilepsy, reduced vision and blindness and insulin dependent diabetes.

For health reasons 2% (14,097) of students are completely exempt from physical education in classes. Compared with previous years there has been a significant drop in the number of students, attending groups for remedial gymnastics in schools.

All this necessitates the use of specialized medical and social programs for early diagnosis and prevention of these diseases in childhood and adolescence. WHO is investing heavily in the organization of complex-targeted program "CINDI" aimed at prevention of chronic non-infectious medical pathology, our country is one of 21 countries participating in this program. European countries England, France, Finland, Germany, the former Soviet Union entering the European Association for International Cooperation,

develop standard "Interadol" to assess the health of the European adolescent population.

2.2.FACTORS AFFECTING THE EMERGENCE OF CHRONIC NO INFECTIOUS MORBIDITY

Many and various are the factors that create conditions for the emergence of chronic non-communicable diseases in childhood and adolescence.

Disturbances in fetal development. Intrauterine failures facilitate the emergence of various complications during childbirth, and this in turn creates a basis for the development of postnatal pathology. Thus, it was found that head trauma occurs most often in inadequate pre-stricken brain and the factors that lead to such a condition most often number of anti- and perinatal causes, provocing by a different pathogenetic mechanisms hypoxic conditions in the fetus. Literary sources dealing with the adverse effects of factors such as prematurity and emphasized low body weight at birth, severe chronic feeding disorders and irrational nutrition in infancy and others. Total is the understanding that they can be regarded as a reason for the later onset of delayed physical and pubertal development, mental retardation and other diverse pathology.

Studies show that burdened with risk factors were 84.6% of students, while 61.1% of them noted a combination of 2 to 6 or more risk factors. Risk factors depending on the environment of origin, can be conditionally divided into endogenous and exogenous, and depending on its specificity - biological, social, environmental, etc., As most often they act on the body combined.

Abnormal physical development of children and adolescents. Deviations may also have regard to their health status. Thus, in children and adolescents with reduced body weight significantly more often than their peers with normal physical development, there are functional disorders, such as low blood pressure, decreased hemoglobin content in the blood, functional disorders of the central nervous system and others premorbid conditions. At 75% -80% of children and adolescents overweight observed various chronic diseases such as obesity, cardiovascular diseases, respiratory diseases and others. As for accelerated physical development, and it has not resolved the question of whether it is an expression of advanced functional maturity and increases the body's resistance or not. Most authors believe that the accelerated should not only be seen as a positive phenomenon, since it no always accompanied by strengthening health and physical perfection. Accelerated physical development can lead to heterohronology in the development of excretory systems and organs.

Feeding. A significant impact on health has nutrition. Equally harmful to the child and adolescent organism are as malnutrition and excessive food intake. Most often students in case of insufficient intake of proteins, vitamins, fruits and vegetables and consequently increased imports of saturated fatty acids, cholesterol, carbohydrates (bread, pasta, pastries), salt. Eating at students most often uniform with use mainly dry food, while a diet regimen and usually not in accordance with hygiene requirements.

Directly related to unhealthy nutrition is the formation of a group of students at risk of obesity. Obesity can be a result of both constitutional predisposition and the high energy unbalanced diet. Overweight is a prerequisite for the emergence of a wide range of diseases: cardiovascular, gastrointestinal, bile-liver, nephritis, emotional disorders and others. The significance of obesity as a risk factor is determined by the fact that 5% to 30% of students currently are obese.

No rational organization of the learning process. Hypokinesia. The growing intensification, irrational organization of educational process, learning mode, information overload and hypokinesia are risk factors.

It is known that students devote to preparing lessons considerable time, and stay outdoors and sport activities and physical activities are limited, while large numbers of students consistently do not get enough sleep. The consequences of the breaches in the mode of life and education adversely affecting the functional state of the cardiovascular system, on vegetative tone, on lipoproteinic profile, on the efficient use of oxygen, causing chronic fatigue and exhaustion, neurotic disorders and so on.

Smoking. Factor with increased health risk is smoking. Targeted studies of many authors outline the sharpest upward trend in smoking among young people **(Fig. 10.7)**, as the starting age of smoking shifting in the middle school age (11-15 years and about 60,000 smokers in that age), by expanding smoking girls and children from some ethnic and social groups.

Data from studies in 2008 showed that in Bulgaria 48% of workers in school and 56% of students smoke on school building every day or occasionally.

Equalize the frequency of regular smokers adolescents from the towns and villages of the country. The number of adolescents who smoke is greater in families where parents smoke. Passive smoking is also a major health risk.

Alcohol use. Alcohol consumption is also a risk factor of importance. Much of smokers students use

alcohol. The use of alcoholic beverages by young people in economically developed countries is constantly growing. Drinking alcohol is a causal relationship with a number of diseases of the liver, digestive system, with the emergence of neuro-psychiatric disorders, emotional and behavioural disorders, fatal incidents (murder, fires, drownings). Studies in the 80s in our country show that among the school contingents drink moderate 12.3% of boys and 8.7 percent of girls and seriously - respectively 8.9% and 1.2%. Established regular consumption in 9% of eighth graders and 40% - in the upper grades.

According to ESPAD (2003) 85% of the surveyed students indicated that they use alcohol and 45% - for drinking in recent years, and to a much lesser extent - of drugs and other intoxicating substances.

Drug use. Lately very dangerous phenomenon with serious health consequences is the use of narcotics and drugs. So far it is difficult to accurately determine the prevalence of drug abuse among children and adolescents because the actual number of drug addicts among them repeatedly exceed objectively reported cases - only 10% of them are registered in medical institutions. Research and expertise in the country give reason to assume that has between 15,000 to 20,000 heroin addicts or systematically abusing. Other studies in Bulgaria show that about 1/4 of students in big cities have some experience with drugs. A study conducted in Sofia schools indicates that at least 15% of students have experience with heroin and marihuana. Quickly lowers the average age of onset of abuse: heroin try 15-16-year-olds, heroin and marijuana - 14-15 year olds. 60-70% of those taking intravenous drug, suffer from chronic hepatitis B and C. The main drug in this country, however, is nicotine. Studies show that 17.4 percent of the 2.25 million smokers in the country (about 390,000 people) have nicotine dependence. Due to the high consumption of tobacco in the country - after 1990 Bulgaria ranks second in the world (4,05 kg per year) after Cuba - and high levels of nicotine and tar in bularian cigarettes- 1.3 and 24

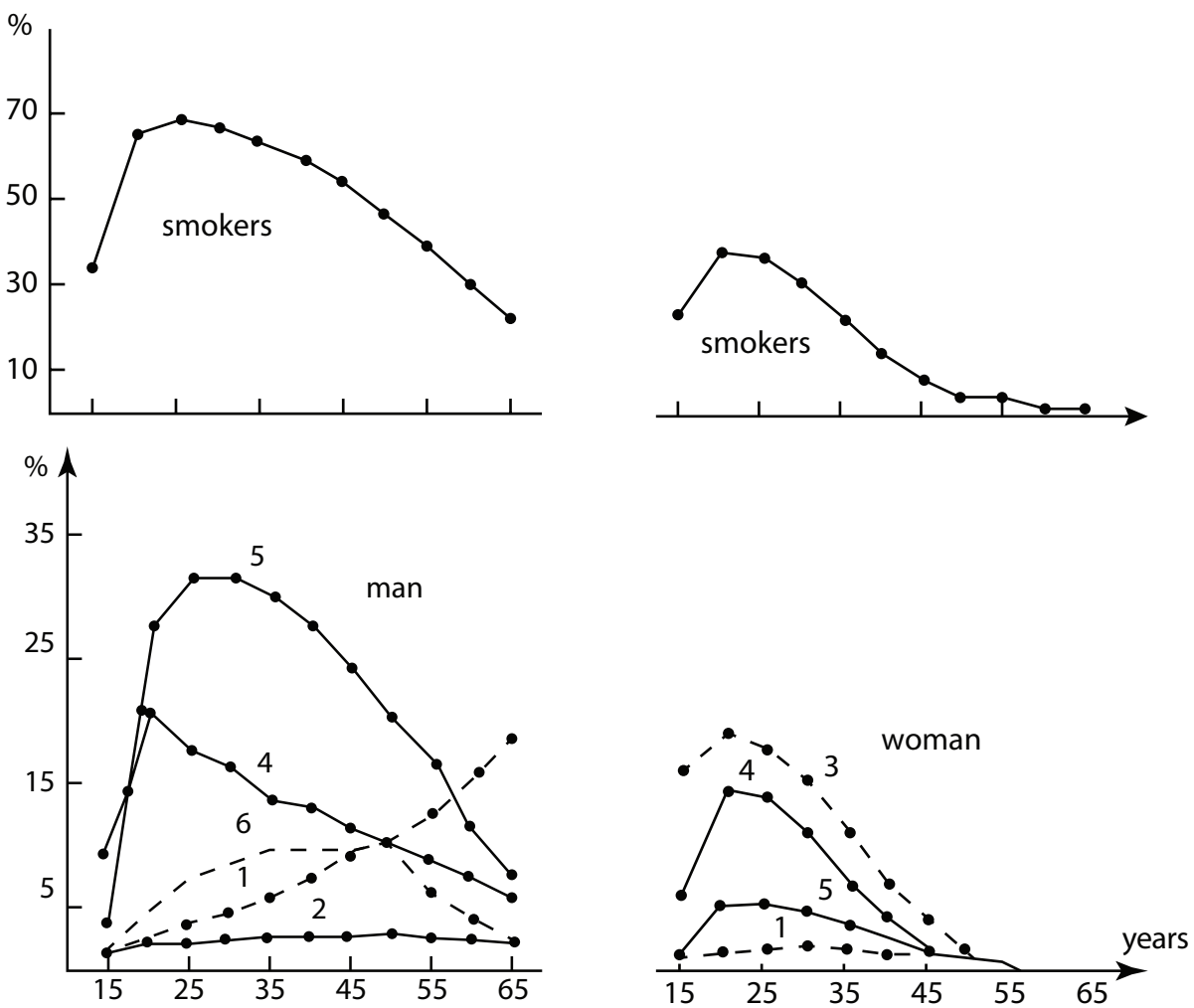


Fig. 10.7. Distribution of TS (share in the total population) by Ch. Merdzhanov, 1995
Above: all smokers (occasional and regular).
Below: 1. TS suspended more than five years. 2. TS suspended for less than five years. 3. Occasional smokers. 4. Smoking cigarette 1-10 dayly. 5. Smoking cigarette 11-20 dayly. 6. Smoked more than 20 cigarette dayly. (five-year age groups); - TS - tobaco smoking.

mg per 1 cigarette, very high risk of subsequent cardiovascular, pulmonary and cancer deseases.

Ecological factors. Great is the role of environmental factors in etiopathogenesis of chronic diseases. Widespread use of chemicals of life (food, clothing, overuse of antibiotics and medications, infusions of serums, immunizations, etc.), as well as increasing of environmental pollution (air, soil, water) and food create opportunities for complicated flow and frequent of chronic non-infectious pathology among children and adolescents. Numerous studies at home and abroad prove a negative health outcomes of children and adolescents in areas with significant atmospheric pollution compared to those living in areas with relatively clean air. This is mostly associated with increased sensibility of child and adolescent organism at all (incl. and chemical-toxic) effects of the external environment. The summarized results of the research show failure to physical growth, higher morbidity, lower index of health among children and adolescents from these areas.

Psycho-social factors. Urbanization with its features - high population density, information preintensity, fast rhythm of life, increased neuro-psychical stress, altered social relationships and behaviour and so on, causes certain changes in the health status of urban population, including children and adolescents. A no small percent of them are exposed to the harmful effects of psychosocial stress and situations of the city, which they can hardly cope.

Risk can be a number of psychosocial factors on public micro- and macro environment. There are observations of the existence of a relationship between psychosocial factors and the emergence of a number of chronic diseases such as allergies, cancer, infectious diseases and others.

Academic overload, high standards of education, psycho-emotional stress at school often lead to chronic fatigue and exhaustion, and provoke in students borderline pathological conditions. Hr. Christozov (1990), studying neurogenic factors associated with school, groups them into 14 major groups, among them the top rate three are related to the learning process and specifics of social relationships in school.

Family. The family, as the main socializing area, with disturbed functions can put children and adolescents, in relation to of their health, at particular risk. In children and adolescents from "problem" families significantly increases the risk of diseases with psychosomatic causes, coronary diseases, neuroses, transient or permanent mental disorders and others. Children living with a parent-alcoholic, two to five times more often than their peers endemic diseases, neurological symptoms and oth. It is essential and the level of social support. In families where children receive little support from parents, increasing manifestations of hostility, which is a prerequisite for the development of coronary disease. Conversely, hyperprotection, as and over the mishandling of children, is a factor that is relevant to the development of schizophrenia.

Risk groups. An important place as a precondition for the emergence of chronic non-infections diseases, occupies the group of so-called "often ill" children and adolescents. 32% of them too early is formed chronic pathology of the respiratory system, and in almost half the cases there was evidence of astenoneurotic syndrome. This risk group affects on "the level of health" of the entire contingent of children and adolescents.

Among risk groups prominently occupies the group of children and adolescents with functional complaints such as fatigue, headache, insomnia, palpitations, dyspepsia, depression and others. These conditions are considered as premorbid and most often are an expression of distress and disadaptation.

2.3. MAIN CHRONIC DISEASES IN CHILDHOOD AND ADOLESCENCE.
Ts.Todorova-Popivanova, A.Manolova

2.3.1. HYPERTENSION

Arterial hypertension (AH) in children and adolescents is defined as a systolic and/or diastolic blood pressure (SBP, DBP) equal to or higher than 95 age percentile, measured in at least three separate occasions.

Epidemiology. Epidemiological studies in different European countries establish average rate of hypertension of 2.3% to 15.3%, in proportion to the relatively persistent hypertension average of 6-7%. Extensive study in Australia of 6346 children and adolescents aged 7-17 years establishes significant distribution among them of hypertension. In static data CSO of MH, in prophylactic examinations of students in Bulgaria in 1993, is registered incidence of morbidity from hypertension in infancy 1-3 years - 0,01 on 1000 exam., in children 3-7 years it increased 10 times - 0.10 on 1000 exam., strong increases in age 7-14 years - 3.38 on 1000 exam. and more in the age 15-18 years - 8.43 on 1000 exam.

Our studies have shown that vascular dystonia of hypertensive type is more common in boys than girls and more in urban compared to rural children. It was found that hypertension is most common among students of specialized schools where workload is greater, and in different age groups up from

15.7% to 36%. Among students of general education schools the percentage is lower - an average of 9.6 percent in cities and 2.1 percent - in the villages (Ts. Popivanova, 1994).

Classification. Hypertension in childhood and adolescence are two types:

• *Primary arterial hypertension (PAH), so-called juvenile hypertension.*

• *Secondary symptomatic hypertension in this age* occur in diseases of the kidney, cardiovascular and endocrine system, increased intracranial pressure, neurofibromatosis of Recklinhausen.

In different age periods these two types have different significance. In nursing and early childhood leaders are symptomatic hypertension until in school age are prevalent cases of PAH.

In newborns, premature infants blood pressure should be measured in: noise in the abdomen, suspected coarctation of the aorta, abdominal tumor, burns, hemolytic-uremic syndrome, congenital adrenal hyperplasia, neurofibromatosis, failure to grow after the introduction of umbilical catheter, suspected kidney disease, Turner syndrome, unexplained heart failure, unexplained cramp.

Clinical picture. The primary arterial hypertension (PAH) occurs in childhood usually asymptomatic or by scant symptomatic of neurovegetative and vegetodystonic type. Children with hypertension are mostly overweight. Increased blood pressure is often the single most important diagnostic criterion. Therefore blood pressure should be measured necessarily once a year for all children over 7 years of age **(Table. 10.4)**.

Diagnosis. The diagnosis of PAH was placed in the presence of elevated values of at least 3 measurements within 1-2 months in different conditions. In **Table. 10.5** indicates the values of blood pressure, which are used for the diagnosis and classification of the severity of hypertension.

In the establishment of high blood pressure it is necessary to collect history, focused on major risk factors for PAH: family history (with hypertension, ischemic heart disease, cerebrovascular disease, diabetes, obesity, premature death from cardiovascular disease), history of eating (increased consumption of salt, carbohydrates and fats), physical activity, in older children alcohol consumption, smoking, cocaine, anticonceptive means, psycho-social climate in family and school, the characteristics of the character and behaviour of the child, his educational and out of class load.

Clinical examination includes a complete status, measurement of blood pressure of the 4 limbs, femoral pulse, auscultation (heart and abdomen), ECG, examination of ocular fundi and registration of body weight and height. There are also mandatory minimum laboratory tests (blood count, urine, urine culture, blood glucose, urea, creatinine, total cholesterol and triglycerides).

The course of PAH in childhood and adolescence is slow and seemingly benign. It was found that the earlier the beginning of the disease (the smaller the

Age	Physiological levels of AP		Normal but higher for age levels of AP		Elevated (pathological) levels of AP	
	systolic pressure	diastolic pressure	systolic pressure	diastolic pressure	systolic pressure	diastolic pressure
2 years	75-104	40-64	105-109	65-69	110	70
3 years	80-104	40-64	105-109	65-69	110	70
4 years	80-109	40-69	105-109	70-74	110	75
5 years	80-109	40-69	110-114	70-74	115	75
6 years	80-109	40-69	110-114	70-74	115	75
7 years	80-109	40-69	110-117	69-74	118	75
8 years	85-109	50-69	110-117	69-74	118	75
9 years	85-109	50-69	110-119	70-74	120	75
10 years	90-114	50-69	115-119	70-79	120	80
11 years	90-114	50-69	115-119	70-79	120	80
12 years	90-119	50-69	130-124	70-79	125	80
13 years	90-120	52-74	122-129	75-79	130	80
14 years	90-125	55-75	130-139	76-79	140	80
15 years	95-125	60-79	130-139	80-84	140	85

Fig. 10.4. Arterial pressure (AP) levels (mm Hg), accordingly child age

Table 10.5. Classification of hypertension in children and adolescents by ages

	High normal blood pressure 90-94 percentile (mmHg)	Significant hypertension (moderate) 95-99 th percentile (mmHg)	Severe hypertension 99th percentile (mmHg)
Newborns			
7 days		SAP 96-106	SAP≥106
8-30 days		SAP 104-109	SAP≥110
Kids 2 years	SAP 104-111	SAP112-117	SAP≥118
	DAP 70-73	DAP 74-81	DAP≥82
3-5 years	SAP 108-115	SAP 116-123	SAP≥124
	DAP 70-75	DAP 76-83	DAP≥84
6-9 years	SAP 114-121	SAP 122-129 (≥125)	SAP≥130 (≥135)
	DAP 74-77	DAP 78-85 ≥80)	DAP≥86 (≥88)
10-12 years	SAP 122-125	SAP 126-133 (≥130)	SAP≥134 (≥140)
	DAP 78-81	DAP 82-89 (≥81)	DAP≥90 (≥90)
13-15 years	SAP 130-135	SAP 136-143 (≥136)	SAP≥144 (≥150)
	DAP 80-85	DAP 86-91 (≥82)	DAP≥92 (≥90)
Adolescents			
16-18 years	SAP 136-141	SAP 142-149	SAP> 150
	DAP 84-91	DAP 92-97	DAP>98

child's age), the more serious the distant forecast, family history is a risk factor especially weighty, since in family burdened children, onset of the disease is in earlier age and the course is more severe.

Recent studies show that not only hypertension but also high normal blood pressure is associated with increased cardiovascular risk, especially when it can not be explained by height and body mass over age gender norms or combined with other risk factors.

Treatment. Treatment of PAH in childhood and adolescence is primarily nonpharmacological and includes a change in lifestyle, proper diet (reducing salt, more fruits, vegetables, protein, fish), increasing physical activity, providing proper daily regimen with enough time for sleep and rrest. The reduction of body mass in children with obesity in many cases affects BP. This is also the approach to children with high normal BP.

Drug treatment is indicated in significant and severe hypertension and the presence of target organ damage. Medicines applied in childhood hypertension should be directed to the basic pathogenic mechanisms: increased sympathetic activity, vascular hypercontractility, bulimia, spasm of the arterioles.

Children with PAH are dispensary and tracked by a general practitioner (GP) - AX I level, pediatric cardiologist - AX II-III level or pediatrician to 18 years of age: in moderate hypertension and lack of complaints examinations are performed at 3 months and in severe hypertension with complaints - monthly. In severe hypertension with organ pathological symptoms observations are an individual plan.

Prevention. Prevention of hypertension in children and adolescents is complex. It is an application of healthy mode of life and education, providing adequate sleep, daily outdoor stay, moderate physical activity, rational diet with restriction of salt, animal fats, carbohydrates, timely removal of mental tension, if needed guidance in health school, correct guidance to the appropriate school and profession.

2.3.2.ATHEROSCLEROSIS

From a number of authors assumed that in the process of life, there are long latency period for the development of atherosclerosis, which dates back even from infancy. Histological studies of children and adolescents died in the first two decades of life, raise doubts that the initial morphological atherosclerotic changes begin in childhood. It is unknown, however, how early was initiated these changes. It has been found that so-called "yellow stain" may occur in the endothelium of the aorta even in infancy. It is believed that they may disappear, to remain un-

changed or later to become atherosclerotic plaques - depending on the living conditions and accompanying other diseases.

Risk factors. Studies in Bulgaria at the end of XX century. (D. Belova, 1981) found in 59.0% of the surveyed children with primary hypertension disorders in fat metabolism conducive to the development of atherosclerosis. Similar changes in the blood were found in children with diabetes mellitus, myxedema, obesity, chronic nephritis, etc.

Overweight, obesity, hypertension, pituitary disorders and other diseases associated with disturbances in the lipid metabolism, are the most common risk factors for early development of atherosclerosis including children and adolescents.

It is noted that there are two groups of children: those with a risk factor for developing atherosclerosis and those with obvious symptoms of this disease. With respect to children of both groups are required and severe early preventive effects for the prevention of development of disease. Great importance for the development of atherosclerosis is hypertension and the factors that facilitate its emergence - mental overload, psycho-emotional stress, anxiety, disturbance, chronic fatigue and more. It is important that the abuse of nicotine, tea, coffee, alcohol, hypodynamia, overfeeding and unhealthy nutrition. It is assumed that the rich in animal fat and saturated fatty acids diet, act atherogenic. The occurrence of atherosclerosis influence also some disturbances of the endocrine glands - pituitary, sex glands, thyroid gland. Of importance is the family history.

Pathogenesis. The pathogenesis of the disease, especially in children and adolescents is not entirely clear. There are groups of factors:

1. Create a predisposing background - genetic, physiological features associated with age and gender.

2. Immediately causing - neuro-hormonal disorders, functions related to metabolism and coagulation factors.

3. Factors enhancing atherosclerosis - intoxications, allergic, infectious, inflammatory processes.

Plays an important role blood pressure. Disturbances in the intermediate metabolism of lipids, hemostasis distortions, an increased amount of active oxygen species and free radicals in the plasma are pathogenetic moments which enable the impregnation of the vascular walls and the formation of atheromatous plaques. The prognosis and course of atherosclerosis depends in children and adolescents and of concomitant main disease, of localization of atheromatous process and the degree of subsequent changes in arterial vessels. Particularly serious is the prognosis for the development of coronarosclerosis, in atherosclerotic of renal artery.

Prevention. Prevention of atherosclerosis must begin in early childhood. Of great importance is the formation in early childhood habits of health - hygienic lifestyle and living stereotype of behaviour, rational nutrition, application of active physical regime, avoiding prolonged psycho-emotional stress, mental overload, fatigue and others.

2.3.3.OBESITY.

Ts. Todorova - Popivanova, A. Manolova

Obesity is a medical condition, which is expressed by an increase in body weight due to the increase of adipose tissue, due to hyperplasia and/or hypertrophy of the fat cells.

Epidemiology. The incidence of obesity varies according to the different authors from 3 to 25%. It occurs in all age periods, of greatest importance in adolescence.

Obese in Germany are 15% to 25% of children and adolescents, in US - 5% to 25% (most common metabolic diseases), and in England - 17%. In Spain, this percentage is lower - 5.3 percent. In our country obesity, according to various studies, ranges between 12% and 13%. Usually, cases of obesity are more common in early childhood and pre-school age - from 5.2% to 7.9% in sledpubertetniya period - from 10.9% to 15.5%. In 2004 Bulgaria overweight among children under 18 years of age is set at 20%, of which obesity is 5%. In a study among students from first grade, conducted in 2008, found that 30% of children are overweight, hyperweight were 17% and obese - 13 percent of them.

Children with obesity are very likely obese teenagers and then obese adults. The probability of a obese child at age 15 to suffer from obesity in adulthood reaches 71%. For this more frequent are expressed forms (II - III St.) of obesity. More often observed obesity among female, pointed out many authors. This is explained by the higher content of fat cells in girls in the neonatal period and during puberty. According to other authors no gender difference in the number of fat cells, but the size of adipocytes in women are greater. Nurseling should be considered to be critical with respect to the occurrence of obesity, since it coincides with the period of enhanced proliferation of adipocytes. According to some studies obesity starts in 26% of cases in the first year of life and 36% of cases - between 3 and 7 years. The high rate of adolescent obesity during puberty is the most common consequence of existing in such an early age.

Older obese commenced in childhood, are at higher risk of developing a number of chronic non-infec-

tious diseases such as type 2 diabetes, hypertension, atherosclerosis, hyperlipidemia, malignant, kidney, liver diseases and associated increased mortality.

Considerably increased risk (risk > 3 times)	**Moderately increased risk** (risk > 2 times)	**Low increased risk** (risk > 1 time)
• Hypertension	• Cardiovascular diseases	• Cancer
• Dyslipidemia	• Osteoarthritis	• Back pains
• Insulin resistance	• Gout	• Malformations
• Type 2 Diabetes	• Asthma	
• Sleep apnea		
• Cholelithiasis		

Obesity in childhood can have significant emotional consequences for children, their self-esteem and quality of life. Studies found that nine year olds connect obesity with poor relationships with coevals, bad grades in school, poor health and physical fitness.

Etiology. Many and various are the etiological and risk factors provoking obesity. These may be overeating, decreased physical activity, family history, endocrine disorders, artificial feeding in infancy, abnormal body weight of the infant at birth and others.

1. Exogenous factors. In the etiopathogenesis of the disease has important role of stress. Stressful impact, however, must be linked to a particular genetic predisposition, since at stress only 30% of the population react to abrupt changes and increased appetite, with all the ensuing consequences. Irregular meals often highlighted as a reason for maintaining the hyperphagia and obesity.

2. Endogenous factors. Importance for the appearance of obesity have organics CNS disorders, in particular lesions in the hypothalamus region that are associated with symptoms of expressed bulimia. Endocrine factors also are related to the onset of obesity.

Classification. The following different degrees of obesity:

- *I degree - weight gain of 15% to 30%;*
- *II degree - an increase in body weight from 31% to 50%;*
- *III degree - an increase in body weight from 51% to 100%;*
- *IV degree - weight gain of 100%.*

In relation to the etiology and clinical, obesity is classified into the following groups:

1. Primary obesity - alimentary, regulatory, metabolic.

2. Secondary obesity - tsentralnonervno, endocrine (pituitary, hypothyroid, adrenocortical, hypoovarian).

3. Rare syndromes of obesity.

Primary obesity is the dominant form in over 95% of cases in children and adults. Usually concerns are discrepancies between import and consumption of energy. In many cases, establishing interference in thermogenesis, which explains both rapid weight loss and its rapid recovery. Genetic factors have a certain significance - in families where parents are of normal weight only 7% of children are obese, while those in which one or both parents are obese, the rate of obese children is respectively 40 and 80%.

Diagnosis. There are many indicators and methods used for the diagnosis of obesity - body mass and body mass index **(Table. 10.6)**, thickness of skin folds, tours (by hand, hip, waist, hips), assessment of adipose tissue, computer setting the volume of fat cells and the like.

For screening diagnosis of obesity during prophylactic examinations of children and adolescents, evaluated the deviation of their bodyweight from averages for age and gender (in tables of the national average weight - $\overline{X}$, and standard deviation - sX). Individual assessment is based on the following groups:

• *Normal weight* - when the weight of the tested person is between $\overline{X} \pm 1sX$.

• *Overweight - measured body mass* and between $\overline{X} + 1sX$ and $\overline{X} + 2sX$.

• *Obesity* - the values of body mass over $\overline{X} + 2sX$.

For the diagnosis assess whether the excess body weight due to increased muscle mass (for active sportsmen children) or by accumulation of body fat.

Obesity is diagnosed and over the ideal body weight (body mass index). Thus avoiding error as obese child be taken in which the excess body weight combined with higher than age-sex norms growth (the child is large for his age without being obese).

Clinical picture. Leading medical history and clinical signs of obesity include:

- *Increased appetite*
- *Strong thirst (usually consumed sweetened soda-drinks, which further increase imports of energy).*
- *Increased sweating*
- *Overtiredness*
- *Neurotic events and headache (transient)*
- *Family history of obesity*

At high degrees forms possible decrease in attention and memory loss.

Complications. The general condition of the children is good, but with increasing degree and age of obesity appear a number of complications, psycho-

social dysfunction, multiple effect on growth and sexual maturation, abnormal carbohydrate metabolism and others. Children with obesity are two to six times higher risk of developing hypertension. Hyperlipidemia affects about 10-20% of obese children, and fatty deposits and fibrosis patches, that are considered precursors of atheromatous changes be established as early as the first decade of their lives.

Treatment. Treatment of primary obesity include diet (800 kilocalories per day at preschool and 1000 kilocalories of school age). In view of the growth and development need to provide enough protein, vitamins and trace elements. Of particular importance is the work with the families of obese children, aimed at changing dietary habits and stereotypes. Physical activity of moderate intensity is optional point in the healing complex.

Medicated means of reducing appetite are not indicated in children.

Forecast. In childhood it is rather bad - only about 25% of children achieving long-term reduction of body weight, at about 1/4 change does not occur, and at about half of the obesity progresses.

All children and adolescents dispensary and tracked by a general practitioner or pediatrician every six months until recovery or until the age of 18.

Table 10.6. International WHO criteria for assessing weight in children 7-19 years, by Body Mass Index (BM) for age and sex

Age (years, months)	BMI for age weight (kg) / height (m)²				BMI for age weight (kg) / height (m)²			
	Subnormal weight (under values)	Normal weight	Over-weight	Obesity (over values)	Subnormal weight (under values)	Normal weight	Over-weight	Obesity (over values)
	Boys				Girls			
7 y. 0 m.	13,10	13,10 – 17,00	17,01-19,00	19,00	12,70	12,70 – 17,30	17,31 – 19,80	19,80
7 y. 6 m.	13,20	13,20 – 17,20	17,21-19,30	19,30	12,80	12,80 – 17,50	17,51 – 20,10	20,10
8 y. 0 m.	13,30	13,30 – 17,40	17,41-19,70	19,70	12,90	12,90 – 17,70	17,71 – 20,60	20,60
8 y. 6 m.	13,40	13,40 – 17,70	17,71-20,10	20,10	13,00	13,00 – 18,00	18,01 – 21,00	21,00
9 y. 0 m.	13,50	13,50 – 17,90	17,91-20,50	20,50	13,10	13,10 – 18,30	18,31 – 21,50	21,50
9 y. 6 m.	13,60	13,60 – 18,20	18,21-20,90	20,90	13,30	13,30 – 18,70	18,71 – 22,00	22,00
10 y. 0 m.	13,70	13,70 – 18,50	18,51-21,40	21,40	13,50	13,50 – 19,00	19,01 – 22,60	22,60
10 y. 6 m.	13,90	13,90 – 18,80	18,81-21,90	21,90	13,70	13,70 – 19,40	19,41 – 23,10	23,10
11 y. 0 m.	14,10	14,10 – 19,20	19,21-22,50	22,50	13,90	13,90 – 19,90	19,91 – 23,70	23,70
11 y. 6 m.	14,20	14,20 – 19,50	19,51-23,00	23,00	14,10	14,10 – 20,30	20,31 – 24,30	24,30
12 y. 0 m.	14,50	14,50 – 19,90	19,91-23,60	23,60	14,40	14,40 – 20,80	20,81 – 25,00	25,00
12 y. 6 m.	14,70	14,70 – 20,40	20,41-24,2	24,20	14,70	14,70 – 21,30	21,31 – 25,60	25,60
13 y. 0 m.	14,90	14,90 – 20,80	20,81-24,80	24,80	14,90	14,90 – 21,80	21,81 – 26,20	26,20
13y. 6 m.	15,20	15,20 – 21,30	21,31-25,30	25,30	15,20	15,20 – 22,30	22,31 – 26,80	26,80
14 y. 0 m.	15,50	15,50 – 21,80	21,81-25,90	25,90	15,40	15,40 – 22,70	22,71 – 27,30	27,30
14 y. 6 m.	15,70	15,70 – 22,20	22,21-26,50	26,50	15,70	15,70 – 23,10	23,11 – 27,80	27,80
15 y. 0 m.	16,00	16,00 – 22,70	22,71-27,00	27,00	15,90	15,90 – 23,50	23,51 – 28,20	28,20
15 y. 6 m.	16,30	16,30 – 23,10	23,11-27,40	27,40	16,00	16,00 – 23,80	23,81 – 28,60	28,60
16 y. 0 m.	16,50	16,50 – 23,50	23,51-27,90	27,90	16,20	16,20 – 24,10	24,11 – 28,90	28,90
16 y. 6 m.	16,70	16,70 – 23,90	23,91-28,30	28,30	16,30	16,30 – 24,30	24,31 – 29,10	29,10
17 y. 0 m.	16,90	16,90 – 24,30	24,31-28,60	28,60	16,40	16,40 – 24,50	24,51 – 29,30	29,30
17 y. 6 m.	17,10	17,10 – 24,60	24,61-29,00	29,00	16,40	16,40 – 24,60	24,61 – 29,40	29,40
18 y. 0 m.	17,30	17,30 – 24,90	24,91-29,20	29,20	16,40	16,40 – 24,80	24,81 – 29,50	29,50
18 y. 6 m.	17,40	17,40 – 25,20	25,21-29,50	29,50	16,50	16,50 – 24,90	24,91 – 29,60	29,60
19 y. 0 m.	17,60	17,60 – 25,40	25,41-29,70	29,70	16,50	16,50 – 25,00	25,01 – 29,70	29,70

Prevention. Great practical importance for prevention is timely disclosure of risk factors that cause obesity and their elimination. It is necessary to avoid overfeeding, particularly in the first weeks and months after birth, when forming fat cells. No less important is the creation of habits for rational nutrition and diet. It is necessary to avoid hypodynamic life and the formation of habits of active motor recreation. Providing appropriate snacks and meals in kindergartens and schools is important, not only to prevent obesity but also to form a correct attitude towards healthy nutrition.

Information on healthy eating should be included in educational programs and in the media.

Children and adolescents with different degrees of obesity need not only dispensary observation but also by competent practical advice of the doctor regarding dietary regimen, lifestyle, and to be teach how to control and regulate their own body weight.

2.3.4. DIABETES MELLITUS

Diabetes is a chronic endocrine metabolic diseases, which occur in all periods of childhood and adolescence, the frequency is highest during puberty. Both sexes are equally affected.

Epidemiology. Spread worldwide ranged from 0.07% to 1.9%. In Bulgaria the average annual incidence was 6.01 per 100 000 children, and the instant morbidity - 0.45%. It is essential prevalence of the disease in towns - 6.91 to 4.55 per 100,000 in rural areas.

In the last 10 years have seen a doubling in the incidence of diabetes in childhood. Dispensarised of students in our country those with type I diabetes are in fourth place as number of cases.

During the newborn disease is the exception - for 100 years in world literature have described about 15 cases. The incidence of diabetes in infancy varies from 0.20% to 0.51%. Most often diabetes occurs between 5 and 15 years of age, as his manifestation becomes more frequent during the period of rapid growth. Increased frequency of diabetes in prepubertal and pubertal period is associated with the growth rate of the Langerhans' islets of the pancreas. It is believed that the sugar disease occurs most often when growth of insular tissue of the pancreas is the highest compared with growth of remaining pancreatic tissue and vice versa. Diabetes mellitus in children occurs approximately equally common in boys and girls.

Classification. Distinguished:

1. Type I insulin-dependent diabetes (formerly juvenile diabetes, primarily affecting children, adolescents and young people under 30 years).

2. Type II non-insulin dependent diabetes (formerly adulten diabetes), primarily affecting adults over 40. Diagnoses and in adolescence, as in 80% of cases combined with obesity.

3. MODY (Maturity diabetes in the young) - mainly affects adolescents and young adults under 30

4. Genetic diabetic syndrome - in syndrome Turner, Klinefelter syndrome and others.

5. Secondary diabetes in mucoviscidosis, polytransfusion haemosiderosis, Cushing's syndrome and others.

Diabetes in childhood and adolescence is mainly primary, idiopathic and genetically deterministic.

• *In type I diabetes* there is a genetic predisposition, with 95% of patients have the HLA alleles DR3 and/or DR4. Besides genetic components are discussed and immunological mechanisms (viral infections). Although the triggers for autoimmune process is still unknown, occurs gradually degradation of β-cells with relative and subsequent absolute insulin deficiency.

• *Type II* is a more common genetically determined as for it manifestation contributes obesity-related with insulin resistance.

• *MODY* is inherited autosomal dominant.

Clinical picture. In our country 98% of sick children with type I diabetes. In these autoimmune process has been slow, but the manifestation of hyperglycemia happens most often suddenly in connection with stress or banal infection.

Polydipsia and nocturia are leading signs. On background of expressed polyphagia, demonstrated a reduction in body weight. Equally often found and anorexia. Patients showing signs of fatigue, severe flushing (rubeosis diabetica), girls often found candida vulvitis. If so far diabetes is not diagnosed, can occur ketoacidosis, abdominal pain, vomiting, exsiccosis and disturbances in consciousness to coma.

Diagnosis. Based on history, severely elevated blood glucose (over 200 mg/dl - 5,55 mmol/l), positive test for sugar in urine and acetonuria. Initial treatment is mandatory in clinical setting and also specific therapy includes training of the sick child and his parents for independent control of the metabolism, adjustments in insulin dose, diet, explanations of complications, for emergencies, behaviour at intercurrent diseases, motor mode and so on. Improper treatment occur early complications, resulting in delayed growth and pubertal maturation, in parallel with hepatomegaly and Cushing's obesity - ie. syndrome Moriak.

Treatment. The goal of treatment of diabetes in childhood and adolescence age is to achieve a continuous compensation of the disease through

diet, insulin therapy and physical exercise. Diabetic children should be brought together with and as healthy children.

Health conformable organization of learning and training, diet nutrition and reducing psycho-emotional stress, moderate physical activity, the right choice of school and future profession and other prevention activities are essential to maintain their performance and health status. Of great importance is the implementation of the rehabilitation of the sick, and the timely detection of early forms of the disease.

Treatment of diabetic children lasts a lifetime and includes individual therapeutic complex of three main points:

1. Diet.

2. Insulin.

3. Motor activity.

The aim is to achieve optimum compensation for metabolism, prevention of late vascular damage, creating conditions for the proper performance of the processes of growth and development. All diabetic children subject to monthly dispensary observation of children's endocrinologist, and in their absence - from pediatrician, to 18 years of age.

Complications, forecast. Of particular importance for prediction of diabetes is the emergence of later disability, affecting organs which have the same intracellular glucose level as the blood - renal glomeruli, vessels, nerves, retina. Vascular injuries are divided into:

- *A typical diabetic microangiopathy* - retinopathy, nephropathy, neuropathy and diabetic gangrene.
- *Non-diabetic microangiopathy* - affects the large arteries and arterioles, and in this case it is a fast, progredient atherosclerosis.

Unfavourable prognostic is the appearance of nephropathy.

2.3.5. NEUROSES, EMOTIONAL AND BEHAVIOURAL DISORDERS

Epidemiology. According to the WHO neuroses, emotional disorders and behavioural abnormalities in children and adolescents occur in 3.0% to 15.0%. Studies in Australia establish a general psychoneurotic morbidity in children 10.0%, in adolescents - 16.0%, in adults - 24.0 percent.

Neurotic morbidity in the country in school age in the late XX century fluctuates between 14.8% and 22.0%. In foreign language schools, where the load is greater, there is also a higher rate. There is a tendency to equalize the values of neurotic prevalence of students from Sofia to the towns and villages of the country. There is an increase of neuroses in adolescence, than childhood, and youth, compared with adolescents. Neurotic morbidity in Sofia pupils in initial training was 9.8%, in the average rate -16.3%, and the top rate - 24.2 percent. In the majority of students - 60% -70%, are found occasional neurotic complaints such as headaches, fatigue, tendency to anxiety, insomnia and oth.

Emotional disorders. They reflect problems related to behaviour and adapt communication of feelings to the specific situation. Typical forms of emotional disorder is the fear of separation, anxiety, depression, hypochondria etc.

Behavioral disorders. These are behaviours that posed problems for the individual or for the those around. It specifies that this is dissociative, aggressive or defiant behaviour, which is a serious contravention of the relevant for age and social norms behaviour. Expression of change to it, can be more escapes from school and home, theft and violence.

Violations behaviour is more common in boys, regardless of age and his type.

Suicide attempts are directly related to the problem of neuroses and mental disorders. In recent years, these attempts, particularly among boys and girls, frequent. According to the WHO suicide occupy the II-nd or III-place among the causes of death of 14-18-year-old adolescents in Europe and their number continues to grow. Studied in our 14-year-olds with neurotic disorders, have attempted suicide in 0.1% of cases in adolescents, and in 1.7% of cases the girls.

Czech researchers found that neurotic symptoms in early childhood have two peaks. The first peak covering the first two years of life, and the second is between the sixth and eighth year. During these two periods occurred almost two-thirds of emerging neuroses at this age.

Etiology. Neuroses are most often multifactorial conditioning.

In the process of maturation and development of the child, psychic conflicts are becoming larger scope and longer duration. In the older students there already morfophysiological prerequisites for suppressing emotional reactions, which on the other hand can lead to an increase in chronic mental stress. During puberty the smallest conflicts with the external environment can provoke strong emotional response. In this age, however, due to the development of diferentiated processes, better assess the adequacy of the response to external stimuli, and also develops resistance to certain irritants from early childhood.

1. A psychological trauma in the family and the school. In the opinion of many authors, decisive in

the etiology of neurosis and mental disorders in students, are a psychological trauma of family and school character. At school etiologic factors most often concern the high demands of the education system, educational overload, psycho-emotional strain, chronic fatigue, various pedagogical inconsistencies in the behaviour of the teacher to the student and so on.

Usually in older children and adolescents psychogenic factors of school environment begin to dominate over those of the family. The family, as the main socializing area, with disturbed functions can also put children and adolescents at special risk. Highest among family risk factors occupies a "lack" of one or both parents - divorce, death, etc., followed by factors misunderstanding in the family, scandals, rude behaviour to the child and others. In children and adolescents living with an alcoholic parent, two to five times more often than their peers meet neurotic symptoms, mental abnormalities. An important factor in the family environment, which is directly related to the mental health of children and adolescents, the level of social support. In families where children receive little social support are increasing manifestations of hostility, which is a risk factor for the development of neurotic conditions, coronary disease and others. Conversely, hyperprotection, and also cold and harsh treatment can play a role in the development of schizophrenic disorders.

A role in the emergence and progress of neuroses play also economic, social and cultural structure of society. Collective institutions, which include children and adolescents, facilitate tracking of the effects of neurotic stimuli.

2. Organic diseases. Single manifestation of certain organic disorders such as encephalitis, certain forms of epilepsy, neoplasms and traumatic status of the central nervous system and others can be emotional and behavioural disorders.

Chronic diseases generally increase the risk of psychosocial problems such as neurosis, deficits in attention and school low results. Behavioral disorders due to chronic illness increases 1.55 times as compared with their levels in healthy children. Abdominal pain and headache, relatively common among adolescents, showed significant coincidence with emotional and behavioural abnormalities, as this relationship is greater for the latter.

Clinical picture. The consequence of the development of neuroses and mental disorders in childhood and adolescence is the formation of another disposition of the individual. Changes to a number of characteristics of the child and adolescent as temperament, emotion, flexibility, general performance and others, and thus impair the ability of the child to social re-integration. In children and adolescents the main spheres of social commitment are three - school, friendly and family environment. The most sensitive indicator of social disadaptation prove violations of relationships in the school sphere, since it is the highest requirements. Disadaptation to student learning, results in low adoption of the material, loss of interest, difficulty concentration, negative attitudes toward school and others. Compared to teachers, and staff disadaptation manifests as negative attitudes and confrontation with teachers deterioration of relations with classmates, loss of friends and others.

Prevention. Prevention of neuroses and mental disorders in children and adolescents in the spirit of contemporary understandings of psychohygienic and psychological treatment, should be directed mainly towards organizing a broad medical and pedagogical and psychological counseling of parents, teachers, incl. and the students themselves.

In this respect, play an important role school doctors, school psychologists and psychotherapists. It is necessary streamlining the whole day's training regimen in school, educational plans and programs, to reduce regimes and school information overload and formation of positive psycho-emotional attitude towards learning. When choosing a school and future career, needs to avoid training and profession associated with a significant neuro-psychological tension, not in accordance with the wishes and possibilities. A large part for prophylactics and removing the risk factors of family environment, provoking neuroses, have family doctors. What is needed is also close to nature, physical activity and especially making since childhood individual skills to maintain mental equanimity.

2.3.6. ALLERGIC DISEASES

Epidemiology. Studies of many authors in recent years speak for the general prevalence of these diseases in childhood and adolescence. According to statistics in the US about 20% of children age to 15 years with allergic diseases. Studies of M. Noecker et al. (1993) suggest that the prevalence of allergic diseases in children and adolescents between 18% and 26%.

An allergy is the cause of 1/3 of chronic diseases in children and adolescents up to 17 years.

Data from prophylactic examinations of students in Bulgaria in 2009 show that the structure of the instant morbidity of asthma in third place - 7,4 ‰. Dispensarised of over 15 thousand students the most are those with allergic respiratory diseases.

Etiology

1. Exogenous allergens. There are numerous conditions and factors that favour the occurrence of allergic reactions and diseases:

- *Use of chemicals of modern life.*
- *A wide and uncontrolled use of drugs.*
- *The mass administration of vaccinations, immunizations, blood and plasma transfusions, etc.*
- *Artificial feeding in infancy.*
- *Invasion of synthetic fabrics in everyday life.*
- *Contamination of air, soil and water, etc.*

2. Endogenous allergens. Besides the above exogenous allergens exist and endogenous allergens. Endogenous conditions and factors conducive to the occurrence of allergic diseases can be: burdened heredity; congenital or acquired immune deficiencies; diseases, suppressing the suppressor activity of T-lymphocytes and others. Studies have shown that some of the endogenous allergens may cause the occurrence of chromosomal aberrations, thereby creating a prerequisite for the spread of allergic diseases in generations - family history.

Pathogenesis. Allergic processes pathogenetically most often the result of an immunologically mediated hypersensitivity of the organism to substances with signs of foreign genetic information - allergens. Now it is assumed that the allergy is appropriate biological process, aimed at the detection of the allergen, which has entered into the internal environment of the organism, thereby limiting the zone of its action. An allergic reaction is essentially a protective mechanism involved in maintaining antigen persistence in the body. Allergic reactions can be divided into two major groups:

1. Allergic reactions immediate type (humoral) where local and global events develop immediately after falling allergen in sensitized organism.

2. Allergic reactions delayed (cellular) where deployment of local and global events occurs after a latency period of several hours after antigen challenge. At allergic immediate reactions fall anaphylactic shock, bronchial asthma, urticaria, Quincke edema, and others. Allergic delayed reactions observed in tuberculosis, in streptococcal infections. In some cases of drug allergy were observed both reactions.

The most common allergic respiratory diseases in children and adolescents are allergic rhinitis, asthmatic bronchitis, bronchial asthma, allergic reactions to vaccinations and others.

- ***Allergic Rhinitis***

Allergic rhinitis in infancy is a common disease that mistakenly diagnosed as infectious. Etiological antigens are mainly inhaled and bacterial, but can also be foods (for example, cow's milk). Allergic rhinitis occurs in two forms:

1. Seasonal allergic rhinitis called. "Hay fever" caused by tree pollens, mostly in the spring, and grass pollen - in summer and early autumn.

2. Permanent allergic rhinitis - last all year. Most often antigens when it is municipal - inhaled, bacterial and food. The forecast for both types of rhinitis is favourable.

- ***Asthmatic bronchitis***

It is a form of bronchial asthma. It is characterized by longer duration, moderate dyspnea, cough and rich auscultatory fidings. It appears most often to 4 years of age, decreasing in pre-school and school age. In its etiology most important is viral and bacterial sensitization. The estimate of the asthmatic bronchitis is favourable, considering that as the child grows, increase its general and local immune defense mechanisms.

- ***Bronchial asthma***

This is one of the most severe allergic respiratory diseases. 30% -50% of cases in adults it stems from childhood. Its distribution by sex is 2: 1 in favour of the boys, after the age of 10 became leveling in the ratios. The most common antigens are household - inhaled and bacterial. The pathophysiological mechanism, leading to obstructive syndrome due to bronchospasm, edema and mucous hypersecretion of mucus glands, creating conditions for ventilatory failure and microatelectasis. The prognosis of asthma in children is relatively good. In terms of prognosis differ two groups of children: those with good prognosis - in asthma without a family history, and those with serious prognosis when there is family history and then by both parents.

- ***Allergic diseases of the digestive system***

Allergic diseases can be a number of events of gastritis, gastrospazam, colic, recurrent vomiting, enteritis and others. The most common allergens are usually different foods.

Allergic reactions may affect isolated oral cavity, stomach, intestine and individual segments thereof, and also combined. Of food allergens that cause children allergic reactions, the most common is cow's milk. It is particularly important for breastfeeding period. The incidence of allergies from cow's milk in "healthy" children is from 0.03% to 1.3% and in case of "sensitive" (in other allergic reactions) up to 30%, most often occurs from 2 to 5 months age.

- ***Drug allergy***

Much of the drugs are simple inorganic and organic compounds and have the properties of haptens.

Medications that are most likely to allergic reactions in children and adolescents are: antibiotics - particularly penicillin and streptomycin; aspirin; ACTH - can give a severe and even life-threatening

reactions; insulin; iodine compounds; sulfonamides; phenotiacinyc drugs and the like.

- ***Allergic reactions to vaccinations***

They are observed in almost all vaccines. Allergic reactions are predominantly of the skin - various rashes, local violent reactions, which may be accompanied by fever, reactions from respiratory and exceptionally common reactions of anaphylactic shock.

- ***Anaphylactic shock***

It is the most serious and violent allergic disease, which often leads to death. It grows in a sensitized organism for repeated insertion of the antigen most often with curative intent. In anaphylactic shock occur functional and morphological changes in the blood vessels, smooth muscle, organs and the central nervous system. Etiological antigens are antibiotics, serums, vaccines and others, and insect venoms.

Treatment and prevention. Held according to the pathogenetic mechanism of allergic reactions occurred. During the attack should reduce the severity of relapses and to cease using various medicated drugs (antihistamines, corticosteroid hormones parasympatholytics, etc.). In extraparoxysmal period takes place specific and nonspecific hyposensitization, rehabilitation of infectious outbreaks and general supportive measures, such as climatic, hardening, health-hygienic regime of life, antiallergic nutrition, targeted rehabilitation, strengthen the nervous system with "emotional hyposensitization" and others. Asthmatic children and adolescents should be exempted from heavy exercise, sports games with a competitive nature and occupations in a closed gymnasium. It is important and vocational guidance of allergic patients.

Dispensary observation of children's pediatrician or allergist.

2.3.7. RESPIRATORY DISEASES

Epidemiology. Respiratory diseases are common and occupy a large share of the overall structure of morbidity in children and adolescents. Stdies in Bulgaria show that all chronic respiratory diseases among students fluctuate from 18% to 31%. Most often are the cases of disease of the upper respiratory tract. The highest is relative share of chronic tonsillitis - from 5% to 15%. According to MH for the years 1991-1993 highest is the frequency of incidence of chronic tonsillitis in the age range 3-7 years - from 14.7 percent to 17.3 percent, and lowest in the age 14-18 years - 7.6% to 9.5%. In chronic tonsillitis, even full compensation, becomes permanent intoxication, which not only contributes to the emergence of other diseases (cardiovascular, rheumatism, kidney, etc.), but also adversely affect the overall situation and development of the child.

In the pathology of respiratory system largest share acute respiratory diseases of the upper respiratory tract. No less important are inflammation of the lungs, especially the group of acute and chronic pneumonia.

To a group of chronic nonspecific diseases of the respiratory system concern the chronic bronchitis, chronic pneumonia, lung emphysema, bronchiectasis, pneumosclerosis and others. That group of diseases includes various nosological forms, requiring a corresponding diagnostic and therapeutic approach. Chronic inflammatory processes most often occur as a result of the spent early childhood or later acute respiratory diseases.

Acute respiratory diseases in children in the first years of life when the lungs grow and differentiate, are dangerous and can lead relatively quickly to the development of irreversible changes in the broncho-pulmonary system. Viral infections such as measles, whooping cough and others, whose background arises pneumonia, can cause profound changes in the bronchial tree - eg. bronchiectasis can develop for several days, i.e. it should be borne in mind that the development of chronic bronchopulmonary process in children is not necessary to pass all stages of disease.

◆ Acute pneumonia

Acute pneumonia occupy a large share in the pathology of childhood and particularly nursing. They are one of the first places on mortality in the first year of life.

Etiology. The agents can be bacteria, viruses, parasites, fungi, foreign bodies. By microbial pathogens play an important role staphylococci, especially Staphylococcus aureus. Pneumococci, a common cause of pneumonia in the past, now have relatively less importance. Relatively rare causes are streptococci. The group of viruses causing pneumonia can be flu, paragrippe, adenovirus. By parasites particular importance Phneumocystis Carinii. In connection with the widespread use of antibiotics and induced a result dysbacteriosis, some fungi from the group of Candida and particularly Candida albicans can cause fungal pneumonia. Non bacteriological causes may be different foreign bodies - solid and liquid, trapped in the airways. For occurrence of pneumonic disease is not enough penetration of pathogenic organism in the lungs, but is also needed altered reactivity and decreased immunity of the child.

Some importance have climatic factors - sudden temperature changes, changes in atmospheric pressure, humidity of the air, in the ultraviolet radiation.

Pathophysiology. In the development of pathological process in pneumonia leadership are two factors:

1. Intoxication.

2. Hypoxemia.

In infancy hypoxemia is developing rapidly due to easy occurrence of abnormalities in the pulmonary circulation. To overcome the shortage of oxygen, the body includes a number of compensatory mechanisms that do not ever have enough, which is why developing hypoxia on cellular level. Particularly sensitive to hypoxemia is the central nervous system. Heart, particularly in infancy, is less sensitive. Especially common in young children, suffering peripheral circulation, due to the sensitivity of the vasomotor center to changes in the oxygen content in the blood. They are often violated and liver functions.

Treatment. Treatment of acute pneumonia is complex: pathogenetic, etiological, symptomatic, general strengthening, dietetic, physiotherapy. Pathogenetic treatment is aimed at eliminating the pathophysiological phenomena, ie hypoxemia, by aerotherapy in light and oxygen in severe cases. Etiological treatment is carried out with different antibiotics, depending on the proven or suspected cause, according to the child's age and severity of pneumonia. When pronounced phenomena of intoxication or suppurative complications, good effect is obtained by short-term (5-7 days) use of corticoids applied in normal doses. Depending on the available symptoms apply appropriate means: cough syrups, cardiovascular agents, analeptics, sedative anticonvulsants and others. Greater the effectiveness of physical methods of treatment - microwave therapy, diathermy - to accelerate the healing and enhancement of immune defense mechanisms. Great effectiveness of physiotherapy explains that lung structures in children have great recreational opportunities. In the complex therapy of acute pneumonia prominently appropriate diet.

Prevention. Prevention of acute pneumonia is form on two principles:

1. Combating infectious origin, in order to limit the spread of the disease.

2. Increasing the protective immune forces.

We have to pay attention to creating the conditions under which exclude the possibility of further infection especially dangerous to children up to 1 year. Preventive measures to increase the overall resistance of the organism, include complex care related to ensuring optimal diet, properly organized daily regimen and well care, stay fresh air, sports activities, health-hygienic culture of behaviour and others.

◆ **Chronic pneumonia**

Chronic pneumonia are among the most common diseases in childhood and adolescence - they found an average 1% to 3% of those surveyed. There are in all age groups but is most common in preschool and primary school age, both sexes are affected almost equally. Chronic pneumonia is characterized by continuous and progressive course, which is usually severe impact on the physical and neuro-psychical development of children and adolescents. The disease limited opportunities for meaningful life and learning, play, sports, various extracurricular activities and more.

Etiology and pathogenesis. Chronic pneumonia is always a secondary character. It most often develops after acute pneumonia, especially in complications in its run - pleurisy, atelectasis, abscessing and others. Acute pneumonia during the neonatal and early infancy often tend to relapse and chronic. The passage of acute pneumonia in chronic, favour a number of factors, such as failures in nutrition, growing and hardening of the child, especially in the early years, and reduced general and local immunity. In early infancy, matter incomplete anatomic and physiological differentiation of the respiratory organs, as well as violations, due to inflammatory processes, of postnatal differentiation of bronchial and lung tissue. The presence of a chronic infectious outbreak (chronic tonsillitis, chronic sinusitis, adenoids, etc.) plays an essential role in the generation and maintenance of chronic pneumonia. Obstruction of the airways is a major cause for the development of chronic pneumonia, and in particular bronchiectasis. Obstruction may occur in bronchial spasm or atony, angioneurotic edema and others. Infectious diseases such as influenza, pertussis, respiratory infections and others can lead to severe pneumonia, which play an essential role in the occurrence of chronic pneumonia. Some importance have probably inherited some features of connective tissue, which under the influence of adverse effects can serve as background for the development of chronic lung inflammation. Perhaps it matters and allergic reactivity of the organism.

Clinical picture. Conventionally in the development of chronic pneumonia can separate three stages:

1. First - a clinic for chronic bronchitis or prolonged pneumonia.

2. Second - clinic with bronchiectasis and fibrosis of the lungs.

3. Third - with signs of suppuration of bronchiectasis and tends to deepen the process.

Some authors believe that the first stage is characteristic of infancy, the second - for pre-school age

and the third - to school age. In reality, such a sequence is not always observed. Chronic pneumonia can occur mild, moderate and severe. The degree of severity depends on the incidence and activity of the broncho-pulmonary changes, the degree of functional disorders, of the frequency and specificity of infectious thrusts. The course of chronic pneumonia is wavy - with phases of remission and exacerbation. The duration of remission is usually 1.5-2.5 months, in some cases the process is not controlled, despite treatment. In the period of remission part of children can be practically healthy, others - with signs of chronic bronchitis.

Treatment. It takes place in two stages - during the exacerbation and remission. During the exacerbation apply antibacterial treatment, mucolytic agents, bronchodilators, corticosteroids in small doses. Wide application have physiotherapy treatments. In the period of remission conducted rehabilitation of infectious outbreaks. Apply general supportive means to increase immunological defenses - nutrition, properly organized daily regimen, vitaminotherapy (C, A, B-complex), medical gymnastics. Especially important is the respiratory rehabilitation to improve lung ventilation and haemodynamic. It is necessary and climatic treatment of not less than 3 months.

Prevention. Prevention of chronic pneumonia is carried out mostly through proper and definitive treatment of acute pneumonia. All children and adolescents suffered from severe pneumonia or frequent respiratory infections, and children and adolescents from families with lung diseases should be placed under dispensary observation of a pediatrician or pediatric pulmonologist. They must provide them with nutrition, properly organized health-hygienic mode of living and education, more frequent and prolonged stay in the fresh air, gentle exercise, adequate quenching procedures, vitaminoprophylactic etc., in order to enhance overall immunity of the organism.

2.3.8. DISEASES OF THE DIGESTIVE SYSTEM

Diseases of the digestive system can be divided into:

- *diseases of the oral cavity, including congenital anomalies;*
- *diseases of the pharynx and pharyngeal lymph ring;*
- *diseases of the esophagus;*
- *diseases of the stomach, duodenum and intestines;*
- *diseases of the pancreas;*
- *diseases of the liver and bile ducts.*

According to studies of different authors chronic non-infectious gastrointestinal pathology in children and adolescents varies between 5.8% and 9.7% in the different age groups. Recently, the proportion of gastrointestinal diseases increases. The most common chronic diseases of the digestive system at all ages, including children and adolescents are chronic gastritis and peptic ulcer. In children and adolescents these diseases are diagnosed most often in school age, especially in the higher classes, but their medical history shows that their first signs are detected as early as preschool. Such signs may be chronic recurrent abdominal pains, dyspeptic disorders and other symptoms of gastrointestinal discomfort of unknown etiology.

◆ Chronic gastritis

Chronic gastritis represents 2% to 8% of the diseases of the digestive system in preschool and school age.

Etiology. Factors favouring the emergence of chronic gastritis are many and varied.

1. Alimentary factors. An important etiologic factor is feeding - systematic violations of quantitative and qualitative composition of the food, in the culinary treatment, in the diet. In this sense, it is disadvantageous the early and in large amounts use rich of cellulose and connective tissue foods, dried foods; early feeding of infants with common food; consumption of spicy, salty, sour, canned food; rapid and irregular meals; overeating and others.

2. Neurogenic factors. They have significant meanings. Nervous fatigue and mental stress suppress appetite and delay the evacuation of food.

3. Infectious diseases. In the genesis of chronic gastritis in children and adolescents are important and acute infectious diseases - dysentery, salmonellosis, epidemic hepatitis; chronic tonsillitis.

4. Allergic reactions. Possible damage to the gastric mucosa of drugs, of various allergic and autoimmune processes. It is not irrelevant and family history.

5. Disorders in the autonomic nervous system. They occur during puberty and also indicate a cause of chronic gastritis. Vagotonia, for example, leads to enhanced secretion and motor activity with the resulting consequences.

6. Toxic factors. Prolonged alcohol abuse and smoking also can cause gastritis. A similar role play also other chemical toxic effects.

7. "Reflux gastritis." The attention of many authors in recent years, attracted by the so-called. "Reflux gastritis." This is a reflux of duodenal contents into the stomach due to impaired motility in this area, in which pancreatic enzymes and bile salts of duodenal juice, leads to gastritis prone to ulceration.

Surveys in recent decades show that both the process of acceleration in children and adolescents, there is increased secretion and motor function of the stomach. Hyperacidic states are observed in 40% to 60%, and hypo- and anacidic - relatively rarely - 3% to 8%. According to some authors functional secretory disorders of the stomach can be seen as premorbid conditions.

Treatment. Treatment of chronic gastritis is conducted in three directions:

1. Organization of mode of life.

2. Curative nutrition.

3. Medication.

Diseased children are released from school classes. We need to provide time for adequate sleep, walks, games. It is a relaxed atmosphere at home, and regulated diet. Medical diet requires food to be served more often and in smaller portions, hot, appetizing in appearance. Avoid canned meats, salted fish and vegetables irritating. Drug treatment is indicated in hyperchlorhydropepsy and comprises administering alkali and anticholinergic agents, as well as ganglioblockers (histamine H_2-blockers).

Prevention. Requires ensuring effective control in school canteens, regarding the use of ecologically clean food, culinary processing, the use of spices and others. Is needed education and formation of health- hygienic habits for regime, diet, particularly learning-to slow and good mastication of food. Is needed timely rehabilitation of chronic infectious foci (tonsillitis, bad teeth, sinusitis, etc.). Children and adolescents with chronic gastritis and functional disorders of the stomach must be dispensary and monitored by a pediatrician.

◆ Ulcer

In recent years ulcer disease becomes more frequent, but occurs relatively rarely in children than in adults. Ulcer disease represents a 4% -8% of all gastrointestinal diseases in children and adolescents. It occurs in all age periods, its frequency is highest in upper school age. Affected are equally boys and girls in adolescence prevail boys (3: 1). More often occurs duodenal, as gastric ulcer than (8 to 10: 1).

Etiology. It was found that 45.6 percent of sufferers of ulcers students observed neuro-psychological overload of curricular and extracurricular activities. In the upper school age, chronic gastritis occurs four times more often than in the primary school age and 16 times more often than children from preschool. In the genesis of peptic ulcer attention is paid to the hereditary factor, which according to studies met by 38.8% to 70% of cases. The burden is most common paternal line. When family history children the disease usually starts earlier and more severe, difficult to treat and often recur. In recent years, a number of authors emphasize the importance and blood group. Patients (adults and children) with duodenal ulcers are most commonly with blood group 0. It is assumed that persons of other blood groups released into the gastric A and B blood agglutinogens with a protective role in gastric mucosa. It also showed that duodenal pathology is accompanied often by a deficiency of immunoglobulins. In children, food allergy was also given as an etiologic factor. Proven is the role of chronic focal infection (Helicobacter pilori). Attention is paid to the abuse of alcohol and drugs, smoking, other toxico-chemical impacts.

Treatment. Treatment of peptic ulcer requires creating a favourable external environment and remove negative emotions and experiences. In exacerbation of the process required bed rest. Medical nutrition designed to give peace of secretory and motor function of the stomach. Remove all succagogue food and appointed mechanically and chemically gentle diet that helps to normalize the acidity of gastric juice. Medical treatment includes giving alkali, antispasmolics, ganglioblockers, vitamins B_1, B_2, B_6, A, mineral alkaline water.

Prevention. It necessary a full meal, a regulated diet, reducing the neuro-psychological stress in everyday life by properly organized health-hygienic mode of life. Ulcer sick children and adolescents are subject to timely and dispensary observation of a pediatrician.

2.3.9. DISEASES OF THE URINARY – GENITAL SYSTEM

Epidemiology. A number of authors point out that much of the chronic nephritis and pyelonephritis in adulthood date back to childhood, when run latent. The representational studies in children and adolescents with renal pathology establish increase of congenital malformations of the urinary system - an average of 23%, ie approximately every fourth child with kidney disease is a carrier of a certain type of congenital abnormality of the urinary system. There is also the unfavourable trend in the dynamics of kidney disease - reduce patients with glomerulonephritis and increased those with pyelonephritis.

◆ Acute glomerulonephritis

Acute glomerulonephritis is the most common nonsuppurative kidney disease in childhood age. Diseased represent 0.5% to 3%, in some cases up to 5% of the underlying neonatal wards children over 2 years of age. Many of the cases are mild and go unrecognized. Acute glomerulonephritis sick more often boys. The most common occurrence of acute

glomerulonephritis in children preceded by infection of the tonsils and upper respiratory tract. There are observations about postvaccination glomerulonephritis. The initial infection is most often caused by beta-hemolytic streptococcus group A. The most common outcome of the disease is the cure - 95% - 98% of the cases. The disease can accept and recurrent character in connection with exacerbation of intercurrent infections or chronic infectious foci. The main method of treatment is bed regimen and rest, dietary and medication. Prevention of acute glomerulonephritis, cover by prevention and early antibiotic treatment of streptococcal and other infections, which may lead to nephritis.

◆ **Primary nephrosis (lipoid nephrosis, simple nephrotic syndrome)**

Primary nephrosis is a disease exclusively of childhood with an incidence of 1-7 children per 100 000. About 80.0 percent of cases are diagnosed in the early and pre-school age period. The highest incidence was observed in children 2 to 5 years, with more frequent involvement of the male sex. The etiology of primary nephrosis remains unclear. Disease often occurs during or after suffering infections - streptococcal, viral, after different intoxications - food, drug, albeit rarely - and after immunization. It has been shown that the primary nephrosis is glomerulopathy, wherein the excessive loss of serum protein is related to the increased permeability of the basement membrane of glomerular capillaries. The prognosis of primary nephrosis is the better, as smaller is the age of the child. Good is forecast as remission occurs shortly after the start of treatment. The better the prognosis and girls. Preventing new relapses is provided primarily to relevant treatment to prevent infections and rehabilitation of chronic infectious foci. The children suffered from nephrosis are exempt from immunizations.

◆ **Chronic non-proliferative glomerulonephritis**

Occurs frequently in children. Was observed in all age groups, incl. and in infancy, predominantly males. It represents a typical immune disease by the subepithelial deposits of immune complexes in the basal membrane and the absence of cell proliferation. The prognosis in children is relatively good. Unfavourable prognostic is the persistence of nephrotic syndrome.

◆ **Chronic proliferative glomerulonephritis**

This is the most common form of chronic glomerulonephritis in children. There are no specific etiologic factors. Are important streptococcal and viral infections, climate and lifestyle factors, genetic predisposition. In essence it represents an immune disease, often with autoimmune nature. The prognosis is serious. Remissions occur, often incomplete and of varying lengths. It can lead to irreversible renal failure. The treatment is medication and diet. Dialysis treatment is indicated for lack of success of conservative treatment. The results of timely dialysis are good - the child returns to the family and the school. Contemporary radical treatment of chronic renal failure - kidney transplantation, also marked a significant success.

◆ **Inherited diseases of the urinary system**

Can be divided into three main groups:

1. Inherited abnormalities in anatomical development and construction of the renal parenchyma.

2. Hereditary nephritis similar syndromes.

3. Hereditary renal tubulopathy.

Congenital abnormalities of the urinary system are becoming more important in practice because of their frequency and increased opportunities for their treatment. According to statistics in Bulgaria 100 000 children 25 are with types of malformations, in need of treatment, which more than 80% of cases is operational. In more than 1/3 of cases, congenital anomalies of the urinary system are accompanied by abnormalities in other organs and systems. Part of congenital malformation of the urinary system can be fully compatible with life and discover as a side finding in elderly. In another part, early at childhood, are manifested complications such as chronic pyelonephritis, renal failure, hypertension, and others.

◆ **Kidney stones**

In Bulgaria of kidney stones disease is a common disease. It was found that 28.0% of all patients with urolithiasis are children from 0 to 14 years of age. The ratio between male and female is 2: 1. In 70% of cases urolithiasis starting from 0 up to 5 years. Localization of gallstones are most commonly in the kidneys, followed by the ureters and bladder. The treatment is diet and medication. Surgical treatment is indicated only when the concretion is large and can not be eliminated spontaneously. Prevention of urolithiasis should be aimed at protecting the child from inflammatory diseases of the urinary tract, of hypervitaminosis D, from recurring and other common infections. Children and adolescents, tend to lithogeny, must accept larger quantities of liquids.

◆ **Night urinary incontinence (enuresis nocturna**)

This is a prevalent disease in the age 4-12 years. According to various studies frequency varies be-

tween 6% and 18%. There are various explanations for the pathogenesis of the disease. Children suffering from eneuresis nocturna are heavy and deep sleep. During the day they distracted and undisciplined. Difficult to regimen. They suffer from its deficiency, but they can not overcome. At the right direction in treatment is to create a conditioned reflex for waking the child at night in strictly defined time in order to create in the cortex watch-point for filled bladder. Moreover, at such children need to create a regular mode of learning, play and sleep. Through psychotherapy you need to convey to the child that the release night is not normal, but can be removed.

◆ **Pyelonephritis**

Pyelonephritis is the most common kidney disease. Early this pathology disease ranks fourth place in frequency after diseases of the respiratory system, digestive and infectious diseases. The most common cause of the disease is Escherichia coli, second are the bacteria of the group Proteus. Often meet and coli- Proteus infections. The occurrence of pyelonephritis favour infection of the upper respiratory tract that facilitate urinary infection through bacteremia, dyspepsia as a primary or underlying diseases, abnormalities of the urinary system and others. The forecast of pyelonephritis is serious. In acute pyelonephritis sustained recovery is achieved in about 75% -85% of sufferers, chronic recurrent forms - 40% -50%. Treatment includes diet, medication, general care to provide warmth and rest with bed regimen, spa and more.

Prevention. Prevention of kidney disease refers primarily to the prevention of acute and chronic recurrent forms. It is associated mainly with timely and targeted treatment of acute stage renal disease, as well as a dispensary suffered. Important in children and adolescents with disorders of the urinary excretion system, and providing proper professional guidance. In chronic kidney disease are contraindicated all kinds of work related to sudden temperature fluctuations and hypothermia, working in conditions of high humidity and chemical hazards. For adolescents with nephrolithiasis is contraindicated work associated with sudden movements and changes in body position, weight lifting, vibration.

2.3.10. MALIGNANCIES

Epidemiology. According to the WHO, malignant neoplasms in developed countries take second place as a cause of death in children over 1 year of age after injuries and accidents.

In literature, malignant neoplasms determine an average 7.15% of mortality among children of 0-14 years.

These diseases are most common in the first five years of life and affects more often boys. Compared with adults, however, the incidence in children is very low. According to our observations in Bulgaria the average annual incidence in children is 15.6 per 100 000, while in adults it is 200 per 100 000 population. According to statistics by MH annual incidence of malignant neoplasms in the age 0-14 years in hospitals of general type over the period 1991-1993 is approximately the same - 1.1 percent.

Children suffer primarily from mesenchymal tumors (sarcomas), and adults - from epithelial (carcinomas). Typical children embryonic and dysontogeny tumors, almost disappeared in adults. In children and adolescents most commonly encountered systemic malignancies, followed by malignant tumors of the nervous system, bone, kidney, and eyeballs. There is a specificity and in the age distribution of malignant tumors. In the first five years of life most frequently observed embryonic tumors and acute leukemia, then 10 years old - bone tumors. Children and adolescents suffer mainly from mesenchymal neoplasms - lymphoreticular blastomas, malignant blastomas the nervous system, malignant neoplasms of bone and connective tissue, embryonic tumors - mainly kidney and eye.

Etiology and pathogenesis. It should not be forgotten that the processes of carcinogenesis in children influence and characteristics of the child expressed in its morphological and functional immaturity, unfinished hormonal status and still incomplete tissue-humoral immunity. In etiopathogenesis of malignant tumors in children and adolescents should be sought unless the acting carcinogenic factors - physical, chemical and biological, as well as hereditary, and the combination of malignant tumors with congenital anomalies and malformations.

Treatment. In recent years childhood age has been significant therapeutic benefit. In literature achieves real cure in about half of treated children and adolescents.

Prevention. Prevention of malignant neoplasms includes the whole complex of measures for health-hygienic lifestyles, training, nutrition, mental hygiene and possible prevention of exogenous and endogenous carcinogenic effects.

2.3.11. VISION ANOMALIES AND DISEASES

Epidemiology. According to research studies, the prevalence of myopia in school age is significant and shows a progressive increase with age - from 2.5 to 17.7 percent, by meeting more frequently with stu-

dents in cities - 18.0%, compared with the villages - 13.2%. In schools with a large load of visual analyser (math, language) the incidence of myopia is higher - 25% **(Table. 10.7)**.

Etiology and pathogenesis. There are two views on the development of myopia in children and adults. According to one myopia develops under the influence of hard tension of accommodative in adverse working conditions - poor lighting and operation of short distance. According to another essential for myopia is heredity. The first is characterized by benign course and good vision correction and other, related hereditary and especially combined with unfavourable conditions of visual work, correct bad, fast progress and is accompanied by damage to the fundus.

Many and various are the reasons that favour the development of visual anomalies. In a study of hygienic conditions in schools very often it turns out that natural and artificial lighting did not meet the hygienic requirements. It was found that students, where learning takes place in the morning reduced visual acuity occurs to 8.3 percent, while students studying in the afternoon, it reached 21%. For increase cases with decreased visual acuity among students, important is also teaching overload, non-hygienic conditions in reading and computer work (properly body posture distance, away from the eyes), use of night hours for self-study. The state of vision reflects the general state of the organism and living conditions.

Students vision can influence and various chronic diseases. Cardiovascular diseases can cause changes in the blood vessels feeding the eye and optic nerve. Significant changes in the eye fundus can occur in kidney disease and hypertension. Diabetes mellitus causes a clouding of the vitreous. Hyperthyroidism, than exophthalmos, causes and diplopia, chemosis, conjunctivitis, infiltrative ophthalmopathy. Serious damage can cause tuberculosis, in which is common disease of the cornea. In severe congenital syphilis register significant eye damage, even blindness. Sometimes the cause of eye disease can be and serious infectious diseases - smallpox, scarlet fever, diphtheria (incl. and flu). Badly affect eyesight and various types of intoxication, drug abuse, alcohol, smoking. Important for visual analyser has vitamin A - hypo-and avitaminosis A cause day-blindness, xerophthalmia and keratomalacia. It was found that children and adolescents who stay a little outdoors in daylight hours and deprived of the effects of natural ultraviolet radiation (which distorts calcium-phosphorus metabolism exchange and hypovitaminosis conditions), is found more often myopia.

Prevention. Prevention of ocular abnormalities and diseases in school age is through properly organized, age and individualized health hygienic mode of living and education, rational nutrition, increased physical activity and time spent outdoors, observing the hygienic requirements for lighting in the workplace, good polygraph formed textbooks and books.

When visual impairment, is performed dispensary observation by an ophthalmologist.

2.3.12. SPINAL DEFORMITIES AND INCORRECT BODY POSTURE

In school age often found damage to the musculoskeletal system, expressed most often in the wrong telodarzhane and spinal deformities.

Etiology. Improper body posture, combined with reduced physical activity, the absence of systematic physical and sports activities, conducive to the emergence of spinal deformities and lead to lasting changes in body posture and stand of the student, with all the attendant adverse effects on the

Table 10.7. Registered diseases and abnormalities of the visual analyser at the main check-ups for children and students in Bulgaria during 1991-93

Diseases and abnormalities	Years	Children		Students	
		1 - 3 years	3 - 7 years	7 - 14 years	14 - 18 years
Disorders of refraction and accommodative	1991	0,43	1,42	6,52	13,28
	1992	0,43	1,24	6,95	10,92
	1993	0,42	1,30	5,24	6,98
Disturbances of vision	1991	1,54	3,93	15,06	19,41
	1992	1,26	4,25	15,34	21,79
	1993	1,49	4,05	14,96	20,70
Blindness	1991	0,13	0,29	1,26	1,79
	1992	0,11	0,25	0,81	1,19
	1993	0,14	0,26	1,20	6,97

body. Muscle of child is still underdeveloped, and therefore under the influence of its own weight or external pressure it often takes the wrong position (sitting humpy, with floopy head and shoulders). If this weakness in the muscles, combines a long time with poor posture, imposed by the dysproportional to the height of the child, children's school furniture (unsuitable chairs, tables), the child can develop deformities of the spine, chest, shoulders.

Epidemiology. Studies of recent decades when students from different regions of the country found similar damage to the musculoskeletal 15% to 30% of students, in some cases and more. Data on MH, registered in conducting basic screening of students for the period 1991-93 show that the highest proportion of spinal deformities in primary and secondary school age (7-14 yr.), as he moving in the range 50.6 to 53.6 per 1000 examined students. In the upper school age (15-18 years) this share is lower - 32.1 to 43.2 per 1000 examined students.

Data from prophylactic examinations in 2009 showed that scoliosis is seven times more often in girls than boys.

Compared to the literature, the incidence of spinal deformities and improper body posture among our students showed no significant differences. However, Russian researchers reported a higher percentage of spinal deformities among students - from 6% to 63%.

Prevention. Prevention of spinal deformities and improper body posture in school age includes active health - educational activities, control and monitoring of students in early school age to develop proper stand, correct posture at the desk, actively hardening, system activities with physical activities, stay outdoor, health-hygienic lifestyle. It is essential to use a proper school furniture, corresponding to the age development of children and adolescents.

When deformations occurring, necessary to carry out complex rehabilitation procedures and appropriate physical exercise.

Dispensary observation at improper body posture and scoliosis I degree is carried out by the GP or pediatrician; scoliosis II-IV deg., kyphosis, lordosis and kyphoscoliosis (hyperlordosis) - by orthopedist.

2.3.13. TRAUMATIC INJURIES

Epidemiology. According to the WHO in 11 of 20 European countries, USA, Canada and Australia, averaging over 50.0 percent of all deaths are caused by trauma, such as age 15-19 years, this value is higher, reaching 75%. Injuries among children and youth contingent in the country in 1991 compared to 1975 increased about 2.5 times, which occupies fifth place in the structure of morbidity by turnover. According to statistics their share in overall morbidity was 3.1%.

◆ Traffic accidents

Special type of trauma in childhood and adolescence is the road transport. Modern large-scale studies of child road accidents in Bulgaria (1994) show that in the country there is an unfavourable tendency to permanently increase the number of wounded and all victims, insignificant - the killed children and adolescents for the past 15 years. Prevailing victims and wounded children and adolescents between the ages 8-14 years. Risky is spring-summer (holiday) season and risky days are registered mostly at the beginning and end of the week. With increasing age, the share of beneficiaries of more severe injuries. The most common injuries are to the locomotor system - mainly fractured limb or the head, with brain damage. Prevention of road accidents in childhood and adolescence is a complex task involving institutions such as the Ministry of Interior, MH, CC for road safety, BRC, MES, public.

◆ Production traumatism

No less important in childhood and adolescence. This kind of trauma is possible with training in professional schools during the manufacturing practice in educational workshops and enterprises. The frequency and nature of production traumatism depend on the observance of hygienic requirements for furniture and layout of the workplace, from the proper organization of the work, of safeguarding the machinery and observance of safety rules, the use of appropriate and in good state working tools and others. Also important are the characteristics of the work environment (lighting, heating, microclimate, etc.). High or low temperatures - overheating or cooling of the body, high humidity, dusty air with a reduced amount of oxygen, contribute to the rapid onset of fatigue, reduce sensory acuity (visual, auditory etc.), respectively to reduce security and agility of movements and so on.

Prevention of production accidents with students is done except through better organization of work processes and ensuring good sanitation and also by virtue of the rules for safe operation, regime of work and rest, use of personal protective equipment (special clothing, protective eyewear, protective headgear and helmets, shields, ear protectors etc.). It is also strict observance of labour legislation and hygienic rules and regulations, relating to the protection and prohibition of child labour in heavy industry.

2.3.14. INFECTIOUS AND PARASITIC DISEASES

At school age, especially in adolescent period -15-18 years, acute infectious diseases are less common than in younger children. Today, significantly reduced the incidence of infectious diseases such as diphtheria, typhoid, encephalitis, tetanus, anthrax, widespread in the past.

◆ Bacterial infections

In childhood is important group of bacterial diseases. These include: scarlet fever, erysipelas, meningococcal meningitis, diphtheria, pertussis.

Scarlet fever. This is an acute infectious disease characterized by general intoxication, angina and a characteristic skin rash. It is assumed that the causes of the disease are different types of group A, β-hemolytic streptococci. The source of infection is sick more often healthy contaminants. The most susceptible are children of preschool and school age. Infant has innate immunity of the mother.

Erysipelas ("red wind"). Caused by β-hemolytic streptococcus group A and is characterized by typical skin irritation. It appears sporadically and exceptionally gives small epidemics in teams. The transmission of the infection becomes more contact time, through broken skin or mucous membranes. Erysipelas in children is very rare. Morbidity leaves no immunity.

Meningococcal meningitis. This meningitis is most common among purulent meningitis. There is relatively rare, more often sporadic and very rare form of limited epidemic foci. Cause is a Gram-negative diplococci Neisseria meningitidis. In 50% to 90% of cases affect children under age 5. Transmission occurs by droplets, most often in moist and cool seasons.

Diphtheria. Diphtheria is an acute infectious disease caused by Corynebact diptheriae, pass with specific fibrinous deposits on input location of the cause and toxic damage in various organs. Very common in the past, common epidemic and endemic among children, diphtheria, thanks to systematic immunization today significantly reduced. Source of infection are sick and healthy infection carriers. The transmission of infection becomes airborne, direct contact and through objects. The most affected is children aged 3 to 7 years, but recently, after the compulsory immunization of children, the age structure of diphtheria is quite changed -1/3 of patients are over 15 years. After morbidity developed a certain immunity determined by formed antitoxins.

Pertussis. Pertussis is an acute bacterial infectious disease, characterized by typical cough. The cause is Bordetella pertussis, which is a Gram-negative bacteria, relatively resistant to the external environment, emitting loud endotoxin. The source of infection is sick, but there are healthy infection carriers. Transmission becomes airborne. Affect infancy - from 2 to 5 years. Morbidity develops almost absolute immunity. Prevention of acute infectious streptococcal diseases is associated with isolation of the patient, monitoring of the contact, study for infestation and appropriate treatment and appropriate vaccine.

◆ Enteral infectious diseases

Large group of infectious diseases are contagious enteral diseases or so-called infectious diarrheal diseases. The majority of acute enteric infections - colienteritis, salmonellosis, shigellosis, cholera, viral enteropathy al., primarily affect childhood and some of them, for example colienteritis are inherent in almost only for nurseling. According to WHO, in various countries around the world die every year from acute infectious diarrhea over 1 million children under 1 year of age. Often these infectious diarrheal diseases are treated as acute gastro-intestinal disorders, etiologically related to errors in the diet. All this leads to underestimation of their infectious nature and high contagiousness and to neglect the subsequent diagnostic, preventive and therapeutic measures.

◆ Viral infectious diseases

Viral infectious diseases such as measles, rubella, smallpox, mumps, poliomyelitis, chicken pox, adenoviral diseases, influenza, viral hepatitis (A, B, C) are widespread and some of them entirely characteristic of the youth age. Source of infection are sick and transmission of the infection usually becomes airborne (for HBV - parenteral (blood) in poliomyelitis - and faecal-oral). In separate nosological diseases besides sporadic cases have been observed in smaller and larger epidemics, depending on the degree of contagiousness. Rubella, measles, chicken pox, smallpox usually is the emergence of disease-specific outbreak that has diagnostic significance.

Preventive organization activities are conducted in two general directions:

1. Improving the sustainability of the population, in order to avoid illness if they make contact with the disease agent.

2. Limit the infectious foci in order to break the possibility of spreading the infection. Rising natural defenses is achieved most effectively by conducting specific prevention - immunizations and vaccinations, according to immunization calendar and passive prophylaxis with gamma globulin.

◆ **Parasitic diseases**

In childhood and adolescence than communicable infectious diseases is essential and infestation. In the pathology of childhood most common parasitic diseases are toxoplasmosis, giardiasis; different types of round helminths causing ascaridosis, enterobiosis, trichuriasis; tapeworms, a cause of various taeniosis and echinococcosis; liver rot - fascioliasis.

Lice. Important for large contingents of children have lice, which, besides its direct harmful effects on the body, can serve as carriers of agents of abdominal typhoid and recurrent typhus. In children and adolescents, from a health perspective, importance are: Pediculus capitis (head lice), Pediculus vestimenti (clothes louse) and Pediculus pubis (pubic lice). Lice easily transferred from unclean children to clothes and hair clean. This is readily accomplished at the touch, particularly in children's team, and also in public places. In establishing nits or lice in a child, carried deworming treatment of the child and also of all family members.

Intestinal helminths. Helminths causing worms invasions are still other common parasites in children groups. The most common are so called geohelmints in which invasions becomes by the external environment. Greater practical importance of roundworms (Nematoda) are Ascaris lumbricoides, Enterobius vermicularis, Trichocephalus trichiuris, but by tape worms (Cestode) - Hymenolepis nana and Taenia echinococcus. Prevention of intestinal helminths is through mandatory testing for worms before entering kindergarten. If the presence of worms, the child is not allowed in the team until full recovery.

It is sanitation of lavatory. Raw fruits and vegetables before consumption should be washed under flowing water. Wash hands before eating and after using the toilet. To kill flies and keep them products and ready meals. The floors can be wiped clean with disinfectant solutions. It is also conducting a wide health protection activity.

Enterobiosis. Enterobiosis is the most common parasites in children and occurs as a typical contact invasion. Of orally ingested eggs hatch larvae which in the lower part of the small intestine and cecum sexually mature over the course of 12-14 days. The average life expectancy of Oxyuris vermicularis is 3-4 weeks. After copulation the males die and the females descend to the rectum, lay their eggs in the perianal folds, then die. Eggs laid ripen and them becomes a new infection through contaminated fingers, objects and food. Eggs are very resistant to disinfectant, but are sensitive to UV radiation. Treatment is carried out such treatment in ascaridosis, with piperazine or with laxatives. It must be accompanied by hygiene protection measures and meticulous cleanliness.

Ascaridosis. Ascaridosis is helminth infection that mainly affects children.

Askarides show greater reproductive capacity. Their eggs develop in the soil from three weeks to three months and become fit for invasion. Consumed ascarids eggs into the lumen of the small intestine is released from its sheath, they go larvae that penetrate the smallest blood vessels of the bowel and refer to the blood vessels of the liver. Fall into liver tissue larvae can lead to the formation of necrotic foci. Further migration of the larvae still in the lower vena cava, the right heart, then to the branches of the lungs, where they can move up trachea and pharynx again be swallowed with saliva and food and once again fall into the small intestine, where they have the most favourable conditions for development. During the migration phase in the body prevail sensitization reactions to invading parasite and its conversion products and mechanical-traumatic injuries. In the second phase of the intestinal ascaridosis, during which the cysts in stationary in the gut for 10-15 months and more, morbid manifestations are connected with the reflex or mechanical dysfunction of the intestine, liver, nervous system, and also with withdrawal of nutrients from the intestinal contents. In the treatment most often used piperazine salts.

Hydatid disease. Echinococcosis is parasitism that has a chronic course and is determined by the penetration and development in many organs or tissues of the larval stage (hydatid cysts) of dog tapeworm. The disease occurs in our country. Man and many herbivores are intermediate and dog - definitive host of Taenia echinococcus. Children infected by hydatid disease more often due to inadequate hygiene habits and frequent communication with dogs. All ages are equally susceptible to the hydatid disease. Clinic is dependent on the location, number and size of hydatid cysts. The most common location in the lungs - 55%, and then in the liver, brain, peritoneal cavity and the like. Echinococcosis long time, months and years, may be no symptoms. Treatment is surgical.

Fasciolosis. Fasciolosis is widespread in animals helminth infection that affects humans and show a preference for children. Source of infection are most frequently invaded large and small ruminants, in the country most often sheep that are definitive hosts of the parasite. The biological cycle passes complicated path of development. Children infected with drinking unclean water or use of raw fruits and vegetables, meadow grasses. The parasite shows a marked

hepatotrophic, which is related to the availability in the liver of the main food for him - glycogen. The diagnosis is provided by finding characteristic eggs of the parasite in feces and duodenal juice. Treatment was performed with hexachlorparaxylol, hexachloroethane, Bithionol and others.

◆ **Protozoal infections**

Toxoplasmosis. This is a protozoal infection caused by Toxoplasma gondii, expression was in utero acquired form and postnatal acquired form. Widespread disease in wildlife. Main source and permanent natural reservoir are invaded cats, whose intestines were performed sexual development of the parasite. Faeces of cats infect other pets and humans. The prognosis in congenital toxoplasmosis is most often unfavourable. Part of sufferers die even in early infancy, others later and a small number live to adulthood. Acquired toxoplasmosis usually has a good prognosis. Prevention focuses on pregnant women, care must be kept from communicating with cats and other pets. It should also avoid consumption of raw meat and semi-boil. For prevention of congenital toxoplasmosis is recommended twice study of pregnant to 2-3 th and the 7 th month of pregnancy. Prophylactic treatment is necessary only mean positive reactions. Treatment was performed with pyrimethamine and sulphonamides. Acquired toxoplasmosis most often heals spontaneously and occurs subclinical.

Giardiasis. Giardiasis is widespread intestinal protozooza among children from all regions in the world, incl. and in Bulgaria, where the disease occurs on average at 4% -6% in children's teams. Cause of the disease is Lamblia intestinalis, which is distributed in the form of cysts and vegetative forms of the small intestine, the duodenum and biliary-hepatic channels. Sick children and adolescents should be allowed to intensive nourishing food with vitamins and reduced fat.

Best specific for vegetative forms, which must always be initiated therapy, is atebrinum. Treatment of cystic forms can continue by anticystic drugs.

2.3.15. GENETIC FACTORS AND HEREDITARY DISEASES. S. Sabeva

Development of the individual, depends on two groups of interacting factors - genetic and the factors of environment (external and internal). Genetic build or genome of an individual is established at conceive, and the complex interplay between genes and environment. Although genes remain basically unchanged, the ambient conditions are constantly changing and may affect the genome by mutation or gene inherited effect.

Chromosomes located in the nucleus of the cells are carriers of thousands of genes. Humans normally have 46 chromosomes arranged in 23 pairs. One of the pairs - sexchromosomes, determines the sex of the individual. Sexchromosomes are heterologous, since the two parts of the pairs are not identical: X chromosome is larger and carries as genes responsible for inherited many specificities, and also the sex of the subject. Y-chromosome is small, with a different forme and carries mainly, if not exclusively, the genes responsible for the detection of the male sex. The other 22 pairs of chromosomes, the autosomes, are homologous, ie identical in size, shape and genetic locus.

Genes are arranged along the chromosomes in linear order, each with its own specific locus. The number and arrangement of loci on homologous chromosomes are the same and genes that occupy homologous loci are called alleles. Each individual has two alleles for each gene - one on each chromosome of the pair.

A man holding a pair of identical alleles of a gene is homozygote. If the gene has its effect when it is present only on one chromosome, it is dominant. This is a recessive gene that carries out its effect only if it is presented in each chromosome pair. Gene or its corresponding expression are X-linked, if they are on the X-chromosome, or are autosomal.

It has established three types of genetic disorders:

1. "Mendelian" or mutations in a single gene that are inherited by known models.

2. Polygenetic or multifactorial heredity whereby genetic mutations and non-genetic factors interact in ways that are not well understood.

3. Chromosome aberrations - chromosome deformities or deviations from the normal number.

◆ **Defects in a single gene**

Genetic disorders worn by single genes are the easiest to analyse and therefore are best studied. They may be autosomal or X-linked, recessive or dominant.

- **Autosomal dominant inheritance (Table. 10.8) ***

Generally these violations are subject to the following rules:

1. Any person concerned should last at least one affected parent.

2. Affected person, entering into marriage with a normal individual has an average equal number of affected and healthy children.

* Tables 10.8 - 10.16 are by Ferriet P. E.

Table 10.8. Some diseases transmissible by autosomal dominant inheritance

Achondroplasia	*Huntington's chorea*
Neuro fibroblastoma of Recklinghausen	*Intestinal polyposis*
Syndrome Peutz-Jeghers	*Retinoblastoma*
Tuberous sclerosis Bourneville	*Polycystic kidney*
Osteogenesis imperfecta (Lobstein)	*Thalassemia minor*
Marfan syndrome (arahnodactylitis)	
Hereditary spherocytosis of Minkowski-Chauffard	

3. Normal children from affected parent (s) have normal children and grandchildren.

4. Women and men are equally affected.

5. The trait can appear in every generation.

6. Heterozygotes are affected.

There are the following deviations from the above rules:

*1. The severity and penetration * of the gene* - the effect of one gene may be influenced both by the environment of the individual, and also of the thousands other genes, which is reflected in phenotypic expression of this gene. Thus, even in a family, affected individuals may have different phenotypes. Rarely, the severity of the dominant gene is modified so that it does not detect any clinical disorders. However, the individual has this gene and could pass it on to the offspring, which in turn can manifest the full clinical picture. This rare phenomenon is known as lack of penetration.

2. The genetic defect manifests itself through "many forms".

3. Mutations occur spontaneously from time to time. Autosomal dominant family tree, begins with a recent mutation occurred and these mutations in autosomal dominant disorders are common.

4. Phenocopy - very rare individual manifests syndrome that is indistinguishable from a recent mutation, but does not transmit the condition to their offspring and do not seem to carry the mutant gene, ie syndrome may be due to non-genetic phenomena or at least a different genotype, the phenocopy is indistinguishable from the individual with an abnormal dominant gene, which incidentally does not transmit the gene to their offspring.

5. Inheriting, limited in sex - a feature that appears in only one sex.

6. Homozygous dominant genotype: it can appear only in the offspring of two heterozygotes or homozygotes for the same dominant gene individuals.

More than 1,500 conditions are defined as defects in a single gene. It is therefore particularly important that the risk of reproducing affected generation be known in advance. The statistical risk of occurrence of these conditions is 50%, without gender differences. Parents should understand that the risk is 50% for each pregnancy, regardless of the outcome of the previous ones. If family history is negative and the case is considered a recent mutation, the risk for brothers and sisters in the same generation is 0, but the affected individual risk to transfer dominant mutant to half of his generation (which is not true for phenocopies).

- ***Autosomal recessive inheritance (Table. 10.9)***

General rules:

1. If the affected person is born of normal parents, then both are heterozygotes and medium ¼ of their generation will be affected; ½ will be heterozygous and ¼ normal.

Table 10.9. Some diseases transmissible by autosomal recessive inheritance and their approximate rate of 100 000 births (frequency of homozygotes)

1. Mucoviscidosis	*50*
2. The majority of inborn metabolic diseases:	
• *Phenylketonuria*	*5*
• *Congenital adrenal hyperplasia*	*2-20*
• *Glycogenosis*	*?*
• *Galactosemia*	*0,4-3*
• *Cystinosis*	*2-5*
• *Cystinuria*	*7*
• *Homocystinuria*	*3-8*
• *Wilson's disease*	*10 (?)*
• *Disease Tay-Sachs (Israeli population)*	*30*
• *Thyroid dyshormonogenezis*	*?*
3. Thalassemia major (Colley) - depending on the geographical location	
4. Disease Werdnig-Hoffman	*?*
5. Ataxia-telangiectasia	*1-10*
6. Friedreich's ataxia	*?*
7. Severe forms of epidermolysis bullosa	*?*

* The frequency of phenotypic expression of dominant or homozygous recessive gene.

2. If the affected child comes from consanguineous marriage, this is conclusive evidence of recessive inheritance.

3. If a person concerned marry genotypic normal partner, all children will be phenotypically normal heterozygotes.

4. If an affected person marries a heterozygote, on average ½ of children will be affected, ½ will be heterozygotes.

5. If two affected individuals marry, all their children will be affected.

6. Men and women are affected equally.

7. Heterozygotes are phenotypically normal, but carry a given feature.

In these cases the risk for their children is 25% and families need to know that the same risk exists for each pregnancy.

- ***X-linked inheritance (Table. 10.10)***

Common rules:

1. Nearly all affected persons are men.

2. The features are always transmitted by heterozygous mother, phenotypically normal.

Table 10.10. Some diseases transmissible by recessive inheritance, linked by sex (linked to the X chromosome)

Daltonism	*Hemophilia A and B*
Agammaglobulinemia	*Hunter Syndrome*
Granulomatosis of childhood	*Ichthyosis*
Duchenne muscular dystrophy	*Syndrome Wiskott-Aldrich*
Ectodermal anhydrotic dysplasia	

3. An affected individual male never transmits hallmark inheritance of his son.

4. Woman carrier, transmits the hallmark of ½ of his sons. None of the daughters will manifest this feature, but ½ of them will be carriers.

5. All daughters of affected male will be carriers.

More than 60 features, most of which are diseases (eg. inborn errors of metabolism), resulting from the mutant genes of the X-chromosome.

Heterozygous woman risked in 25%, to have an affected child, and chance to have a boy is 50% and 50% of boys will be affected.

- ***X-linked dominant inheritance***

General rules:

1. Affected males transmit the hallmark of all his daughters, but none of his sons.

2. Affected heterozygous females transmit the condition of ½ of their children, regardless of sex.

3. Affected homozygous females transmit the hallmark of all their children.

Similar inherited are rare and women are often slightly affected than men. The risk for offspring of affected women is the same, as with autosomal dominant inheritance.

◆ ***Multifactorial (polygenic) inheritance***

Most human traits and diseases are the result of the interaction of two or more genes with internal and external environment. In many defects and diseases affecting the family occurs more often, than could be explained by chance, but the pattern of expression is definitely not Mendelian. In these cases, the relative importance of the genes, respectively the environment, is rarely known. Anencephaly and spina bifida are examples of malformation where many factors come into play: race, geographic location, socioeconomic status, season and sex. They all showed a statistically significant frequency, which differs from the expected. Assuming both parents are normal and family history was negative, increased risk of any malformation is about 5%, if you already have an affected child. If violations at two children in the family are identical or similar, the risk of further inheritance increases of about 10%. Thus, even after two such affected children in the offspring, the chance of normal children in a future pregnancy is still 90%. This relatively optimistic forecast can be given only after very careful study of family history, with a special survey among members of the families of both parents for identical or related anomalies, and after careful examination of consanguinity. If there is any, it increases the possibility of occurrence of an autosomal recessive trait, in which the risk for the future generation increased to 25%.

◆ ***Chromosomal aberrations***

- ***Autosomal abnormalities***

Trisomy*. The most common are the largest group: trisomy 21 (G) - a syndrome Down, trisomy 13 (D1) and trisomy 18 (E). The frequency of occurrence is 1: 700 live births of Down syndrome, and must be given its variations, depending on the age of the mother (in young gilts it is about 1: 2000 live births; in mothers over 40, increases of 1 : 50 live births), to 1: 4500 live births for trisomy 18, by maternal age has a minor effect, and 1: 7000 live births with trisomy 13.

Trisomy 21 (G). Children with Down's syndrome are distinguished by certain characteristics of the head, limbs, nervous system, intellectual development, and metabolic enzyme systems. Typical are microcephaly, brachycephaly, flat face, hair, eyelids with presence of epicanthus, small gray-white spots

* Counted abnormalities (aneuplodia) in which observe a chromosome more. One of pairs replace by triple.

on the periphery of the iris - disappearing at the end of the first year of birth. The nose is small, broad-based, mouth often kept open due to the large tongue, arms are short, especially at the level of the middle phalange of the fifth finger, which is skewed towards the midline. The big toe tends to separate from the second finger, with broad depression between them. Find the congenital heart disease in 35% of patients, physical and mental development is delayed; the average IQ is about 50. The life expectancy of these children is reduced due to heart disease, if any, and also due to increased incidence of acute leukemia. However, many experienced even elderly.

Trisomy 13. In her observed very hard malformations than trisomy 21, which leads to premature death before the age of three and most often before the third month. Not noticed any difference in the effect on both sexes. The most common violations of the nervous system (convulsions, meningomyelocele in 50% of cases), the head (microcephaly, micrognathy, split palate divided, microophtalmia and coloboma of the iris, retinal dysplasia, low-lying deformed ears); heart and vessels (intraventricular and septal defects, availability of right-hand heart, capillary hemangiomas); limbs (polydactyly tended to flectioned fingers); malformations kidney, colon, persistence of fetal hemoglobin.

Trisomy 18. As trisomy 13, it is characterized by severe malformations, that result in death before the end of the third year. Experiencing the second decade is an exception. There is mainly affecting the female gender by ratio of 3: 1. The most common violations are nervous system (abnormalities in the cerebellum, cerebral neuronal heterotopia); head (narrow convex forehead, which continues into the nose, micrognathia); heart and vessels (heart malformations primarily in ventricular septal, abnormalities in pulmonary and aortic valve); limbs (flection and contracture of the fingers and a cross-pointer on the middle, finger, dorzoflection of toe, etc.); abnormalities of the lung, bladder, kidneys and ureters; increased muscle tone.

Table 10.11. Syndromes associated with the partial autosomal deletion

Short arm of chromosome 5 (5r-). Syndrome "cry of the cat"	***Short arm of chromosome 4 (4p-)***	***Short arm of chromosome 18 (18p-)***	***Long arm of chromosome 18 (18q-)***	***Chromosome 21 Antimongolism***
Delays in fetal development and later	*Lag fetal development and subsequently*	*Underdevelopment - impermanent*	*Developmental delays*	*Developmental delays*
Weak cry, resembling a meowing cat in early childhood (laringomalacia)				
Microcephaly	*Microcephaly*	*Microcephaly*	*Microcephaly*	
Mental retardation	*Mental retardation*	*Mental retardation*	*Mental retardation*	*Mental retardation*
Hypotension	*Convulsions*	*Hypotension*	*Hypotension*	*Hypotension*
Round face	*Cranial asymmetry*	*Pterygium colli - inconstant*	*Retraction of the median face level*	
Hypertelorism	*Hypertelorism*	*Hypertelorism*	*Ocular anomalies*	*Pronounced root of the nose*
Epicanthus	*Coloboma*	*Epicanthus and eyelid ptosis*	*Hypoplasia or atresia of the external auditory canal*	*Big ears*
Low set ears	*Low-lying soft ears (abnormalities in the cartilage)*		*Cardiac malformations*	
Prevalence of female sex		*Prevalence of female sex*	*IgA deficiency*	
Other malformations	*Other malformations*	*Other malformations*	*Other malformations*	*Other malformations*

- **Chromosomal deletions ***

Full monosomy to an autosomal is incompatible with life, except in the form of mosaic. This means that only a fraction of the cells of the affected individual are monosomy, while others have a complete set of chromosomes. Partial loss is compatible with life and numerous typical syndromes associated with such loss of chromosome material have been identified **(Table. 10.11)**.

- ***Syndromes related to aberrations of sex chromosomes***

Gonadal dysgenesis (syndrome Turner, syndrome Bonnevie-Ullrich). Due mainly to the complete or partial absence of one of the two X-chromosomes in women (XO). Its incidence is approximately 1: 3000 live births girls. In many affected newborns establish dorsal lymphedema of hands and feet and lymphedema or free skin fold at the back of the neck. These features are almost pathognomonic. In young girls after puberty seen low growth (less than 150 cm), short fourth metacarpal and metatarsal bone, malocclusion, frequent otitis of middle ear, oestrogenic determined underdevelopment (underdeveloped mammary glands, infantilism of the external genitalia and uterus, primary amenorrhea, haired from a female type, but sparingly), heart malformations, numerous pigmentation and nevus, hypertension and varying degrees of mental retardation.

XXX syndrome. These individuals have three X-chromosomes and two bodies of Barr or centered sex chromatin. The condition is found primarily in health facility for persons with mental retardation, but also, although rarely in normal women during routine tests. Although sometimes in such women is set infertility, some of them have a generation, that is chromosomally and phenotypically normal.

They found some rare anomalies of the X-chromosome - for example XXXX or XXXXX without a particular phenotype, although the risk of mental retardation appears to be increased by increasing the number of X-chromosomes.

Syndrome Kllnefelten (XXY). It occurs relatively frequently - at about 1: 400 live births boys. Most of the patients are mentally retarded and observations in special medical facilities for mentally retarded persons show frequency 1:50. Affected individuals are high and eunuchoidal with small underdeveloped testicles. There are a large number of clinical variations. Testicular development varies from hyalinosis, dysfunctional tubules to some sperm productivity. Gynecomastia occurs frequently and increased content of follicle stimulating hormone in urine. The diagnosis is rarely put before puberty. Some patients have 3,4 or even 5 X-chromosomes with one Y. Generally, the larger the number of X-chromosome, the greater the degree of mental retardation, and the number of malformations.

XYY sindrom. It was first opened in 1960 with six white men without major problems. It was found that this chromosome aberration is not rare (median 1: 500 according to some authors). With the exception of high growth, it is not accompanied by any particular phenotype. Assumption of violence and crime associated with this type of aneuplodia not been of proven.

◆ ***Prevention of genetic disorders***

Genetic consultation which aims to prevent the conception of an individual with serious inherited disorders, is one of the main tools for prevention. It is based on the assessment of genetic risk, based on in-depth study of family history and can be comple-

Table 10.12. Certain metabolic disorders in which the heterozygous carriers exhibit partial enzyme deficiency in a test sample of one or more tissues in vitro

Type of abuse	*Enzyme*	*Examined tissue*
• Glucose-6-phosphate dehydrogenase (favism)	*• Glucose 6-phosphate dehydrogenase*	*• Erythrocytes. Fibroblasts in tissue culture*
• Galactosemia	*• Galaktozo- 1-phosphate uridyltransferase*	*• Erythrocytes. Leukocytes and fibroblasts in culture*
• Disease Tay-Sachs	*• N-acetyl hexosaminidase A*	*• Serum. Tears. Leukocytes and fibroblasts in culture*
• Disease Von Gierke (glycogenosis type 1)	*• Glucose-6-phosphatase*	*• Platelets*
• Disease Lesch-Nyhan	*• Hypoxanthine-guanine phosphoribosyl - transferase*	*• Fibroblasts in culture*
• Homocystinuria	*• Cysthathionine synthetase*	*• Hepatocytes. Lymphocytes in culture*
• Hypophosphatase	*• Serum alkaline phosphatase*	*• Serum*

* Loss of chromosome material

Table 10.13. Some metabolic and other disorders for which prenatal diagnosis is possible

Disease	*Diagnostic test*
• *Tay-Sachs*	*Hexosaminidase A*
• *Metachromatic leukodystrophy*	*Arylsulfatase A*
• *Familial hypercholesterolemia*	*Membrane receptors of LDL*
• *Hurler (mucopolysaccharidosis I. H.)*	α-iduronidase
• *Other mucopolysaccharidoses*	*Various enzyme activities*
• *Cystinosis*	*Hook-up the ^{35}3-cystine*
• *Homocystinuria*	*Cysthathionine synthetase*
• *Glycogenosis type II*	*α-glucosidase*
• *Glycogenosis type IV*	*Amyl (1.4-1.6) transglucosidase*
• *Galactosemia*	*Gal-1-P uridyltransferase*
• *Combined immunodeficiency*	*Adenosine deaminase*
• *Syndrome Lesch-Nyhan*	*Guanin- hypoxanthine-phosphoribosyl transferase*
• *Hypophosphatase*	*Alkaline phosphatase*
• *Hemophilia A*	*Antigen of factor VII*
• *Falciform anemia (Drepanocythaemia)*	*The synthesis of β-chain / Analysis of endonuclease for retention Hpal of ADN*
• *Homozygous beta-thalassemia*	*The synthesis of β-chain*
• *Homozygous alpha-thalassemia*	*Hybrid with I / AND marked complement*
• *Thalassemia beta-delta*	

mented with the opening of heterozygous carriers between brothers and sisters, whenever possible **(Table. 10.12)**.

Recently, genetic counseling acquires new dimensions to the development of different methods of prenatal diagnosis, if necessary, proceed to break the pathological pregnancy. Such methods are ultrasound (especially valuable in detecting malformations of the limbs, nervous system, internal organs, myelomeningocele, anencephaly, hydrocephalus, etc.); amniocentesis (amniotic fluid can be tested for: fetal chromosomal anomaly, enzyme deficiency, - **Table. 10.13** genotype HLA, amount of alpha-fetoprotein); and fetal-copies (due to the increased risk for pregnancy rarely used, but is particularly valuable method for the diagnosis of hemoglobinopathies, hemophilia A, etc.).

REFERENCES

1. **Bojanov A.** Epidemiological study of neuroses in children, pupils and students, in order of psychohygiene of the educational process. dis., S., 1977. (in bul.)

2. Children, family, school and society at the beginning of the XXI century. ed. **Sl. Slavov, G. Hristov, M. Nikolova, V. Vassilev, Y. Takeva**; 1 - Physical Development and functional status of children, 9-152; 2 - Psychosomatic deviations and disorders of social value, 417-496. Cameo Design Ltd, 2007. (in bul.)

3. Child care and Genetics. In: The Merck Manual of Diagnosis and Therapy. (Ed) **D. Holvey and J. Talbott**. Merck Sharp & Dohme Research Laboratories, USA, 1972, 900-931.

4. Childrens health and the environment in Europe: a baseline assessment. ed. **D. Dalbokova, M. Krzyzanowski, S. Loyd**, WHO, Reg. Off.For Europe, 2007, 125 p.

5. Childrens health and environment: Developing action plans. ed. **L. Licari, L. Nemer, G. Tamburlini**, WHO, Reg. Off.for Europe, 2005, 87 p.

6. **Christozov, Chr.** Neuroses in childhood and adolescence. S., Med. and phys., 1990. (in bul.)

7. Decree № 39 of the Ministry of Health, SG. 106/2004 on preventive survey and dispensary. (in bul.)

8. Decree № 2 of the MH SG. 16/2003 on the organization and conduct of preventive examinations of subjects from 0 to 18 and dispensary observation of compulsory health insurance persons. (in bul.)

9. **Dietz, W.** Childhood Obesity susceptibility cause management, J. Pediat., 5,103,676, 1983.

10. **Ferrier, PE** Genetique et maladies hereditaires. In: Precis de pediatrie. 3 edition. (Ed.). P. Ferrier, Payot Lanusanne, Paris, Edisen, St - Hyacinthe, Quebec, 1984, 18-53.

11. Gigiena of children and adolescent. ed. **G.N. Serdyukovskaya,** M., Medicine, 1989, p. 320. (in russ.)

12. Health Act, SG. 70/2004, 4 Sect. I Health protection of children; Section. II Reproductive Health; Section. IV Genetic health and genetic research. (in bul.)

13. Hygiene of children and adolescents (contemporary problems). ed. **B. Miteva. S.**, Med. and phys., 1989, p. 224. (in bul.)

14. Hygiene problems of modern school. ed. **Vl. Boyadzhiev.** S., Med. and phys., 1985. (in bul.)

15. **Ivanova L., K. Angelova, N. Vasilevski**. Nutrition and chronic non-infectious diseases. General principles of good preventive practice of CINDI program, Sofia, NCPHP, 2004. (in bul.)

16. **Kliorin, AI.,** Obesity in childhood. L., Medicine, 1988, 256. (in russ.)

17. **Luna R., P. Alvarez-Vasquez**. The role of diabetes duration, pubertal development and metabolic control in growth in children with type I diabetes mellitus. J. Ped. Endocr. Metab., 2005, 18/12, 1425-32.

18. **Manolova A., G. Tzolova, P. Dimitrov, E. Teolova, M. Nikolova**. Healthy children in healthy families - method mat. Program CINDI, Sofia, 2010, 118 p. (in bul.)

19. **Marcelli D., A. Braconnier.** Psychopathologie de l`adolescent, Masson, Paris, 1984, p. 480.

20. Obesity in childhood. ed. **M. Damyanova.** S., Med. and phys., 1990, p. 166. (in bul.)

21. **Penchev, G., A. Radivanska**. Gastroenterology in childhood. S., Med. and phys., 1982, 408. (in bul.)

22. Physical development, physical ability and neuro-psychological reactivity of the population of Bulgaria. ed. **P. Slunchev.** S., 1992. (in bul.)

23. **Popivanova, Ts**. et. al. Social meaning diseases and adaptation capacities of 6-18 years students from Sofia. 1994, p. 212. (in bul.)

24. **Rahneva R.** Hypertension in childhood. S., Med. and phys., 1990, p. 210. (in bul.)

25. **Solomon, GF,** Psychoneuroimmunology. Academic Press, 259-280, 1981.

26. **Stoimenov, J.** Study the impact of certain biological and social factors on the emergence and development of mental illness. dis., Pleven, 1977, p. 232. (in bul.)

27. **Steinberger J., S. Daniels.** Obesity, insuline resistance, diabetes and cardiovascular risk in children. Circulation, 2003.

28. **Tanner, JM** Puberty and Adolescence. In: Child Life and Health-Fifth Edition, Edited by RG Mitchell J. and A. Chourchill, London, Glouchester Place, 1970.

29. **Tzolova, G.** Children traffic accidents - state and problems. dis., S., 1994, p. 159. (in bul.)

30. **Whitaker R.** Obesity prevention in pediatric primary care. Arch. Ped. Adolesc. Med., 2003, 157, 725-8.

2.4.CHILDREN WITH SPECIAL EDUCATIONAL NEEDS.

Vl. Radulov, M. Tsvetkova, S. Sabeva

According to WHO, worldwide people with different disabilities and abnormal development of over 514 million. Causal factors are of various nature. Their distribution by type and number of injured persons are:

- *Inherited diseases* *100 million*
- *Non-trainsmitting somatic diseases* *100 million*
- *Malnutrition* *100 million*
- *Disabled* *78 million*
- *Transmitting diseases* *56 million*
- *Functional mentally disturbances* *40miliona*
- *Chronic alcoholism and abuse drugs* *40 million*

With regard to children highlights that according to minimum estimates, every tenth child suffers from hereditary or acquired bodily, mental or sensory defect. According to recent studies in this area these children are between 15-20%.

The changing public attitude towards children with special pedagogical (educational) needs - SPN (SEN) may be conditionally divided into five periods:

1. Period of isolation. Under the influence of progressive ideas, raised by the french enlighteners in the XVIII century, gives initial impetus for the opening of the first special schools. In 1760 in Paris Charles Michel de Lepe opened the first school for deaf children. 24 years later, in 1784, led by the ideas of Denis Diderot, Valentin Hayui opens in Paris and the first school for blind children. Much later, in 1841, was founded the first school for the feeble-minded children by Edward Seguin in France.

Taking into account the undisputed contribution of special schools, however, parallel, albeit uncon-

sciously, yet its appearance they put children with disabilities in isolation, separating them from their healthy peers.

Without denying the good will and desire for humanity, not realizing the consequences of that, society directs its attention to the development of special institutions that actually have closed communities. Over the years, special schools drag behind and special boarding schools and hostels for adults, special workshops and enterprises, specialized homes for the disabled elderly, etc. Among large part of society is formed notion, that children with disabilities are not like the others, because all of them should be "very special", i.e. and isolated from society.

2. Period of humanization. Creating special schools, regardless of the many "for" and "against", society continues to develop his care to children with disabilities. At the end of the XVIII century society up to the idea of creating special laws protecting the disabled. At that time appear and two types of organizations: organizations of disabled people, profiled in the individual disability, that unite themselves disabled and protect their rights, and organizations for disabled people, created by healthy people in their support. Thus laying the foundations of public support in favour of children with special educational needs.

3. Period of linking education with rehabilitation. According to their capacity, albeit in varying degrees, individual groups of children with disabilities can master the general education subjects in the curriculum.

Children who have completed special schools, however, haven't the necessary skills for independent life. This gives rise, mainly in the 30s, along with general education to develop and special rehabilitation programs, including general cognitive, daily and social skills. Linking education with rehabilitation improves the lives of children with disabilities.

4. Period of integration. In the years after World War II began to have a new concept of training, rehabilitation and vocational rehabilitation of disabled children and adults - the concept of integration. The development of the idea of integration leads to make the change in the education of disabled children from special schools to integrated education (training in ordinary schools under the guidance of specialists). At the same time the efforts of society to guide and professional integration.

5. Period of equal participation in society. Today the idea of integration enjoys strong public support, but young people with various disabilities are taken very hard for work. Complete professional integration means not only accepting of disabled people from society, but also their equal participation in life. This may be accomplished by two major requirements:

• *Preparation of a suitable occupation in terms of a specific disability.* This effectively means that doctors, teachers, psychologists, sociologists and parents must take account of actual professional capacity of the particular child, without any overestimation or underestimation of abilities.

• *Exercise of suitable profession, so quality as by healthy people.* This is the main criteria for the professional integration of young people with disabilities. Professions such. masseuse, a piano tuner, computer programmer, tailor, carpenter or university professor must be equivalent in quality to the performance of healthy people.

◆ *Categories of children with special educational needs*

Historical development of education and rehabilitation of children with special educational needs is associated primarily with self and independent occurrence of pedagogy of different categories of them, much later to speak for "defectology", ie. e. special pedagogy. Although special education studying some common problems associated with compensatory mechanisms, the specificity of research methods, integration, school management, etc., it remains one of the most common set of universal encyclopedic knowledge, relating to the problems of children with disabilities. Therefore priority development receive its branches, which are autonomous sciences and belong to different categories of children. *

- ***Visually impaired children***

Visually impaired children, depending on the degree of visual disorder, may refer to the following groups:

• *Totally blind* - with visual acuity (visual acuity) 0.

• *Children with perception of light* - with visual acuity from 0 to 0.01.

• *Partially sighted* - with visual acuity of 0.01 to 0.05.

• *Poorly sighted* - with visual acuity of 0.05 to 0.2 for better eye.

The above groups are not associated with known 3 groups of visual disability and are determined by educational needs.

* The terms "defectology", "defective children" are socially and individually unacceptable - repel society, traumatize parents and relatives, suppress individual. Used also formerly terms "tiflopedagogy", "oligofrenopedagogy" and "surdopedagogy" are also outdated and inaccurate - eg. totally blind children educated in special schools are only about 20% of all visually impaired. Modern terms are "special education", "children with special educational needs", "pedagogy of visual (auditory, intellectual) impaired."

Table 10.14.

Country	0-4 y.	5-15 y.	16-50 y.	50-64 y.	65-74 y.	over 75 y.
England (1991)	668	1 886	13 772	11 876	18 658	89 335
Finland (1990)	227	254	1 602.	922	1 138	3 872
Bulgaria (1989)	without evidence	304	3 585	2 768	5 717	

Depending on the timing of the visually impaired children can be divided into:

• *Born blind and children where the visual violation has occurred up to 5 years of age* (they are considered born blind in terms of training needs).

• *Blind later* - with visual impairment occurred after 5 years of age.

The most common visual disturbance include: damage to the retina; glaucoma; congenital eye damage; damage to the optic nerves; myopia; damage to the cornea; nystagmus, aphakia, iris problems. **Table 10.14** reflect on the number of visually impaired persons (blind and visually impaired) in some countries:

New research in England showed an increase in the number of the blind and visually impaired, compared with data from 1980-1991 - the blind respectively by 26% and a visually impaired - by 82%, a trend established also for other countries.

- ***Hearing-impaired children***

Degree of hearing impairment allows the following classification:

• *Children with socially adequate hearing* - decrease 0-30 dB for speech frequencies (0.5, 1 and 2 kHz).

• *Hearing impaired people* - 30-60 dB.

• *Practical deaf* - 60-80 dB.

• *Deaf* - over 80 dB.

Table 10.15.

Country	Year	Data in %
USA	1977	3%
England	1975	1%
Netherlands	1978	1%
Sweden	1983	0,5%
USSR (ex)	1984	1%
Hungary	1981	2,3%
Greece	1989	1%
Bulgaria	1994	1,2%

In terms of training needs children with hearing problems may be divided more of the following major groups:

- *Deaf (early-deaf) without speech experience.*
- *Deaf (deaf-later) with some speech experience.*
- *Hearing impaired people with advanced speech with a few shortcomings.*
- *Hearing impaired people with significant speech immaturity.*

Hearing loss can be congenital and acquired. About 75% were acquired. Most common are inflammatory disorders of the middle ear - 80%.

- ***Children with mental retardation***

Modern classification includes the following four levels of violation of IQ:

- *Slight intellectual failure - 50-69 *.*
- *Moderate intellectual failure - 35-50.*
- *Severe intellectual disability - 20-35.*
- *Deep intellectual failure - below 20.*

A particular category of children are those with IQ between 70 and 80 who should not be attributed to abnormalities. In the special literature they are called "children with mental inhibitions in development." According to the WHO, people with intellectual disability across countries are on average between 1-3%. **Table 10.15** provides information for some countries.

- ***Children with neuro-somatic diseases***

One of the most common classifications divides many nosological units and forms the circle of somatopedy into three main groups:

1. Diseases of the musculoskeletal system.

2. Diseases of the internal organs.

3. Diseases of the nervous system.

In connection with the modern differentiation by accommodation in recreational and sanatorium schools in Bulgaria, using the following classification:

1. Allergic and other non-specific respiratory diseases.

2. Specific pulmonary and other tuberculosis diseases - pulmonary tuberculosis, bone and joint tuberculosis.

* Either: mild, moderate ... mental retardation

3. Endocrine diseases.

4. Cardiovascular, rheumatic, cancer, other diseases of the internal organs, skin diseases.

5. Orthopaedic diseases - chronic dislocation of the hip, scoliosis and other deformities of the spine, congenital or acquired deformities of limbs, missing limbs.

6. Organic neurological disease - infantile cerebral palsy, poliomyelitis, muscular dystrophy.

7. Functional neurological diseases - neuroses, "monosimptomic" neurosis, neurotic syndromes.

- ***Children with speech disorders***

Speech disorders can be divided into the following groups:

1. Violations of the articulation, adding sounds, replacing sounds - distortion of sounds (dyslalia), dysarthria, a common oral misstatement (blurred speech) and others.

2. Disorders of phonation: aphonia, falsetto, hoarseness, monotone voice, tremulous voice and others.

3. Violations of speech: tahylalia (fast speech), bradylalia, haltingly (difficulty rate and rhythm) and others.

4. Violations language: Alalia (violation of the language in its mastery and incomplete formation), aphasia (language disorder after its finished form), telegraphic style, agrammatism, stuttering.

5. Violations of reading and writing: alexia, dyslexia, agraphia, dysgraphia (this also includes the "mirror writing").

6. Violations of breath: rapid rate of breathing, short exhalation, antagonistic diaphragm movements and movements of the chest.

7. Disorders of perception: agnosia, perceptual immaturity, perceptual lag.

- ***Children with multiple disabilities***

This is a special category of children where there is more than one impairment in it in different combinations with varying degrees of manifestation and a leading disability. For example, in blind-deaf children usually resulting damage is considered blindness. In some deaf-blind children may also have intellectual disability or somatic disabilities.

According to WHO, the number of these children is steadily increasing.

◆ ***Features in training***

Students share with SEN may vary between 2% and 20%, depending on the model of classification. When using the "medical model" that focuses on disability or handicap, SEN settle in 2% of students. This classification helps identification and measurement of physical, functional and social consequences of the disease or trauma.

The second model of classification is based on the description of SEN. Thus the definition of disability is based solely on the need for special assistance, which explains the higher proportion (20%) of children with such needs.

<u>*Learning.*</u> In the scheme of the proposed special training in member countries of the Organization for Cooperation and Economic Development (OCED), as well as in most countries in the world, there are three main forms:

1. Pedagogical support for children with SEN in normal classes mass school (Canada, Iceland, Italy, Norway, Sweden).

2. Special classes in mass schools (the most widespread).

3. Special schools - day or boarding schools (Austria, Belgium, Germany, Holland, Eastern Europe). In some countries, there are many alternative forms of special training, as a combination of the three basic forms.

<u>*Educational institutions.*</u> Children with special educational needs can be educated in these schools and health institutions

1. Special schools.

2. Integrated training. This is the education of children with special educational needs in mass school, usually under the guidance of specialist teachers. There are different models of integrated education, according to which the integration process is strictly individual for each child.

3. Special classes for children with disabilities in mass schools or "daily classes" - classes for healthy children in special schools. Both forms are peculiar controversial models of integrated education.

4. Training in health care facilities. This includes so-called clinical programs, involving children in need of prolonged treatment.

5. Training home. Under the current in our Education Act, children who due to serious health reasons, proven by medical authorities, can not attend school have the right to be educated at home by a teacher from the nearest special school, corresponding the type of disability.

6. Social homes (institutions). The training here mainly covers children with multiple disabilities, focusing on the formation of elementary useful skills for independent life.

<u>*Training programs.*</u> In recent decades, and especially since 1990 - the adoption of the UN Charter on the Rights of the Child and the launch of OCED project "Active life for teenagers handicapped children. Integration into the school", the tendency of integration of pupils with SEN in mass school.

The education of children with special educational needs includes 2 main types of programs:

1. Academic.

2. Special.

Visually impaired children, children with neurosomatic disabilities and children with speech disorders, that have normal intelligence, master academic knowledge in general education programs of ordinary public schools. Academic programs for other categories of children have adapted, i.e. changed is the volume and content of the material.

Special programs are strictly differentiated according to the type and degree of disability. In visually impaired children with emphasis on the formation of useful skills (general cognitive, daily and social), orientation and mobility (learning the techniques for independent and safe travel with a white cane or guide dog), visual assistance (mastery of methods and tools for efficient use of low vision), tactile art (modeling, embossed painting, producing items of different materials). Upon hearing impaired children special programs have a strong focus for rehabilitation and related of training to poor hearing and develop spoken language and overall communication. The emphasis in children with intellectual disability is placed on the formation of a wide range of useful skills with important social value. Carry out work on the correction of behaviour and using a variety of therapies such as art therapy, music therapy, dance therapy, etc. In children with neuro-somatic illnesses special programs focusing mainly on kinesitherapy and various activities related to medical rehabilitation. Special programs for children with speech disorders are directed primarily at correcting their education in public schools. They can also apply various types of therapy (eg. psychotherapy for stuttering).

In two groups of children with special educational needs has been a serious sensory deficit - these are visually impaired and hearing impaired children. They need special ways of getting information. Totally blind and partially sighted children literacy Braille. Braille is large in size and has a low reading speed as read by touch with fingertips of both hands. At the same time it is the only means of literacy, is universal and easily be computerized, which makes it indispensable today and in the future. Poorly sighted children use in their training optical and non-optical means. No-optical means are large print, lined paper, special lighting, colored plates to change the traditional black and white contrast and more. Optical means are divided into two main groups: for the near and distant vision. Another way to obtain information from the visually impaired is speaking book (record of verbal text). It solves partial problems of persons who are unable or unwilling to learn Braille.

Totally deaf and children with severely impaired hearing communicate with each other using gesture-mimic speech, in which each word is represented by a character sign, with active movements of both hands and using a facial expression of the person. An essential part of communication of deaf and hearing impaired people children falls on dactyl alphabet in which each letter is represented by a different position of the fingers. It should be seen as an integral part of the gesture-mimic speech, as each word for which there is no precise sign is dactylated.

In some children with neuro-somatic diseases or those with multiple disabilities requires the use of various atypical parts of the body to carry out a number of important activities, such as reading, writing and self-service. For example, children with paresis, paralysis or missing upper limbs are trained in writing by mouth or feet. In similar cases, blind children can be taught to read Braille with such tactile sensitive areas as the tip of the nose, chin, lips and more.

The results of the introduction of integration in member countries of the OCED - show that basically two groups of students increasingly benefit from training in mass education - namely poorly sighted and blind and those with diseases of the musculoskeletal system. The problems of students with emotional and behavioural disorders are solved or through integration in a normal class with additional educational support, or, more often, by targeting to special classes or special schools.

To successfully implemented the integration of students with SEN in public education must be given to the following main factors:

1. Curriculum. It should be aligned with national educational program; must be given to personal and professional qualities of teachers. In most cases it is necessary to prepare a personal training program, development of special materials and additional means of communication. The importance of individual training program to integrate students with problems is assessed both in relation to the effect of their training, and that of healthy students. The general requirements for such a program include: adequacy, timely update and evaluation of results at each stage. Individual program combines pedagogical, educational and therapeutic part, which set the main objectives, which seek participants in a multidisciplinary team, working out the program. Indicate the role of parents at each stage of the project.

2. Personal and social development of students. Efforts should be directed to the full development of the child, access to other children without SEN, taking into account the linguistic, ethnic and cultural characteristics of the child.

3. Learning environment. Type of classroom size, shape, acoustic and visual characteristics.

4. Comprehensive school environment. Dimensions and characteristics of the school and the surrounding area as a whole - access to building links with other schools and community institutions.

5. Teaching and non-specific support. To teachers working with problem students indicate several additional factors: heart attitude towards students, raising their self-esteem by successfully passing the stages of the individual program, good discipline, consistency in the relationship student-adult individual counseling and decision-making.

6. Therapeutic support. Helping children to overcome the difficulties, that are not in the strict sense "training", but that are relevant to them or to other needs, significant for personal development (eg. logotherapy, physiotherapy, psychotherapy, music, art, etc.).

7. Technical Support. Includes means that are needed to optimize and support the training of the required level (aids vision and hearing, physical assistance and equipment, development of specific tools and game teams, etc.). Integrated individualized training improves school performance as a troubled and all other students.

REFERENCES

1. **Brouillette, M.** Theories to explain the development of special education. In: P.Mitter, R. Brouillette, D. Harris, eds., Special Need Education. London - Philadelphia, 1993, pp. 29-42

2. **Clough, P., G. Lindsay.** Integration and the Support Service. Changing Roles in Special Education. NFER-Nelson, 1991,169 p.

3. **Daunt, P.**, The "new democracies" of Central and Eastern Europe. In: P. Mittler, R. Brouillette, D. Harris, eds., Special Need Education. London-Philadelphia, 1993, pp. 101-103.

4. **Dobrev Zl.** Mentally retarded children. Print base to MEST, Sofia, 1995. (in bul.)

5. **Guilliford, R.** Special Educational Needs. London, Routledge and Paul Kegan, 1971.

6. **Hegarty, S.** Meeting Special Needs in Ordinary Schools. London, 1993, 213 p.

7. OCDE. L'integration scolaire des enfants et adolescents handicapes. Ambitions, theories et pratiques. Paris, 1994,101-103.

8. **Petrov, Iv., St. Mutafov.** Somatopedy. University Press "Kl.Ohridski ", 1994. (in bul.)

9. **Tsvetkova-Arsova M.** Training of deaf-blind children and adolescents, "St.. Kl. Ohridski ", S. 2004, 385 p. (in bul.)

10. **Wedell, K.** Varieties of School Integration. In: P. Mitter, R. Brouillette, D. Harris, eds., Special Need Education. London - Philadelphia, 1993, pp. 225-237.

2.5.CHILDREN WITH MULTIPLE DISABILITIES. M. Tsvetkova-Arsova

Children with multiple disabilities are a special, even unique group that can hardly fit within the traditional standards and beliefs about learning, and the norms of human behaviour. This is a group that can hardly be considered a summary or be placed under a common denominator. The reason is that virtually every child with multiple disabilities is unique in itself and different from other children, within the same group.

One of the first emerging definitions of children with multiple disabilities is 1974, adopted by the US department of education. It reads: "Children with multiple disabilities are those who, because of the depth of their physical, mental or emotional problems, need educational, social, psychological and medical care beyond traditional care provided in mass and special education programs in order to reach most of social interaction ... ". Another American organization - the association of people with profound disabilities (TASH), also defines this category of persons with an emphasis on the kind care and support necessary for people with multiple disabilities. According to her, "these are people of all ages requiring significant and continuous support in more than one major life activities in order to participate in public life and to enjoy a quality of life available to citizens with minor or no violations ... ". Best S. (1986) consider persons with multiple disabilities with a focus on their inabilities, indicating that these are individuals who "may not receive relevant information from the environment and to become independent learners and can not use environment, operate independently."

Can certainly say that children with multiple disabilities have a fundamental need one - **a very special training**.

Particular attention should be paid to **blind-deaf** children who are one of the groups of children with multiple disabilities. First, it is necessary to point out that in the west (Anglophone, German, Spanish, French) and Bulgarian literature observed a discrepancy in terminology. In western terminology blind-deaf speak for **deaf blind** (Taubblind, sordociegos). According to US Public Law training to persons with disabilities by 1990. " blind-deaf children and adolescents are those who have hearing and visual impairment, the combination of which causes such deep needs in communication and other developmental and educational needs that these persons can not be trained in special programs for students only with hearing or just visual impairment or other programs for persons with profound violations, without specific assistance to meet this dual combination of sensory disturbances "(PL 101 476 USC, Chapter 33 section 1422).

Another popular definition of blind deafness belongs to the organization of the Nordic countries (Norway, Sweden, Denmark, Finland, Greenland and Iceland). According to this definition "a person is blind-deaf when combined with profound hearing and visual disabilities. Some blind-deaf people are totally blind and totally deaf, while others have residual hearing and vision. The depth of the combined visual and hearing disabilities means that they are unable to automatically enter the services and facilities for persons with only visual or only auditory disorders. "

Children with multiple disabilities can be divided into different groups according to various signs. Important criteria for their classification are:

a) the degree of manifestation of the disability;

b) age of onset of disability;

c) a combination of disabilities.

Causes for multiple disabilities

Number of children with multiple disabilities has increased dramatically over the past 50 years. It is believed that the reasons are mainly two:

1. The development of medicine as science,

2. The total pollution worldwide.

Nuclear accidents like the one in Chernobyl in 1986 led to dangerous pollution in large areas mutations and birth of children with various disorders and malformations.

While today medicine is able to save and prolong the lives of children who in the past would not survive under natural selection. It has advanced significantly in protecting the lives of premature babies, including babies born before the seventh month of pregnancy. Medical science still knows relatively little about how to prevent the onset of disability, as well as its subsequent treatment and removal.

Recently, serious research is being conducted on stress as another possible reason for increasing the number of children with multiple disabilities. Studies are mainly on the impact of stress in pregnant women.

Characteristics of children with multiple disabilities

Considering in particular blind-deaf that one of the groups of children with multiple disabilities, Alsop L. (2002) stated that they have the following characteristics:

1. A different view of the world because of different information received him.

2. Difficulties in communication or inability to communicate in a meaningful way.

3. Serious difficulties in establishing and maintaining interpersonal relationships.

4. Acute tactile sensitivity and even tactile fear.

5. Self stimulants behaviours and problems in following the discipline and rules, causing in turn, sensory deprivation, isolation, frustration, confusion and fear.

6. Serious health problems.

7. Lag in motor development.

8. Ineffective use of reserved senses, sensory integration difficulties.

9. Difficulty in summarizing the information.

10. Difficulties in nutrition, sleep problems, etc.

Ryan, P., B. McGinnity, L. Jacobs (2002) indicate some more typical psychosocial characteristics:

1. Isolation from the world of objects and the world of humans.

2. Offend and strong vulnerability.

3. Difficult understanding of events, activities, people who happen are around them.

4. Strong depending by surroundings in many ways and activities.

5. Tendency to depression, falling into sadness, crying, frustration.

Against the background of these characteristics should be guided by the following principles concerning the personality of the child with multiple disabilities:

1. There isn't a common, pooled account or appearance of children with multiple disabilities.

2. Children and students with multiple disabilities can participate in almost any activity or occupation.

3. Students with multiple disabilities communicate in different ways.

4. Many children and students with multiple disabilities can move independently or with minimal assistance.

5. Students with multiple disabilities can be accommodated in various schools and teach both special and in mass learning environment.

6. Educational teams are essential in planning individual plan and program.

7. Families of children with multiple disabilities are key actors in the educational team.

Evaluation of children with multiple disabilities

Children with multiple disabilities require a wide range of care. Having to use a **team of experts** to perform the evaluation and development of individual education plan or program (PEP). The team of professionals varies by disability of the student. Traditionally it includes: teacher of students with multiple disabilities, psychologist, speech therapeutist, visual therapeutist, instructor for orientation and mobility, audiological, social worker, physiotherapeutist, a specialist in early impact (if the child is in pre-school age), a medical practitioner - family physician or nurse, parent. If necessary, the team may include other specialists.

There are three basic approaches to work and evaluation by team for children with multiple disabilities:

1. Multidisciplinary approach.

Each specialist carries out its observations and evaluate students in the area, prepare a written report on his observations and recommendations for further work with students. In this approach lacks interaction between specialists. This hampers the development of individual education plan or program.

2. An interdisciplinary approach.

In this approach, each specialist again performed individually and independently own's observations and evaluate student, then all discuss theirs observations and jointly work on developing an individual education plan or program.

3.Transdisciplinary approach.

This is a typical American approach where all specialists come together and jointly carry out their observations on the student, as one of them plays the role of host and manage evaluation. All together discuss their impressions and develop individual plan or program.

Areas of training of visually impaired with multiple disabilities

Education of children with multiple disabilities is not usually with an emphasis on academic subjects, but on the formation and management of functional skills and habits. Training should provide for the acquisition of skills in the following seven main areas (Silberman R., 1986):

1. Motor skills.
2. Cognitive skills.
3. Communication skills.
4. Skills for self assistance/self serve: skills for nutrition; toilet; hygiene skills.
5. Social skills.
6. Foreprofessional skills.
7. Skills for leisure.

Problem behaviour in children with multiple disabilities

One of the main difficulties faced by professionals working with children and students with multiple disabilities, are various problem behaviours exhibited by this group of children. They can consist of:

- aggression towards others
- self agression (auto-aggression) or injure
- stereotypes or self stimulate behaviour (mannerisms),
- behaviour of non-cooperation (refuse participation or performance of an activity or task),
- frequent and causeless change mood
- socio-sexual problems related to behaviour (masturbation, fetishism, exhibitionism, etc.)
- echolalyc behaviour (verbatim repetition of heard words, sentences, questions)
- phobia (anxiety reactions to certain objects, people, activities, seats),
- placing any object in the mouth and more.

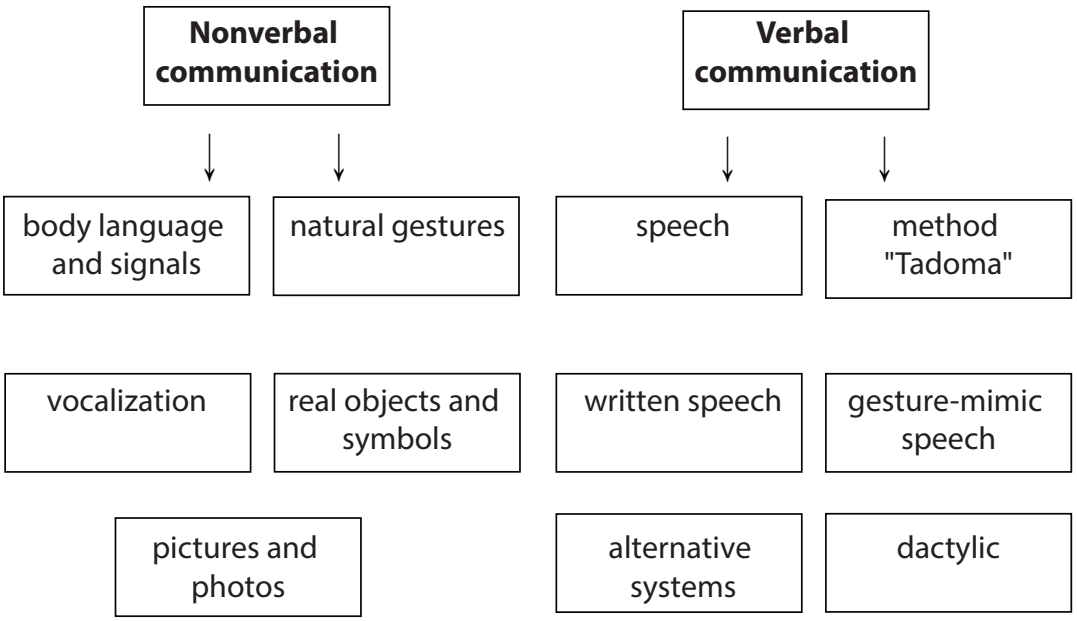
Communication in children with multiple disabilities

Another frequent and especially typical problem for children with multiple disabilities is communication. Communication can be extremely complex to them, because the majority of students have different forms and degrees of intellectual, physical or speech-language disorders, that do not allow them to communicate in a standard and accepted way. Blind-deaf will encounter the greatest and most serious difficulties. Depending on whether you use speech in the process of communication, it can be divided into verbal and nonverbal.

Images and photos. They are usually combined in complex systems, are often designed in the form of computer software. Spread and gained popularity in Bulgaria set of images is the American system Mayre Johnson, which offers images for more than 700 objects and activities. The images are simple, associative and visual, to help the perception of the activity, object or event. Students with multiple disabilities derive more benefit if the observed image of the particular object, such as a glass from which to drink, or toy, which play, than their stylized image.

Gesture-mimic speech. Each country has its own gesture-mimic speech, such as different systems often have a number of similarities or include the same or at least similar gestures for certain words. In Bulgaria using gesture-mimic speech, which was established on the basis of unification of gestures used by deaf and is accompanied by an appropriate gesture and facial elements of pantomime. It follows the syntax of the Bulgarian language.

Verbal and non-verbal communication with deaf-blind (in Crook C., 2000)



Version of gesture-mimic speech is the English system Makaton. It is designed to meet the specific needs of adults with profound disorders that haven't a hearing problem. Makaton system is usually used in combination of display image (graphic sign) with the performance of the gesture, accompanied by a verbal articulation.

Dactylic. It is part of a gesture-mimic speech and is displaying the letters of the alphabet by placing the hands in a specific situation. Dactylic is very appropriate form of communication in total blind-deaf, as they are carried in the palm of *dactylic in the hand of blind-deaf (dactylic hand in hand)* Communication is thus slowly, as having spelling of each word.

Lorm system. A variant of spelling out the words, but do not use dactylic-official alphabet of the deaf, and each letter is expressed by pressing different parts of the palm and fingers of blind-deaf.

The method "Tadoma." This is a rare method of communication and is also used primarily by blind-deaf. The method "Tadoma" is expressed in understanding spoken language of others by placing hands of blind-deaf on certain places, where you can feel the movements and vibrations of the articulator organs: his mouth; directly on the lips; on the throat.

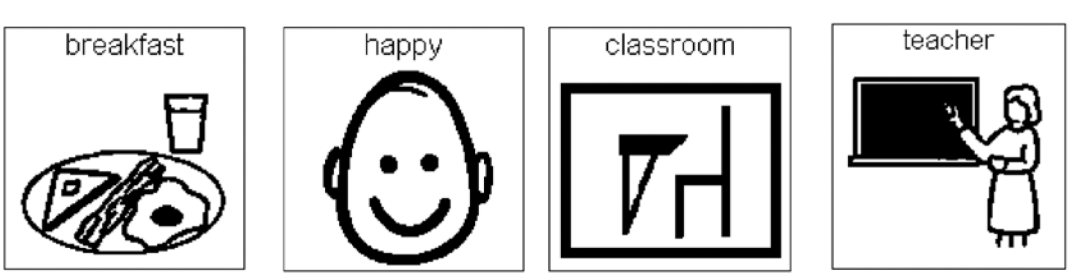
Written language. It offers various opportunities for communication through various forms or types: flat print type; Braille; brailing hand in hand. Flat print type, either normal size or in large print option is a good opportunity for students with residual vision.

Alternative systems of communication. Some students with multiple disabilities can not use these means of communication. While they may have sufficient cognitive abilities (but have mobility restrictions - eg. Muscular dystrophy, etc.). In these cases can be used alternative or electronic systems of communication: low-tech systems; mid.- tech systems; high-tech systems.

The first group systems include: real objects, pictures from the system Mayre Johnson **(Fig. 10.8)** panels for attachment on them symbols, pictures and photos. The second group systems includes: *Single buttons*, which previously is recorded communication by voice of a parent, teacher or other person close to student; *Panel with two buttons*, suitable for making a choice between two activities or two objects. *The third group* systems include electronic aids.

Real objects and symbols. The inclusion of real objects in communicating with students with mul-

Fig. 10.8. Illustrations of pictures from system of communication Mayre Johnson



tiple disabilities is available and for those who have deep cognitive limitations. Communication is done by the student pass real subject, but it can also submit relevant object to indicate a desire for a particular activity.

Natural gestures; body language and signals. It is relatively inferior hierarchical form of communication, that is suitable for students with significant mental disorders - eg. pressing a certain part of the body is a signal for testing pain and discomfort; pointing to a particular subject is a sign of his request; removal of the teacher to a place is a natural way to indicate a need or desire, etc.

Vocalization. Vocalizing also located on the lower stage in the systems of communication. Through it you can also specify a limited range of feelings, desires, needs, eg. by issuing a characteristic sounds and vocalization, and through tears and laughter, the student can show whether happy, angry, hungry, miserable and so on. Students with combinations of mild forms of disabilities can be taught integrated into public education - eg. if the student has impaired hearing and eyesight, or decreased vision and monoparesis. In this case it could use the massive curriculum and receive resource support from special education only in certain areas - for example. orientation and mobility, specific techniques of reading and writing, useful skills and more.

Opportunities for educational placement of children with multiple disabilities

Students with severe combined disorders are educated in special schools generally. Schools for children with impaired vision, teach such students in special classes, applying individual approach to each child. Now in Bulgaria over 50% of the total number of students in two schools for children with impaired vision (in Sofia and Varna) are with multiple disabilities. Centers set up by non-governmental organizations also carry out such training.

REFERENCES

1. **Alsop, L.** Understanding Deafblindness: Issues, Perspectives, and Strategies, vol. 1 and 2. SKI-Hi Institute, Utah State University, Home Oriented Program Essentials, HOPE Inc, Utah, 2002.

2. **Best, C.** The multi-sensory impaired (Deaf-Blind) in the mentally handicapped population - an Unknown quantity ? -In: D. Ellis (ed.). Sensory Impairments in Mentally Handicapped People, College-Hill Press, San Diego, CA, 1986.

3. **Crook C.** Modes of communication for the deaf-blind, ELP lectures, October- November 2000.

4. **Ryan, P., B. McGinnity, L. Jacobs.** Psychosocial aspects of Deafblindness. -In: Alsop L. (ed.). Understanding Deafblindness: Issues, Perspectives, and Strategies, vol. 1 and 2. SKI-Hi Institute, Utah State University, Home Oriented Program Essentials, HOPE Inc, Utah, 2002, 17-39.

5. **Silberman RK** Severe multiple handicaps, -In: Foundations of education for blind and visually handicapped children and youth, G.Scholl (ed.), New York, NY: AFB, 1986.

6. **Tsokova D.** Training and education of children with significant difficulties Agency Data Ltd, S., 1997. (in bul.)

7. **Tsvetkova-Arsova, M.** Training visually impaired with multiple disabilities and blind-deaf, ed. Ekoprint, S., 2002. (in bul.)

8. T**svetkova-Arsova, M.** Training blind-deaf children and adolescents, "St.. Kl.Ohridski ", 2004. (in bul.)

9. **Welch, TR, KM Huebner.** The Deaf-Blind child and you. - In: KM Huebner, JG Prickett, T. Rafalowski Welsh, E. Joffee (eds.). Hand in Hand: Essentials of Communication and Orientation and Mobility for your Students who are Deaf-Blind, AFB, New York, 1995.

2.6. AUTISM. M. Tsvetkova-Arsova

In 1943, American psychiatrist L. Kanner published an article dedicated to the unique group of children who fail to establish relationships with other children and adults. So first began to pay attention to children with autism.

In spite him Austrian psychiatrist H. Asperger described in 1944 similar events and designates them as **autistic psychopathy**. Neither Kanner, or Asperger associated autism with schizophrenia (although it felt kind of psychopathy). According to them, autism differs in three elements:

- the problem occurs at an early age,
- gravity seemed to decline with age,
- no patient reported the hallucinations.

In the 50s and 60s of the twentieth century autism is seen mainly as a form of "childhood schizophrenia".

70 years of the twentieth century began a new era in research and treatment of autism. To discuss the diversity of autism by intellectual failure, to specify behavioural and educational problems and methods to overcome them. Autism is seen primarily as a biological disorder in brain development.

80 years of the twentieth century autism strongly distinguished from childhood schizophrenia. He is seen as emotional and behavioural disorder with specific symptoms of missing or poor communication and the need for special training and early strategies of influence. The third edition of the American Psychiatric Association (DSM - III, 1980) distinguishes autism from childhood schizophrenia and classify it as a generalized disorder of development and specifies that it is not an emotional disorder that can affect the development of normal cognitive processes, and kind of disturbance of brain functions, leading to cognitive decline, strange behaviour and inability to communicate. DSM - IIIR 1987 propose a list of criteria for the diagnosis of autism.

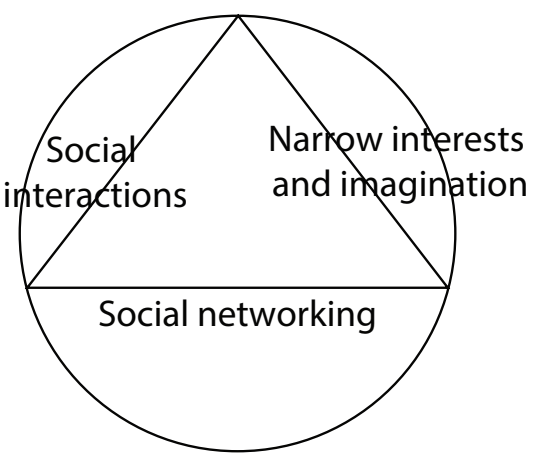
In the 90 years of the twentieth century by DSM - IV and DSM - IVR expands the definition of autism, including Asperger's syndrome in the group.

In the last fifth edition of the American Psychiatric Association in 2013 (DSM - 5) again talk about autistic spectrum violations (Autism Spectrum Disorders), indicating multiple subcategory of autism spectrum. In this edition indicate new forms and methods to diagnose autism and define its two main features: impaired social interaction, and restricted and/or repetitive behaviours. Autism is often violation - he was seen in 4-5% for every 10 000 people, according to data from the 90s of XX century. Modern studies have shown a sharp increase in the number of children with autism, as some places settled 273% increase (California - USA, 2002). In the UK data shows that autism is present at 3-4 per 1,000 people. Some recent studies (Amaral et al., 2011) indicate that one of every hundred children is diagnosed today with autism. 2012 indicating the frequency of a child of 88 children. Autism is said to have acquired a dimension of global health crisis. It affects more often in males than females, with a ratio of 4-5: 1.

Autism is difficult to diagnose because of the large group of developmental disorders that belong to it. Distinguished three major characteristics of autism:

1. Qualitative abnormalities in social interaction.
2. Qualitative disorders in verbal and nonverbal communication, and in the imaginary (creative) activities.
3. Extremely narrow repertoire of activities and interests. Graphical characteristics of autism can be

Triad of autistic disorder



represented as follows (by Tsokova, 2004):

Qualitative abnormalities in social interaction consist of:

- missing or limited interpersonal perception, resulting in difficulties in reporting stress in others, understanding foreign needs, attitudes, etc .;
- missing or special requirements for comfort under stress - e.g., Illness or fatigue, seeking comfort in stereotyped ways;
- missing or damaged opportunity to follow - can not waved for goodbye etc .;
- missing or particular social game - e.g., no activity in ordinary party games, prefer solitary games, etc .;
- significant disruption in the ability to build friendly relationships.

Children with autism do not understand and difficult to master complex rules of social interaction.

They are not easily assimilated social signs, no social instinct and intuition. Often demonstrate indifference to others. The pursuit of self-isolation is pronounced. It is possible, however, the child does not want to remain without a mother, to show alarm in her absence, though not manifested emotional attachment to it. Sometimes even the attitude towards the present parent can reach negative repulsive.

Quality violations in verbal and nonverbal communication, and in the imaginary (creative) activities are manifested in:

- missing or poor nonverbal communication by facial expression, eye contact, facial gestures (mimic), gestures, posture. Often a conversation may have "stray" look, do not smile, stare;
- lacking creative activities, such as performing the roles of adults, fantasy images or images of animals, lacking interest in fairy tales and fantasy stories with situations and circumstances;
- there are violations in the production of speech in terms of content, rhythm, intonation, strength and height;
- have violated the forms and content of speech to include stereotypes and repetitions as echolalia or mechanical repetition of certain words, using the third person singular, instead of first-person singular (for example, instead of saying "I want water" speaks "Tony wants water" and others.);
- impaired ability to initiate or maintain a conversation with others.

A narrower repertoire of activities and interests occur through:

- presence of stereotyped, mannered body movements such as nodding head, strange or circular movements with his fingers, turning in a circle, etc .;
- persistent interest in certain parts or details of objects (eg the wheels of a toy car);
- appearance of confusion and anxiety in a change in the environment or it ordering;
- misunderstanding and intolerance to changes in daily routine (for example, when changing the route to school or home, when changing the layout in the activities for the day, etc.). ;
- limited interest or interest only in one direction (collecting own collection of strange objects, manic curiosity only in one area, for example, biology) and intolerance to new ideas.

Some typical symptoms for differentiating autism from other developmental disorders such as intellectual disability or learning difficulties are demonstrated in **Table. 10.15.**

Table 10.15. Typical symptoms characterizing autism

The child can not make contact with other children 	Child refuses changes in daily routine 	The child showed physical hyperactivity 	The child engages in bizarre, meaningless games 
The child reacts as if there is a hearing problem 	Child shows their needs through gestures and keeping others 	The child does not pursue or avoid eye contact 	The child behaves cold and reserved to others 
Child refuses training 	Child laughing for no apparent reason 	The child is experiencing inexplicable attachment to certain objects 	
The child feels no fear of real dangers 	The child does not like physical contact (ex. to be hugging and kissing) 	The child loves to rotate objects in a circle, around their axis 	

Children with autism think specifically and understand the language literally. For them, metaphors, allusions and sarcasm are incomprehensible - eg., "This is as shelling peas" - they will look around and look for beans. For them it is often difficult to say what they need - words often get lost. For example, when they are hungry, angry, confused, they often just cry. All this does not mean that autistic children are intellectually limited - back, very often they can be famous scientists or artists - eg., indicate that Leonardo da Vinci, Maria Sklodowska-Curie, Beethoven, Mozart, Newton, Mark Twain was a behaviour typical of persons with autism.

In the tenth edition of the International Classification of Diseases **(ICD-10)** defines eight categories of generalized disorder of development:

- infantile autism,
- atypical autism,
- syndrome Rhett,
- Asperger's syndrome,
- disintegrating disorder of childhood,
- disorders with hyperkinesy associated with mental retardation and stereotyped movements,
- other generalized disorders of development,
- nonspecific generalized disorders of development

In **disintegrating violation childhood** child develops according to norms during the first two years, should regress at least two of these areas, for example, speech, social skills or adaptive behaviour, motor development and others. It is possible to demonstrate social and communicative disorders and typical behaviour for autistic disorder.

In **Asperger's syndrome** (also called high-functioning autism) worsening of social interaction, routine and repetitive patterns of behaviour and action. No note corresponding to age develop habits of self-improvement, specific adaptive behaviour and curiosity of childhood, lack of spontaneous sharing of pleasures. At the same time it is a typical manifestation of persistent interest from bits and details of items. Is later formed basic motor movements (walking, running, etc.), there may be strict adherence to routine activities.

Table 10.16. Approaches to contact and encourage communication in children with autism (Wetherby, 1999)

- Eat food that the child loves to him, without offering thereof;
- Operate a mechchanical toy which perform some actions or movements, and once she stopped pass her of the child;
- Give the child four blocks, one after another, which he put in a box and then immediately submit him figure of animal, also put in the box;
- Check with your child some books or magazines;
- Open bottle with soapy foam, blow several soap bubble, then close the bottle tightly and submit it to the child;
- Start a variety of social games with the child when he expressed satisfaction, interrupt the game and wait for the child to ask for more;
- Inflate the balloon and gradually deflate it, give it to the child or hold it to your mouth and wait;
- Hold your child in front of a toy or food, which it does not like and wait;
- Place food or toy that the child likes in a transparent container, closed it tight and submit it to the child;
- Place hands on the child in cold, wet or sticky substance, e.g., jelly or cream;
- Ball rolled to the child, after that condition would roll back to you three times, immediately replace the ball with another toy;
- Involve your child in arranging puzzle. Once the child put together three parts, give it an element that does not fit;
- Involve your child in activities with the use of a substance that could easily waste, spill, broke. A sudden waste of the substance to the child and wait;
- Place the subject in an opaque container, shake it in front of the child and wait;
- Give the child materials for the implementation of interesting for him activities, but without a necessary for activity subject. Keep items out of reach of the child's hands and wait;
- Give the child materials for the implementation of interesting for him activities, but without a necessary for activity subject. Let a third person came to you and take this object, away and sit on the other side of the room, holding the object so that the child sees it and wait;
- Waved an object and say "Bye" before you remove it from the table. Repeat the operation twice more and the fourth time he did not say anything.
- Hide the plush toy under the table. Tap on the table and remove the toy. Let toy "congratulated" the child. Repeat the operation twice more and the fourth time after removing the toy, do not say anything.

Rett syndrome affects mainly females. It is characterized by slowing growth and physical development and gradual regression in development. A loss of learned targeted habits of arms or exhibit strange movements with the hands that resemble washing, twisting the fingers and others. There are sleeping problems and possible syncope. During the preschool observed serious difficulties in social functioning.

In atypical autism (denoted as generalized non-specific developmental disorder) diagnosis to be placed is PDD-NOS (Pervasive developmental disorders - non-specified). It is placed, if children's events are less than manifestations in autistic disorder, although they are exactly the same.

Autistic disorder characterized by the presence of noticeable improper social interaction and relationships and restricted repertoire of activities and interests. Manifestations of the disorder vary greatly depending on the age and development.

Working with children with autism is not easy because of the very large range of developmental disorders that they demonstrate. In any case, it is important for them to create suitable living arrangements, including activities they like and find attractive. Promotion for a job well done is a useful criterion for them. It is essential to ensure a constant environment in which there not occur frequent and significant changes or changes are implemented gradually. "Oddities" that students with autism demonstrate should be taken seriously and should not be underestimated. If they are harmless and do not violate the daily routine, or no danger very student, they can be tolerated and accepted as part of routine activities (e.g. if the student has a habit arranged in a certain order school belongings, if they wish to sit on the right fixed place in the classroom, cafeteria and other school premises, if he need a glass of milk at a specific time, etc.) - **Table. 10.16.**

Some modern methods, approaches and strategies for working with children with autism (in Shapkova - Taneva, 2012) are:

1. The program TEAACH (Treatment and Education of Autistic and related Communication handicapped Children) or "Impacts and training of autistic children and children with similar communicative disabilities. " This is the first systematic approach to working with children with autism, created in 1970 in the United States. In its basic concepts are adapting the environment to the needs of the child and provide better visual organization of the environment.

2. The program ABA (Applied Behavior Analysis) is known as the method of Lovas. This method is a comprehensive program for the development of social, playful, everyday skills, communication skills, coping with any problem behaviours, etc.

3. PECS (Picture Exchange Communication System) or "System for communication by exchanging pictures." This system involves the use of images to promote and develop communication skills in the child.

4. Game activities. Many gaming activity can promote fellowship, social and living skills in children with autism. Suitable for example, games with clay and plasticine, games with beans and other grains, games with soap bubbles, water games and much more.

5. Art therapy - through art (paintings, etc.), music, drama, dance, puppets and more. Art therapy is an appropriate tool for dealing with persons with a wide range of offenses (not just with autism) in any age. It helps to model human behaviour, develop creativity.

6. Montessori therapy. Maria Montessori in Italy created a new pedagogical approach based on special didactic materials. These are mainly wood, colorful materials, through which children develop their concepts of color, his tactilitty, ideas about shape, size, etc., and to acquire skills in reading, writing, social and other skills.

REFERENCES

1. **Amaral, D., D. Geschwind, G. Dawson** (eds.). Autism spectrum disorders, Oxford University Press, 2011.
2. **Asperger, H.** Autistic psychopaty in childhood, In: U. Firth (ed.). Autism and Asperger syndrome, Cambridge University Press, 1991.
3. **Coleman, M., C. Gillberg.** The Autisms. Fourth Edition, Oxford University Press, 2012.
4. **Fey, ME, AG Kamhi** (eds.). Treatments of Autism spectrum disorders. PH Brookes Publishing co., 2012.
5. **Kanner, L.** Autistic disturbances of affective contact, Nervous child, 2, 1943, 217-250.
6. **Lubetsky, MJ, BL Handen, JJ McGonigle.** Autism spectrum disorders, Oxford University Press, 2011.
7. **Mirenda, P., T. Iacono** (eds.). Autism spectrum disorders and AAC, PH Brookes Publishing co., 2009.
8. **Reber, M.** (ed.). The Autism Spectrum. Scientific Foundations and Treatment. Cambridge University Press, 2012.

9. **Roth, I., P. Rezaie** (eds.). Researching the Autism Spectrum. Contemporary perspectives. Cambridge University Press, 2011.

10. **Shapkova-Taneva P.** How to work with children with autism. Small books to help teachers, RAABE, S., 2012. (in bul.)

11. **Tsokova D.** Autism. Introduction to the theory and practice of violations autistic spectrum, "St.. Kl.Ohridski ", S., 2004. (in bul.)

12. **Tsvetkova-Arsova, M.** Training visually impaired with multiple disabilities and blind-deaf, Ekoprint, S., 2002. (in bul.)

13. **Vasileva N.** Praxis disorders in children with autistic syndrome and guidance to overcome them. -In: Collection "Teamwork in patients with motor deficits", S., 2009. (in bul.)

14. **Vasileva N.** Early identification of violations autistic spectrum children - diagnostic card. J. Special Education, issue. 1, 2012. (in bul.)

15. **Wetherby A.** Early identification of children with ASD: recent research and family-centered practice, Symposium on best practice in supporting the development of children with ASD, March 1999, Providence, RI, USA, 1999.

2.7. ART THERAPY. T. Popov

Occurred as a field of scientific knowledge and discipline somewhere around the middle of last century, art therapy is a phenomenon having roots in antiquity of mankind. Then more or less give him mystical, religious, mythical and even cosmological properties. For example, in Thracian mythology haunted by the image of Orpheus, who with playing his lyre positive impact on human and animal; similar character is Gu Pas from ancient Chinese mythology., playing the zither. In the fourth century to Ch. Aristotle discovered the effect of catharsis (purification, cleansing) through theater, which is later became the basis of psychodrama by J.K. Moreno in the 20s of the twentieth century.

Today art therapy is a phenomenon that is essentially the use of art - of various types and genres, directly as a remedy for a wide range of diseases, and prevention and prophylaxis, as well as for rehabilitation. That is together with the use of art as a factor in education and aesthetic impact, as an educational component in the formation of personality (especially in children and adolescents).

The essence of art therapy can be defined as a method of treatment based on the use of artistic creation, ie original psychotherapeutic field with characteristic views, form of work and apply to certain contingent of individuals. The parameters of the impact of art therapy are not limited to psychiatry for treatment of ill persons, but are extended in educational and social activities of humans and are also associated with public use art to express and harmonize the inner world of man .

The field of art - therapeutic impact can be expanded as methods and technologies for the rehabilitation of persons with limited possibilities - type rehabilitation, which is based on the ability of man to shape perception of the environment and the arrangement of their ties with him in symbolic form.

Art therapy in the strict sense covers particular the application of art and its varieties, and in - the broadest sense - the use of art in general - of different genres and types of art as a therapeutic agent.

2.7.1.FORMS AND TYPES OF ART THERAPY

For the effectiveness of art - therapeutic activity are important as quality practitioners art - therapists, their qualifications, training and experience, as well as the selection of various forms and methods of art - therapeutic work, techniques, methods and practices, which are applied to various persons and contingents.

Marker for the classification of the forms of art - therapeutic work may be the first age of clients: art therapy with children; with adolescents; with adults; with very old and the elderly, etc. The forms of art therapy can differentiate between and according to the condition and health status of people who are undergoing therapeutic or prophylactic art - therapeutic activity: art therapy with psychiatric patients; such somatic pathology; with characteropathy; clinically healthy persons; border with psychological disorders; clients motivated by personal "growth" etc. To distinguish the types of forms of art - therapeutic work can serve approaches or models such as clinical art therapy, psychodynamic, humanistic, transpersonal and others. Overall, however, they adopted two kinds of art - therapeutic practice with the relevant divisions: individual and group.

The types of art therapy in the first place limited according to the different types and genres of arts applied: music therapy (active and receptive); dance

and movement therapy; dramaterapy (Theatre - therapy); therapy with art (with all different techniques of pictorial art and sculpture); therapy with poetry; bibliotherapy, etc.

In this direction in recent years have seen the emergence of many new methodologies and approaches. Some of them certainly have a national character and determination - eg. very popular with folk tales therapy in Russia.

Among the newly established are: some techniques of physical therapy as Rozen - method, so-called Bistans of Rolando Toro, the Japanese system "Shiatsu", "motional analysis of Carrie Rick", etc.

2.7.2. ART THERAPY, SOCIAL WORK AND PUBLIC HEALTH

Protection and strengthening of health is a fundamental objective of medicine and priority social activities and promotion of public health.

Hygiene, as ancient science has contributed and contributes greatly to the development of medical activity in the field of public health and social practice. These efforts sought hygiene to communicate and interact with a number of other sciences and fields of scientific knowledge, but also with culture and the arts.

In many cases, various alternative methods in art proved very effective not only in the field of treatment and rehabilitation but also for impact protection. This is especially true for working with children and adolescents at risk, with deviant behaviour, with various addictions. Through art relatively easily is the way to children's spirituality and detect mechanisms of influence, education and rehabilitation. In social work in various institutions for children with special events, more often - actively using art - therapeutic techniques and methods in pedagogical activity and psychological interaction. Most - widely in such cases the music therapy, dramatherapy, locomotor therapy, painting and other various artistic activities and techniques.

The use of art therapy in this contingent with success leads to positive changes in the behaviour of children and adolescents, for their self-esteem and their relationships with others and the environment. In many cases occur a number of positive changes in interests, motivation for life, values system. Patients (children) reveal themselves, but also the existence of many talents and aptitudes, gifts. Comes harmonization of personality - "mental hygiene".

In children and adolescents with various states of disease (neurotic somatic) art therapy is used widely and successfully.

Especially notable achievements are observed in the field of rehabilitation activities. Various art - therapeutic techniques help to restore the functions and activities, of self-esteem, and particularly important - for inclusion willing patient in the healing process.

In the field of geriatris and work in public institutions for old and very old people use art therapy it is also very useful. Through various art - therapeutic techniques and methods successfully combat with depression, low self-esteem and hopelessness of the old and sick people, loneliness and abandonment of life.

2.7.3. ART THERAPY AS A PREVENTIVE AND PROPHYLACTIC MEANS

Prophylactic and preventive direction of art therapy extend to those cases, where it is medically fit persons such the norm, that do not require treatment in the true sense of the term, and more rather remedial measures for the implementation of various types arttherapeutical techniques and methodologies to protect themselves from reaching the illness and pathology.

There are differences in the use of art in close therapeutic (medical) plan and in the **educational** activity. With reason, however, for art therapy in the schooling and educational sphere it claims that its current and prospective direction.

The close link between the medical and pedagogical approach to the use of art is determined mostly by the fact that in both types of art therapeutic activities aimed at strengthening mental health, to achieve harmony, creative activity and vitality. Practicing different types and genres of art are used in educational and social activities, as acting psychogenic and preventive factors. They help to resolve the psychological and emotional problems, that contribute to emotional balance and to achieve positive changes in the behaviour of children and adolescents.

When children are at norm, at them relatively easy to overcome age crisis of development (e.g. the so-called crisis of the third year of puberty, etc.) And practicing art support mental development, the formation of their personality and its components.

More difficult, however, these processes occur in children and adolescents with any problems in mental development or those in the behavioural plan. In many of these cases and direct communication is difficult due to the degree of development of speech, thinking, opportunities for introspection and expression of emotional states, preferences and needs. In such cases, art and various forms of gaming, support children in their self-expression, enable communication with others, a manifestation of their

feelings and latent opportunities.

Through the art of identifying and individual and typological characteristics of children and adolescents. Art helps to establish experienced traumas of past and present conflicts, the existence of situations with negative impact on the psyche and behaviour.

In children and adolescents, art therapy is also the important tool in the treatment of deviations in behaviour, and in the prevention of neurotic disorders (e.g. in various neuroses, such as hysteria, psihasteniya, neurasthenia, logoneuroses etc.).

Art therapy is used in the presence of functional disorders of the nervous system, that have not yet shown themselves as disease, but as symptoms of various diseases and disorders.

Such disorders eg. as depression or aggressive behaviour, expression by children of stubborn, caprices, often crying, conflictness, easy irritability, fears and so on. Such behaviours are often trivialized or connect with the child's upbringing. They may, however, be alert for neurotic disorders, where necessary taking timely corrective complex measures to no fail to persistent adverse events in children's behaviour, or neurotic disorders.

Successful art therapy is administered in children and adolescents who are depressed, shy, experienced or experiencing family trauma, various forms of physical or mental abuse, violence and so on. These children need self-determination, of appearances and pleasant experiences, by purposeful physical activity, that leads to their involvement with some interesting, useful and evocative work.

Different forms and types of art therapeutic work are applicable in lush, incontinent, distracted children, as well as those who can no longer concentrate on the implementation of a job. Last requiring such activities that engage them optimally, contribute to the development of their voluntary restraint, to hardening of the nervous system, to facilitate the formation of positive character traits, such as focus, organization, discipline, independence, ambition, skill overcome difficulties and so on.

Children who lack fluency of movement, lightness and dexterity, coordination of movements, that occur as clumsy and awkward, and so on, are suitable object for working with various art forms, here particularly successful can be applied some techniques and approaches of motor or dance therapy. Forms and elements of dance, and music therapy, role plays, ballet classes and more. They are an effective means of acquiring proper body posture and body behaviour, for the supply of elegance and smooth gait, for ease and flexibility, and even to overcome various spinal deformities.

Various techniques of art therapy are not always uniform applicable to all categories of persons. For example, therapy through poetry is completely unsuitable to work with individuals who defy verbal communication. It also carries risks and art therapeutic activity of schizophrenic patients, etc.

In art therapy work with children in pathology, as a highly influential outlines various methods of music therapy, and techniques of art, to application, modeling and more. They have a particularly high positive effect in children and adolescents with mental disorders, autism, Down syndrome, cerebral palsy, various coordination disorders, in joints and so on. If them are proven and curative effect of dance therapy.

Significant opportunities for positive impact art therapy provides at work in the social sphere. For example the use of art therapeutical techniques at work in child social institutions, provide children socially acceptable outlet for reaction to aggression or various other negative feelings, relieves unconscious internal conflicts, affected the development of empathy and positive relationships in the group, develops a sense of internal control.

2.7.4. FOLK TALES THERAPY

Scientifically form of art therapeutic work, folk tales therapy has a relatively short history. Its development and its imposing as relatively independent region dates back to somewhere in the 70s - 80s of the twentieth century (this does not apply to purely utilitarian use of fairy tales, which dates back to time immemorial). These forms of communication, albeit unconscious way, acted educative and enlightening the younger generation, they were kind of educational tool and method for transmission of experience between generations.

Today to folk tales therapy developed new techniques and methodological formulations, expanding sphere of influence. Treatment with tales has its use in children and adolescents, and adults. Introduced in kindergartens and schools with contingent in norm, but also for individuals with special educational needs, and children with difficulties in development, and centres for rehabilitation, and work with disabled people.

Nowadays, the use of the genre of fairy tales has decreased significantly when it comes to their classic version.

Now the main task of folk tales therapy becomes synthesis of the most effective psychological technologies in fabulous shape, and the integration and adaptation of psychotherapeutic many maneuvers, in a unified wonderful context.

Distinguished many **varieties** of this type of

art-effective therapeutic practice: group storytelling, as a new or already familiar tale of a third person; inventing or composing new stories, or their "additions"; productions (drama) and various theatricalisation of tales; fabulous puppet therapy (various options - such as puppetry with puppets - marionettes, so-called "shadow theater"); preparing puppets for fairy puppet therapy; so called "fairy painting"; staging of tales of sand (i.e. sand-play, in its individual and group forms); image fairy-therapy; meditation by tales (including psychodynamic meditation) and so on.

Treatment with tales of children contributes to:

- The development of creative (divergent) thinking of the child;
- Improvement of verbal language (the child learns skillfully and properly formulate his thoughts);
- The development of fantasy and imagination;
- Development of the ability to thoroughly figurative thinking, to establish causality;
- The development of empathy and ability to listen (eg in the course of analyzing children learn to sympathize with the characters, and to listen to what say others children).

2.7.5. THERAPY WITH SAND FIGURES

Although it can not be assigned to the most popular and most commonly used art therapy techniques, therapy by sand figures has its established place in art therapeutic practice.

Treatment with sand figures applied by some psychologists and psychotherapists sometimes adjunctive therapy, as part of other therapeutic techniques or as an advisory methodology.

The positive impact of treatment with sand figures on children can be determined with the following main points:

- Spontaneously gives them the opportunity to express their inner peace; -
- Helps them learn to recognize their emotions and feelings;
- Helps them to understand and control their desires and behaviour;
- Helps children to become more confident in themselves;

Classical therapy by sand figures begins with the child to be invited to choose only toys and play in the sandbox. The choice belongs exclusively to the child and the psychologist (psychotherapist, educator) is the role of observer can intervene only when requested by the child. According to Jungian psychotherapists sandplaces are reliable and safe space where children feel generally protected. The children themselves form their own compositions themselves rearrange figures. By playing with the figures stimulate the imagination of children, stepped to the process of transferring their domestic introduced to real life, their exteriorisation. Thus develop and mental processes, are activated thinking fantasy, assists in his emotional development.

2.7.6. IMAGE-THERAPY

Image therapy, or also called fairy image therapy is a relatively new but very promising art therapeutic method.

Image therapy by A. Gnezdilov goes towards recreating and remaking, demand and switch over to new images. The basis for this is the role play, change characters in role-playing situations that people (patients) accepted. In the toolbox of image-therapy includes numerous old costumes and all sorts of accessories, hats, jewelry, lace, robes, who are elected by the participants dressing.

Immersion in a new fairy-tale image, the individual can compensate for something that lacks in real life. The newly image may declare or to highlight the very nature of the individual, or refers to features that he carefully tries to hide.

Own choice of characters in role-playing scenarios and provide them the opportunity to get to know their strengths and weaknesses, as well as to transform them, correct or model. The choice of a character can serve as a personal example and motivation to help overcome difficulties and experiences. And the role of the art therapist is to make a kind of "editing" of all these roles and situations who live in the minds of their participants with a view of reality.

In children, the context of the subject matter-roleplaying suggests any metamorphosis. Generally tend to identify with various fairytale characters, with characters from comics, movies, plays, children can opt for incarnation in image-therapy every possible character. Their choice they dress up in costumes, using any form accessories and fabulous new image. So they enter into new subject matter - roleplaying situations and leading art - therapist support them, directs, modeled.

Although relatively new art therapeutic method, image therapy shows its effectiveness. It provides real applications development and successful distribution to search for new options and routes of administration and in new circles of participants - either alone, or adjunctive therapeutic or psychocorrective technique as a means of prevention and resocialization.

2.7.7. ART THERAPEUTIC EDUCATION

Back in the 50s and 60s of the last century in various countries began organizing and conducting the training of art - therapists at different levels, in different forms, with different duration and direction. It is essential and basic education - whether they are doctors, educators, psychologists, psychotherapists, artists or other professions.

With the great tradition, status, prestige and recognition art - therapeutic education in the UK, USA, Netherlands, Germany, Belgium, France, the Nordic countries et al. Theire education system, implemented in different institutions by approved plans and programs, function in part standardized methods, and accordingly gives recognized both at national and international level educational qualifications. So after passing through various stages of short courses, most training or retraining, art - therapists are trained longer and more complete programs and acquire varying degrees of specialized higher education: bachelors, masters, PhDs.

Teaching (courses) in art therapy for medical specialties, educators, psychologists, defectologists (special education), rehabilitation therapeutists, development of theses and training courses (AGT) exists in Bulgaria. At the level of the European Union made successful attempts for unification and universalization of curricula, teaching methods, classes, etc. In this spirit and the creation in the late 90 - ies of the last century the European Association of Art - therapeutic education (EAAT). At this stage in the European consortium for art - therapeutic education, members 31 higher education institutions from the UK, Holland, Belgium, Germany, France, Sweden, Italy, Spain, Slovenia and others.

REFERENCES

1. **Hill, A.** Painting and Illness, London, 1951, William & Kossolapow, L., Introduction in ECARTE & Directory of European Training Courses, London, 1999.

2. **Kopitin, Al.** Theory and practice of art therapy, St. Petersburg, 2002, ed. "Peter." (in russ.)

3. **Kossolapow, L.** Introduction in ECARTE & Directory of European Training Courses, London, 1999.

4. **Lebedeva, LD** Practice art therapies: approaches, diagnostic, system of occupation, St. Petersburg, 2003, ed. "Rechy". (in russ.)

5. **Liebmann, M.** Art therapy for Groups, London 1987, Croom Helm.

6. **Markova D.** Fine Art as therapy, Plovdiv, 2001, ed. "Miniature". (in bul.)

7. **Naumburg, M.** Art Therapy & Its Principles and Practices, New York, 1966, Grune and Stratton.

8. **Popov, T.** Therapy and prevention through art, Sofia, 2004, ed. "Education". (in bul.)

9. **Popov, T.** Art therapy in children, Sofia, 2008, ed. "Defect" (in bul.)

10. **Popov, T.** Child, art, family, Sofia, 2002, ed. "Musica Viva". (in bul.)

11. Practice in art therapies ed. **A. Kopitin**, St. Petersburg, 2000, ed. "Peter." (in russ.)

12. Psychotherapeutical encyclopedia in art therapy ed. **V.D. Karvasarskiy**, sec. edition, St. Petersburg, 2002, ed. "Peter." (in russ.)

13. **Stefanova, Al.** Development of artistic expression through art - therapeutic method thesis, Sofia 2005. (in bul.)

14. **Susanin, I. E.** Introduction in art therapy, Moscow, 2007, ed. "Cogito - Center." (in russ.)

15. **Wood, C.** The History of Art Therapy and Psychosis, in Art, Osychotherapy and Psychosis, eds. K. Killik and J. Schaveren, London & New York, 1997, Routledge.

3. HYGIENE OF EDUCATION.
B. Miteva

Training reflects the interaction between the organism and adolescents active, targeted educational impact. The biological meaning of this interaction is to maintain a balance between organism and learning conditions, to allow for optimum adjustment of the growing organism, for its favourable morphological and functional development.

Deployment of all spare psycho-physiological abilities to maintain optimal performance of adolescents and therefore better medical and pedagogical effectiveness it matters following factors:

1. Mandatory condition is mental and physical activity of adolescents corresponds to their age features and options. The volume, content and relative weight of school subjects directly related to this condition. In connection with scientific and technological progress and the large flow of information from knowledge, the school can not take them and incorporated into curricula. Knowledge given to students

in the upper grades must cover the basics of science and to cultivate their habits of self-study and interpretation of data from different sciences. Otherwise it leads to information overload, associated with the regime overload, that are considered to be some of the main shortcomings of modern education.

Years of research have shown that subjects can be divided into several groups on the relative weight: Most difficult are mathematical disciplines, followed by learning the native language and foreign language. Third place - biological objects, in fourth place - those with a narrative character and fifth - those related to physical effort (physical education, labour, polytechnic and industrial training). At last severity group included lessons in music and painting. So ordered subjects should occupy a place of daily and weekly schedule of lessons, depending on the physiological curves of performance. Naturally, the most difficult objects to be placed at optimum performance. Developed methods of hygienic assessment of daily and weekly program, allowing for adjustments in their preparation.

◆ ***Degree of relative difficulty***

• With high relative difficulty "are subjects of cultural and educational fields: "Bulgarian language and literature", "Language", "Mathematics", "Informatics and Information Technologies", as well subjects identified as those of the pedagogical council of the school.

• With moderate relative difficulty are subjects of the cultural - educational areas: "Social sciences and civic education ", "science and ecology " and subjects identified as such by the pedagogical council of the school.

• With low relative difficulty are subjects of cultural and educational areas: "Arts", "Lifestyle and Technology", "Physical culture and sport" as well subjects identified as such by the teaching staff of the school.

Proper distribution of subjects in order of relative difficulty and different duration of the school day

4 hour school day	*5 hour school day*
1 hour of medium difficulty	1 hour - medium difficulty
2 hours - high difficulty	2 hours - high difficulty
3 hours - high difficulty	3 hours - high difficulty
4 hours - low difficulty	4 hours - low difficulty
	5 hours - medium/low difficulty
6 hour school day	*7 hour school day*
1 hour - medium difficulty	1 hour - medium difficulty
2 hours - high difficulty	2 hours - high difficulty
3 hours - high difficulty	3 hour - high difficulty
4 hours - high difficulty	4 hours - high difficulty
5 hours - low difficulty	5 hours - high/medium difficulty
6 hours - medium difficulty	6 hours - low difficulty
	7 hours - medium difficulty

For about 10% of the students, however, said row a burden for subjects not fit their individual preferences and interests (for some of them, for example, math is a favourite subject and thus a light acquired). Therefore, the weight of subjects is relative.

2. Each school work should begin at the optimum excitation of nerve cells in the brain, i.e. they are not "tired" to form slightly new contingent links and relevant knowledge and skills.

3. The creation, actively by educator, positive emotion, motivation relevant to the work ahead, leads to increased interest in school work, to put into effect a subcortical-cortical mechanisms in conditioned reflex reaction.

4. Each school work must proceed gradually, with no maximum load. This enables the organism of students to adapt to the task, to overcome the inherent inertia of every living cell and tissue by including "new level" of the mechanisms of regulation.

5. It is necessary at the outset to create conditions for properly established habits (working stereotypes), given as their durability and also difficulty in correcting them or making new ones in later age.

6. Repetition, training of the established habits are the main way to increase efficiency and effectiveness of school work. As the training is achieved hypercompensation (after proper recovery - break), which is a physiological manifestation of increasing the functionality of students in the field. Each subsequent effort starts from a higher functional level.

7. Including more analysts in teaching methodology, inclusion of I and II signalling systems eases the perception of the material. This is the physiological rationale, for the inclusion of advanced visualization with audiovisual training, of laboratory practice, lessons employment training, to the possibility of distancing phenomena of fatigue and exhaustion.

In its impacts traditional pedagogy relies mainly on the cortex of the child, the left brain hemisphere - structural native speech of logical, abstract thinking, i.e. of the II-nd signal system. Important, however, and the role of the right brain hemisphere as a carrier of I-st signal, concrete-shaped thinking, of involuntary memorizing, orientation in space, of musical and artistic inclinations and perceptions and others. Permanent relations between the two signaling systems, the role of vertical cortical-subcortical connections and hence emotions, motivation, attitude, rejects unilateralism in the training of the child by including primarily the left hemisphere of the brain. Including permanent and structures in the right hemisphere of I-st signal system and to the upper school age, requires a new approach in pedagogical impact. This leads to easier acquired of the material, to a more permanent memory - to better performance.

In social and information environment in which develops student today, **the computer** is an element leading to historic new type of training organization. On the basis of age morphological and functional characteristics of the growing organism, computer training can be a factor for adverse effects, especially on the visual system, musculoskeletal system, psycho-emotional sphere.

Changes in the functional state of the visual system, central nervous system, sympathico-adrenal activity in first class at the computer learning activity shows decrease in operating capacity and increasing neuro-emotional tension after 20 minutes. The second program hour in a computer work is of lower efficiency than the first hour. Similar studies of 11-18-year-olds establish good adaptation of teenagers at a computerized learning activities and games for 40 minutes. Proves the tension of adaptive mechanisms of functional performance to 90-minute work. Visual complaints are leading, occur subjective and objective phenomena of fatigue after 40 minutes. Complaints from the locomotor system are specific, related to the forced sitting posture and occur at the end of 90 minutes. By Regulation N 9 of MH (SG. 46.1994) regulates the maximum duration of the work of students with PCs **(Table. 10.17)**.

8. The lesson, school day, week and year organisation is an important factor for the sanitation of the learning process.

The lesson is a basic form of learning in our schools. Along with all the above indicated psychophysiological requirements, as an essential element of hygiene lesson appears to be its duration. Practice shows that the duration of the lesson of 45 minutes allows to solve basic pedagogical tasks, especially for older students. For incoming first class children 6 - 7 years old this duration is impossible, inefficient - due to fatigue occurs rapidly (it connects with the possibilities of 6-10 year olds active attention in the order of 15-20 min). In consideration comes the need for continuity between nature and duration of activities in kindergarten and elementary school, so redundant classes of 30-35 minutes for children from first class are hygiene suitable. In legal documents for public education (1991 and 1992) the length of the lesson is: I - II class - 35 minutes and in the other classes - 40 minutes.

For best teacher, lesson structure (introductory, basic and final part) is associated with different phases of performance (initial state, high performance and reduced). The ability of teachers to connect own specific educational objectives with subjective and objective phenomena of occurrence of fatigue in children, depends on the effectiveness of his lesson. Very effective is represented, especially in the lower school age, so-called micropauses. At the first sign of fatigue lesson is suspended for 2-3 minutes, the children are, do some breathing light exercises with limbs and body (improvements musical accompaniment and inflow of clean air). Thus tirelessly new areas of the brain include and a break for active workers.

Hygienic organization of the working day and week is also based on the physiological curves performance in students. phase of the initial state is characterized by a lower level of performance. It is an expression of early adaptation to the job and depends on the age of the child. In primary school age students are more difficult to work inclusion due to the predominance of excitement and weakness of inhibitory cortical processes and their concentration in the brain. The middle school age work inclusion is still difficult because of the presence of imbalance of the main nerve processes, dependent largely by the ongoing neuro-endocrine alterations in sexual maturation. In the upper school age initial state already

Table. 10.17.

Class	On the day		In the week	
	Jobs in min max	Maximum number of sessions	Maximum number of sessions	Jobs in min max
I	20	1	2	40
II-III	20	2	4	90
IV-V	30	2	4	120
VI-VII	40	2	5	200
VIII-IX	40	2	6	240
X-XI	40	2	10	400

accomplished more easily due to the improvement of basic neural processes and their dynamics and especially by the development of the internal retention and concentration.

Phase of optimal (steady) performance is expressed in actively working condition, with increased alertness, accurate and quick perception, good mobility of mentation, quickly and correct implementation of the tasks, i.e. there is a high educational efficiency.

In the early phase of decreased performance through voluntary effort and using reserves of psychic regulation performance is maintained at a high level due to compensatory capacities of the organism. At the end of phase these opportunities decrease, appears volitional instability, emotional excitement. The volume of work performed is reduced and quality is deteriorating. Strengthening is subjective signs of fatigue - headaches, infirmity and psycho-physiological changes. This phase occurs faster in primary and secondary school age. *

Sometimes at the end of the school day, week or year, there was a final phase upswing. In reduced general performance student mobilize reserve forces and manifests extreme effort, increased emotional arousal and progress in work. Typically, this phase lasts a brief, upswing in work quickly stopped and signs of fatigue worsen.

Lowering the efficiency of the students is characterized by subjective and objective phenomena of neuro-sensory and mental (intellectual) fatigue and exhaustion. Upon the occurrence of fatigue, observed phase conditions that have periodic nature. In the first phase weakens the power of effective internal retention and unlock repressed it unnecessary for the given academic task reactions. Remains prevalent excitatory processes - excitatory-motional phase. Students become restless, inattentive, with unmotivated movements on desk, talk to each other. If academic work continues, and weakens the strength of excitatory processes in the relevant brain centres. By negative auto inductance inhibitive nerve processes irradiated and developed so-called protective retention. It is a signal for work interruption. During this phase, also called passive, students become apathetic, tired, sleepy, did not take part in the lesson. Pedagogical efficiency is very low. However, if the work is not interrupted distortion of the so-called. "Law on the strength of neural processes", the phenomena of equalization, paradoxical and ultraparadoxical phase, with profound changes in cortical-subcortical relationships and reducing the activation function of the formatio reticularis. In equalisation phase reactions of students are the same in weak and strong stimuli. Further, with the progress of fatigue may lead to the paradoxical phase in which the reaction to weaker stimuli is stronger, and vice versa. Ultraparadoxical phase is such a state of deepening in fatigue, of obtainment a positive reaction to negative stimuli, and vice versa. Such conditions of students reactivity are unfavourable for its adaptation to academic work. The lower age is the pupil, the earlier occurring respective fatigue phases.

The first lesson and day, are for initial state with relatively low performance. The second lesson and day of the week with high performance and efficiency. Lowering performance starts from the third lesson and day for younger age groups students and from the fourth hour and day for larger ones. Postponing the phenomena of fatigue and retention of performance in the school day and week, had an essential role hygienic organization of individual lessons, their daily and weekly schedule.

The duration of the learning process depends on the age of the children. According to previously existing Public Education Act (SG. 86, 1991) and its Implementing Regulation (SG. 31, 1992) I-II class are allowed 20 hours per week or four hours a day, II - III class - 22 hours a week, or 3 days 4 hours and 2 days 5 hours, V - VIII grade - 25 hours per week and five hours a day, for IX - XII grade - 30 hours per week or six hours a day.

Besides proper arrangement of subjects during the day and the week, according to their weight and performance of students, meaning and a double hours. Conflicting views are on this issue. Assimilation of the knowledge and skills when paired lessons can not ignore, however, sometimes excessive burden on students, especially if they are from the group of high difficulty objects. Compulsory here is break between the two hours.

Important hygiene requirements for the organization of the school day is recess. To be effective, it must be long enough. The experience has led to the introduction of breaks lasting 10 min and an extended intermission to 30 min, in the middle of the school day. To use the maximum rest and readjustment of the organism to the coming hours, breaks should be organized properly with active recreation (but not organized or with the competitive nature active rest), breakfast outdoors or in ventilated areas (corridors and extensions to them).

* Tracking changes in various physiological and psychological function enables you to illustrate graphical or tabular phases of efficiency in daily, weekly and annual dynamics, through the so-called. physiological curves (eg. in pulse rate, blood pressure, respiration, the activity of the attention, on the stability of clear vision, etc.).

If after subjective and objective phenomena of fatigue academic work continues, hold process in the focus of excitation obtain character of so-called. inert (stagnant) detention, which is one of the causes of neuroses in students. In chronic non-recovery after nervous fatigue (excessive mental load with school work) leads to overstrain. Overstrain students have frequent headaches, sleep disturbance, appetite, apathy towards school work, total lowering the training opportunities. Significant distortions of abstract thinking, leads to serious violations in teaching of physical-mathematical disciplines. Learning of mother languadge, interference occur in spelling, wealth of literary speech and others. In the absence of medical and parental intervention, can lead to obsessive states, to disturbances in the behaviour of students, to single or multiple neurotic reactions, to severe conflicts in the system student-teacher.

School holidays and the duration of the school year are associated with geography of the country. In our school year begins September 15 and ends for elementary school students on May 30, on average - on June 15 and above - on June 30th. Regulated two longer school vacations - winter and spring 10 days and 3-4 days after completion of the first term. Especially important for the recovery after the school year is summer vacation from 2-3 months, in accordance of the age of the students. Changing climatic conditions, spent outdoors, active motive rest, rational nutrition, free at the request of the student cultural activities are essential hygiene requirements for full recovery.

9. The high medical and pedagogical qualifications and professionalism, health and especially mental health of teachers are factors that have a bearing on stressful situations for children and students - and therefore their performance and health.

As a potential precondition for anxious of students (IX-X class), to indicate the relationship between the personality and situational anxiety (personality disposition for anxiety response). Dependence is higher in younger age and girls. With increasing age was observed and deepening the level of depression.

Bad mental health of teachers is a major cause of stress reactions among students, influenced by subjective emotional evaluation of students to their teachers and their personal characteristics (disposition for anxiety response, localization of control, intraversion and neurotization).

Good mental health of the teacher, conversely is the cause of low anxious of students, also influenced by the personal disposition of anxiety and localization of control.

10. Essential for the prevention of fatigue and overstrain, is improving the conditions of the learning environment, associated with the device and furnishing of schools, lighting, ventilation, microclimate, dust and gas composition of air, noise factor, the quality of teaching aids.

11. One of the most important tools to combat fatigue, to maintain a good performance is rational daily routine of students.

The daily regimen is scientifically based sequence of work and rest, consistent with the age and individual characteristics. He is not uniform, and each adolescent using the parent and the teacher, need to build your individual mode, according to him age, health status, individual capacities, using a model schemes for daily regimen **(Table. 10.18)**.

The physiological basis of daily routine is to create a dynamic working stereotype. It binds to the rhythmic oscillations in nature, with day and night modes of a plurality of functions in the organism, which are in strict dependence one/another, are coordinated in time. This complex and changing system of functions, is base for the activities of people in day. It turns out that in building its organism at the appointed time is willing to engage in specified activities (school work at school, homework lessons, sleep, sports activities, etc.). Establish favourable working condition. Any activity in this state will run more efficiently with less energy consumption. Will allow for the most efficient adaptation of the child's living conditions. Modern data for chronobiology created the concept of "internal clock" that has adopted the coordinating functions of the biological system for rhythms. Was established relationship between the retina and midbrain, discovered was the importance of small bilateral nucleus located above the site of the crossing of the optic nerves (i.e. suprachiasmatic nucleuse - SCN). Neurons in the SCN is encoded with the average effect of light falling on the retina (daily and artificial light) and it controls hypothalamic - pituitary-adrenal system, pineal gland and its hormones. These data indicate the importance of the light, especially daily, as a determinant of circadian rhythms in humans.

In the construction of the daily routine needs to consider biological rhythms. Excitability of nerve cells in the brain in the majority healthy children shows two boom - between 8 and 12 hours (higher and longer) and between 16 and 18 hours.

The living arrangements of children from 1 month to 3 years based on several physiological features: rapid growth and development in the beginning and gradually slowing; incomplete differentiation of many organs and systems, especially at the beginning of the digestive tract; gradual development at the beginning of I-st signaling system, followed

Table 10.18. Model table for the daily regime of students

Classes / Regime moments in hours	Age in years										
	1 7-8	II 8-9	III 9-10	IV 10-11	V 11-12	VI 12-13	VII 13-14	VIII 14 15	IX 15 15	X 16-17	XI 17-18
Classes at school	3-4	3-4	4-5	4-5	4-5	4-5	5	5	5	5	5
Homework preparation of lessons	1	1-1,5	1-1,5	1,5-2	2	2	2,5-3	2,5-3	3-3,5	3-3,5	3-3,5
Mobile games, exercise, walking outdoors, the way to school	3,5	3,5	3,5	3,5	3	3	2,5	2,5	2,5	2,5	2,5
Extracurricular and extraclasses optionals - reading, music, workshops and service home	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1,5-2	1,5-2	1,5-2,5
Morning gymnastics, hardening procedures, feeding, toilet	2,5	2,5	2,5	2,5	2,5	2,5	2	2	2	2	2
Dream	11	11-10,5	11-10,5	10,5-10	10-9,5	9,5-9	9,5-9	9,5-9	9-8,5	8,5-8	8,5-8

by the development of the II-nd signal system - by speaking the first words and the further enrichment of speech; with significant development of motility and enrichment of the main activity of children - game. Therefore, during this period the construction of the daily routine involves the establishment of hygienic regime for breeding, nutrition (6 times in the early months to 4 times a day at the end of the first year), providing enough sleep (from 16-18 hours to 12 hours a day for 3-year-olds), targeted gaming activities for the development of motility and psyche, time to spend outdoors (walking and games from 1.5-2 hours 2 times a day), time for quenching events.

The daily regime of preschool children (4 to 6 years) is also based on a series of physiological features: improvement of the functions of the sensory organs, of motility (walking, running, jumping, throwing), game, by incorporating elements of labour in child's daily routine, significantly develop central nervous system (regulation of relations between the cortex - subcortex, inhibitive processes, II-th signaling system). A major highlight daily regimen during this period is to provide kindergarten organized educational sessions. In the I-st group held two sessions a week for 15 min; in the II-nd group two sessions a day four days, one of which is music or physical education; in III-th group - also two classes a day, 4 days, but lasting 20 min and in IV-th group - two days of the week are 3 of the same duration. The dream (afternoon and night) is 12-11 hours, feeding was four, games, walks in the fresh air is 4 to 3.5 hours a day, tempering is a compulsory element in the daily routine of children of this age period. Allow enough time for the reinforcement of health and hygiene habits in children.

Key elements of the daily routine of the student organization are modes of learning in school, preparing lessons at home, extracurricular activities and various types of self-activity, nutrition, sleep, outdoor living, physical activity.

Essential to reduce information overload is hygienic organization of the preparation of homework. A number of studies have shown that the duration of the preparation for the next day need not be greater than 1-1.5 hours for I-IV class, 2-2.5 hours for class V-VIII and 2.5-3 5 hours IX-XI grade. The determination of its place in the all-day budget time, the implementation of rational methods for preparing lessons (starting from the written tasks and gently objects), creating optimal environmental conditions (thermal and acoustic comfort, illumination), the opportunity to rest (of every 35-40 min) help to ease the preparation of homework.

Mobile games, walking outdoors, sports and exercise or so-called motory rest, ensures continuous and efficient operation, increased performance. Thus, primary school age it is 3.5 hours, for middle school age - 3 hours and upper - 2.5 hours. Athletes students have a special motory mode. Active motional rest is a powerful prophylactic agent against hypodynamy and dismovement of children, espe-

cially in developed countries - with large information boom with the development of computerization and television.

Strong enough restful sleep is one of the most important regime elements of adolescents.

In the physiology of sleep establishes two main types - slow wave sleep (SWS) and paradoxical sleep (PS). SWS begins falling asleep and usually consists of four stages; the first phase is short, characterized by a decrease in the frequency of the alpha wave rhythm gets desynchronized, behavioural person is light nap; the second phase is characterized in that in the course of the low-frequency and low voltage-alpha-rhythm periodically appear fast (14-15 Hz/s) waves or the so-called "sleep spindles". Waking up during these two phases of sleep is relatively easy. Over the next two phases of sleep deepens, which on the EEG track resulting in increased number of slow waves. Delta activity in the third phase reaches 50% and in the fourth phase exceeds that percentage. Usually when inhibitive processes become very deep should gently stir (or just strengthening) of EMG and sleep again become superficial and described cycle is repeated. The first cycle is the most up to 90 min.

PS is characterized by low voltage activity, close to the frequency of alpha-rhythm, often accompanied by rapid eye movements and a complete lack of EMG. This dream is often accompanied by dreams and although EEG is very similar to that of waking, waking threshold is highest. Typically cycles end with PS, but during the first cycle it is very short and hardly perceptible.

In overnight usually the person goes through four cycles. The third and fourth phase of SWS are presented primarily in the first half of the night, and the first and second phase and PS - in the second half of the night and mostly in the early morning.

Of total sleep time the first phase of the SWS occupies about 5-7%, the second - 50%, third - 7% and the fourth about 16%. PS of neonatal occupies 50% of total sleep time and gradually decreases as a fifth year reached 20%, which basically remains throughout life.

SWS and PS have their own separate functional significance of restorative processes in the CNS and the organism and are not compensated with one another.

Three main characteristics determine the hygiene sufficiency of sleep;

1. Frequency (alternating sleep and cheerfulness).

2. Duration.

3. Depth.

Chronic lack of sleep for children can lead to abnormalities in their health - neurosis, functional disturbances. Strong mental agitation, excessive muscle work, great mental stress, disorders are the most common causes of sleep deprivation in children. Unnecessarily prolonged sleeping and lounging are also reflected negatively on the organism of adolescents. According adolescence age is recommended following duration of sleep:

I - III class	10 to 10.5 hours
IV - V class	10.5 to 9.5 hours
VI - VIII class	9.5 to 9 hours
IX - XI class	9-8 hours

Physically weak, chronically and frequently ill children recommended additional one or two hours daily sleep. Violating the depth of sleep due to involuntary movements and dreams (respectively at the end of SWS and through PS) caused most commonly by certain stress conditions (control exams, great sorrow or joy, fatigue, etc.). Important for proper sleep is and going to bed at the same time. Children fall asleep quickly and easily wake up if confirmed reflex "time to sleep." Well ventilated room and linen, moderate room temperature (17-18 ° C), moderate dinner without overeating and exciting the nervous system foods and drinks, favour the onset of sleep.

Extracurricular activities are added to the overall workload of the students. The total daily duration of primary and secondary education is 1-2 hours for upper -1,5-2,5 hours. For this regime element particularly negative matter is intervention of "ambitious parents", which include children both to learn a foreign language, music, ballet and so on. Watching TV is also regulated by the age of the children. Uncontrolled and continuous watching television leads to increased hypodynamy, reducing time to sleep, a variety of social and educational failures, stress.

In determining an individual or group scheme of daily regimen should take into account different conditions and forms of education.

In classes in I shift (before lunch) is able to create best physiologically consistent regime both at school and at home. One-shift training, however, is problem with both the economic capacity of the country and with the mass spread of education. In classes in II shift there are many opportunities for violation of hygiene suitable daily routine. Children go to school already tired, not after prolonged rest after a night's sleep, then preparation for afternoon classes. Usually violating residence of fresh air, active motional rest. The only advantage of training in II shift is perhaps the possibility for the normal duration of nocturnal sleep.

In the semi-boarding schools or called. "with an all-day training" (form widespread in the country, especially for primary education and for certain types of schools) there are conditions to create better op-

portunities for the rational construction of the daily routine, especially for hygienic organization of the educational work and self-training lessons, active rest. For children with variations in health, 6-year-old first-graders can provide conditions for afternoon sleep.

Adequate day mode can be organized in schools - boarding. Usually these are some special schools - in the arts, in vocational training, in some villages due to the remoteness of the school; remedial schools and social homes for children and adolescents. Problem in boarding schools is as the creation of differentiated daily regime according to the type school and individual approach to children, depending on the type of personality, her abilities and health status.

School age. The medical position and arguments for lowering the school age based on the fact that in most countries in the world 6-year-olds are in school. In England, the US, Japan and Switzerland primary school age is even 5 years.

The establishment of the school maturity of 6-7 years old children before entering school includes two parts: one - from indicators of physical development of the child, and the other - for indicators of mental development. The degree of physical development is assessed by growth in the right position, weight, body proportions, break of permanent teeth. Mental development is assessed on the sustainability of attention, short-term auditory memory, motor memory, mathematical ideas, speech, drawing tests and others.

It was found that the majority of 6-6,5-7-year-old children start school with middle and high school maturity. School immature group is most at 6-6.5 year olds - 23% for boys and 16% - girls. When 7-year-old also established school immature, but at a lower rate. To obtain favourable results in reduction of primary school age are needed new educational content at 5-day school week and school day organization of work, consistent with the age morphological and functional features and capabilities of children. In the weekly and daily schedule must be addressed in sufficient volume of programming hours and activities of artistic and aesthetic cycle; to allow for individual expression of children, for afternoon sleep 6-year-old first-graders in enough move activity (3 hours daily and 3 hours sports activity per week).

Also very important is the inclusion of preschool children in kindergartens, enhancing with educational activities their socialization.

REFERENCES

1. Adaptation of child's organism to educational and of physical load. ed. **A.G .Hrepkova and M.V. Antropova**. M. Pedagogy, 1982. (in russ.)

2. **Balk, D.Y.** Sch. Health. 53, 1983, 6, 365-371.

3. **Batoeva D.** Adaptation of children to education. S., Med. and phys., 1983. (in bul.)

4. **Berndt, L., F. Strover, G. Tiesler.** Social ped. 1982, 12, 604-609.

5. **Berenson, G.S., G.C. Frank et al.** Amer. J. Dis. Child. 136, 1982, 9, 855-862.

6. Decree № 24 of the Ministry of Health, SG. 78/2006 on health requirements for the preparation and observance of the weekly schedule of classes. (in bul.)

7. **Frolich, G.** Kinderartzt. 13, 1982, 10, 1537-1541.

8. Functional and adaptive possibilities of children and adolescents. ed. **M.V Antropova**. M. Pedagogy, 1974. (in russ.)

9. **Gorinski, P., E. Polus - Sceniawska, Z. Kosarrny - Roczn** - RZH, 23, 1982, 5-6, 363-369.

10. **Grombah, S. M.** Sov. Pedagogy. 1981, 12, 42-46. (in russ.)

11. Hygiene of children and adolescents. ed. **B. Miteva**. S., Med. and phys., 1989, 220. (in bul.)

12. Hygiene problems of modern school. ed. **Vl. Boyadzhiev**. S., Med. and phys., 1985, 242. (in bul.)

13. **Nikolova R.** Evaluation of the impact of mental stress on indicators of heart variability, Scripta periodica, Vol. Vl, 1,2003,11-18. (in bul.)

14. **Shpangenberg St.** Health training requirements. Model of the modern school, Sofia, ed. "Avangard", 2005, 273. (in bul.)

15. The personality of the child. ed. **G. Piryov and D. Batoeva**, S, Med. and phys., 1985. (in bul.)

4. LABOUR-VOCATIONAL TRAINING FOR STUDENTS. A.Alexandrova

◆ ***Labour-Vocational Training***

There is a great healing importance of work for adolescents. Improve is the quality of basic neural processes, conditional reflex activity. The formation of the working dynamic stereotype, fitness level of the body of adolescents lead to biologically advantageous for him functioning. It also improves mental development - attention, memory, observation, ie specifically shaped thinking. Beneficially influenced the development of the musculoskeletal system and especially functional ability, coordination, accuracy, speed of movement. Muscle strength and endurance also increase. Improve and functions of the cardiovascular and respiratory system. And improve the functions of all involved in physical activity analysts: visual, auditory, cutaneous and more. Indicators of physical development towards higher values. Thus, occupational training by increasing the level of metabolic processes, stimulates growth and development of the whole organism.

The inclusion of labour-vocational training in the education system has a big hygienic effect on performance and fatigue. It allows for the inclusion in school work and other more analysts and systems, less engaged primarily in psychosensory load of students; musculoskeletal, skin - by thermoregulation and more. This leads to alleviate the complex process of abstract thinking, improving work capacity, reducing or eliminating the phenomena of mental fatigue and exhaustion.

The problems of hygiene of labour-vocational training are related to:

1. Knowledge of the age and the individual morphological and physiological characteristics of growth and development of adolescents. Lag, for example. the girls by some indicators of physical development and especially their efficiency after age 13 have an impact on their performance. In all teenagers have smaller maximum physical and functional capabilities than adults. This explains their more rapid fatigue in workload (physical hardness of a 14-year-olds is 70%, while 16-year-olds is 80% of that of adults, and their efficiency respectively 70% and 78%). Not without significance are instability of neuro-regulatory mechanisms, temporary disturbances proportionality of development of some organs and systems.

In adolescence observed enhanced heat exchange, sweat and fat release, features in the development of the psyche. Gender, health status of adolescents are also important in workload.

2. Reporting age increased sensitivity, greater vulnerability and tiredness. Insufficient resistance to various unfavourable factors of work environment of growing organism compared to adult - for example imperfection in adaptation mechanisms, failure in the process of desintoxication, blocking the cell respiration of industrial poisons earlier and at lower levels, increased pulmonary ventilation in adolescents and others.

It has been found that the process of adaptation of adolescents to certain physical factors of the environment (temperature, humidity, velocity of air movement) proceed more favourably in comparison with other factors such as noise, vibration, chemical substances.

Thus, the thermal impact results of the stronger expressed thermoregulatory response in the young organism, and also as a lower age than in adults (for younger students thermoregulatory mechanisms are involved in less thermal load). Especially sensitive is the young organism to the effects of chemical factors. Even exposure to chemicals in concentrations at the limit (MAC), in contrast to older, adolescents are observed already some changes (reduced capacity, weakening the strength of neural processes in the brain, changes in immunological activity, delayed physical development, increased general morbidity, etc.). Increased sensitivity is the age of adolescents and to the noise factor. There are more expressed adverse changes in the auditory analyser, central nervous system, cardiovascular system in noise effect by levels of 70, 80, 90 dB at 16-year-old adolescents comparing 17 years old. When 18-year changes were less pronounced or absent.

3. Consideration of changeable nature of the workload in the learning process. In terms of technical and scientific progress - the development of technology and informatics, workload of students is mainly psychosensory character with mild or moderate physical load.

◆ ***Vocational guidance***

It is a psychological preparation of students for their future work, taking into account their health, physical and mental development, work capacity, interests and inclinations. These requirements are associated with the needs of economic and cultural development of the country. Giving students a tentative data for future profession throughout the learning process and learning of their interests, abilities, physical development, health, and functionality are the two directions of practical activities for career guidance. It is the duty of the physician serving school till VIII class, to give psycho-pedagogical characteristics and a medical report on the health status of children.

Professional consultation is the final stage of career guidance. The doctor, educator and psychologist conduct thorough examinations and specifically outline the outlook for the overall development of the student, ie Finally giving in to cover the data available to the student with the requirements for future professions. The positive profkonsultatsiya drawn to the profession biggest part of students, ie practically healthy students. It is associated with issues of professional suitability and unsuitability in the availability of relevant professional relevant criteria for different professions. The negative proforientatsiya not permitted under approved by M3 and MES lists for students with a bias in health, to certain professions. Of importance, however, is the assessment of physician forecasting further development of the disease. The inclusion of chronically ill students in community service and has great personal and social significance. Professional advice to students of class VIII and XI of the work of methodological guidance offices.

◆ ***Hygiene requirements to professional employment training***

Job training for students from I to IV class takes place in classes work and creativity, of these V to VII - through major general theoretical subjects - physics, chemistry, biology, etc., and classes for work and technics; in the upper grades training is organized in vocational schools.

In Bulgaria in 2000 the system of vocational education and training includes career guidance, vocational training and vocational education.

Vocational training provides the acquisition of professional qualifications or part of the profession and its improvement.

Vocational education provides the utilization of educational minimum for secondary education and the acquisition of professional qualifications.

The degrees of proficiency are first, second, third and fourth.

The inlet minimum educational level for acquiring the respective degrees of professional qualification is:

1. First degree - complete class VI;

2. The second and third degree - completed VII grade or primary education;

3. For fourth degree - completed secondary education.

The graduating educational level for acquiring the respective degrees of professional qualification

1. First degree:

a) primary education - for students;

b) primary education completed or VI or VII class - for persons aged 16 years;

2. For second degree - completed X or XI, class acquired the right to take state matriculation exam for secondary education or secondary education;

3. For third degree - secondary education or acquired right to take state graduation exams for secondary education.

Right to carry out training for acquiring professional qualification are:

1. vocational schools, vocational secondary schools, vocational colleges and vocational training centres;

2. junior high and primary schools, secondary schools and special schools in separate classes if they meet the conditions set by the state educational requirements.

Training for acquiring professional qualification can be done through individual work.

The acquisition of professional qualifications in vocational education and training is regulated by programs - programs A-D.

The programs that can train students are:

1. A program of up to 3 years for students who have completed at least class VI;

2. B programs lasting up to four years for students who have completed primary education or completed secondary education grade;

3. C programs lasting 4 years for students who have completed primary education or 5 and 6 years for students who have completed primary education or completed VII grade;

4. D programs up to 1 year for students with completed primary education or completed class in secondary education grade.

Institutions in the system of vocational education and training are:

1. vocational schools;

2. vocational secondary schools;

3. vocational colleges;

4. vocational training centres;

5. centres for information and guidance;

6. centres for train the trainers;

7. National Agency for Vocational Education and Training.

To conduct labour training is necessary to ensure an appropriate base. Classes in chemistry, physics, astronomy and biology are conducted in laboratories that must have size 66-70 m^2 and laboratory room area of 16 m^2. Furnished with special two-seater laboratory tables, display tables, as in the laboratories of chemistry and physics must have the aspiration chamber.

Educational workshops on woodworking, metalworking, work-rooms for sewing and cooking and electrical engineering must have relevant area **(Table. 10.18)**.

One of the most important health and hygiene requirements for training and production environment in school workshops and workshops is the proper selection of tools. If the employment training is carried out with tools and implements for adults, it leads to unnecessary load on the fragile musculoskeletal system in children and often an increase in production injuries. Similar results were obtained when working with faulty and unsafe tools.

In the hours of labour education students from primary school working with paper, cardboard, clay, plasticine, wood and others. Here, particular attention should be paid to the selection and usage of tools and implements - knives, needles, awl, scissors, brushes and more. For example, the needles must not be a thread longer than 40 cm, the hammer must have a weight of 250 g and a handle length 220 mm, etc.

Educational workshops in woodworking must have carpentry countertops in three sizes with respect to the height of students - 75,5 and 80,5 cm. For students with lower growth provides footrests with a height of 5, 10 and 15 cm. In practice, the selection of appropriate counter it, a student stands up to him and puts granted free hand on its surface. In the corresponding height of the counter arm is not bent at the elbow and palm rests freely on it.

Educational workshop on metal is furnishes with two dimensions looms - a height of 85 cm and 95 cm. Fitter's looms are arranged parallel to the windows at spacing of not less than 1 m.

In agricultural work may be required students to lift and carry weights. In these cases should be monitored for compliance with the relevant rules: boys 14 years - no more than 6 kg; 15 years - 8,2 kg; 16 years -12; 17 years - 15,4 kg; the girls of 14 years - no more than 6 kg; 15 years - 6,8 kg; 16 years - 8,0 kg; 17 years - 9 kg.

To prevent damage to health by training envisages several measures of hygiene and safety. Normalization of work by adolescents is as follows:

1. Establishing age limit for employment.

2. Limit the length of the workday and hygiene organization mode of work.

3. Determination of the norm for labour productivity in accordance with the age possibilities of the organism.

Adolescents under 18 years of age are not allowed to work in enterprises with difficult and hazardous working conditions. The duration of the working day of the 16 - 17-year-old is 6 h, as in exceptional enterprises are allowed 15-year-old adolescents and duration of the working day to 4 h. Now accepted norms for productivity of growing be determined in percentage or in parts of the hourly productivity of adults and no by the daily performance or absolute units made products.

Table 10.19. Standards for design jobs

N	Type of room	Area 1 place (m^2)	Number of jobs	Total area (m^2)
1.	Woodworking workshop	3,0	15-18	
2.	Machine room in woodworking			25-36
3.	Timber-yard			18-25
4.	Workshop for metalworking	3,0	15-18	
5.	Machine room in metalworking			25-36
6.	Warehouse for metal			18-25
7.	Workshop on applied electrical engineering	3,0	15-18	
8.	Warehouses at the workshop applied electrical engineering			18-25
9.	Work-room of technical drawing	3,0	15-18	
10	Work-room for cooking	3,0	15-18	
11	Work-room for labour with textile materials	3,0	15-18	
12	Cabin for painting		18	
13	Cabin for welding		18	
14	Room for teachers		18-25	
15	Wardrobe with sinks		25	

REFERENCES

1. Career Guidance and health ed. **B. Vazvazova**. S. Med. and phys., 1982, 151. (in bul.)
2. Hygiene of children and adolescents. ed. **B. Miteva**. S., Med. and phys., 1989, 220. (in bul.)
3. Hygiene problems of modern school. ed. **Vl. Boyadzhiev**. S., Med. and phys., 1985, 242. (in bul.)
4. Law on Vocational Education and Training. SG. 68/1999 (in bul.)

5. **Nikolova R.**, Evaluation of the impact of mental stress on indicators of heart variability. Scrip. Period. vol. VI, 1, 2003, 11-19. (in bul.)

6. **Preeze, V.N.** in.: Adaptation problems in hygiene of children and adolescents. M., Medicine, 1983, 94-100. (in russ.)

7. **Serdyukovskaya, D. N.** Production factors and students sensitivity. Coll. Gigiena children and adolescents. M., 1975, 57. (in russ.)

8. **Stefanova St.** Lead impact and professional risk in adolescents studying in non-ferrous metallurgy. dis., S., 1983. (in bul.)

5. HYGIENE OF PHYSICAL EDUCATION AND HARDENING. HEALTH EDUCATION/HEALTH PROMOTION. A.Alexandrova

Physical education and hardening of adolescents appear also important preventive tool for improving their health, physical development and abilities, to maintain optimal work capacity and efficiency of education.

Especially stands out the importance of physical education in the background of scientific and technological revolution that creates new materialnotehnicheski living conditions - reducing the physical load (hypodinamy and hypokinesy), which in turn lead to a lowering of functional status and physical fitness of the man, distortion adaptability of the organism to the environment. The inevitable through various forms of physical education not only to cover all adolescents in sufficient volume weekly activities, and also to identify: the content, conditions and methods of application, conformed to the age, gender and other individual characteristics.

5.1. PHYSIOLOGICAL BASES OF PHYSICAL EDUCATION

Motor habits. Physiological specificity in physical education and sport is that young people acquire new, necessary for their mobility habits and skills, and with the habits and improve motor skills, makes so-called motorial dynamic stereotype. This is achieved in the process of exercising and training in a specific physical discipline or certain sport.

Based on the construction of certain orderliness any learned movement creates a new level of receptivity of brain centres for consolidation and improvement of the ever-widening circle of studying movements.

A perfect leisure and mastering the complex of coordinated movements can be made easier if the training sessions start at infant and primary school age. The varied education of children in physical education leads to consistent management of increasingly complex movements and rich motorial options.

Motor skills. In parallel with motor skills develop and improve and motorial performance. Basic link in the process of development of motor skills is the improvement of the activity of the central nervous system, resulting in specifying spatial and temporal correlations of excitation and detention in various cortical centres.

Mastering the new motor skills and the formation of physical qualities speed, strength, endurance and agility are two sides of physical education.

• *Motor speed quality* is due to the rapid onset and course of the reactions in the cortex influenced by different stimuli. As a result, increases the speed and movement of the human body (or parts thereof) in the space or to one another.

• *Motor power quality* is characterized by a degree of tension that develop muscles in excitement. It is conditioned by increasing the excitability of nerve cells and increase strength and concentration processes of excitation and retention. This quality is formed and perfected also by conditioned reflexes. The development of the lability of the nerve processes and neuromuscular apparatus at this quality has a low level.

• *Motor quality endurance* is associated with significant muscle work for a long time. It was mainly driven by the ability to maintain a certain rhythm in the activity of individual systems throughout the organism.

• *Motor quality agility* occurs in the implementation of complex, coordinated movements, according to the situation. When it important is mobility of nervous activity.

Under the influence of systematic physical activity achieved the reconstruction of various organs and body systems and their relationships. The body begins to work more economically and acquires the ability to quickly mobilize its functionality and reserves.

It was found that students from the sports schools, with a high number of tested performance compared with their peers not sport - significantly higher levels of body mass, chest circumference, vi-

tal capacity, arm strength, etc. Similar results of studies of children from children's sports schools.

Under the influence of systematic physical exercises bone and muscle system are also undergoing changes. Changes in the rate of growth of bones and their microstructure. Thickens compact substance of the long bones. Increasing the diameter of the tubular bones. Occurs reorganization of the spongy substance, tabs are arranged along the power lines, according to the mechanical and biochemical processes at the appropriate place. It is an extension of the active hand at tennis-players.

Under the influence of training and especially during hard exercise, increases muscle mass. Trained muscles have a well-developed circulatory system (especially capillaries). Changes occur in the chemical composition of muscle tissue, which provide a rich reserve of energetic reserves of glycogen, ATP and its more economical use during physical effort.

The heart of trained adolescents with larger measure, mainly at the expense of the working heart muscle hypertrophy of the left ventricle. It is also a greater stroke volume.

When trained children and adolescents experience more low pulse rate and the maximum blood pressure. Pulse pressure is higher (the expression of a larger stroke volume). All these changes lead to significantly more economical heartbeat.

Under the influence of training and changes occur in the respiratory system, such as increasing the vital capacity of the lung, reducing the frequency of breathing at rest. At dosed sub- and maximum load,lung ventilation in well-trained individuals than double or more that of the untrained.

This increase occurs mainly at the expense of deepening breathing, unlike untrained, where it is mostly due to more frequent breathing.

When athletes students observed favourable changes in the blood, increasing the number of red blood cells and hemoglobin content.

A number of studies have found that under the influence of physical exercise increases the efficiency of the cells of the cerebral cortex and their resistance to strong stimuli, improves the analytical and synthetic activity of the central nervous system and the interaction between the two signaling systems. When physically trained children quickly generate positive conditioned reflexes: increases in strength and concentration of attention. The success rate in these children is higher.

Pronounced changes were seen in the physical development and activity in systemic exercise. The beneficial effect is the higher, the sooner begin systematic exercises.

5.2. MEDICAL CONTROL ON PHYSICAL EDUCATION AT SCHOOL

Medical control over physical education of children and students include:

1. Determination of physical development, physical fitness and health status of children.

2. Control of athletes students.

3. Medico-pedagogical control over class-lesson and extracurricular forms of physical education.

4. Tempering students.

5. Sanitary control over sports venues.

6. Sports medical advice and health education work.

Strenght groups. Based on data for physical development, physical fitness and health at the beginning of the school year, students are divided into so-called "Strenght groups" - basic, preparatory and special.

1. Basic group. It includes students without deviations in physical development and health, as well as athletes. Students from this group participate in the school curriculum in physical education in full, may participate in sports sections and competitions.

2. Preparatory group. It includes children having minor variations in physical development and health, and it mainly functional. They participate in activities in the school curriculum to the exclusion of highly demanding exercise. After appropriate physical training and discretion of the physician they can pass into the main group.

3. Special group. Students having variations in health status and physical development of permanent or temporary, are included in a special group. They are subject to dispensary observation and conduct in special groups classes for remedial gymnastics. After improving their condition and discuss with doctor can be transferred in the preparatory or main group.

Athletes students undergo periodic medical examinations, which coincide with the main, as they additionally carry samples of dosed exercise. Three days before the competition or on the day of the race they pass pre-competition tests. Medical officer serving contest, checked medical records, removed from the contest ill students and provide medical care to the needy.

Medical and pedagogical control on physical education lesson includes an assessment of lessons, determine its density and physiological curve.

Properly conducted a lesson in physical education contains three parts: introductory, basic and final.

• *The introductory part covering* the first 5-10 min of hours and carried preparing the body for the up-

coming activity. It covers draw up, walking, jogging, generally developing and preparatory exercises.

• *The majority part* still 25-30 min and allowed the main tasks of the lesson: learn technique of exercises and improvement of basic physical qualities - speed, endurance, strength and agility.

• *The final part* of the task for 3-5 min to reduce the load and bring the body to a state of relative calm. By quietly walking and relaxation exercises removes oxygen debt, lowered the strength of excitatory processes in the cerebral cortex, reducing metabolism, normalize blood circulation and breathing.

Physiological curve, obtained by sequentially measuring pulse rate and blood pressure during the lesson in one or two students, when properly conducted lesson has the following characteristics: the tip of the curve should be in the middle or the second half of the main part, but does not exceed by more than 80-100% pulse rate at rest position. Exercise should be arranged so that the physiological effect of them is expressed in a gradual increase in the pulse curve, keeping it in the majority part of a constant, slightly wavy level and drop at the start of the final part, at the end is reached no more 10% above baseline.

5.3. HARDENING OF CHILDREN AND ADOLESCENTS

Of the various forms of physical education in the learning process is closely linked with hardening of adolescents.

Air, sun and water are the natural environment in which to conduct physical education and sport. They are also the means of tempering that, mainly by improving thermoregulation, increase vitality, performance and hardiness to a number of unfavourable environmental factors.

The process of tempering is a complex and diverse set of physiological phenomena aimed primarily adaptation of the body to correct thermoregulation. It was found that under the influence of irritation of skin and other receptors of climatic factors occur as several amendments in the production of heat - i.e. chemical thermoregulation and in elimination it - i.e. physical thermoregulation of the organism.

External stimuli arising from the sun and air baths or water procedures, by reflex way engage in thermoregulatory reactions cardiovascular, respiratory and other body systems. Their activity is gradually reconstructed, resulting in compensatory-functional capabilities of the body are substantially improved.

The purpose of hardening is achieved in accordance with the following principles:

1. Graduability - hardening starts with weaker stimuli applied for a short time and gradually increasing severity and duration.

2. Systematic impact - piecemeal implementation of quenching treatments and especially their long break are the cause of loss of effect achieved.

3. Complexity or diversity of annealing funds - the most successful hardening occurs when factors such as heat, cold, solar, humidity, air movement are using in their different combination at a variety of conditions.

4. Individual approach - hardening takes place depending on age, sex, health status, determining the tolerance of the body to hardening procedures.

Hardening by air. The air is the most "soft" hardening factor. Its effect is based on physical properties (temperature, humidity, speed of movement), and is the greater as it is primarily a greater temperature difference between the skin and the ambient air.

Hardening by in air to begin in the summer or early autumn warm days in the open air at a temperature of 20-30 ° C, for 20 min, and then slowly and gradually its duration can be increased to 2-3 hours. Healthy and older children quenched only panties, and a smaller underwear, light and free clothes. Air baths should be combined with physical exercises (games, gymnastic exercises, walking). In winter, hardening with air may be effected indoors in advance well-ventilated room at an air temperature not lower than 16-18 ° C. The duration of air baths to the top must be 10-15 min, then increased to 20-25 min, with a gradual decrease in air temperature.

Peculiar form of hardening by air is all year sleeping with the window open and light clothing during the cold season.

Tempering with water. Water is much more acting hardening factor. Used in various water treatments - wet rubbing, pouring and bathing in open ponds. When applying any procedure with water at a lower temperature than that of the body and particularly in the area of the cold and cool baths (at a water temperature of less than 20 ° C and between 20-25 ° C), receives quick and sharp contraction of skin blood vessels. A significant portion of the blood is pushed to the inside of the body. This increases blood-fill of internal organs, increases blood pressure and hampers the work of the heart.

Properly conducted hydrotherapy activate the activities of all organs and systems of the body, increases metabolism, activates blood forming apparatus, is training the cardiovascular system, increases efficiency.

Rub the body is carried out with moistened cloth, sponge or by hand for 5 min. Starting with a water temperature of 25-30°C, gradually every 2-3 days latter is lowered by 1-2 ° C, up to 15-16 ° C.

Pouring is carried out with a shower, a shower - watering can or other container, starting with a water temperature of 28-32°C, in which the day is lowered by 1°C, in order to reach 17-18°C. The duration of the procedure is a maximum of 2 min. Then children wiped to dryness and redness of the skin (as in the rub).

Bathing in open ponds has the strongest hardening effect, due fastest and most chilling of the body. Starting at a water temperature of 23-25°C and gradually in the course of the sessions is reached to 17-18°C. Soaking in the beginning should not be more than 3-5 min, gradually increasing to 15-20 min. Before entering the water body should be preheated, and during bathing children to swim or are constantly on the move.

Tempering with sunlight. When it is achieved toning the body and increasing its possibilities of adaptation to high temperatures, in the skin to form vitamin D_3 and other biologically active substances that stimulate the metabolic processes in the body, activating blood-forming organs and enhancing the body's defenses. Sunbathing improve appetite and sleep children.

Most suitable for sunbathing are morning hours between 8 and 11 h. Sun exposure should be preceded by preparation: undressing of "dappled" shadow over the first three days respectively for 10, 20 and 30 min. Only on day 4 starting under direct sunlight, starting with 10 min and at each subsequent day residence time is extended to 10 min, until it reaches about 2 h. Sunbathing should be administered at intervals 1,5 h postprandial and 0,5 h before the meal. After the bathroom needed 20-30 min to stand in the shade, then recommends the adoption of water treatments. Caution should follow the principle of gradual because of the risk of skin burns - is needed permanent protection from UV rays.

The impact of hardening procedures may increase if accompanied by appropriate general hardening mode. Conversely, as expected beneficial effect of morning water treatments may not happen if the day the child is dressing a lot more than it is required by climatic conditions; if he sleep with closed windows; if he no spends a few hours of the day outdoors, according to their age and so on.

5.4. HEALTH EDUCATION/HEALTH PROMOTION

Schools have an important role as a medium for promoting health. Schools represent an excellent opportunity to show kids and adults that health is crucial. This can be achieved not only by offering relevant formal training programs, but by creating a school environment that establishes overall health.

Enlightenment model of health education in the twentieth century finds its alternative model of cooperation in health promotion.

Defining difference between them is that between **information** and **training**. The training focuses on the **active** involvement of students in shaping their own knowledge and competence of action as opposed to passive understanding of learner programs directed primarily at **informing**. Both models offer fundamentally differing views on health and use qualitatively different pedagogical approaches. Cooperating model in health promotion into account the rules and culture of the school, requires working with the environment and surroundings, evaluating the process of health promotion and cooperation with the local community.

Health education activities to inform students on the problems of health and protection, as well as building the habits and skills. It covers both the thematic times for cycle of human and all other school activities to improve health - eg. days of health or counseling for parents.

In State educational requirements (standards) Ministry of Education for educational content topics related to health education are included in:

- The subject "Man and Nature" from 3-6 class and are aimed at forming in students attitude and knowledge the human body and basic life processes in humans; hygiene rules for a healthy body; detection of harmful substances and human impacts;
- The subject "Biology and health education" of 7-8 class, and are aimed at acquiring knowledge about the structure, life processes and hygiene of human beings - eg. disabilities and diseases, hygiene rules of behaviour and healthy lifestyle, analysis of relationships and dependencies between certain state of the organism and specific rules for the prevention, etc.

The child may be included in the promotion of health even with entry into school. Children 6-10 years can now assess the changes in their physical and emotional state, notice environmental factors that affect their health, they now build habits of personal hygiene. In elementary school it is important for children to learn healthy skills such as personal hygiene, dental care, healthy eating, physical activity, etc., and also communication skills and such decision-making.

With adolescents it is appropriate to discuss the problems of puberty, mental health and unhealthy habits. In upper secondary discuss issues of mutual influence of other topics of interest to this group. Attention should be directed to the preservation and

development of the activity and ability to work, be explained to the responsibility for building a healthy environment and society.

Issues related to sexual and reproductive health to the fore at the beginning of puberty. They are turned on and prevention of diseases transmitted sexually.

The tasks of medical specialists are: to provide updated and verified information on the problems and provide individual counseling. Depending on the willingness of teachers, medical professionals can take, partly or wholly, information and advising students and workers in schools on issues of sexual and reproductive health.

Given that in school are taught and students with disabilities, diseases and/or psychosomatic disorders, it is necessary to be affected and themes that give an idea of some diseases and disabilities, for first aid, use of drugs, care for their own health.

Healthcare professionals should be involved in the development of curricula in health education, if possible, at the very educational process and also in the following recommended activities:

• a newsletter for health or under "Current health" included in the school newspaper;

• health boards in the school building;

• presentation of current health messages on administrative and pedagogical advice and whole-school assemblies;

• regular events for students and/or parents concerning one or more health problems;

• annually, at the same time, trainings for parents on relevant topics.

Of great importance is the **coordination and collabouration** with parents, the local community in the settlement, government and non-governmental organizations, working on related health programs.

REFERENCES

1. European Network of Health Promoting Schools, Copenhagen, WHO reg. Office for Europe, 2004.
2. Health Education. **Mladenova S.**, ed. "Arctic", Sofia, 2009, 120 p. (in bul.)
3. Hygiene of child and adolescents ed. **V.N. Kardashenko.** M., Medicine, 1980, 167-222. (in russ.)
4. Hygiene problems of modern school ed. **Vl. Boyadzhiev.** S., Med. and in phys., 1985, 242. (in bul.)
5. **Lazarov, N.** Issues of physical education. S. 1975, 7, 426-438. (in bul.)
6. Program CINDI, Healthy children in healthy families **Manolova A., G. Tzolova, P. Dimitrov, E. Teolova, M. Nikolova**, P. 2, Medical Services in Schools, 2010, 118 p. (in bul.)
7. **Ruschukliev, J.** Physiological bases of sports training. S., Med. and phys., 1976. (in bul.)
8. WHO - Report. The Healthy School. ed. **Young I, T. Williams**, 1989, p. 36.

6. HYGIENE REQUIREMENTS FOR LEARNING ENVIRONMENT. A.Alexandrova

6.1. HYGIENE REQUIREMENTS FOR ARRANGEMENT OF CHILD ESTABLISHMENTS AND SCHOOLS

Construction and operation of child establishments and schools in the settlements is mainly in the area of public services with a total area of terrain of 25-35 m^2/child (a nurseries or garden groups) - at least 20 -25 m^2/child, already adopted residential areas; 25-30 m^2/student and 50-60 m^2/student in college - at least 8-12 m^2/student in adopted urban areas.

For child establishment density of construction is up to 30% and landscaping not less than 40%. Schools respectively density up to 40% and landscaping - over 20%.

Some types of schools as professional build and in "mostly production area" of the production area (also in "high-tech zone"). Construction of schools and kindergartens is done in mixed central areas.

◆ ***Nurseries and kindergartens***

Range of children from children's and educational institutions shall be determined as follows:

1. Childcare - children from 3 months to 6 (6.5) years - nurseries, kindergartens, combined kindergartens.

2. In educational institutions for children 2.5 (3) to 9 years - kindergartens and schools from I to III class (this type of establishment provided for in small towns where the number of children for childcare form 3 and fewer groups, and students - 3 and fewer classes).

Groups-assemble up to 20 children (to age 3) and 25 children (for 2-6 year olds).

When building a child's main office basic are following hygiene requirements:

1. Adherence to the principle of group isolation of children in the building and around the area with a view to their high susceptibility to infectious diseases and lack of immune protection.

2. Providing conditions for physical activity both indoor and outdoor.

3. Maintenance of favourable thermal mode.

Area of the setting. The area for the construction of the kindergarten must be sufficient in size, far from the streets with high traffic, industrial plants emitting dusts, gases or create noise. For most favourably accepted indistrict disposal of children's institutions.

The area of the kindergarten should have no more than 30% built-up area. Shape following types of areas:

1. Physical education/playground area:

• *When nursery with a capacity of 4 groups* - at least 55 m^2, with 6 groups - at least 65 m^2.

• *In kindergartens, combined kindergartens with a capacity of 4 groups* - from 150 to 200 m^2. For each group more surface area is increased by 25 m^2, but not more than 330 m^2.

On the part of the terrain of the general physical education/playground in kindergarten with more than 4 groups provide showers and pool for hardening children with depth 0,4 m and an area of 15-20 m^2.

2. Each group of children from 2.5-3, at the kindergarten playground is provided with adjustable shading and an area of 120 - 130 m^2, of which game on hard surface 2.5 to 3 m^2 per child.

3. For children 3 to 6 years are formed areas for specialized kind activities, with an average area of 120 m^2, which are used consistently by the groups.

In kindergarten with 3 or more groups of children over 2.5 years provides natural area and an experienced garden area of 15 m^2 per group.

Half of the area of terrain landscaped in the form of shelter belts along the periphery of the area, around the group's playgrounds and outside the building.

Building of kindergarten. Designs to two floors. The entrances and staircases are as follows:

• *For every two nurseries groups and four garden groups* - common entrance and stairs.

• *For single nursery group kindergarten allowed separate entrance.*

• *For the business units and the isolation unit* - separate entrances.

Nurseries groups must be provided with the following premises: wardrobe-filter, game-dining room, bedroom, toilet and washroom, office and kindergarten - wardrobe-filter, study-room, bedroom, toilet and washroom, office. Study-room is the main premise for a game for mandatory activities and dining. The most appropriate is to be a rectangular shape and area of not less than 50 m^2. Its depth, with unilateral natural lighting, should not be more than 6 m. Every child must be provided by 2,5 m^2 area and 7,5-9 m^3 volume. In half-day daycare groups are allowed bedroom and study-room are in one room with 100 m^2, as with movable walls are divided into two functional areas. To kindergartens and combined kindergartens provide rooms for general and separate use on schedule. In kindergartens washroom in the entrance of the toilet, the latter is equipped with a personal children toilets.

To establishments with 4 or more groups of children over 2.5 years provides gymnasium with storage for apparatuses and toilets, and at 6 and more

groups with children from 2.5 years is allowed swimming pool measuring 6/12 5 m and a maximum depth of 0,8 m.

Besides spaces for children, and provide premises for: medical services; business part-kitchen, laundry, office of the director, health office; bathroom and shower for staff.

◆ ***Secondary Schools***

Secondary school occupies a central place in the system of secondary education as the mass school.

According to current design standards, the areas are grouped according to age of the students and by function in sectors that are unified into three zones:

1. Zone for educational work in I-st period of training, which includes facilities for students of I -III class.

2. Zone for educational work in the II-nd and III-training period, covering sectors for natural and general sciences.

3. Multi-purpose area which covers the following sectors:

- *Disciplines of labour and production training.*
- *Aesthetic disciplines.*
- *Public work.*
- *Library and Information Center.*
- *Sports.*
- *Nutrition.*
- *Healthcare.*
- *Methodological and administrative management.*

Terrain for secondary school. The school area with its subsidiaries, is regarded as a single complex with the school building. Its area is sized at 25-30 m^2 per student. Substantial medical and pedagogical matters is the size of the radius of the serviced area. Even from conference of the International Union of Architects in Rabat in 1958 maximum distances from home to school building have been adopted: 1 km for students from elementary school and up to 4 km - for those of secondary school.

Different opinions exist regarding the shape and density of the school terrain. As recommended optimal square shape with a ratio of built-up to free area 1: 3 (25%: 75%). From the hygienic point of view the most profitable unbuilded part of the school area to be divided as follows: playgrounds and gymnasiums areas - 50%; green areas - 40% farmyard -10%. To neutralize the negative impact of factors and nuisance associated with urbanization (dust, noise, chemical hazards, etc.), huge school grounds, covered with worsening microclimate surfaces (asphalt, concrete, sand, tiles etc.), are becoming "a discussion" at the expense of intensive and rational landscaping while maintaining terrain and natural features (rocks, groups of trees, shrubs, etc.). The necessary areas for sports and active games are realized in a local sports complex, designed for several schools in the region.

In insufficient terrain allowed the export of certain areas or functional sectors outside the school no closer than 200-300 m.

Educational facilities must be located no closer than 15 m from the street regulation line and adjacent areas, and the rest (canteens, act- halls, workshops, gyms, etc.) - not less than 5 m. The open sports facilities designed a distance not less than 15 m from the school premises.

School building. The height of the school building should be no more than three floors, and except in urban areas - no more than four floors. By increasing the number of floors is reduced opportunity for rest and spend outdoors and increases noise and air temperature in classrooms in the upper floors is the cause of discomfort microclimate. In big cities today are designed and constructed buildings for 1000-1500 students, but in practice there learn significantly larger number of students in connection with two-shift training. This large capacity of the school building is inappropriate from educational and health-hygienic point of view, which is why the view can not build schools for more than 700-900 students. Studies show that infectious morbidity in schools with a capacity of 300 students is 3 times lower, and in those with 500-700 students is 2.5 times lower than in schools with 1,000 students.

1. Classroom. Basic school premises still remain classroom and laboratory.

Classrooms for the first period of study is designed as multipurpose rooms for classes in general education courses, practical training, various noiseless games and activities. It provides from 1,5 to 1,7 m^2 per child for up to 30 children in class. For students from elementary school to provide playrooms used for group and individual games, film, music, art. It is close to provide areas for outdoor activities, equipped with the necessary equipment. Educational facilities in elementary school to orient the east, south or southeast. A major element in the "General educational disciplines" for II and III training period is also the classroom.

The area it should be not less than 50 m^2, so that each student to provide a minimum area of 1,25 m^2. In modern technical means of training used in our schools, this area is insufficient and does not allow to follow some basic hygiene requirements. For example, frequently the distance from the first table to the whiteboard is significantly less than 2 m, the learning tables are placed close to the outer and inner walls of the room. Therefore students sitting near no thermal insulated outside walls are heat discomfort and significantly more often suffer from colds.

Based on hygiene studies and architectural calculations found that the area of educational facilities should be increased to 65-81 m^2. Along with rectangular and square classroom offers other configurations - pentagonal, trapezoidal, segmental and others. In our country are generally buildings for rectangular classrooms, glazing on one of the long sides. It is assumed that the most appropriate ratio between the sides in the classroom is 3: 4, length of the room 9 m, a width of 6 m and a height of 4 m. These dimensions are determined by the need for visibility and hearing of last desks, natural light for those farthest from the windows, and required air volume of each student 12-20 m^3/h at rate frequency of ventilation - 3.

2. Language laboratories. Some of the language lessons are conducted in specialized laboratories. They are equipped with audiovisual systems, control panel and projection equipment. They are furnished mostly for half class (18 students), with individual cabins-boxes. Limited together with glass partitions.

3. Resorts self. In some modern schools commonly practiced independent work of students, which is held the so-called places for self and group activities. They provide for 5-10% of the number of students. Can be semi-enclosed rooms for individual work or open work places for individual or group activities, designed with movable furniture.

4. Repositories. Storage for training appliances and materials in the general education sector are separated repositories, used and as workplaces of teachers.

5. Corridors. The corridors are used as reservoirs of fresh air and recreation during breaks in rain and cold days. They should be wide enough - no less than 2,8 m.

6. Lecture halls and laboratories. In the sector "sciences" includes lecture halls with an area of 1,4-1,5 m^2 per student; laboratories - 2 m^2 per student and preparatory to 18-25 m^2 total area. Lecture halls in physics, chemistry and biology require installation fitment for demonstration desktop of the teacher, with water supply, sewerage, gas, electricity and ventilation fireplace. Provides direct connection with the preparation.

7. Workshops and laboratories for labour training. Sector "Disciplines for labour training" includes workshops on woodworking and metalworking, measuring 66 m^2, rooms for tailoring and cookery size 32-66 m^2, electrical and others. Sizing is usually about 18 seats - half class. This sector can be designed as a separate building in the courtyard of the school, with a wardrobe of clothing, sinks and bathroom.

Laboratories in music and choreography, as well as those in drawing and modeling must provide a minimum of 2,2 m^2 area of a workplace.

8. Sports facilities. As is known, the effectiveness of physical education classes depends not only on its proper construction, but also the conditions under which they are held. Therefore, in any modern school must have a sports hall with an area of at least 162 m^2, height 4,5-5 m This provides each student a 15-20 m^3 air (45-60 m^3/h at triple exchange air). These rooms must be in a separate one-story wing of the building (with exit to the garden), two dressing rooms, showers and toilets. Additional showers are necessitated for swimming pool, which are sized based on a 1 shower cell of three students. The number of outdoor sports facilities depends on the number of students, but the most necessary and for younger students are short straight running track and pit for long jump. To sports facilities for athletics can provide and cross country runs, pit high jump and sector for shot-put. Designed and playgrounds for sports ball games - basketball, volleyball, handball, football.

9. Food bloc. For schools with more than 180 students design a dining room and a smaller capacity - only buffet. In large schools have device of two cupboard - hot and cold snacks (one for students from l-st period and one for students ll and lll period), with the possibility of seating. Buffets generally have a "neutral" place in the school building - on the ground floor, close to the conference hall or canteen, to a secondary entrance with direct connection for importing products.

When device sector "Feeding" is necessary with the following basic principles:

• *Establishment of the food unit into a separate body or wing of the school building.*

• *Provide sufficient area per student in the canteen (about 1 m^2).*

• *Create conditions for proper technological processing of products* to the maximum preservation of valuable nutrients.

• *Ability to comply with hygiene requirements and food safety in the preparation and serving of food* (diversified, flowability, disinfection of dishes, etc.).

• *Making a proper diet and rational nutrition of students of different ages.*

Some schools have separate food unit with a fully-developed kitchen. There are also those with only built canteen and offices (without kitchen). In the last food supply is provided by a central "kitchen-parent" *or "catering".*

10. Wardrobes. Hygiene matter is and location of wardrobes. So far confirmed two ways of arrangement wardrobes in school buildings - single individual lockers near the classroom or office and global central wardrobes for the entire campus, or for blocks and floors. The most appropriate solution for educative establishments with laboratory, or semi-board-

ing training system is building a central wardrobes in the common room of the basement, near the main entrance and with separate boxes for each class.

11. Library - Information center. Includes a reading room with a catalog book, depository, premises for activities with electronic and other means of training, area for copying technique. The room for occupation by electronic means working primarily with PCs. According to the "Regulations on the health and hygiene requirements for the use of video terminals" computer rooms opened up in spaces with north, northeast and east exposure, with single glazing and mandatory equipment with sunscreens. To this office must have additional room with an area of 12-15 m^2, storage for spare materials. The floor should have 2 cm anti-static coating (flooring, ceramics, cement). These offices are located no more than 15 work-places with a minimum of 5 m^2 per one (in classrooms with traditional sizes have no more than 9 work-places).

12. Sector "Health". It includes: doctor's office (18-25 m^2), dentist's office (18-25 m^2).

13. Sanitary block. Washrooms and toilets are located on each floor separately for boys and girls. The number of toilets is determined by the number of classes in the ratio 1: 1. Teachers and staff use separate toilets. In schools with students over VII grade must be arranged rooms for woman's personal hygiene.

14. Administrative premises. This group is the teachers' room. In the new schools organize "school sectors" or "teaching centres", which consist of: operating room, providing 2 m^2 per teacher, equipped with a large conference table and private offices and several private rooms for individual use for work or recreation; wardrobe with private bathroom; office.

◆ *Sanitary technical development of child establishment and schools*

Light, heat and air comfort in child institutions and schools depend on the systems used for lighting, heating and ventilation.

Heating. Several studies show that stronger adverse effects have on self-esteem, ability to work and morbidity of adolescents as overheating so and over cold, due to immaturity and untraining of their thermoregulatory mechanisms. Also cold incidence increases when changing ratios between the temperature of outside and inside walls, and fluctuations in air temperature in classrooms exceed 5°C. The mechanism of these changes can be explained by the beginning of neurotic reactions related to the change in the stereotype of temperature effects.

There are limits of microclimate parameters for the premises with different functions; for example, the air temperature at the reception and gambling-room for nursery age is 21 ° C; bedroom - 19 ° C; classroom - 20 ° C; sport hall - 15 ° C; swimming pool - 29 ° C; WC - 17 ° C; workshops - 14-16 ° C, and so on. The relative humidity in the children's offices should be 30-60%, and the rate of air movement - from 0,2 to 0,4 m/s.

The best system to maintain thermal conditions in children's institutions and schools are water low pressure heating and radiant heating.

Ventilation. To maintain air quality childcare and educational facilities, it is necessary to provide a continuous ventilation. Natural ventilation is done by opening the upper windows or windows goals in the classroom during breaks. The latter is particularly effective when you can create flow by opening windows opposite. During school hours corridors ventilated for 15-20 min, to exchange air that is polluted during recess. Due to the difference in temperature in the hall and classroom, clean air from the corridor enters the classroom through the cracks around the door. Artificial exhaust ventilation is provided in rooms where the air of the stronger contaminates, such as sinks, toilets, showers, wood- and metal-working workshops, kitchens, gymnasiums, chemical laboratories and others.

Lighting. Numerous studies prove that the essential factors for increasing myopia among adolescents are insufficient and inadequate natural and artificial lighting of student work-places. At the same time it was found that with an increase in the level of illumination of the working areas of the learning areas productivity increases to 10%, and in some cases - to 30%. This is due to the improvement of basic visual functions and according to some - and stimulating role of good lighting on the memory capacity, logical thinking and more. To provide conditions for visual comfort in the main rooms of children's institutions in which children perform visual work, the light coeficient should not be less than 1: 4, and the coefficient of natural lighting (CNL) - 1,5 - 2,5%. In other areas such as reception, changing rooms, rest rooms, the light factor may be less (1: 5, 1: 6). In new construction of schools are looking for ways and means to increase the light factor (eg. 1: 3) and CNL (3-5%). Apply widely glazing on the exterior walls, double lighting, upper natural lighting through ceilings of glass-concrete or wired-glass in one-storey buildings and others.

Artificial lighting should be sufficient, without direct or reflected brilliance. From health-hygienic view most acceptable after natural lighting is luminescent and LED. When light fixtures are designed and installed according to modern standards and schemes, they give a soft, diffused light, that is close

to the natural spectrum. In proper operation and maintenance of these light sources is constant, evenly distributed, not blind, does not flicker. The brightness of the working surface of the desks should be 300 lx. In educational manufacturing premises norms depended by the type of labour, characteristic of visual work by degree of precision, category of visual work, the contrast of the object with the background, the type of lighting **(Table. 10.20)**.

For example, training workshops for leather goods and textiles is associated with visual work of II category, in workshops for woodworking, metalworking - III category, etc.

Table 10.20. Lighting requirements according to the category of the visual work.

Artificial lighting (e lx)	*Category of visual work in production premises*		
	II	*III*	*IV*
When combined lighting	*1000-4000*	*400-2000*	*300-750*
In general lighting	*300-1200*	*200-500*	*150-300*

6.2.HYGIENE REQUIREMENTS FOR FURNITURE

Furniture in nurseries and gardens must meet some basic requirements to:

- *Corresponds to the age anatomy-physiological characteristics of children.*
- *Easy to clean with water and treated with disinfectant solutions.*
- *Be safe in trauma and toxicological respect.*
- *To be aesthetically shaped.*
- *To move easily from children to form a temporary spots.*
- *Do not only utilitarian value, but also be an element of the children game.*

The most common furniture are, playpens and diaper tables - for children from nursery age; chairs and tables, cabinets for storage of toys; cribs of various sizes - for nurseries and kindergartens; tools for organized activities.

The number of sports equipment (fences, staircases, turrets, beams, etc.), which are used for the organization of the main types of movements are made of durable materials, dyed with synthetic dyes and are fastened securely.

Certain hygiene requirements must meet and toys, as materials for their production should be completely harmless to children's health; be easy to clean, and if necessary disinfected.

• For color are allowed only harmless to health dyes, pigments and varnishes;

• The toys have no sharp edges and peaks, which can cause injury to children;

• Their weight must not exceed 100 g for children up to 1 year, 400 g for children up to 7 g .;

• The level of noise emitted by toys when used in a home is allowed as follows: when the toys to drive mechanism - up to 45 dB/A; with melodious sound effect - up to 45 dB/A; other sound effects - up to 65 dB/A;

• In toys made of paper and cardboard texts should be printed with contrasting colors, colors of light tone, the letters for children up to 10 years to be not less than 2,3 mm and others.

Modern furnishing of learning spaces requires:

- *free, light and movable furniture;*
- *differentiation and adaptability of chairs and tables to the growth of students;*
- *presence of convenient storage and easy movement of modern audio-visual teaching aids;*
- *colorful, durable decoration similar to the world of children and adolescents and more.*

Benches. For students from primary grades are still used and are considered more suitable desks, which can be a two-seater. They must ensure the wellbeing and high performance, promote the formation of normal body posture of student and avoid spinal deformities and myopia. This is achieved through proper arrangement of children to desks at the beginning of the school year, depending on their height.

A number of countries are made desks in five sizes according difference (15 cm) in height to those using them students - Group A, with growth below 130 cm to Group E, with growth exceeding 175 cm. At the same time, due to their small size and limited work opportunities for flexible use in schools recently introducing individual worktables. Recommended furnishing of classrooms spaces becomes furniture holding devices for height adjustment, which can sit students from several growths groups.

In making desks necessary compliance with the correct ratio between its main elements: differentiation, distance, depth and height of seat, sizes of back and others.

• *Differentiation* is called vertical distance between the rear edge of the desk and table seat. This distance size must comply with the distance between the child's seat and the bottom edge of the elbow, on flex at right angle hand. In greater differentiation - high table or stool, the student in writing is forced to twist your body to the left and lifting his right arm in the shoulder. In less than adequate differentiation - low table or high seat - the student leans forward.

In both cases, creating conditions that contribute to the distortion of the spine **(Fig. 10.9)**.

Fig. 10.9. Position of the body at different differentiation



• *Seat distance* is determined by the ratio of plummet, descend from the end of the table and the end of the seat. The distance is zero when the plummet falls exactly on the outskirts of seat, positive is when it is outside the seat, and negative when it falls on seat. The most favourable is a slight negative distance at which the student keeps his body upright and his shoulders are resting on the back of the desk.

• *The dorsal (back) distance* is distance between the end of the table and back (horizontal) - it must not exceed by more than 5 cm diameter of the chest.

• *The depth of the seat (seat width)* must meet 2/3 of the length of the thigh, to provide adequate support for the leg muscles, which in such cases are relaxed.

• *The height of the seat* must be equal to the length of the lower leg plus 2-3 cm.

• To give support to the back muscles, *back (height)* should reach the lower edge of the scapula.

School board. In school premises using various educational boards: completely static, with a static middle part and movable wings, with horizontal or vertical creeping wings. Class board must be clearly visible from all work-place in the classroom, not to glare, to provide sufficient contrast between the background and the writing on it. On the board can be installed and locally artificial lighting. The distance on the board from the last ranks should not be greater than 8,5 m, and the first - it is not closer than 2 m. New classrooms boards are: fiberglass, lighted, screened (white), folding, sliding on rails, magnetic, electroaccustical and more.

Classical teacher desk becomes the remote control of teaching devices.

Computer room. There are certain requirements for the furnishing of computer labs. For example, the working area should be light, with a matte finish, a small thermal conductivity and is not a source of static electricity; worktable have a slight slope of 3-5 ° back and adjustable in height from 0,20-0,55 m; backrest provides support in the lumbar region, with a slope to the seat surface 80-100 ° and more. With the right posture distance between eyes and the screen should be 0,50-0,70 m, and between the eyes and keyboard - 0,45-0,50 m, look must fall within the top of the screen. Certain requirements must meet and PCs. For example: screen video monitor must be stable image without flicker and change the brightness of the signs; the screen brightness does not exceed more than 3 times the brightness of the surrounding environment; keyboard to be stable, the maximum thin, with noluminous surface and a tilt angle from the horizontal plane 5-15 °.

6.3.HYGIENE REQUIREMENTS FOR TEXTBOOKS

There are a number of requirements to printing form of textbooks and other printed teaching materials with respect to the paper, the type, page prints, illustrations, volume, mass and so on.

Paper. From the hygienic point of view the most profitable books to be printed on an offset or typographic papers, mitelfayn or wood-free, a glazed brushed surface, low translucency, a small mass and a thickness of 0,075 mm. A number of authors demonstrated that noglazed paper retains its surface much more microorganisms, including and pathogenic. It has been found, for example, that tuberculosis bacteria are retained viable on dirty pages of textbooks and books for 3-5 months. In some countries already produce paper for textbooks, impregnated with antibacterial solutions.

The paper to be white, which provides a maximum contrast when printing letters. It should have a smooth surface, no furrows, spots or fibers. It should not be very shiny (glossy) but dull, not reflect light and does not prevent the correct vision. Glossy paper is suitable for printing only color figures, drawings, portraits.

Type. The most important hygiene requirements for the type of textbooks are: simple and legible characters without unnecessary ornaments, with dense black color, with well defined edges and details without defects. Their height is determined by the age of the students: 2,8-3,0 mm for primary pupils; 1,75 mm for students in upper. Minimum spacing lines to 0,5 mm, and between the letters - 0,5-0,6 mm.

Page type-setting. Hygiene standards exist regarding the set of the page. For example, the distance between words - 2 mm, the distance between the printed lines - 2-3 mm and more.

Length of the print line. It is an important element of the hygienic point of view. It was found that the smaller the student is, the more difficult and tiring for the eyes is transferred from line to line in reading. So students often "lose" the order is returned several times to start it, thereby violating the speed of eye movements and oculomotor muscles get tired more.

In the older students in which neuromuscular apparatus of the eye is already more developed and strengthened, is obtained opposite reaction. In reading textbooks printed with long lines establishes three times more refixations, i.e. do not use the increased possibilities of the eye for "economical" reading without unnecessary reflexive movements. So in textbooks for young students apply longest printed line and in books for older students - in shortest.

In issuing textbooks apply two-column text because of the opportunities this method of saving paper, more rational arrangement of illustrative material and so on. This set is permissible only in books for older students and then by subject that do not require continuous reading memory - history, geography and more. In textbooks for students from primary school two-column text it is not recommended because the reading speed slows down, load of optic analyst increases, fatigue occurs faster.

Print. The optimal in hygiene relation printing is saturated black, clean, even and well defined alphabetic lines. Color printing, especially bright red and bright green, are not recommended because it irritates excessive retina and quickly tired reader student.

Illustrations. Clear drawings and pictures, simplified diagrams and tables, contribute to the most natural way of important hygiene rule - students do not read continuously and for along print text. The ratio between the text and illustrations in textbooks for young students should be 1: 1.5, while for large 1: 0.5. The distance between the text and illustrations must be above 4,5 mm, and in colored illustrations - not less than 6,5 mm.

Books and bags. For primary school textbooks are not allowed heavier than 0,3 kg. For them most suitable for carrying educational materials are tubular bags with straps type "backpack". Heavy handbag can lead to curvature of the spine or stretching of the ligaments in the shoulder or wrist, and now no use.

6.4. ARCHITECTURAL REQUIREMENTS AND DESIGN OF SPECIAL EDUCATIONAL INSTITUTIONS. Vl. Radulov, M. Tsvetkova

◆ ***Adaptation of traditional buildings.***

Occurred in the late XVIII and early XIX century special schools for children with various disabilities at first had to be placed in at least suitable for purpose buildings. In this case it is necessary to comply with the following basic requirements:

• *From what group of persons with disabilities will be used building.* For example, visually impaired children need better lighting in the building, securing stairs, swing doors and facilitating overall orientation. Hearing impaired children require opportunities for visual communication, and those with neurosomatic diseases - from conditions for convenient and easy movement.

• *To place with or without boarding - house will be used.*

• *What type of training and rehabilitation will take place in it.* This requirement is important because it affects the deployment of special equipment and other teaching aids.

• *Is some professional training.*

With appropriate adaptation of traditional buildings can be achieved too much. Success depends largely on the financial capacity and cooperation between different groups specialists.

◆ ***Construction of new buildings of the traditional type***

When discussing the project of the building, is useful to consider how the above requirements, related to the adaptation of buildings.

1. Selection of suitable terrain. Usually special schools are located in low noise neighborhoods of the city or in the near suburb. Good transport links are required. Experience in many countries shows that windy areas are not appropriate. Even with the construction of the first special buildings in Western Europe in the XIX century, architects provide great schoolyard with opportunities for various motor activities and sports, to maximize use of natural resources.

2. A varied environment. No matter what children will study, environment to the school should offer a variety of objects for observation and opportunities for better organization of leisure. This means that the school could be located to various natural areas, park, suitable commercial sites and cultural institutions.

3. General requirements for the building. Very suitable is it to be dyed in bright tones, can be different from a distance. Building or complex of buildings do not need from the high-rise building. Today optimal considered one or two storey buildings, built of modern materials, with possibility of fast internal reconstruction. Very useful, if porter's lodge to be designed reception-hall for parents and a small shop for selling school works in arts and crafts. Avoiding the difference in levels, shaping various functional sectors through a different texture to the floor and suitably colored walls, create convenience for all children and adults.

4. Compliance with the specifics of the learning process. Whatever educate children, classroom sizes should be close to those in mainstream schools,

although the small groups that work. It is assumed that the modern educational sector in the special school should include the following three modules:

• *Training* - which have individual banks, classroom board, place the teacher and cabinets for storage of school supplies.

• *Of life* - with bathroom, basic kitchen equipment and space for a snack.

• *Relax* - this part of sector is furnished with sofas, carpet and various gaming tools.

Besides offices for general educational disciplines, required to design and rooms for special programs, depending on the category of children with disabilities. Since all modern special programs include skills training for independent life, it is no unnecessary to design so-called training apartment, with necessary equipment, which will enable students to learn practical to live in it, as support it.

The education of visually impaired children, especially children with hearing impairments, require locating special equipment. The intensity of the lights in teaching visually impaired, may vary at three levels - 500, 750 and 1000!x.

5. Living conditions. If the school is a boarding school, the bedroom should be no more than two beds and in rehabilitation centres recommended single bedrooms. Traditional study-halls have long been obsolete his time. Self-training to be carried in a special module near to bedrooms. Optimal living conditions mean opportunities for a wide range of cultural activities. Besides the concert hall, modern special school should offer rest rooms and a disco with opportunities to practice some skills, related to the preparation of the party.

6. Medical care and rehabilitation. Each special school needs not just of the medical office but of the medical block, which includes special consulting rooms related to the disability. It is useful to provide premises and deployment of equipment, by means of which in a school setting can be carried out medical researchs. The swimming pool and the gym should have a good marking and safe sports facilities. Appliances such as a pole, rings and more. can move on rails to retract the walls. Recreational devices are required for each special school, since many of the programs listed healing physical exercise.

7. Therapeutic services and vocational training. The project for special building may include a school psychologist's office, located in the medical unit. Children with special educational needs, especially those with multiple disabilities, need different types of therapy - psychotherapy, music therapy, dance therapy, art therapy, behavioural therapy, etc., which should provide suitable premises. Differentiated professional training in children with multiple disabilities is limited to the so-called labour therapy.

8. Opportunities and conditions of extracurricular activities at school. Playground in the schoolyard, eg., must be surrounded by a small embankment, making it safer and more versatile. In appropriate places in the yard can be arranged experimental field and a zoological spot.

9. Center for extracurricular activities. Modern special school serves children who study outside, such as: pupils integrated in general educational schools; students found in healthcare facilities over a long period of time; studying at home, for a variety of serious injuries. To assist them in modern school building of special school, designed so-called resource center for the production of educational materials, such as simple visual aids, braille texts and texts in large print for blind and visually impaired, visual materials for the development of communication in children with hearing disabilities, materials for cognitive development of children with intellectual disability, etc.

◆ *The "cottage" **

One of the main weaknesses of special schools is early and prolonged release of the child from the family environment and placing it in the "barracks" atmosphere of traditional boarding-schools. Back in the 70s of XIX century founder of the first school for the blind in the United States - Dr. Samuel Howe, offered as an alternative system "cottage." Answering the above special requirements, this system provides for designing individual, usually one or two storey huts for 10-15 children, each of whom lives in a separate room, included in the module with a common living room and kitchen. Thus, as far as possible approximation to the family atmosphere, creating conditions for a natural formation and practicing a variety of useful skills and habits. On the terrain designed educational, medical and housing for vocational training. In free space in the middle of the area usually have sports and gaming facilities.

Today the system "cottage" completely dominated in special schools of developed countries - it is more useful as educational and social. In Bulgaria the first successful steps have been made with the construction of settlements SOS - Kinderdorf for disadvantaged children.

REFERENCES

1. **Anderson, Cl.** School Health Practice. St.Louis, USA, 1980.
2. Decree № 9 of MH/SG. 46, 1994 Health requirements when working with computers in schools. (in bul.)
3. Decree № 3 of MH/2001 Health requirements for kindergartens. (in bul.)
4. Hygiene problems of modern school. ed. **Vl. Boyadzhiev**. S. Med. and phys., 1985, 242. (in bul.)
5. Hygiene of children and adolescents. ed. **B. Miteva**. S., Med. and phys., 1989, 220. (in bul.)
6. **Jilov, J. D. et al.** in.: Actual questions of training and education students. M., 1974. (in russ.)
7. **Kornevskaya, El., L. D. Rogachevskaya.** Hygienic questions school buildings. M., 1974. (in russ.)
8. **Milev, P.** Contemporary requirements for textbooks. S., National Education, 1983. (in bul.)
9. **Polievskiy, S.A.** Hygienic aspects for contemporary sports facilities. M., Medicine, 1981. (in russ.)
10. Regulation № 7 of MRD/2003 (to LTD - 2001) for rules and regulations for development of the different types of territories and construction areas. (in bul.)
11. **Roberts, F.K.** Education for the visually handicapped: a social and educational history. In: Foundations of Education for Blind and visually handicapped children and youth., Ed., Scholl G., AFB, NY, 1986, 1-18.
12. **Sharova, M. A.** in.: Hygienic aspects protection health of children and adolescents. M., 1984. (in russ.)
13. **Tsvetkova - Arsova M.** - Training of blinde-deaf children and adolescents, ed. "St. Kliment Ohridski ", Sofia, 2004, 385 p. (in bul.)

V. Frolkis, Y. Grigorov A.Reshetyuk,N. Verzhikovskaya, St. Vizev, P. Nikolova, M. Koleva, L. Ivanova

11 AGING / GEROHYGIENE

1. AGING, ANTI-AGING, OLD AGE, THE MECHANISMS OF AGING. V. Frolkis

1.1. BASIC CONCEPTS. BIOLOGICAL AGE.

Knowledge of biological age patterns in the development of aging and its mechanisms are necessary to the doctor for an objective assessment of health, prediction for probable duration of life, assessment of the reasons for the development of various diseases and the development of therapeutic and prophylactic measures. Such diseases such as atherosclerosis, hypertension, coronary heart - and ishemic brain disease, cancer and diabetes occur mainly in the second half of life and that are often associated with the aging process. Therefore the most effective means for the prevention of these diseases are the impacts directed at the rate of aging.

Must strictly distinguish between the notions of aging and old age, cause and effect.

Age. Old age is a naturally occurring final stage of development age.

Aging. Aging is a destructive process that develops as a result of increasing age damaging effect of exogenous and endogenous factors leading to the failure of physiological functions in the body. When aging, is observed limiting the adaptive capabilities of the organism, reducing its reliability, development of age pathology and increase the likelihood of death. The involvement of environmental factors in the development of aging justifies the requirement for optimal lifestyle and environmental conditions, conducive to slowing down the pace of aging. Environmental factors affecting biological processes affect life expectancy.

Anti-aging. In the course of evolution with aging occurs and the process anti-aging, vitaukt (lat. vita - life and auctum - increase). Vitaukt is process stabilizing vital activity of the organism and increasing its reliability. It is aimed at preventing damage to living systems with age and increasing life expectancy. Thus the overall development - etagenez (from greeks etas - age and genesis - origin, development) is the result of unity and opposites of two processes - aging and anti-aging (vitaukt). Their mutual relationship determines the characteristics of species and individual life.

Age periods have no sharp boundaries. Along with increasing life expectancy, the idea of timing of aging changes. Thus, the average life expectancy in ancient Rome was 28-30 years old, 40 year olds are believed to be old men and 60-year-olds - for depontinuses, taking place only for sacrifice. According to the WHO classification now age 45-59 years is considered average, 60-74 years - for elderly people, 75 years or more are called old and over 90 years - longevity.

Aging and vitaukt arise with the birth of the body. Change their relationship divides the whole individual development (etagenesis) into three periods - progressive, stable, degradation (ontogenesis, mezogenesis, gerontogenesis).

Biological age. Calendar years (the amount of time experience) should be distinguished from biological. People are aging at a different pace and duration of their upcoming lives, their adaptation abilities in the same age, differ significantly from each other. Biological age is a measure of the aging of the body, for its health and upcoming longevity. In other words, the biological age is integral assessment of the viability of the organism, which can be expressed as life expectancy as an indicator for retrospective characteristics of human beings, i.e. the traveled section of the life cycle. Biological age is a means for nosological diagnosis. The determination of biological age is a very important characteristic of the rate of aging, develop a system of preventive measures and implementation of pension policy. The more calendar age of human ahead biological, the slower is its rate of aging and so a greater should be the duration of his life.

In humans, aging can develop unevenly. Often the rate of aging of some systems, for example, car-

diovascular, nervous and endocrine, outpacing the rate of aging of the other. This is what determines the complexity of the determination of the biological age, which as complex has to characterize the rate of aging of the whole organism. Biological age is determined based on a comprehensive characterization of the functional status of various body systems and evaluation of its adaptation capacities. Therefore, to determine the biological age is important, firstly, to study the combination of functions, naturally changing with age (visual acuity, hearing, speed of propagation of pulse wave, muscle strength, blood pressure, vital capacity of the lungs etc.), and the other - wider use of functional loads to establish the level of adaptation of regulatory mechanisms.

1.2. AGING SYNDROMES. SPECIES AND INDIVIDUAL LIFE

◆ Features of aging

There are general laws and fundamental mechanisms of aging in different species and individuals. Along with that, however, noted species and individual characteristics of aging. Comparing the aging of animals of different species delimits so-called chronobiological changes, ie those correlating with astronomical time. As is more species lifespan, the more pronounced these modifications (e.g., age-related changes in the connective tissue and the vessel wall). Etabiological changes correlate with biological age (for example, changes in the neuro-humoral regulation of the biosynthesis of the protein). Species-specific changes are characteristic of animals of one species and not inherent in the animal of another species (eg, changes in the activity of many enzymes, lipid metabolism, etc.).

There are different syndromes of aging. All of them can be separated depending on the rate and the specificity in the sequence of aging in different systems of the organism.

Syndrome of accelerated aging. For it is characteristic of a faster rate of age-related changes, than most individuals in the population, in which cases the biological age is older than the calendar. There are complex symptoms, characterized syndrome of accelerated aging. It includes prenosological events, which are mostly related to neurohumoral and vascular changes, increased fatigue, reduced physical and mental performance and reproduction, memory impairment, emotional instability, inadequate vascular effects, delay restoration of hemodynamic and respiratory changes after loading and so on.

Syndrome of delayed aging. Delayed, retarded aging is characterized by a slower rate of age-related changes. Extensive clinical and physiological studies have shown that many functions of the nervous, cardiovascular and respiratory systems in long-living correspond to those in subjects 65-75 years. People with delayed aging are candidates for longevity. The *accelerated aging* is characterized by early development of age-related changes or their greater markedness in this or any other age period. Accelerated aging contribute passed illnesses, unfavourable environmental factors, including stressful situations, that can affect different parts of the circuit aging changes, to accelerate, change or reinforce their usual way.

Species lifespan varies widely - from several hours to several tens of years. The sharp jump in the change of species life becomes at stage person. He was associated with the occurrence of a high level of adaptation regulatory mechanisms, evolution of the brain, thinking, psyche, improving the regulation of homeostasis.

The maximum life span in species "Homo sapiens" is 110-120 years. Each stage of the individual development is programmed, including aging and termination of life. At all levels in living organisms, from arise until the end of their lives, over time irreversible changes occur that lead to a condition in which vital processes terminate and cease their individual existence. In unicellular organisms that exist disappears with the mechanism of cell division. Allowed even the existence in them of potential immortality due to lack of "corpse" - in fact both new cells contain "something" from the old, but also have "something" new, which makes them different.

More recent data (1982-1988) show that with the destructive development in old age occur and new, vital adaptive mechanisms maintaining homeostasis for life. For the last 100 thousand years maximum life expectancy of people has increased by about 14 years. This increase happened at the expense of improving the environmental conditions of life, mixing of gene banks of various nations and peoples and social transformations. An important indicator for the health of the population is the average life expectancy - number of years, which at an average be alive a generation, provided that the mortality of the population will then be at the level of the present time. The average life expectancy in Bulgaria in 1956-1957, the was 64.2 years among men and 67.6 on women and 2003-2005 respectively in 69 and 76.3 This, together with increasing life expectancy, increasing diversity of this indicator for men and women, which is associated with a number of social and biological factors.

One of the most important demographic characteristics of the XX and XXI Century is the aging of the population in many countries of the world, i.e. increase both the relative and absolute number of

people from ages above. Population aging leads to a change in the structure of morbidity, greater prevalence of diseases characteristic of old man populations, need to study the peculiarities of the development and treatment of these diseases, developing means to prevent premature aging and increase the working capacity of older people. Attracting retirees to work and various forms of community activity, has a beneficial effect on their health, source of moral satisfaction and long time maintain their life tone.

1.3. GENERAL LAWS AND MECHANISMS OF AGING

Aging is associated with changes arising at all levels of organization of living matter - molecular, subcellular, cellular, systemic, total organism.

The development of aging-is characteristic heterochronics - difference in aging time of individual organs and tissues. Atrophy of the thymus, for example, in humans begins at age 13-15 years, gonads - in climacteric period (48-52 years for women), while some functions of the pituitary remain at a high level to a deep old age. Heterotropics, expression of the aging process is different for different organs and different structures of the same organ (eg, aging in fascicular zone of the adrenal cortex is expressed to a lesser degree than that of glomerular zone, excreting respectively glyco- and mineralocorticoids). The age changes in the body occur at different speeds (heterokinetics). For example, changes in the musculoskeletal system slowly occur with age, while changes in several brain structures arise later, but quickly progressed, breaking its function. The age changes in the body develop with different direct (heterocathephthenics) - some metabolic functional tests going out to old age, others grow and third - wave similar changes.

Hypotheses. A significant contribution to the formation of modern ideas about the nature of aging have Hufeland, I. Mechnikov, I. Pavlov, D. Mateev, A. Bogomolets, A. Nagorny, A. Magnus-Levy, A. Komfort, B. Strehler. Their research is characterized by the search for fundamental mechanisms of aging and seeking to develop means affecting life expectancy. I. I. Mechnikov rises autointoxication theory of aging, reaffirming that aging is the result of autointoxication the body, associated with bowel function. He believes that by establishing a reasonable lifestyle and diet will increase the lifespan of people. I. P. Pavlov connects leading mechanisms of aging with changes in neural activity. A. A. Bogomolets worshiping believes that the leading mechanisms of aging are determined by age-related changes in connective tissue. Based on these ideas he proposes the use of cytotoxic serum for positive effect on the body in old age. A. V. Nagorny and his school collect big factual material about the peculiarities of pass of aging as a process of attenuation self-reviving of protoplasm. According to D. Mateev pace of aging is determined by the balance of the processes of fatigue and recovery. One of the synthetic theory of aging is adaptation regulatory (V. V. Frolkis, 1985).

There are two traditional views on the reasons for the development of aging.

1. Aging is genetically programmed process resulting from naturally developing a program, putted in the genetic apparatus. In this case, the factors of the environment and the internal environment can influence, but insignificant, the rate of aging.

2. Aging is a result of the destruction of the body due to the inevitable damaging effect of changes that arise in the course of life itself - stochastic, probabilistic process. In accordance with adaptation-regulatory theory aging is not genetically programmed, but is genetically determined by the biological properties of the organism. In other words, aging is devastating probabilistic process, developing into an organism with genetically programmed properties.

Aging is multi-factorial process caused by many factors, the effects of which are repeated and accumulate for life. These include stress, illness, activation of free radical oxidation and accumulation of the peroxide products of metabolism, of xenobiotics impact, changes in the concentration of hydrogen ions, temperature disabilities, inadequate removal of decay products of protein, hypoxia and others. Aging is a multifocal process. It occurs in various structures of the cell - nucleus, mitochondria, membranes, etc .; different types of cells - nerve, secretory, immune, liver and the like. The rate of aging can be determined from the ratio of the aging process and vitaukt. Mechanisms of anti-aging (vitaukt) can be divided into two groups.

1. Genotypic - genetically programmed mechanisms:

• *System of antioxidants* link free radicals.

• *System of microsomal oxidation in the liver*, disposing toxic substances.

• *A system of DNA* repair, liquidating disability of this macromolecule.

• *Antihypoxic system, preventing* development disorders of oxygen oxidation in the respiratory chain.

2. Phenotypic mechanisms, occurring over the life due to the processes of self-regulation and facilitating the preservation of the adaptation capabilities of the organism:

• *Emergence of multi-nuclear cells.*

• *Increase the size of the mitochondria against the reduction of their number.*

• *Hypertrophy and hyperfunction of the individual cells in conditions of the death of a portion thereof.*

• *Increased sensitivity to mediators in conditions of reduced nerve control.*

Table 11.1.Selected theories of aging

Cellular
Free radical damage
Glycosylation and other cross-links
Changes in DNA or chromatin
Decreases in the accuracy or quantity of protein synthesis
Limited cell division capacity ("Hayflick limit")
Decrease in DNA repair activity
Organ Systems
Role of immune phenomena
Role of neuroendocrine phenomena
Population
Theories associating aging with differentiation or growth cessation
Rate of living
Theories based on the evolution of life span in mammals

(Adapted from Weindruch, R. H. Walford, R. L.: The Retardation of Aging and Disease by Dietary Restriction. Springfield, IL, Charies C. Thomas, 1988.)

◆ ***Molecular and cellular mechanisms of aging***

Disturbance genetic apparatus of the cell. The majority of studies have linked the primary mechanisms of aging changes in the genetic apparatus of cells and the process of biosynthesis of the protein. It has been shown that changes occur in all units of the transmission of genetic information - DNA, structure of chromatin, transcription and translation of the genetic information, protein synthesis. DNA damage was restored due to a special system of DNA repair, reducing the activity of which, contributes to accelerated damage of the whole molecule and accumulation of its fragments. Significant changes occur in the stage of translation and construction of the protein molecule. In accordance with the widespread assumption of errors (no still enough evidence), with age can be accumulated errors in the genetic information which causes the "faulty" proteins. In accordance with the genoregulatory hypothesis mechanisms of aging associated with age-related changes in the regulation of the genome. As is known, proteins are the basis of life processes. Enzymes, contractile elements, many hormones, receptors, ion channels and other are proteins. Genoregulatory changes lead to changes in the ratio of synthesis of various proteins, to limit the potential of protein synthesis systems, to activation of previously inoperative genes and to the occurrence of so-called protein of aging. All this leads to aging of cells, disrupting their function and death.

Violation of cellular bioenergetics. Material changes arise at the stage of formation, transmission and use of energy in the cell. In many cells, oxygen consumption decreases, reducing the activity of respiratory enzymes and content of energy-rich phosphorus compounds - ATP, creatinephosphat. An adaptation value at what may have activation of glycolysis, increase in the conjugation processes of oxidation and phosphorylation. It is known that the formation of energetic potentials occurs in the mitochondria of the cells. With age reduces the synthesis of mitochondrial proteins and their quantity, which leads to degradation and is an important cause of distortion energy of the cell. Significant changes occur in lipid metabolism. Changes phospholipid composition of cell membranes, which essentially affects the functions of cells. In the blood increases content of total cholesterol, triglycerides, atherogenic lipoproteins (apo B, LDL cholesterol), non-esterified fatty acids, reducing the activity of lipoprotein lipase. All this contributes to the development of atherosclerosis.

Reduction of cell mass. Changes in the function of the cells and their death is a result of aging and affects the activity of organs and whole organism. The number of neurons in the brain decreases by 10-20%, and in some structures of the brain - by 30-50%, the number of nephrons of the kidney and of the lung alveoli is reduced by 30-50%. Cell mass in the body of 25-year-old men represent 47% of total body weight and 70-year-olds it is only 36%. Basic morphological manifestation of aging is atrophy of organs and tissues, which is characterized by a reduced number of parenchymal cells.

In each organ, along with atrophied cells are normal and hypertrophied. The destruction of a part of the cells results in a greater load on other cells, and this contributes to their hyperfunction and hypertrophy.

Functional changes (modifications). Considerably changed the functions of cells: reduces the ability of neurons to perceive information; the secretory cells - to synthesize and secrete substances, of contractile cells of the heart (myocardium) - for long to maintain a high level of working capacity. An important manifestation of vitaukt is enhanced function of a number of cells in the aging process, for maintenance work of the organs. It is known that at ordinary level of organ function not all cells and functional units involved in its operations. This reserve is created to enhance the function of the organ under load. In old age, this reserve is largely already used in a resting state, which limits the functionality of the organ under load.

In the mechanism of cell aging important are changes in the cell membrane. With age falls excitability of many cells, modify the length and shape of

the potentials of action. Alteration of electrical properties of individual cells is the basis for the development of age changes in ECG, EMG, EEG.

One of the main age features of individual cells and cell aggregates is the decrease of their lability, i.e. ability to reproduce fast rhythms of excitation without transformation.

It is known that certain cell formations hold automatism, i.e. ability to spontaneously excites the centres of automatism of medulla, heart, some of the vessels of the gut, ureteric and others. Aging decreases the activity of the guides of the rhythm, frequency of theirs of depolarization. Great importance in the provision of conjugation between excitation of the cell and its function are calcium ions. Upon aging weakens the active transport of calcium, its gripping and release of cellular organelles, which inevitably deteriorates the functions of the cells. Sudden changes in aging occur in the immune system, to the degree of the immune response. Upon aging the thymus mass decreases by 90%, and spleen - 50%. In old age reduces the formation of antibodies decreases production of substances activating the immune response, and vice versa - accumulating substances suppressing the function of immunity, reduces the number of B-lymphocytes, especially T-lymphocytes. Along with the extinction of protective immune responses, may increase the activity of autoimmuned, contributing to the development of cancer, atherosclerosis, parkinsonism.

For all the systems of the aging organism is characteristic limited range of reactions, leading to the arising of paradoxical, inadequate answers.

Consecutivity and regularity of the aging of different cell types. For understanding the mechanism of aging of an organism important is the knowledge of the sequence of aging of the different cell types. Widespread is the notion that primary aging is inherently for non-dividing cells. Cell division allows for the removal of age changes. L. Hayflick suggests the existence of a certain limit cell division which determines aging - living during of cell population.

In terms of overall body cell aging is a complex set of their own age changes and regulatory influences of the internal environment of the body. In connection with different mechanisms of aging are three types of cells:

1. Cells, which is inherently primary aging (nerve, connective tissue, etc.).

2. Cells aging process which includes their own age changes and regulatory influences (secretory, muscle, etc.).

3. Cells in which the naturally aging is mostly secondary and mediated through a whole complex of intraorganic influences (epidermis, epithelium of many organs, etc.).

◆ ***Neuro-humoral mechanisms of aging***

Age changes of neuro-humoral regulation are the leading mechanism of aging of an organism. They define the changes in thinking, psyche, memory, emotions, performance, reproduction, regulation of homeostasis and others. The primary changes in the neuro-humoral regulation distort metabolism and function of cells and tissues. Conversely, thanks to the mechanisms of neuro-humoral regulation are improved processes of anti-aging, increased life expectancy of species.

Disturbance of nervous regulation: No rare cases where mental activity, decades to old age, remains at a high level, remaining stable in conditions of significant changes in other organ and systems. Ability psychic activity to preserve a high level, proves the unsoundness of ideas about aging as involution, i.e. that from aging suffer earlier phylogenetically younger mechanisms.

In most cases, however, increases with old age mental rigidity - conservatism in judgments, negative attitude towards new, glorification of the past, aptitude to teachings, overestimation of one's own personality. With age, decreased attention, memory, psychomotor activity, changes in higher nervous activity. Due to the disintegration of brain activity often observed defects in behaviour. Often develop retrograde amnesia, characterized by recovery in the memory of long ago occurred events and loss of recent memory. With progressive atherosclerosis is linked to the reorganization of the emotional sphere, negative nuance of past events. More from the school of I. P. Pavlov found that age changes in higher nervous activity are associated with reduced mobility of nerve processes.

Upon aging significantly alter the functional activity of the brain, reduces the lability of many of its structures. The main electroencephalographic changes are delaying the alpha rhythm, appearance or amplification of slow fluctuations, decreased ability to absorb imposed rhythms. Excitability of individual nerve centres is amended uneven, resulting in smoothed differences of excitability in the different sections of the brain, occurs "izoexcitation". This leads to a distortion of integrative activity of the brain, contributes to the emergence of inadequate reactions, neuroses.

In old age increases the susceptibility of a number of brain structures to many physiological active substances. Because this many drugs with centrally acting, prescribe for elderly in small doses. Neurochemical basis of all age changes in brain activity are

changes in brain mediators metabolism - noradrenaline, dopamine, acetylcholine, serotonin, gamaaminotransfatty acid and others.

Big role in the aging process and the emergence of diseases, play a dysfunction of the limbic system and the hypothalamus. As is known, the hypothalamus by nervous and humoral pathway regulates the status of the internal environment (homeostasis) of the body, metabolism and organ function. The relationship of age changes and the activity of the hypothalamus is so obvious that many researchers "fit" here the biological clock of aging for the whole body. Upon aging "reliability" of the hypothalamus as a top central regulator of all vegetative functions decreases, which leads to the emergence of arterial hypertension, coronary insufficiency, diabetes, i.e. to the manifestations of the "collapse" of the central regulation of homeostasis.Especially important the changes in hypothalamic regulation in the development of climax.

Hypothalamic-pituitary area involved in adaptive stress responses (general adaptation syndrome). In old age, the syndrome is less pronounced, thus increasing the damaging effect of stress. The changes of the functions of the hypothalamus are associated changes in sexual behaviour, feeding, emotional reactions.

Important mechanisms of aging are associated with that age weakens the nervous control of the tissues and organs. This leads to disruption of metabolism, limiting their functionality.

Violations of hormonal regulation. Significant changes in hormonal regulation occurs in aging. Blood concentration of various hormones in the aged change unequal: when one increases, the other - decreases, in the third does not change. All endocrine glands are controlled by the hypothalamic-pituitary region. For the characteristic of age changes in hormonal regulation should be assessed changes in various units of this complex system. Important in the aging of body, in the development of menopause in women have changes in the system of the hypothalamic-pituitary-gonadal. In men, a progressive decrease the concentration of testosterone in the blood and increases the content of estradiol and progesterone, whereas androsterone concentration increases. Along with that, with age increased concentration of gonadotropic hormones of pituitary - follicle (FSH) and luteinizing (LH), which is a compensation mechanism for extension the function of the gonads. In aging decreases the activity of the hypothalamic-pituitary-thyroid and continuously maintain a stable level system hypotalamus-pituitary- cortical substance of adrenal. In the aging process develops insulin insufficiency. The weakening of the function of the beta-cells of the pancreas, the activation of contrainsulinic mechanisms, altered sensitivity of tissues to hormones contribute to the development of diabetes. CNS constantly receives information about the state of the internal environment of the body. Upon aging arise substantial changes the phase of the feedback: weakened cardiac reflexes, as well as those of the vessels and lungs; is changed and the response of the nerve centres of the action of hormones. This helps to violated the regulation of the internal environment of the body.

A recovery-stress syndrome. The complex of age changes of neuro-humoral regulation leads to that in old age develop many amendments similar with stress. This condition can be defined as stress-recovery syndrome. The age changes in hormones in humans and rats are similar to those arising under stress. This is the activation of simpatico-adrenal, vasopressive, hypothalamic-pituitary-glucocorticoid system, reducing the amount of insulin, on thyroid stimulating hormone, thyroxine, thyroglobulin, sex steroids, aldosterone, systems of microsomal oxidation, alteration of emotional balance in a negative direction, the emergence of disturbing feeling, of fear, confusion and others. Stress is characterized not only by neurohumoral changes, but also with a complex of tissue and cellular changes. Very similar changes occur in aging - immunodepression activation oxidation of lipids, free radical damage to cells, hypercholesterolemia and others. The development of a recovery-stress syndrome in aging ultimately limits adaptation capabilities of the organism, contributes to the emergence of distortions in it and weak impacts, contributing to the development of age pathology.

2. AGING AND DISEASE. St. Vizev, V. Frolkis

Aging as a destructive process, limiting the adaptive capacity of the body inevitably leads to the emergence and development of diseases, of geriatric pathology. Therefore, the main non-infectious diseases-atherosclerosis, ischemic heart and brain diseases, arterial hypertension, cancer, diabetes, parkinsonism, Alzheimer's disease and oth. - progress in the second half of life.

In old age diseases occur more frequently, acquire and accumulate quantitative and qualitative characteristics. There are different types of connections of aging with one or another disease:

1. Aging can grow and be transformed into illness.

2. The manifestations of the disease can be summed up with the manifestations of aging.

3. Aging can create prerequisites for the development of the disease.

There is a link between the syndrome of aging and the nature of the evolving pathology. Accelerated aging is one of the main factors contributing to the early development of the most severe human diseases. The determination of biological age and aging syndrome allow prediction the nature of the emerging pathology.

The exact differentiation of physiological from disease processes in old age is really difficult. In practice, the most common is recorded gross pathology at the level of the organism. But when it comes to processes that develop at the cellular or subcellular level and are closely intertwined with the process of aging, then reading becomes more difficult, and sometimes impossible. Indeed, aging is a prerequisite for the emergence of diseases, on the other hand once incurred the diseases violate normal functioning of the body. Aging process limits the adaptive capabilities and support the development of pathology mostly chronic-degenerative nature. A majority of people in the elderly, however, enjoy good health. Large-scale epidemiological studies in Bulgaria in XX century (1977-1985) found that in many areas of the country the population of the "third" age showed higher health indicators.

Much of modern gerontologists do not accept the view, that often in old age accompanying diseases, such as atherosclerosis, diseases of the musculoskeletal system (osteoporosis), neoplasms, metabolic diseases, etc., due to age-related changes. These diseases, with varying frequency, occurring both and in the children, young, adult age.

Occurred senile changes can easily bring old body of balance and to include some disease process. The latter causes a certain defensive reaction. Not coincidentally at clinic turns great importance to the differential diagnosis of diseases and conditions. Many signs of aging and old age are close to the signs of some diseases.

Between aging and disease process, however, there are certain differences. They relate mainly to differences in the mechanisms of development, variations in rhythm.

Conversely, not any disease or adverse effects of the environment accelerates aging. Indicate many examples of longevity achieved in subjects lived under very difficult conditions and often suffered. This indicates that the genetic factor is one of the determinants for the implementation of the program of life.

Atherosclerotic process, eg., often accompany the life of the old one. When it substantially amended and activities of other organs and systems. Part of the events occur inevitably in aging, mainly in the later age. This does not mean, however, that they are the result of atherosclerosis in the arteries.

Undoubtedly, developing atherosclerotic process already accelerated the pace of aging and brings him in pathological type. So often reported total units in the development of both processes, especially in its final stages. The primary mechanisms of aging and atherosclerosis however, are not identical. There are convincing data for the differences between them. Therefore aging, such as genetically programmed process should not be judged unilaterally and only by the final results, by the diseases it causes. Existing differences however does not mean lack of mutual determination and connection.

Aging contributes to the development of diseases, by age changes of immunity, the development of a recovery-stress syndrome, free-radical damage to cells and others. However, the main role is played by age geno-regulatory changes and changes in protein synthesis. Depending on the regulation of which genes breaks down, protein synthesis of which is amended, will develop one or other pathology. In cancer this is the synthesis of cancer proteins; in atherosclerosis - of apoproteins, which are the basis of lipoproteids with different density; of diabetes - insulin; in Alzheimer's disease - amyloid protein and the like.

All this justifies the need of geno-regulatory therapy, aimed at restoring the normal regulation of the genome, of normal ratio of synthesis of proteins. The geno-regulatory therapy can become the most effective method to treat the major human diseases.

REFERENCES

1. **Berdishev, G.** Ecologic-genetical factors for aging and longevity. L., 1968. (in russ.)

2. **Berdishev, G.** Developments in genetics and new approaches and tasks for studing problem of aging and adaptations (Aging and adaptation). K., 1980, p. 15-17. (in russ.)

3. **Butenko, G.M., V.P. Voytenko.** Genetic and immunological mechanisms aging pathology. Kiev, Health, 1983, p. 142. (in russ.)

4. **Ferrari E., L. Cravello, B. Muzzoni.** Age-related changes of the hypothalamic-pituitary-adrenal axis: pathophysiological correlates. Europ. J. of Endocrinology, 2001, 144, 318-329.

5. **Frolkis, V.V.** Regulation, adaptability and aging. L., "Medicine" 1970. (in russ.)

6. **Frolkis, V.V.** Physiological mechanisms of aging. Science. L., 1982. (in russ.)

7. **Frolkis, V.V.** Hemoregulatory mechanisms and development of age pathologies. V Congress of gerontologists and geriatrists. Moscow, november 22-25, 1988. (in russ.)

8. **Komfort, Alex.** Aging. The biology of senescens. New York - Chicago - San Francisco, 1964.

9. **Korkushko, O.V., D.N. Kotko, J. I. Plachinda.** Chance developments ishemic health disease in 50-89 years age of along time investigation. K., "Medical science", 1984. (in russ.)

10. **Korkushko, O.V., L.A. Ivanov.** Hypoxia and aging. Kiev, 1980, p. 276. (in russ.)

11. **Kouznetsow, S.** Correction of biological age: is it possible, 16-th Congress of the Int. Assoc. of Geronthology, Adelaid, Austr., 1997, 277.

12. **Magnus-Levy A.,** Physiology des Stoffwechsels. In Hand-buch der Pathogenic des Stoffwechsels. ed. C. von Noorden, Berlin, 1906.

13. **Shok N.,** Metabolism in old age. Geriatrics, 1, 232, 1948

14. **Stoynev G.** Aging, old age and disease. Doct. cand. dis., S., 1977. (in bul.)

15. **Stoynev, G., St. Vizev.** Epidemiological researches for hyperlipoproteinemy and evaluation health status of populations. Dyslipoproteinemia in atherosclerosis in old age people. Kiev, 1985, p. 6-9. (in russ.)

16. **Streler, B.** Time, Cells and Aging. New-York - London, 1962.

17. **Vizev, St.** Aging, old age, longevity. S., Med. and in phys., 1985. (in bul.)

18. **Vizev K.** Biological age - medical and social problem and its response to some endocrine factors. Sofia, ed. "Angela," 2009, 168 p. (in bul.)

3. HEALTH STATUS AND MEDICAL ASSISTANCE. N. Verzhikovskaya

In recent decades the countries of the European Community observed pronounced process of demographic aging of the population. In Bulgaria the proportion of people aged over 60 years increased from 11.4% in 1960 to 22.9 percent in 2005. On the estimates of the United Nations, in the future this process will deepen. One of the important health consequences of demographic aging of the population is the constant increase in the proportion of the elderly (75 and over), which is close to 25% of persons over 60 years.

In Bulgaria in 1950-1954, the average life expectancy for men was 62.2 years and women 66.1 years, in 2003-2005 this indicator was 69 and 76.3 years respectively. According to UN projections in 2020-24, the average life expectancy for men will be 73.5 years and women 80.3 years.

Such demographic situation will affect health outcomes and well-being of the population and should be considered in solving socio-economic problems of countries in planning the development of the health system and social protection.

The concept of WHO, according to which health is not merely the absence of disease and disability, but also a state of physical, mental and social well-being of people takes on particular significance in relation to the elderly. At that stresses that care for the elderly should not be associated with the disease and must ensure full use of their functional capabilities.

- ***Evaluation of the health status***

To determine the need of older people from various medical and social services, need to know their health status. The complex assessment of the health status of the elderly is done not only on the basis of generally accepted health and demographic indicators such as morbidity, disability, mortality, life expectancy, but based on specific indicators, such as physical activity and ability to self-service.

Morbidity. Morbidity is one of the most informative health indicators. The level and structure are amended in the aging process. It is known that at 70 years of XX century only is 2-3% of this age group are healthy. The overall level of morbidity in persons over 60 years is 2-3 times higher than the incidence of people of working age. Amend the relationship between acute and chronic forms of the disease as adults increased chronic diseases - turnover in these diseases is 80-90%. In this growing and the gravity of chronic diseases in the age group of 60-70 years, the proportion of individuals with complicated forms of chronic illness is more than 50%. Chronic diseases are most commonly found in working age (40-49 years), but then began a process of "accumulation" of chronic pathology and the pension period many patients enter diseases occurring earlier and deepening of old age.

A characteristic feature of the pathology of the adult population is plurality. According to a number of authors in the sick persons over 60 years are diagnosed an average of 3 diseases in those over 75 years - 9-10 diseases.

The most commonly seen combination of diseases of the cardiovascular system, respiratory diseases, musculoskeletal system, endocrine system and metabolism. The complexity of the pathology aggravates the course of the disease and atypical pass impedes a correct diagnosis and treatment.

To the characteristics of the pathology of adults also relates extension time of recovery from the disease. It is noted that the duration of rehabilitation after an illness in adults is 1.5-2 times longer than in the young.

Age is one of the factors that influence the structure of morbidity. In those 30 years of age first place in the structure of morbidity occupy diseases of the respiratory system, followed by digestive, injuries and poisoning, diseases of the nervous system and sensory organs. In the age group 40-59 years also predominant pathology of the organs of respiration, but its relative share decreases and diseases of the circulatory system are increasing. In the age group over 60 years the most common are diseases of the circulatory system (almost 1/4 of turnover for medical care falls on people suffering from these diseases and the group over 80 years - more than 1/2). Next come the diseases of the digestive system, respiratory system, nervous system and sensory organs, musculoskeletal system and connective tissue. These five classes of diseases are more than 85% of all diseases in adults and the elderly.

The structure of the circulatory diseases leading nosological units are ischemic heart disease (IHD), hypertension (HD), atherosclerosis and vascular brain damage. The share of each of these nosological units depends on many factors - the quality and way of life, place of residence (region, city, village), availability of medical assistance and others. The results of epidemiological studies in several European countries show that the majority of primary sufferers of HD were aged 40-49 years and likely to get sick from CHD is most expressed in the age group of 50-59 years. The highest level (frequency) of CHD in both sexes falls on age 70-74 years, of myocardial infarction also over 70 years. The incidence of insults in the age group 60-70 years old is an average of 2 times, and in the group over 75 years - 4 times higher than the working age.

By increasing the rate of aging increases the frequency of non-specific respiratory diseases (pneumonia, bronchitis, pulmonary emphysema, etc.).

With age and growing incidence of diseases of the musculoskeletal system. Sharply increasing household injuries, which is associated with destructive changes in bone and joint system with aging. So femur fractures in people over 60 years were 80% and those of the ulna - up to 70% of such injuries.

A common reason for seeking medical care of older people are endocrine diseases - mainly diabetes.

An important feature in determining the level of morbidity in the elderly is that morbidity by turn - over for medical care does not reflect the actual incidence of disease.

This is related to a number of reasons, such as changed social status, acceptance of the disease as an inevitable companion of old age, long course of the disease, limited mobility of old man. Actual indicators of morbidity of older people can be obtained at full coverage by conducting comprehensive medical examinations and analysis of data from three - even five-year turnover for medical assistance.

Disability. Worsening health status of the elderly reflects the change in the level and age structure of the disabled population. In parallel with the aging population is increasing the number of old people recognized for the first time disabled - eg. in Ukraine in the 90s of XX c. the number of old people - disabled has increased twice.

Mortality. Aging and growing mortality rate. In XX century maximum magnitudes of mortality have approached to the older age groups. For this period, however, they have changed causes of death: if at the beginning of the century these were diseases of the respiratory system and infections, it in the second half of the century - diseases of the circulatory system and malignant neoplasms represent 80% of all causes of mortality.

To assess the health status of older people are important and such *integrated indicators of the degree of preservation of their health and physical capabilities*, such as mobility and the ability to self (the degree of which determines the volume and form of public assistance to this category of population).

Physical activity. Physical activity, mobility, ability to independently move determines opportunities for communication of older people. Physical activity is fully maintained in 90-95% of persons aged 60-64 years, but only 20-25% of 80 year olds. The reduction in motility rapidly progressed after 75 years. Complete loss of mobility (bed) is at 1.5 to 3% in persons over 60 years, in those over 80 years the index is 5%. But back, in 60-80% of pensioners, according to medical and social research in several countries, mobility is preserved completely.

Ability to self-service. It roughly corresponds to the level of mobility (this capability is determined by a number of factors - loneliness, psycho-physical condition, social and economic status, availability of medical-social support, not only from ill or not a man, and what is the severity of his illness). The ability to self hampered at: weakening eyesight and hearing, disorders of the musculoskeletal system, violations in the urinary system and others. On average, depending on the region, 8-15% of people over 60 need intermittent or constant attendance and care, for those 70 years and more - 20-30%.

The group of persons with an increased need for outside help in the first place relate living alone elderly and isolated residents couples where both are weak. They represent an average of 1/5 of persons over 60 years. Care for living alone now has more passes on society. The process of their increasing

in overall structure of the elderly population will be preserved in the future. This is related to the collapse of multi-family for several generations, by reducing the number of children, the difference in life expectancy between men and women.

Data from epidemiological studies on the health status of the population over 60 years in many European countries, through integrated indicators to preserve the level of health, show that this is a heterogeneous group of people. Even on the background of poor health, a significant portion elderly remain until old age socially active and assess their health and physical abilities to be satisfactory. Be able to think that older people have more unrealized possibilities for performing different types of activities, than is accepted.

- **Medical care of the elderly population**

Deterioration of the health status of the elderly population determines its need different types of support (depending on the degree of aging). The high proportion of chronic diseases determines the prevailing need for outpatient care, including at home. According to WHO, most elderly people - over 75%, are outpatients.

More than half of those over 70 have a need for medical care at home. About half of the calls for fast and urgent medical care, accounts for people in retirement. The need for stationary support of elderly people is three times greater than that of the adult population. On average 15-20% of people over 70 have a need for psychiatric consultation in outpatient or stationary settings.

With age greatly increased the need of rehabilitation. In this complex of rehabilitation measures - medical, psychological, physical and social rehabilitation, should be used not only for recovery after illness, but also for the prevention of disability of older people, maintain their ability to self-service and the ability to live longer in their home. Practically in one or another degree, by various types of rehabilitation need's all in no working age.

Medical assistance to the population in retirement becomes in a generally network for health. Primary link in the system of medical care of older people is the family doctor. He performed primary care for elderly population, diagnosed and develops tactics of treatment. It also is a major factor in the coordination of medical and social aspects in serving the elderly.

It was found that the need for ambulatory assistance to the elderly on average 12-18 visits per year.

The need of the elderly from stationary medical care is provided in hospitals for general care or multi-specialty hospitals.

Positively evaluated so called "Residential stationares", where the sick elderly care family, social workers, nurses at the Red Cross.

A progressive and economically justified form of medical care for the elderly is a "Day hospital" for people who do not need of daily care.

For the prevention of disability of older people in many countries to create centres, where they performed medical, psychological, physical, social and occupational rehabilitation.

For persons with reduced or no ability to self, needing outside help, in the system of social security established a home services.

REFERENCES

1. Bone Health and Osteoporosis: Report of the Surgeon General. Rockville MD: US Dept. of Health and Human Services, Office of the Surgeon General, 2004.

2. **Chebotarev, D. F.** Geriatrics in clinic for internal deiseases. Kiev, Zdorovje, 1977, 250 p. (in russ.)

3. **Gardner C. D., D. L. Tribble, D. R. Young, D. Ahn.** Population Frequency Distributions of HDL, HDL (2) and HDL (3) Cholesterol and Apolipoproteins A-I and B in Healty Men and Women and Associations with Age, Gender, Hormonal Status, and Sex Hormone Use: The Stanford Five City Project - Prev. Med., 2000, 31 (4): 335-346.

4. Geriatric Medicine, ed., **K. R. Cassel.** N. Y., Springer, 1990, XXVII, p. 697.

5. Infections diseases and immunity of adults. ed. **R. A. Fox**. Moscow, Medicine, 1987, p. 446. (in russ.)

6. **Kuznetsova, S. M., I. D. Grachev.** Cerebrovascular pathology at old persons with different character of work. Coll. Gerontology and geriatrics. Kiev 1988.83-86. (in russ.)

7. **Manolova A., F. Ribarova, L. Cider.** The Osteoporosis problem today. Scripta Medica, 2002, vol. 2: 17-28.

8. **Maximova, S**. Evaluation of aging through biological indices. dis. Sofia, 1991, 240. (in bul.)

9. **Shipkovenska E.** Cardiovascular risk - a problem with many unknowns, Sofia, ed. "Filvest", 2004, 168 p. (in bul.)

10. **Verzhikovskaya, NV, T. L. Ehneva.** The employment rehabilitation at home-interne for adults. Coll. Gerontology and Geriatrics, Kiev, 1988.148 to 153. (in russ.)

11. **Vizev, St.** Aging and atherosclerosis. dis., Sofia, 1989, p. 378. (in bul.)

4. NUTRITION IN ELDERLY.
Y. Grigorov, P. Nikolova, L. Ivanova

Certain requirements for rational nutrition are associated with aging changes. The aging process involves reduction of physiological functions, occurring at different times for different organs and systems. Changes occur in metabolism, reduce opportunities for synthesis. The basal metabolism decreased by 30% from 20do 90 years of age. Contractile ability and stroke volume of the heart are smaller. Lung capacity decreases by about 40%, that the possibility of exercise weakens. There is a significant decrease in heat production, the production of some hormones, the activity of insular apparatus and antiradical enzymes; increases serum cholesterol; develops acidotic reaction of the internal. Because of weakened immunity older people become more susceptible to infections.

The aging process occurs known changes in body structure, they are very individual. As age reduces the active body mass while reducing muscle mass, which in the age period from 30 to 70 years of age is reduced from 450 g/kg to 300 g/kg. There has been a reduction in total body water, mostly at the account of intracellular, it is precisely this reduction correlated with reduced no fatty body mass. At the same time increase the percentage of fat mass and simultaneously occurs redistribution of body fat. Typically is centralized accumulation from limb to the body. There are assumptions about the relationship between body fat redistribution and the emergence of some metabolic disorders and chronic diseases, such as hypertension, dyslipidemia and gallstone disease.

Skeletal mass is reduced during aging, so-called. senile osteoporosis. For women this is the most significant in the years after menopause, reducing both cortical and trabecular bone mass by about 18-30 percent between the ages of 50 and 75 years of age. In men, the changes are later, but their reduction for this period is also significant - 8-15%. Since osteoporosis is multifactorial causes, aging is only one reason, but on her also influence hormonal, nutritional and constitutional factors.

Among the most directly influence the nutritional status changes are those of the digestive system.

Although food and smell senses are not functions of the digestive system, they have a direct impact on nutritional intake. In the elderly is a proven increased threshold of gustatory and olfactory senses, which has its substrate changes in papillae and endings of taste and olfactory nerves. In people over age 70 establish changes in motility of the esophagus, accompanied by spontaneous gastroesophageal reflux, that a significant proportion of people remain symptomatic. The most significant changes, have a direct correlation with the nutritional status of the individual, are the changes in gastric physiology - reduced secretion of hydrochloric acid, "intrinsic factor" and pepsin. It has been shown that the total acidity of the stomach reduced by 40% in the period between 45 and 65 years of age. In about 68% of adult patients have shown achlorhydria. This is associated with an increased incidence of atrophic gastritis with age. In addition to changes in motility, leading to an increased rate of gastric emptying, was an increase of pH in the stomach and in the proximal small intestine, that stimulates bacterial growth (putrefactive microflora).

Depending on the degree of these distortions show decreased absorption of iron, calcium, vitamin B_{12}, folic acid. There is no clear evidence that there are changes in the exocrine function of the pancreas, although there is evidence of decreased activity of pancreatic lipase, and hepatic function by preserved histological structure of the liver.

There is no hard evidence that changes in the gastrointestinal tract in the course of normal aging, uncomplicated by gastrointestinal pathology, can disrupt the absorption of macronutrients - fats, proteins and carbohydrates.

The situation is different with micronutrients. Hypoacidosis and reduced "intrinsic factor" in the stomach cause decreased absorption of vitamin B_{12} and folic acid. Among the fat-soluble vitamins convincing evidence of impaired absorption only for vitamin D. This explains the decreased calcium absorption in elderly people. They are observed and reduced adaptation to low calcium import than younger individuals. Achlorhydria decreases mainly absorption of nohem iron. In addition, when older people observed abnormal utilization of iron in red blood cells. For other trace elements convincing evidence of reduced absorption so far has only for zinc. It has been shown that the absorption of copper remains unchanged.

The basic principles of gerodietetics are:

◆ ***Energy balanced nutrition with actual losses of aging organism***

Elderly naturally reduces the basal metabolism and loss of energy for physical activity, because of need the energy value of the food is gradually reduced as the aging of the body - general at 1/3 for the period from 30 to 70 years. If the recommended energetic value of its daily ration in age from 20 to 30 years we assume 100%, then from 30 to 40 years, it should be 97%, 41 to 50 - 94%, from 51 to 60 years of

age - 86%, 61 to 70 years - 79% over 70 years - 69%. Therefore gerodietetics recommended daily calorific for men aged 60-74 years, range up to 2200 kcal, for women of the same age -1900 kcal, reducing at the age of 75 years to 2100 kcal for men and 1800 kcal - in women. Failure to comply with this principle of gerodietetics increases the risk of overweight and development and progression of age-dependent pathology **(Table 11.2.)**.

◆ ***Therapeutic and prophylactic direction of***

Table 11.2. Average energy needs of the adult population *

Age (years)	Physical activity	Average energy needs			
		men		women	
		MJ/day	kcal/day	MJ/day	kcal/day
1	2	3	4	5	6
60-75	low	9,1	2181	7,5	1792
	moderate	10,3	2472	8,5	2030
75 +	low	8,8	2111	7,4	1764
	moderate	10,0	2393	8,4	1999

Recommended and adequate dietary intake of complete protein						
Age/sex	Body mass index (BMI) (kg)		Recommended dietary intake			
	male	female	g/kg BM/day		g/day	
			male	female	male	female
60-75 years	74	59	0.8	0.8	59	47
75 + years	70	57	0.8	0.8	56	46

Recommended and adequate dietary intake of fat-soluble vitamins (average daily)					
Group	Възраст/пол	Vitamin A (μg)	Vitamin D (μg)	Vitamin E (mg)	Vitamin K (μg)
Adults	Men 60-75 years 75 years +	 800 800	 10 15	 15 15	 74 74
	Women 60-75 years 75 + years	 700 700	 10 15	 15 15	 59 59

Recommended and adequate dietary intake of soluble vitamins (average daily)								
Group	Age/sex	Vitamin C (mg)	Thiamine (mg) B_1	Riboflavin (mg) B_2	Ниацин (mg) PP	Vitamin B_6 (mg)	Folate (μg)	Vitamin B_{12} (μg)
1	2	3	4	5	6	7	8	9
Adults	Men 60-75 years 75 + years	 80 80	 1.2 1.2	 1.3 1.3	 16 16	 1.7 1.7	 400 400	 2.4 2.4
	Women 60-75 years 75 + years	 70 70	 1.1 1.1	 1.1 1.1	 14 14	 1.5 1.5	 400 400	 2.4 2.4

Recommended and adequate dietary intake of minerals (average daily)									
Group Age/sex	Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zink (mg)	Copper (μg)	Iodine (μg)	Selen (μg)	Fluorine (mg)
1	2	3	4	5	6	7	8	9	10
Male 60-75 years > 75 years	 1200* 1200*	700 700	 330 330	 8 8	 11 11	 900 900	 150 150	 55 55	 4* 4*
Female 60-75 years > 75 years	 1200* 1200*	 700 700	 280 280	 8 8	 8 8	 900 900	 150 150	 55 55	 3* 3*

* Adequate dietary intake

nutrition

According to WHO experts in Europe about half of premature mortality up to age 65 are caused by diseases that are largely determined by wrong diet. It can be considered that diseases such as coronary heart disease, stroke, many types of cancer, anemia, liver cirrhosis, diabetes, obesity, hypertension and diseases of the musculoskeletal system in adults can be prevented by rational nutrition. An active propaganda of a healthy lifestyle, including the principles of rational nutrition in the last 30 years in the US has led to a reduction in mortality from cardiovascular pathology by 40% and 2/3 of this effect is dependent by changes in diet. Irrational diet is cause of cancer in 30-40% of cases in men and 60% women. It is the rational nutrition leads to substantial therapeutic and prophylactic effect, which on the organism level occurs after 1-2 years, and on the level of population (increase in life expectancy, reducing mortality) - 10 years after the amendments made.

1. Necessity of fat. Requirements for recommendations for fat component of food:

- *Fat content to 60-55 g/day or 15-30% of the energetic value of the ration.*
- *Optimal fat with different degree of saturation - saturated, monounsaturated and polyunsaturated, below 10% of the daily calorific.*
- *The ratio of poly- saturated fatty acids - 0.6.*
- *Of the total fat content the vegetable fats must represent no less than 33%.*

In recent years, in connection with the clarification of the essential role of the synthesis of eicosanoids (for prevention and treatment of atherosclerosis, cancer pathology, for increasing the immune status of the organism) of the fatty acids of the family omega-3 (eicosapentaenoic, decosahexaenoic, gamma linolenic etc.), at standard nutrients enters and their content in the feed, which should be not less than 1-2 g/day. Consumption of omega-3 fatty acid is provided at the account of fisheries and fish oil. The total consumption of cholesterol in adults is limited to 250-300 mg per day.

An excess of vegetable fats is no desirable due to the potential in the body to accumulate products from the oxidation of unsaturated fatty acids. It is also necessary to observe a certain ratio between the content of polyunsaturated fatty acids and vitamin E. For the prevention of atherosclerosis recommended limiting the products with high atherogenic potential and rich in cholesterol, without excluding food completely, while rich in lipotropic factors - dairy products (cottage cheese), liver, eggs.

2. Need for carbohydrates. The carbohydrate content of the total energy value of the diet should be 55-60% or 300-250 g per day, and this amount of easy sucking carbohydrates (mainly the disaccharide sucrose in the composition of sugar - 0-10 energy %) is reduced to 30-35 g/day, of monosaccharides - up to 15% of the total carbohydrates. With food must come mainly complex carbohydrates (starch) - 55% of all carbohydrates with large amounts of indigestible fiber (pectin, cellulose) - no less than 20-25 g/day.

Recommended many different complex carbohydrates mainly of bread (preferably whole wheat, rye, rye and wheat), pasta, potatoes. Easily absorbable mono- and disaccharides should be limited, given their impact on fat metabolism, synthesis of cholesterol, the functions of normal intestinal microflora, reduced glucose tolerance. Preferred products containing mainly fructose - seed-grain fruits, honey, watermelon. It is useful to increase the consumption of raw fruits and vegetables, but after appropriate machining. Fiber (cellulose, hemicellulose, pectin, etc.) are very important for older people to prevent constipation and reduce cholesterol. The thermal treatment partially degrade some fibers, thereby facilitating mastication and digestion of fruit and vegetables.

3. Need for protein. Very high requirements of gerodietetics on protein in the diet. The synthesis of protein decreased by 40% in people over age 60 compared to age 30 and later fell by another 5 and 8% respectively to 70 and 80. In parallel with this decline and decay of proteins. Reducing the mass of functionally active organs (muscles, liver, kidney)/ and the synthesis of proteins, dictate the need for gradually decreasing the level of protein in the diet according to the aging of the organism.

The protein content in the diet of adults and the elderly should not exceed 1,0-0,8 g per 1 kg of body weight (in prerequisite for compliance with ideal body weight), which generally represents 50-60 g/day or 12,5 - 13% of the calorific value. Observing with quantifying protein content in the diet of adults is dictated by the fact that consumption of increased, compared with the existing norms of protein in the diet, usually leads to strain on the kidneys and other organs of metabolism and removal of amino acids and calcium, and consumption of more low levels increases the risk of malnutrition, which is particularly favourable in the elderly and in presence of diverse pathology. It is important that the amount of animal protein is not less than 50% of the total part of the protein.

Recommended need of animal protein to meet by the account of protein from dairy products (skim milk, cottage cheese), chicken and fish. It is not appropriate to fully pass on plant food.

Elderly diet should be mainly lactic-plant. Vege-

tables and fruits are the main sources of vitamins, that are essential against the often evolving elderly endogenous vitamin deficiency, as well as of mineral elements - potassium, calcium, magnesium, iron, zinc, manganese, copper, selenium, etc., of the cellulose. Currently convincingly established reverse development, in particular of the atherosclerotic process, not only under the influence of pharmacotherapy, but at prolonged rational nutrition.

To products possessing therapeutic and prophylactic properties in atherosclerosis, include: sunflower oil, olive oil, fish products, fish oil and fat of marine mammals, seaweed, meat products (wholemeal flour), products high in fiber, products containing specific components that normalize lipid metabolism as: red radish, onion, garlic, apples, currants, fruit, vegetables, root-fruit, prunes, hood sponges, marine invertebrates (molluscs, crabs, oysters), spices (ginger, anise, cinnamon, cardamom, cloves, mustard) lactic acid products.

Most of these products have a prophylactic action and in respect of cancer diseases and also in most other diseases in elderly. It is worth noting the role of vitamin A and its precursors (carotenoids), vitamin E and C as the prophylaxis of cardiovascular pathology, as well as of cancer diseases; vitamin D and calcium - in the prevention of osteoporosis, etc.

A big problem in the elderly are diseases of the central nervous system - senile dementia, Parkinson's disease, etc., which are determined by age changes in the brain. For example, one of the nutrients which play a key role in cerebral function in animals and humans, is zinc. In individuals who receive a large amount of histidine, develops "zincuria" characterized by cerebral dysfunction, altered mental status, that completely regressed by acceptance of zinc. In adult humans is noted decrease in the alpha rhythm of the EEG at a low level of thiamine in the diet, on the contrary, EEG characteristics in adults with a high content of iron in the body were similar to those recorded in young people. It is interesting to note that the dementia are observed in adults when cobalamin deficiency earlier and more frequently, and when still no signs of anemia. Persons over '60 has also established a clear correlation between cognitive abilities and the level of vitamin C, B_{12}, folic acid and riboflavin.

◆ ***Compliance of the chemical composition of the diet to the age changes of metabolism and functions in aging***

Due to the lack of specific data on the nutritional needs of older people, their determination was made primarily on the basis of extrapolation to more precisely defined needs of young individuals. There is evidence that protein metabolism changes occur at the molecular and cellular level. Aging establishes reduced efficiency of protein utilization, relative to unit cell mass. Stressful conditions such as frequent acute and chronic diseases can significantly increase the demand for protein. The need for protein not yet been definitively established, but experimental and clinical data indicate that his part (adopted for people at a younger age) in senior age groups must be reduced. For example, daily demand for protein, fat and carbohydrates for men older (60-74 years) age: proteins (all) 60 g/day of these animal - 30 g/day, fat - 60 g, carbohydrates - 290 g, for women was 50, 25, 54 and 260 g/day. For people over 75 years daily need for basic nutrients decreases.

The need for vitamins and mineral elements in the elderly remains high enough **(Table 11.2.)**.

Vitamins are required as catalysts of the current with less intensity metabolic processes. On the one hand food daily to be submitted to the body vitamins with antisclerosis and lipotropic properties - C, B_6, B_{12}, B_{15}, inositol, choline, folate and others. It is very important and adequate introduce of vitamins with antioxidant action (E, A, carotenoids) and vitamin D, expect the changes in bone mineralization, calcium absorption and osteoporosis.

On the other hand, the capacity of the skin to synthesize vitamin D under the influence of ultraviolet light decreases with age, and older people are exposed for a short time in the sun. It has been found that the synthesis of metabolically active form of vitamin 1,25-dihydroxyvitamin D in the kidneys was reduced, but the provision of more substrate (25-hydroxyvitamin D) may lead to an increase of its levels in the blood. These results indicate that perhaps the nutritional needs of older people vitamin D were higher, although there are no known specific needs of vitamin D for an old man. Recommended dietary intake of 10-15 μg vitamin D daily.

A large is percentage of elderly with atrophic gastritis leading to a reduced capacity for effective absorption of vitamin B_{12}. It is believed that intake of 3 μg per day might be more appropriate instead of currently accepted reference values from 2,4 μg. Prevailing opinion is considering impaired absorption of folates that dietary intake of 400 μg per day is sufficient.

It has been found that the need for vitamin B_6 to maintain glucose tolerance and normal cognitive function of elderly people is higher than it was thought till now. Increased needs for vitamin B_6 in elderly are associated with established in recent years higher protein needs. The results of recent studies on elderly people held in metabolic cages, showed average daily needs of vitamin B_6 1,7 mg for men and 1,5 mg for women.

In connection with the changes in the absorption and metabolism, of bone and vascular changes it is essential that regularly supply the body with calcium, magnesium, potassium, iron and other biomicroelements. In this age many factors can cause disturbances in the calcium balance, bone mass loss and osteoporosis: inadequate import of calcium; the imbalance of calcium/phosphorus; the presence of substances inhibiting the absorption of calcium from food; physical inactivity; changes in the endocrine control and renal function. Recommended intake of calcium to grow to 1,000 mg per day for age 65 and up to 1200 mg - for over 65 years. Is necessary (considering involvement in bone formation) increased acceptance of fluoride, mainly by drinking water.

In the elderly, due to reduced gastric secretion and acidity of gastric juice, reduced intake of complete protein and vitamins, often occurs iron deficiency anemia (women, however, needs somewhat reduced due to menopause). Pressing a selection of foods ensuring better intestinal absorption of iron.

Intestinal absorption of magnesium decreases only slightly with age, but lower reference intakes are the result of that are determined on the basis of lower mean bodyweight.

Despite the reduced zinc absorption in the gastrointestinal tract in the elderly, no evidence of breaches in his overall balance. One explanation for the reduced demand for zinc in the elderly is reduced no fatty body mass, limited physical activity and limited ejaculation in older men.

Since the energy requirements decrease, while those of essential nutrients remain constant, or even increased, the nutritive density of the diet (the quantities of nutrients relative to 1000 kcal or 1 MJ) must be greater.

It should be noted the important role of trace elements in the diet (although their content now is not normalized). For example, chromium refers to the trace elements, the need for which is in the range 50-200 μg/24 h. Violations of carbohydrate metabolism and increase insulin plasma are one of the causes of cardiovascular pathology, and the deficit of chromium can be a significant risk factor for the development of this pathology in the elderly.

A deficiency of silicon in food leads to deformation of the bones, joints and to the violation of the function of the connective tissue in general. The silicon content in the tissues (especially in the aorta) decreases with age. Important in the elderly has adequately supply the body with such trace elements such as vanadium (participation in lipid metabolism), nickel (participation in metabolism and structure of membranes, ability to stabilize RNA and DNA), molybdenum (metabolism of muscle tissue and intimal arterial wall), cobalt (deficiency results in anemia), fluorine (part in calcium metabolism), since in connection with the functional age changes of suction in the gastrointestinal tract, their entrance in the body decreases.

◆ ***Equilibrium of diet with respect to the essential factors of nutrition***

Need of strictly defined entry (ratio) in the body of various nutrients is dictated by the close correlation between various kinds of metabolic processes.

Prolonged dysbalance of one of them change need of an entire row others. For example, excessive receipt of polyunsaturated fatty acids requires increased dietary intake not only of vitamin E (tocopherols), but also other antioxidants; exceeding the required amount of incoming dietary fiber foods - increased content of vitamins and trace elements in food; icreased consumption of carbohydrates - of thiamine; mainly protein food increases the need for vitamin B_2, etc.

Based on specific clinical research has found that best conform to the age characteristics of metabolism in elderly a weight ratio of proteins, fats and carbohydrates 1.0: 0.8: 3.5.

◆ ***Basic (alkaline) purpose on feeding***

It helps the correction of developing in elderly acidotic changes in the homeostasis.

Lowering the intensity of metabolic processes, changes in kidney function, reducing the functional possibilities of the respiratory system, the development of tissue hypoxia are prerequisites for development in nearly one-third of adults a compensated metabolic acidosis. For its correction (and it is necessary because of the effects of acidosis on the course of tissue oxidation processes, the synthesis of protein, neurohumoral regulation and many other vital processes) food must contain mainly substances having basic properties (beets, carrots, tomatoes, cucumbers, apples, oranges), as well as dairy products, calcium-rich.

◆ ***"Enrichment" of diet with products and foods that normalize intestinal microflora in adults and the elderly***

In the aging process in the intestinal tract begins to prevail putrid microflora producing toxic products.

The normal aerobic microflora back, synthesize vitamin K, B_2, B_6, B_{12}, H, pantothenic and folic acid; it promotes the removal of cholesterol and its metabolites from the body; increases its immunity; forming short chain fatty acids, contributes to energetic providing of body.

To the particularities of nutrition that normalize microflora of the intestinal tract, refers compulsory use of lactic acid products. Important is the significance of dietary fiber. Excessive use of products which are rich in proteins, especially meat, contribute to the development of putrefactive microflora.

◆ ***Food fortification with alimentary geroprotectors***

To alimentaria effects that can increase life expectancy, include: a reduced calorific diet; reduction in the level of consumption of protein, fat; deficiency of tryptophan; diet prevalence of "alkalizing" products; nutrients that can keep free radicals and the peroxidative processes in the body - antioxidants.

To the alimentary geroprotectors with antioxidant properties include: amino acids - methionine, cysteine, glutamic acid; mineral elements - magnesium, manganese, copper, zinc, selenium; vitamins - B group, P, vitamin K, A, E, ascorbic acid; many substances of plant origin - flavonoids, polyphenols of aromatic herbs for seasoning, tannins, lactic acid, coloring matter of beet (betaidin) and others. Possess antioxidant properties and food products mainly of plant origin: beans, sweet peppers, turnips, potatoes, tomatoes, cucumbers, celery, leeks, peas, chicory, fruit juices.

In epidemiological studies have established a correlation between the intake of dietary antioxidants and mortality of heart- and cerebrovascular disease, and various cancers. Some authors indicate that a diet containing increased amounts of antioxidants, and intake of antioxidants, such as pharmaceuticals (in the treatment of diabetes, atherosclerosis, hypertension in the elderly) may increase the length of active life in good health 5-10 years.

Table 11.3. Recommended daily range of products for the elderly (approved by MH of Ukraine)

Name of basic foodstuffs	*Quantity g/24 h (gross)*
Bread wheat	*75*
Rye bread	*150*
Pasta, bulgur	*50*
Butter	*20*
Vegetable oil	*20*
Beef, sausages	*60*
*Kefir**	*200*
Cream	*~20*
Cottage cheese	*50*
Fish, fish products	*50*
Eggs (one, two a week)	*20*
Cabbage	*200*
Carrots	*100*
Beet	*100*
Potatoes	*150*
Onion	*50*
Green peas	*50*
Apples (or other fruit)	*500*
Sugar (or honey)	*30*

** or yogurt*

The chemical composition of the proposed ration fully reply to needs of gerodietetics: energy - 2000 kcal; protein - 75 g; fat (1/3 of vegetable origin) - 60 g; cholesterol - 300 mg; ballast substances - 250 g, calcium - 800 mg, zinc - 12 mg, thiamin - 1,7 mg; folacin - 250 μg, etc.

◆ ***Use of food products and foods that are easily exposed to nutritional enzymes***

This requirement is based mainly on consideration of age decreases the activity of digestive enzymes, to decreased secretory and motor activity of the intestinal tract. Compliance with this requirement is an important culinary food handling.

◆ ***Diet***

Distribution of food intake during the day should be strictly regulated. The most rational is the four meals - first breakfast must represent 25% of total daily calorific value, the second - 15%, lunch - 35%, and dinner - 25%.

The last intake of food should be not later than 2-3 hours before bedtime. Some persons may be recommended more frequent diet - 5or 6- multiple intake of food in small portions.

Therefore, it is impossible for account of the food products to ensure the physiological needs of adults and older people of certain biologically active substances in food (eg., calcium and food fibers), it is necessary to use new products with increased biological value, or food additives.

REFERENCES

1. **Ausman L. A., R. M. Russell.** Nutrition in the Elderly, in Modern Nutrition in Health and Disease, ed. Shils M. E., Y. A. Olson, M. Shike, Will & Wilkins, Balt., Philadel, London, 8-th ed., Vol. 1,770-781, 1994.

2. Decree №23 of the Ministry of Health, SG. 63/2005 on the physiological standards of nutrition of the population. (in bul.)

3. **Dirren, H. M.** EURONUT-SENECA: A European Study of Nutrition and Health in the Elderly. Nutr. Rev. 1994, 52: (II) S38-S43.

4. **Favré-Berrone M., H. Dupin.** Les Personnes Agées, in Alimentation et Nutrition Humaines, coord. Dupin H., Y.J. Cuq, M. I. Malewiack, A.-M. Berthier, ESF editeur, Paris, 511-523,1992.

5. **Garry, P. J., B. J. Vellas.** Aging and Nutrition. In: Ziegler E. E., Filer L. J. Jr., eds. Present Knowledge in Nutrition, Seventh Ed., ILSI Press, Washington, DC 1996, 414-419.

6. **Grigorov, Y. D.** Characteristics of nutrition. in Bases of gerontology. Moscow, Medicine, 1969, 569-580. (in russ.)

7. **Kozlovskaya, S. D., Y. D. Grigorov, T.M. Semesko.** Rational nutrition for old age workers. in Coll. Gerontology and geriatrics. Kiev, 1988, 121-127. (in russ.)

8. **Markova M.** Feeding in elderly. in.: Food Hygiene ed. Vl. Boyadzhiev and M. Markova. Sofia, Med. and phys., 1987, 163-169. (in bul.)

9. Nutrition of Elderly People. Report on the Working Group on the Nutrition of Elderly people of COMA. London, HMSO, 1990.

10. **Petrovskiy, C.S., V.D. Vanhanen.** Nutrition in elderly and old age. in.: Food Hygiene, ed. Petrovski C.S., V.D. Vanhanen. Moscow, Medicine, 1982, 357-365. (in russ.)

11. R**ussel, R. M.** Micronutrient Requirements of the Elderly. Nutr. Rev. 1992, 50: 463-66.

12. **Smiciklas-Wrigh, H.** Aging. In: Brown M. L. ed. Present Knowledge in Nutrition, Sixth Ed., ILSI Nutr. Found., Washington, DC 1990, 333-400.

5. AGE AND WORKING CAPACITY. CREATIVE LONGEVITY.

A. Reshetyuk, M. Koleva

Demographic aging of population in developed countries determines the increase in the average age of workers, and increasing the proportion of "aging" or "older" workers (As an "adult" or "aging" workers WHO defines all workers, who have difficulty in starting work or profession due to age - mostly over 45 years). Accordingly, the relative share of younger workers decreases. In parallel, within the length of service of a generation of workers, mass production (machinery and technology) continuously updated, which requires continuous training of staff. Qualification and particularly retraining, as well as the body's ability to adapt to the highest modern demands of work (speed and performance) have the privilege of youth.

- ***Psychophysiological characteristics of older workers***

It is known that the performance of older workers has its positive and negative sides. The negative, than the reduced maximum working capacity, include:

1. Decreased adaptation possibilities of the visual analyser, resulting in decreased visual acuity, reduced ability to dark adaptation and the need for quality lighting in the workplace.

2. Total weakening of the functions of the central nervous system and changes in mental status, such as: slowed reflexes (up 40%), increased time to learn new methods, impaired memory, reduced adaptability to changes in the working environment, low self-esteem of own opportunities, unwillingness of updates and retraining, lack of flexibility and tolerance, persistence of opinion and tendency to "criticisms."

Changes in the body in relation to age affect the "sensitivity" of older workers to a number of factors: ergonomic, physiological, physical and chemical. The injuries of the musculoskeletal system caused by *monotony* are most pronounced in older workers. Due to decreased muscle strength and endurance older workers may no longer time to work in an *awkward posture*. Furthermore, when working in a forced posture accelerating degenerative changes in the joint system. All this reduces the possibilities for *lifting and carrying weights,* that aging workers perform more difficult and at increased risk of injury.

The reduction of muscle strength and impaired neuromuscular coordination are responsible for lowering the *speed* in performing work movements. Older workers have limited ability to perform activities requiring precision, as they are associated with significant static load and visual strain. *The increased oxygen* demand at work, leads to rapid onset fatigue and increased risk of injury. *Anthropometric changes* should be considered in the ergonomic design of workplace.

The noise in the working environment more irritating older worker and does not allow him to concentrate.

Its body is more susceptible to the harmful effects of *whole body and local vibrations*. Older workers have difficulty tolerating *high temperatures and increased atmospheric pressure*.

The lighting in the workplace is crucial because of the reduced adaptation options and the weakening of eyesight with age.

The combined effect of poor lighting, heat, noise and vibration, sharply reduces efficiency of older workers.

Structural and functional changes in their body are cause risk for them, in contact with *chemicals* in production, to be more pronounced. With age increases sensitivity to *carcinogens*. This may be due to changes in the enzymatic activity of mixed function oxidases. Attempts to explain the increased sensitivity to chemicals with concomitant age changes in toxicokinetics and toxicodynamics, not exhaust in depth the problem. There is strong evidence of increased skin absorption and changes in hemodynamics of vital organs (kidney and liver) that substantially change the distribution in the body and excretion of noxae.

To the positive aspects of employability of older workers, except precision and high quality of work, concern and conscientiousness, maturity, security, a sense of responsibility, prudence, commitment to work, less absenteeism (especially short-term), less fluctuation, better maintenance of the workplace.

International organizations (UN, ILO, WHO) disagree with the trend for exemption from producing entities with longer service (resp. age). They recommend in production to create favourable conditions for older workers. Recommendations include: to continue working the same job, reduce their workload, to avoid overtime, to develop individual modes of operation with extended lunch rest and additional rests or short breaks, to increase lighting of work places, to moving from heavier to lighter work without affecting their prestige, to provide time for rehabilitation and others.

- ***Working capacity***

Working capacity may be considered as *total, professional and special.*

• *Total efficiency* is determined by the functional state of the organism, ie directly depends on health.

• *Professional efficiency* is determined by: total disability (ie health), training, motivation, ability to absorb innovations, hygiene conditions, work organization and others. The main criterion of the level of occupational efficiency is effectiveness measured by the quantity and quality of production.

• *Special efficiency* is the professional ability to work in extreme conditions: high and low temperature, high pressure, hypo- and hyperoxia, acute and chronic physical and mental load (overload) of the body. In connection with the lowering of the age adaptation reserves of the organism, as a rule are "forbidden zones" for the activity of the elderly.

Clinical medicine classifies the functional state of the human as 3-5 class, focusing on disease conditions:

1. Health.

2. Clinically healthy or so-called practically healthy.

3. Sick in compensated condition.

4. Sick in subcompensated condition.

5. Sick in decompensated state (Sick in subcompensated and decompensated state - by a doctor's note for temporary disability, are output of production).

Permanent disability in Bul;garia is rated on a scale, that implies recognition of group of disability and combines health with opportunities in for realization the profession:

III group disability - "restricted activity" - unfit for his profession, but able-bodied for other professions with lower qualification;

II group disability - disability for any kind of work under normal conditions, able-bodied in individual created favourable conditions: reduced working hours, individual mode and more. restrictions;

I group disability, without and with foreign help - full disability, need for control and surveillance (According to current legislation the recognition of disability, associated with labour adjustment, is for a specified period, after which the person is subject to re-certification).

To solve the vocational rehabilitation of aging workers should be given much more detailed classification of functional status of a healthy person **(Table. 11.4)**. In this classification I - IV class total efficiency consistent excellent, very good, good and normal health. On V class - least reduced functionality so-called "practically healthy" at the VI class - often suffered of acute inflammatory diseases, of VII grade - sick in the stage of compensation and VIII-X class - disabled in the stage of compensation, subcompensation and decompensation of health.

A similar approach is used for classification of occupational efficiency:

• *I - I V class* - first class workers, very good, good, average;

• *V - VII class* - limited employable;

• *VIII - IX class* - unemployable under ordinary conditions;

• *X class* - completely unemployable persons.

As a rule in intensive industries employ persons belonging to the I-V class efficiency (V class is considered critical). At the expense of "crowding out" of unadjusted workers (those of IV class and V class) maintain the level of production mode, ie needed

Table 11.2. Classification of general and professional working capacity

Class of efficiency	Maximum values of indicators related to oxygen saturation of the body		Relative disability		Equivalent to the professional activity walking speed in km / h
	Oxygen consumption in l / min	Power of physical load in W	Total	Professional	
I	5,0	100	2,06	1,43	7,6
II	4,8	96	1,65	1,28	6,8
III	4,6	88	1,32	1,15	6,1
IV	4,3	84	1,0	1,0	5,3
V	4,0	76	0,87	0,75	4,6
VI	3,6	72	0,72	0,51	3,8
VII	3,2	64	0,57	0,32	3,0
VIII	2,7	56	0,43	0,19	2,3
IX	2,2	44	0,28	0,08	1,5
X	1,7	32	0,15	0,02	0,8

workers with "excellent - good" health.

In the usual (no first range in technology and work organization) industries, employ persons III to VII class efficiency, tended to prevail workers with reduced working capacity and low, which is determined by proven demographic trends of an aging workforce. Here eliminate workers VI and VII grade efficiency.

- ***Age dynamics of total and professional working capacity***

Important functions such as power limit of physical and mental load on the body, the density of the working day decreased by an average of 1% per year, starting from 20-22 years of age. More strongly reduces the durability of the workload, i.e. limit of working time - at the age of 40 the first two indicators decreased by 18% and limit working hours - by 55%.

By increasing the burden on labour and deterioration of the working environment, lowering the physiological functions is accelerating. For example, among drillers of the deep coal mines, whose contingent is formed by physically and mentally healthy and resilient young men, physical performance is reduced by an average of 6% annually, while the master miners working more easily - just 1% per year .

The most relevant criteria for professional aptitude are the performance indicators of the professional activities - quantity and quality of production **(Table. 11.5)**.

The highest labour efficiency was observed in age 35-50 years, with a maximum of 45 years. In the age dynamics of occupational efficiency observed following functional periods:

1. Professional evolution (15-44 years).

2. Professional involution (after 44 years).

3. Professional development (15-22 years).

4. Professional perfection (23-44 years).

5. Professional disadaptation. The latest period includes pre- and postpension years of working cycle of the individual. In the first (pre-retirement) the effectiveness of the work of aging workers is higher, and in the latter - lower than the average for the entire contingent workers. Labour efficiency of the average 60-year-old worker has a higher efficiency than the average 20-year-old worker, but the older worker will most likely be forced to give way to younger, as it is perspective to produce.

According to experts from WHO, age dynamics of labour productivity of engineers, skilled and low skilled workers is similar to that presented in the table.

WHO experts also note that engineers serving simple (no complex) machines reach maximum efficiency of labour to 25 years of age. At age 50 the effectiveness of their work is substantially reduced. When servicing of more complex machines peak of their engineering mastery moves to 40-45 years, and then slowly lowering was observed in labour efficiency.

Skilled workers aged 55, compared to younger (20-25 years), better manage the servicing of complex machines - i.e. experience and qualifications maintain a high level of occupational efficiency in

Table 11.5. Age dynamics of occupational efficicency of employees in industry

Age, year	15	20	25	30	35	40	45	50	55	60	65	70
Average labor efficiency as part of the maximum	0,18	0,77	0,91	0,96	0,98	0,99	1,00	0,98	0,92	0,83	0,71	0,56
Middle class professional efficiency	VIII	V	IV	III	III	III	III	III	IV	IV	V	VI

workers over 50 and over 60 years.

Age differences in professional efficiency not observed in administrative staff and vendors. At the same time postal employees (sorting) showed a stepwise decrease in labour productivity after age 25, physiological this is warranted by the very high speed at high aggregate physical load during the work shift. Nevertheless, the labour productivity of 65-year-old workers here is only 8% lower than that of 25-year, as a result of professional selection (remain better).

The impact of spontaneous or deliberate selection of the best workers in the most prestigious or more severe and complex spheres of human activity shows that intensive "crowding out" of workers from production in 30-40% of professions begins at age 30. In precise procedures associated with high visual tension, professional unfitness develops and after age 25.

Physiological basis of length of service and the likely high life, in equal genetic data, are the following laws:

1. Optimal (in intensity, extensiveness and mode of labour) develop and improve used physiological functions, in the dynamics of life.

2. Unused functions quickly fade with age on account of atrophy and elimination of relevant morphological structures.

3. Functional overload (excessive intensity, extensiveness, insufficient rest and fatigue) destroy the body, accelerating the biological and professional aging.

4. The operation of sub-optimal level also accelerate biological and professional aging, but to a lesser degree than over loading.

5. When mental workers, need optimal combination of mental and physical exertion, especially at the beginning of service.

With professional longevity distinguished representatives of the professions, in which professionals work under a regime of self-regulation of professional activities. This is tense, even overly strenuous labour, but labour tense is generated internally by demand of the organism, by the harmonious interaction of motivation and based on her mobilization of forces of the body. Man lives in harmony with himself and the environment, including micro- and macrosocium.

Such living conditions have writers, artists and scholars in the past, but also rural residents in traditional areas of longevity, mainly in terms of slight hypoxia (low mountainous areas). Main features of rural long aged have their moderation, lack of speed and overload at work, mental and social well-being.

Systematic, statistically processed data, show that the creative activity of researchers in chemistry peaked between the ages 30-35 years, then begins to decline - to 50% of maximum is reached at the age of 45, and up to 5-10% - to 70 years of age.

Among the overwhelming majority of representatives of science, highest creative activity was observed in the age 35-40 years. Nobel Laureates have made their discoveries even at an early age. As for the arts and humanities, the highest successes were recorded after 40 years.

The age evolution of labour productivity depends on the quality of work - the higher the quality, the period of high efficiency is longer. Conversely, high functional stress the body during labour imposed rhythm of work cause functional disharmony, distress and conditioned by them psychosomatic pathology - accelerating the biological and professional aging, decreased ability to work, professional degradation, premature retirement.

Such conditions are created not only for work on conveyor or other systems "machine-man", but also in individual labour organization at the account of higher standards or of shortening the time for individual operations, but also in new forms of payment based on a total volume of work done.

This is typical of mainstream professions: turners, fitters, machine operator, swagers, installers in radioelectronics, instrument-making and automotive industries, workers of the main occupations in the textile industry, etc.

According to the WHO, chronic diseases determine low efficiency, with subsequent disability and premature death among aging workers. The risk of this with loggers, miners and construction workers is higher than the lawyers, administrative workers and teachers, and aging workers are concentrated particular in occupations characterized by low-skilled labour.

Regardless of the general laws of the age dynamics of total and professional efficiency, it should be noted that aging takes too individually. In "physiological portraits" and professional characteristics of aging workers have more differences than similarities.

It is therefore considered that the need for individual approach to professional rehabilitation of older workers increases with age.

- ***Professional rehabilitation***

It includes:

1. Creating a legal basis for the employment of aging workers, incl. retirees, based on the recommendations of the UN, ILO and WHO.

2. Creation of special jobs for them.

3. Geroergonomic equipment of work place. For example, simplifying the control panel of the machines at the same time complicating the machines them-

selves (computerization).

4. Providing free rhythm of work and taking oversight of work process.

5. Shortening working hours. Organizational most convenient and cost-effective is "partial employment" by working half-time, i.e. two adult worker in a workplace (for one shift they will produce more output than total in the full-time for two).

6. Labour-medical expertise, medical rehabilitation and rational readjustment of aging workers. Convalescences during the work rehabilitation to be arranged to work under favourable conditions of work and free work-mode. These measures prevent the recurrence of the disease and increase the professional efficiency to complete the process of readaptation to work.

7. Physiological rationalization of the regime of work and rest - first by shortening the duration of labour and more frequent periods of rest. The density of working time can not be changed or even lower, but due to the increase in efficiency, productivity increases (in some cases in turners to 40%) while simultaneously reducing fatigue. This measure is a first and basic in practical accessibility, medical and manufacturing efficiency.

REFERENCES

1. Aging and Working Capacity. Report of a WHO Study Group. WHO Technical Report Series, N 835, Geneva, 1993,49 p.

2. Employment rehabilitation of aged workers. Coll. Gerontology and geriatrics, ed. **V.V. Bezrukov**. Kiev, 1988. 160 p. (in russ.)

3. **Momm W. R., R. Ransom.** Disabiluty and Work, in Encyclopaedia of Occup. Health and Safety. ed. J. M. Stellman 4-th ed., ILO, Geneva, vol. 1, 17.2-17.36, 1998.

4. Occupational Health, ed. **M. Lukanov**. Med. and phys., Sofia, 1984, p. 380. (in bul.)

5. Ordinance by MH for the medical expertise of efficiency. SG. 47/2005. (in bul.)

6. Precis de Medicine de trawail, sous la dir. de **H. Desoille, Y. Sherrer, R. Truhaut**. Travailleurs Ages, 6 edit., Masson, 1048-1055, 1991.

7. **Reshetjiuk, A. L.** The Working Ability ol Aging Workers. Gerontology & Geriatrics Education, 1992, N 1/2, p. 91-102. (in russ.)

6. PREVENTION OF PREMATURE AGING. St. Vizev

Today, most authors agree that almost all people are dying of disease or a violent death. Proven is a direct connection between the development of morbidity and premature aging. Therefore, the prevention of age pathology is the prevention of premature aging. Premature aging essentially the most frequently determined by the development of the atherosclerotic process. The hereditary individual program of aging is the main factor that determines the time of onset of old age.

Previous studies still can not give a complete answer to the question to what extent senile changes in the vessels are associated with atherosclerotic process. That these are two different processes speak many cases of developed atherosclerosis (sometimes hard form) in young individuals, even in children. Conversely, when longevity is often not detected signs of expressed atherosclerosis, but they, albeit slowly getting older. There are many open questions about the causes and mechanisms of emergence and development of disease. It is clear that atherosclerosis, as the primary pathological process in the elderly is closely linked with a number of social factors, of which the greatest emphasis on nutrition, working conditions and lifestyle, active locomotor activity and psycho-emotional stress.

Prevention of premature aging should start from the early stages of ontogeny. In most broadly it should include rational way of life, a wide range of health-hygienic events with medico-social, medico- psychological and medico-biological nature. We need early prevention, detection and treatment of diseases that alter the natural rate of people aging. Creating rational labour organization, according to the physiological features of individuals of different age periods, elimination of occupational hazards, creating a broader base for organized recreation, tourism, sports and physical culture, raising the level of knowledge in the field of gerontology and geriatrics.

Indicators to assess the premature aging. Premature aging reduces the various forms of social activity and reduces the area of public appearances. Therefore, the evaluation of premature aging should be used complex of indicators that quantify naturally change with age. For mass epidemiological studies practically preferred clinical (functional) indicators that are easily accessible and at the same time are highly informative in determining the so-called

biological age. The most frequently used methods of functional diagnostics. Particularly suitable are those which allow to diagnose hidden failure of individual systems of the body.

Often used and methods of integrated assessment of biological age, using multidimensional mathematical statistics.

Risk factors for premature aging. There are a number of internal and external factors predisposing to the development of premature aging and age pathology. Risk factors for its appearance include family predisposition to "short aging" ,genetic expression of the age pathology, prolonged psycho-emotional stress, irrational lifestyle, unbalanced diet, chronic degenerative pathology, occupational hazards, smoking, alcoholism and others. A solving a number of fundamental issues, related primarily to detect the nature of the processes of aging and presentation of practical references.

Basic preventive measures. For effective prevention of premature aging follows:

• Thorough to study the leading mechanisms of aging, including the approbation of the methods for determining the biological age in humans.

• Dynamic monitoring of the relationship between the development of biological age and risk factors of premature aging.

• Inclusion of professional groups (or populations) with an increased risk of premature aging.

• Implementation of remedial measures with medico-social, medico- psychological, hygienic and ecological character.

• Clarify the factors predisposing to the development of age-degenerative pathology and its relationship to premature aging.

• Development of specific methods of diagnosis, prevention and rehabilitation of people with age pathology and phenomena of premature aging.

• Dynamic development of systems of events in order to create a rational lifestyle and active behaviour in old age.

• Strengthening the role and importance of socio hygienic factors, such as optimal work, healthy nutrition and lifestyle, medico-social services.

• Improving the forms, organization and structures of geriatric care and others.

Prevention of premature aging should include a complex of measures to remove adverse occupational risk factors; creating a broad base of organized recreation, sports and physical education for all adults, disabled, etc.; establishing a system for professional reorientation and retraining of contingents operating in hazardous conditions and create for them favourable conditions of work - in volume, intensity, length of the workday and others.

Modern gerontology attaches particular importance to the *active motional regimen* in the prevention of premature aging. It is known that labour, active physical regime, increase resistance to stress conditions, have a positive influence on cardio- and cerebrovascular system, affected tissue hypoxia, improves gas exchange, function of the external breathing and more. It was also found that it has a beneficial effect on the state of the musculoskeletal system; increases in muscle performance; tolerance to higher demands of the adult organism; enhances the mobility of the joints; spine; the movements of the old man become more coordinated. Of course, exercise should be consistent with the functional capabilities of the body. The elderly are appropriate forms of sessions with physical exercises - mostly walking, morning gymnastics, and some sports such as hiking, fishing and more.

From environmental factors, that have a significant impact on the aging process, takes mainly place *nutrition*. It is one of the most important factors of the external environment, that substantially optimize or deteriorates metabolism and functions of the body.

An important principle of gerodietetics in the prevention of premature aging is a balanced diet in conformity with the energy losses of the body. With aging are reduced metabolic processes. Decreases internal respiration, which imposes gradual decrease of energy from food intake.

The high *mental stress* also named as one of the major risk factors for premature aging. Experimental models of premature aging, resulting in permanent mental and emotional stress, support the view of the role of distress.

In the prevention and treatment of premature aging importance given to some *medication,* received conditional name geriatric. These are biologically active substances, with a wide spectrum of activity aimed at activation, stimulation and correction of the disturbed metabolic and physiological processes. These preparations should contain different combinations of vitamins, minerals and trace elements, essential amino acids. They must be submitted and all drugs having whole stimulant effect on the body. The adoption of geriatric medicaments and nutritional supplements for physiological stimulation of aging organism, is scientifically justified by contemporary notions for aging and old age.

REFERENCES

1. **Hadzhihristev, Ar.** The phenomenon of Middle Rhodopes longevity, dis., Plovdiv, 1994, p. 320. (in bul.)
2. **Korkushko, O. V., V. I. Zapadnyuk.** Prevention of precocious aging. Manual of gerontology. Moscow, 1987, 387-405. (in russ.)
3. **Stoinev D.** Prevention of cardiovascular disease in the elderly. Sofia, Med. and phys., 1976, p. 94. (in bul.)
4. **Vizev, K. St.** The biological age as medical and social problem, ed. "Angela", Sofia, 2009, 168 p. (in bul.)

K. Milenkov, L. Tsoneva-Pencheva,
R. Nikolova

12 MENTAL HEALTH (PSYCHOHYGIENE)

Summary definition of "health" given by experts from the WHO is "physical, mental and social well-being" and "mental health" is the ability of the mature personality to build harmonious relations with others and participate creatively in altering the biological and social conditions of environment. Mental health is not just the absence of disease or mental disorders, and is an expression of optimal social adaptation.

Sigmund Freud (1856-1939) states that mental health is "to love and to be loved." When most people (without mental illness) M. Jahoda identifies five criteria for mental health:

1. the absence of mental illness
2. normal behaviour
3. adaptability to environment
4. inner harmony of personality
5. right perception of reality

Psychiatry has leading role in studying the dynamics and conservation, strenghtening and restoration of mental health. Mental health is not only adapt to all conditions, as freedom from anxiety and tension: freedom from frustration; compliance/submission; permanent happiness; reduction of achievements and creativity; lack of personality characteristics; undermining of authority.

Psychohygiene is a complex of scientific knowledge and practical activities, aimed at preserving and strengthening of mental health, to prevent the occurrence and development of neuro-psychological disorders. Psychohygiene not content just to provide scientific information and suggestions of teachers, doctors, criminologists, legislators, psychotherapists and writers, it puts them and the requirements for maintaining mental health.

Psychohygiene far beyond the narrow tasks of psychiatric therapeutics, as cover comprehensive care to preserve the health of healthy and enhance their creative abilities.

The recommendations that WHO makes to the development of national policies on mental health, focus that the national mental health policy should be geared not only to mental illness, but also include activities aimed at recognition and coverage problems affecting the mental health of the whole society. They should include social integration of severely marginalized groups, such as refugees, victims of disasters, socially isolated, mentally disabling, the elderly and infirm people, women and children victims of violence and abuse, as well as the poor.

1. DISTRIBUTION OF MENTAL ILLNESS AND DISORDERS. K. Milenkov

According to data from epidemiological studies, approximately every third inhabitant of the country at least once in their life has *problems of mental health response*: irritability, anxiety, insomnia, headaches, sadness, stress or other specific symptoms, sometimes becoming crisis and other protracted reactions; neuroses or more systemic syndromes and morbid states of group of psychosomatic sufferings, memory loss, attention, will, interspersed temporarily or permanently with fear, doubt, hypochondria, depression, suspicion, sensory fraud, obsessions, phobias; formation of more serious mental illness such as schizophrenia, cyclophrenia, epilepsy, oligophrenia, dementia and so on. Around 20-25% of the daily flow of patients in general medical practice, relevant to mental health. In a study of the views of GPs is reported that between 20 and 30% of the symptoms of bodily diseases are the result of psychological factors, without interference by organic causes.

By analogy with the US and developed European countries it can be argued that the country about 10% of the population at any time needs *assistance in connection with psychiatric symptoms*, and 3-4% suffer from serious mental illnesses that reduce their ability to participate fully in public life - limited social functioning of sufferers. Much of the needs of these persons are wrongly stated - affects bodily disease

or dysfunction and thus inaccurately addressed to internists, cardiologists, dermatologists, naturohealers, extrasenses, and so on. In all such cases, they are an expression of a clear need for a complete and competent mental health care, respectively psycho hygiene consultation.

Men are at higher risk for illness of personality and alcoholism; women - for depression and anxiety; adolescents - for infectious diseases, excessive introspection on the appearance of the body, problems with nutrition and diet, but also with suicide; the elderly except to suicide and despair have an increased risk for dementia, cerebrovascular changes and Alzheimer's disease.

Around 200 000 Bulgarian citizens need and use the services of *psychiatric dispensary services*. In the psychiatric register includes approximately 50,000 suffering from oligophrenia, 25 000 - from epilepsy, 20,000 - schizophrenia, 15,000 - from cyclophrenia. Suffer from neurosis and psychosomatic diseases are too many and far exceeds the total number of dispensary, because most of them served in the general health network of other specialists - neurologists, cardiologists, internists, home doctors and so on. (Register for them no carry on and about 80% of them did not reach psychiatric services).

Steadily increasing in recent years in our country the number of people dependent on alcohol, tobacco, drugs, psychopharmacological and other psychoactive substances. The large number and variety of stimulating, exciting, soothing, hypnotic, leveling emotions, mind-altering, causing sensory fraud, detachment from the real world and immersive in "illusive nirvana" drugs, are arranged in unifying a group of psychoactive substances. The main factor for the occurrence of addiction and subsequent mental and physical disease changes, and changes in social functioning, reaching the asocialisation and antisocialisation is social, not medical.

According to the representative surveys almost half of the population (about 2.8 mil. aged 11-79 years) *smoke tobacco* in a significant proportion of smokers are established features of morbid addiction (nicotine toksikomaniya - about 390 thousand. People). It is estimated that more than 300,000 Bulgarian citizens suffer from alcohol dependence.

Over 10,000 have shaped heroin addiction and as many use this drug. Other 10,000 are dependent on derivatives of cannabis indica, 7-12000 breathe glues, solvents, fuel and volatile substances, 40-50000 drug abuse psychoactive substances (can not approximate or estimated number of athletes and others taking psychostimulants).

Epidemiological studies show that as much *earlier age starting substance abuse*, sooner develop dependence and the more difficult it can be overcome. Such data is based on one of the postulates of psychohygiene that much more important and promising not to allow use of psychoactive substances, i.e. leadership here is primary prevention.

Start use of psychoactive substances in Bulgaria is alarmingly early: heroin and derivatives of cannabis indica begins average age of 14, and adhesive is less than 10, while in Europe adolescents a few years later are drawn into drug addiction.

Bulgarian market of narcotic cocaine is relatively "newer and expensive" and therefore used less frequently, but its spread is widening.

Registered *psychiatric morbidity* in Bulgaria is between 25 and 30 percent, but the dispensary is not mandatory and does not cover all ailing. Special epidemiological studies conducted by the screening questionnaires show that 100-150 and in some places up to 300 ‰ of the studied populations have any quantitative or qualitative changes in the overall mental activity or a part of it (these tests include individual symptoms such as irritability, temper , insomnia, anxiety, and so on., but some of them are predictors for subsequent shaping of disease states). These figures are similar to the findings of other foreign authors.

2. PSYCHOPROPHYLACTICS-FACTORS AND INTERVENTIONS. RISK FACTORS. K. Milenkov L. Tsoneva-Pentcheva

DETERMINANTS OF MENTAL HEALTH

Key risk factors and indicators impacting negatively on mental health are:

◆ Medico-biological, mental disorders, somatic disorders, family history and more.

◆ Socio-psychological: stress/distress, crisis, unemployment and others.

◆ Behavioral: use/abuse of psychoactive substances: alcohol, drugs, tobacco and others.

◆ Other

Risk Factors of the social environment:

◆ Unemployment/Financial problems

◆ Social isolation

◆ Social instability and disorganization

◆ Stress/Distress

◆ Crisis situations

◆ Negative impact on the nearby environment

◆ Difficult access to health care and other services

◆ Stigma (in terms of mental health disorders, visits to a psychiatrist/psychologist)

Indicators of social instability and dislocation:

◆ criminality and violence
◆ alcoholism and substance abuse
◆ suicidal behaviour: suicide, suicide attempts
◆ population mobility
◆ poverty and deprivation
◆ population density
◆ marital status
◆ distribution according to ratio divorce/marriage

Many elements that are relevant to mental health and its prevention can be covered in the following 10 interrelated groups:

1. Type of prevention - primary, secondary and tertiary.

Primary prevention. It aims at avoiding new diseases. These include national care to strengthen the body and mental development - rational nutrition of all the people, respect for school and occupational hygiene, rehabilitation bits of the population, removing the factors leading to asthenisation - intoxication, trauma, acute and chronic infections; raising material welfare and social security; ubiquitous healthy psychological climate; environmentally mode of life, hygiene rhythm of work and alternating with rests, entertainment and sports; enrichment of health awareness and health education; removing distress and psychological trauma and oth. Timely detection of latent diseases, prodromal conditions, subclinical forms and more is of particular importance. For example, detection of hereditary deficiency of the enzyme phenylalanine hydroxylase by testing the urine of infants and immediate application of appropriate diet and medications, can completely prevent the clinical development of one form of oligophrenia, that inevitably would have evolved if this diet and therapy not apply from the first hours after birth. Prevention of accidents and brain concussions is the prevention of future cerebroasthenia, characteropathy, encephalopathy, epilepsy and others.

Secondary prevention. Secondary prevention aims to eliminate faster disease. This includes the entire process of complex treatment by all means, combinations, approaches etc. by drugs, psychotherapy, physiotherapy, surgery, etc. It also incorporates: treatment with depot preparations, neuroleptics, thymoleptics, cardiacs, antihypertonics, antistenocardics, antiepileptics and other as maintenance therapy, as well as continued administration of lithium, carbamazepine, valproates and other drugs such as antireccurent means at periodic ongoing psychoses. Prevention and prevention of alcohol relapse are possible with the appropriate depot preparations and psychotherapy.

For neurotic and protest reactions most important themselves adjustment of interpersonal relationships, within the meaning of the so-called deconditioned therapy. Autogenous training in many cases is very effective secondary prevention. Developed multiple variations of secondary prevention of addiction to tobacco, drugs and other psychoactive substances.

Secondary prevention of behavioural deviations in crisis, protracted reactions, panic states and others, it may unfold in three stages:

- *Remote, which is planned and conducted in long periods - in preparation for months or years before a psychological trauma - strengthening mental resistance.*
- *Close begins in latent or prodromal period.*
- *Immediate applied immediately at the onset of overt signs of crisis, respectively recidivism.*

Tertiary prevention. It aims to minimize disability. The main factors here are the rehabilitation, dosed labour, movement, retraining, resocialization and all their varieties for correction and/or compensation of the defect.

The therapeutic society, culture therapy, music therapy, art therapy, socio therapy are also effective ingredients. The practical dimension of effectiveness, is the extent of the social functioning achievement.

2. Scale - national, group and individual.

• *National scale* include measures for higher living standards, eliminate common hazards, adaptation of education, to science and the needs of the population, the construction of ethics, peace and creative psychological climate, social security and so on.

• *The group scale* covers certain groups; students generally, students of a certain grade school; workers from a factory, manufacturing plant, a particular profession; retired; like-minded people; family; women; soldiers, etc.

• *In individual plan* intertwined components of biological and mental development. One must work on vocation, desire and opportunity, not according ambition. To prevent distress H. Celye recommends that you do not set unattainable goals.

3. Age - children, youth, mature, elderly and senile. Each is distinguished by certain characteristics that have significant pathophysiological and pathoplastical impact on the appearance and course of mental disorders. Certain diseases appear only in certain age periods.

4. Nosology. Nosologic units are neuroses, psychosis, psychopathia, crises and disadaptation, oligophrenia, psychosomatic afflictions, narcomania, addictions, dementia and so on. It is not indifferent to what morbid group is focusing efforts of psychohygiene. Clarifying the etiology and pathogenesis easy, but not always successfully solve the needs of prevention and promotion. Different forms and ways

of functioning of nosologic units, in turn require additional details and considerations for successful prevention. Psychohygiene has its important place and behaviour to severe (cancer, tuberculosis, endocrine, postoperative, chronic, etc.) sick, in preparation for birth, at the emerge of puberty and menopause, at wanted or unwanted pregnancy, etc. etc.

5. Specific or non-specific nature of prevention activities. Specificity is considered in two directions:

1. Specific (causal) prevention to a specific known cause (alcohol, infection, trauma, production hazards, of radioactivity, distress, etc.). This shows definite need for the involvement of two or more disciplines.

2. Specific regarding mental health and mental processes (psychotherapy, healing psychological climate, psychopharmacs).

Non-specific prevention covers all general hygienic, hardening and strengthening activities, living conditions, proportionate inclusion of work, recreation, sport and entertainment, nutrition and so on.

6. A totality of liable contingtents - healthy, risk (with an increased disease risk) and sick persons. These three contingents require different emphases and priorities for research and preventive interventions. At first, most numerous contingent will direct the general care of a healthy lifestyle, development and creativity, carefully planned strictly limited measures to monitoring and, if necessary - targeted screening. Persons at increased disease risk (children of alcoholics; people with mental and other afflictions; with proven genetic relationships; people living or working in strong, unexpected or prolonged stressful conditions, etc.) require the most attention to early detection of predictors and implementing effective prevention programs. For ailing and suffered persons in the foreground, stand out interventions for secondary and tertiary prevention.

7. Approaches. Apply approaches on:

- *eliminate pathogenic factors.*
- *strengthening protective factors and strengthen the human factor.*

Both varieties could be successively or simultaneously necessary and directly related to a specific purpose, context and priority. The second variant include and all interventions to stimulate and develop upon the existing positive inborn qualities, such as giftedness, ability, talent, etc.

8. Methods. Apply medicated, pedagogical, psychological, psychotherapeutic, social, rehabilitation, resocialization, etc. methods, equally in hospital and outpatient settings. In any medical intervention should be provided and to prevent unwanted side effects of drugs (neuroleptics, antidepressants), operations, shocks, irradiation, immunizations, inappropriate recruiting, random iatrogenic effects and so on.

9. Organizational forms

- *According offices, their tasks activities and opportunities.*
- *According to the effectiveness of the screening methods and remedial interventions.*
- *According skills and personal abilities of professionals.*

In the Health Act (2005) indicates that the state, municipalities and NGOs organize activities for protection of mental health related to:

1. Provide people with mental disorders affordable and quality medical care, care and support needed for their lives in the family and community;
2. Protection of mental health at risk groups: children, students, old ages, persons residing in social institutions, military, detainees and prisoners;
3. Active prevention of mental disorders;
4. Support of public initiatives in the field of mental health care;
5. Specialized continuous training of persons who carry out protection activities on mental health;
6. Implementation of training programs for strengthening and protecting the mental health of those who teach, conduct medical activity, social adaptation, organization and management, protection of public order;
7. Scientific research aimed at strengthening mental health;
8. Public awareness of mental health problems.

Psychohygiene in Bulgaria is mainly realize of psychiatric services, with the assistance of other state and non-state institutions. For treating more serious mental afflictions work for the country around 7000 beds. Almost as other beds serve patients with mental illnesses and disabilities. General scheme of psychiatric care covers 4 types of services:

• *Stationary* - clinics, hospitals, wards.

• *Semistationary* - day and night hospitals.

• *Outstationary (ambulatories)* - dispensaries, wards, offices, incl. in general profile DCC.

• *Complementary (additional)* - work therapy farms, workshops and so on. Every year in psychiatric services are performed by more than two million reviews and advice about 1/3 of which are preventive.

Psychohygiene are operating and other institutions (outside MH): Ministry of Education, Defense, Interior, Transport, Red Cross and others.

Prophylactic activity is mainly the responsibility of psychiatric dispensaries. Its details can be defined as: research-finding; particularly sanitary; research; organization-methodical; educational-teaching; health-educational training; consulting.

Psychiatric dispensaries should develop into centres for mental health.

Among the organizational factors for development of psychohygiene, prominently occupied and developed in WHO national, local and other networks and programs: hospitals for health promotion; school health; cities for health; environment, health-enhancing and others. Psychohygiene has a special place in the WHO program "Health for All". In most of its 38 tasks, included mental health problems, some are devoted entirely to him - eg. task 12 - "Reducing the prevalence of mental disorders and suicide," task 17 - "For tobacco, alcohol and psychotropic substances", while others have infiltrated more or less on similar topics - eg. task 7 - "For children and young people with their psychic potential, psychological support for children at a disadvantage"; task 13 - "For the development of health programs" and others.

10. Willingness and attitude of patients. Is positive, negative, indifferent and so on. The medical and all other professionals (teachers, psychologists, public administrators, etc.), involved in prevention activities, should comply with readiness, training, desire or reluctance of subjects to conduct that activity: boarding schools, medical check up,researchs, rehabilitation activities and so on.

These 10 groups provide excellent opportunities to develop the most appropriate programs and activities according to actual situation, tasks and opportunities and according to the priorities, that may change in different stages **(Fig. 12.1)**.

To mental health and psychohygiene relevant all medical specialties and many no medical. In obstetricians expansion of indications for forceps and vacuum extractor must comply with the requirements of primary prevention. Possible side effects such as cranial impressions, cerebral microhemorrhages, so-called minimal brain damage, remain with the respective clinical manifestations. Infectionists also play an important role in preventing effects of meningitis, encephalitis, rubella, typhoid and many others. Traumatologists and neurosurgeons can limit post-traumatic encephalopathy, epilepsy and so on. Pediatricians promptly may find difficulties in mental development. Of psychotherapy, drug and technical preoperative preparation depends largely mental balance and peace of the patient to be surgery, but also in early and late stages of resuscitation and post-operative period. Of hematologist depends on timely detection of Rh incompatibility to avoid many accidents and disease abnormalities after birth and blood transfusion. Toxicologist, surgeon, intern, a familial doctor take a leading part in psychosomatic distress and suicide attempts. Of genetic counseling depends in many cases, family planning, which reflects directly on the mental condition of the parents, children and society. Skillful use of contraceptives

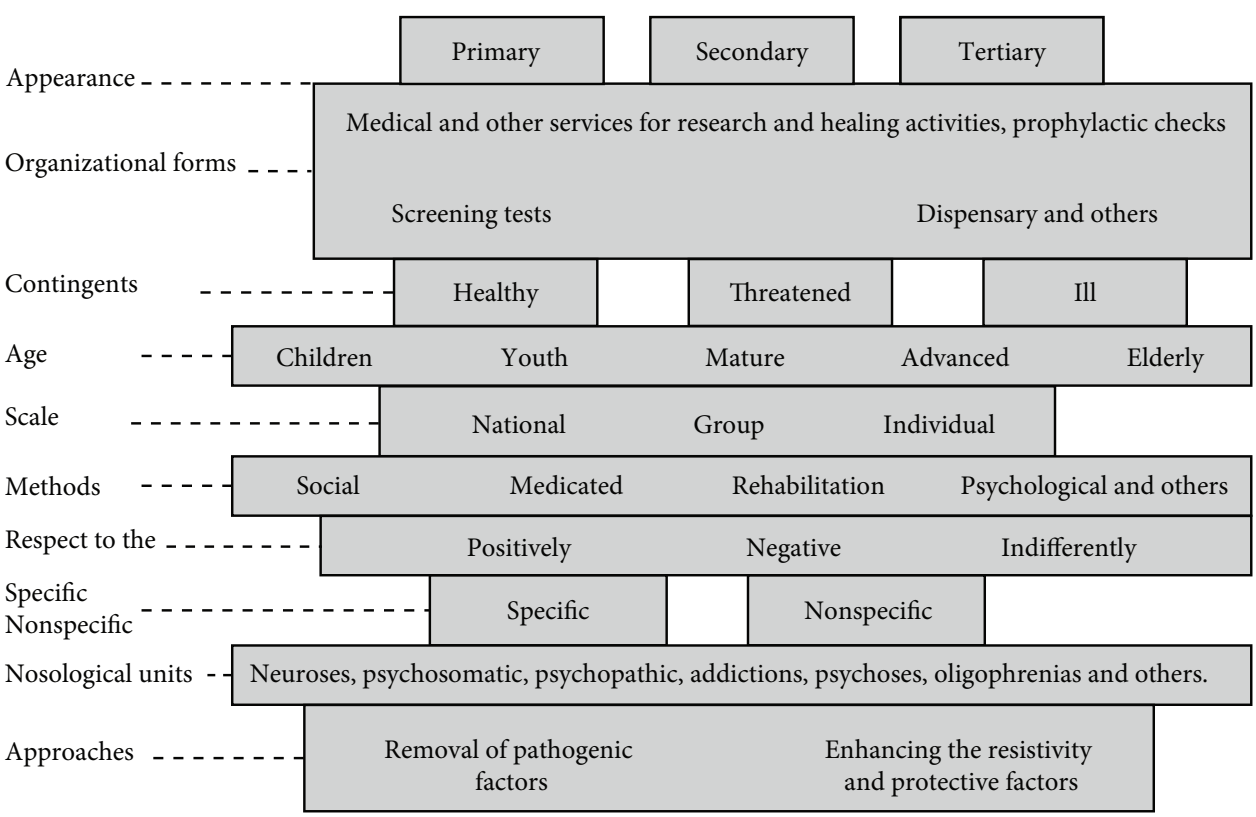


Fig. 12.1. Psychohygiene (one of the options)

has a huge psychohygienic matter. Of organizer and health manager depends promptly be seen all these problems and find their solution. Red Cross with "helplines" and many other activities in peacetime and wartime, perform useful psychohygienic work. Educators, psychologists, public figures, journalists, employers, professional, political and religious leaders also actively involved in shaping the human personality, determination and compliance with valuable qualities of life and thus - directly or indirectly - in psychohygienic interventions. It is important for mental health, personality characteristics and equability of medical professionals. Peculiarities of character, education, professional fitness and agility, efficiency, fatigue and tiredness, mood, professional satisfaction, preliminary psychological attitudes, expectations, psychoclimate and many more other factors are reflected in one or another way on the diagnostic and therapeutic process, the organization, quality and the effectiveness of medical treatment.

Pessimistic, deprecive or melancholy mood of doctor, nurse clinician, etc. can spread and the patient, which is different from atrogeny. Moreover, pessimism of doctor could lead to therapeutic nihilism and professional inactivity, and this in turn adversely affects on the total medical care.

The preliminary paranoial or paranoid attitude can cause serious omissions, errors and consequences. Back, required is so-called empathy - the ability to understand emotions, motivation and behaviour of the patient.

3. SUICIDOLOGY AND SUICIDOPREVENTION.
L. Tsoneva-Pentcheva
K. Milenkov

Suicide is a complex problem for which there is no single cause, no single occasion. It is the result of the interaction of biological, genetic, psychological, social, cultural factors and environmental factors.

According to the World Health Organization (WHO):

• A million people worldwide commit suicide each year;

• Every 40 seconds someone commits suicide somewhere in the world;

• Every 3 seconds someone attempts to take his life;

• Suicide is among the three main causes of death among young people aged 15-35 years.

Currently, suicide and suicide attempts are a major public health problem. Their prevention is among the priorities of the European Union (EU) health. Suicidal behaviour is one of the indicators to assess the level of mental health and social well-being of any society.

European Network for suicidoprophylactic determined suicides and suicide attempts as a burden to society because:

• suicides kill more than road accidents, especially in young age;

• suicides are associated with many lost years of potential life and loss of "gross internal product";

• suicide attempts with greater frequency, especially in younger age groups;

• suicide attempts are associated with high utilization of primary and hospital health network and the resources of health insurance;

• suicide attempts and suicide have a negative impact on: the family, the social environment and the whole society - their psychological, social and financial impact is immeasurable.

According to the NHIC in 2006 the ***suicidal death*** in Bulgaria amounted to 12.7 per 100 000 people. During the period 1999 - 2005, it was higher than the death rate from traffic accidents. It should be particularly noted that for the first time since 1989 the ***suicidal mortality*** in 2006 dropped below that of ***traffic accidents***.

According to the information database to the National Programme for suicidoprophylactic at 2006 in the health network of the country registered 2144 suicide attempts not resulting in death. This means that during the year daily average of 6 people have attempted to take his life - one of them in children and adolescents. The indicator amounted to 27.9 per 100 000 people.

3.1. GROUPS WITH HIGHER RISK OF SUICIDAL BEHAVIOUR

Persons at increased risk for suicidal behaviour:

• persons with suicidal behaviours (thoughts, expressed intentions, committed suicide attempts);

• people with mental and severe somatic diseases;

• persons with other forms of anti-adaptive behaviour - drug addiction, alcoholism and more.

Social groups at increased risk of suicide (risk of making a suicide attempt, finished or unfinished death):

• members of the "closest" circle of persons who have committed suicide or attempted suicide;

• unemployed and social weak persons;

• persons who are victims of violence;

• elderly and lonely people;

• Other: children deprived of parental care and

behavioural abnormalities, disabled, disadvantaged due to defects, disabilities and serious illnesses, prisoners.

Other social groups, among systematically must carry out activities on mental health promotion and suicidoprevention:

- students (10-18 years);
- troops;
- Interior ministry officials

Currently suicidal behaviour is perceived as a disorder with many dimensions, which results from a complex interaction of biological, genetic, psychological, social factors and environmental factors. Studies show that between 40% and 60% of people who commit suicide visited a physician one month before the suicide; most of them have visited a general practitioner.

A general, factors that contribute to suicide among **adolescents** eg., are varied and include: depression, emotional isolation, loss of self-esteem, excessive emotional stress, mental disorders, romantic fantasies, looking for excitement, alcohol abuse and others substances, presence of firearms and others means of self-destruction.

Most often suicide is the result of the action of several different factors. The current lack of a specific personality characteristics predisposing to suicide, making it difficult to identify adolescents at increased risk of suicide.

Study among adolescents in Denmark has identified the following characteristics associated with suicide attempt, ordered according to their importance: suicidal thoughts, thoughts of death, use of "hard" drugs, use of "soft" drugs, living conditions, drinking, destroyed family /broken home/, divorce of parents, death of relatives outside the family, an unemployed father, size of school class.

Developed models, based on the assumption that suicide does not occur by chance, but in individuals with individual predisposition, but that they attempted to commit suicide only when both occur triggers and in the presence of access to the mean of suicide **(Fig. 12.2)**.

3.2. KEY FACTORS AND INDICATORS DETERMINED SUICIDAL BEHAVIOUR.

Socio-demographic indicators

Sex. Men more often commit suicide; women often made suicide attempts. In Bulgaria in 2006 suicidal death rate among ***men*** amounted to 20.2 na100 000; it is higher than that among ***women*** - 5.7 100 000. Sex balance amounted to 3.5: 1.0. That same year, the index of suicide among men is 16.1 per 100 000, and among women - 39.1; the ratio of female: male was 2.4: 1.0.

Age. The average age of male suicide is not significantly different from that of women, respectively 54.9 ± 0.8 years and 55.3 ± 1.5 years. Accordingly, the average age of the attempted suicide of men was 38.6 ± 0.7 years and women - 32.5 ± 0.4 years.

Location. The mortality rate due to suicide among rural residents is 18.0 per 100 000; it is higher than that in cities - 10.5. In contrast, the index for suicide attempts in urban areas is higher than in rural areas, respectively 31.3 and 19.5 per 100 000 people.

Social status. Among those who have committed suicide, the highest proportion of pensioners - 42.2 percent. Second place in the social structure of persons who have committed suicide are economi-

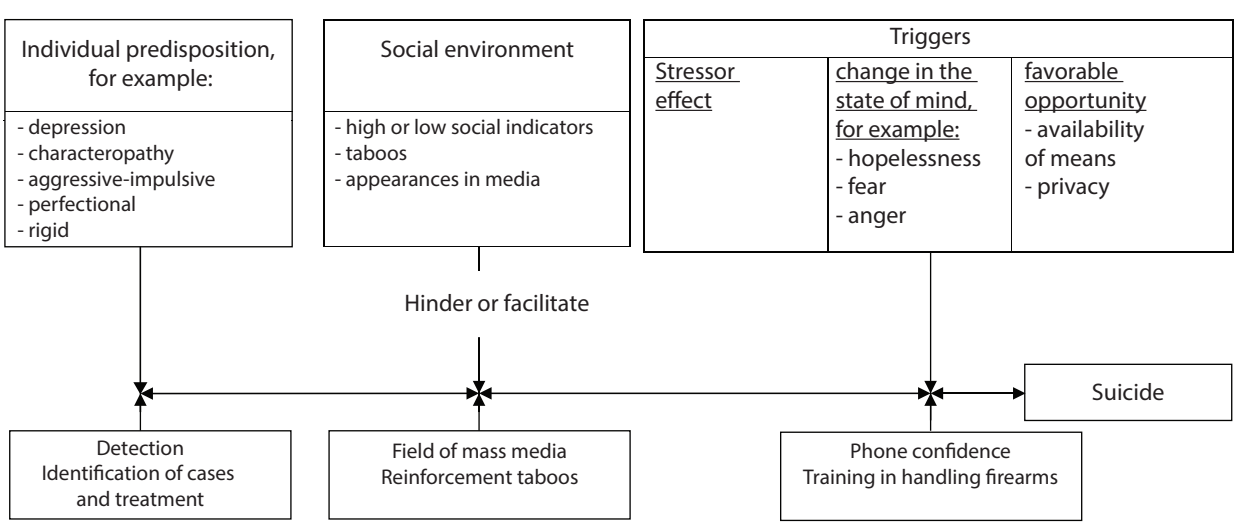


Fig. 12.2. Model of causation of suicide and suicidoprophylactic

cally active suicides; their share totaled 30.1 percent. Unemployed up - 19.5% of all persons killed own life. In the social structure of parasuicides dominated economically active - 30.1%, followed by the unemployed - 23.6%, ie at the time of the suicide attempt 53.7% of parasuicides were potentially or actually economically active age. Thirdly share of students - 22.5%.

Medico- biological risk factors for suicidal behaviour

Only oneself his suicide is not a disease, it is not necessarily a manifestation of the disease, but mental disorders are a major factor associated with suicide.

Mental disorders:

- **Depression (all forms);**
- **Personality disorder (antisocial and borderline personality with traits of impulsivity, aggression and frequent mood changes);**
- **Anxiety disorders;**
- **Alcoholism;**
- **Abuse of other toxic substances (medicines or abuse of drugs by young people);**
- **Schizophrenia;**
- **Organic mental disorders;**
- **Other psychiatric disorders**

Depression is the most common diagnosis among committed suicide. It is an important factor of suicidal behaviour among adolescents and adults; especially increased suicidal risk in people with late-onset of depression.

COMMON SYMPTOMS OF DEPRESSION:

- a feeling of heaviness in the majority of the day, every day;
- loss of interest in usual activities;
- weight loss (when not on a diet) or weight increase;
- unusually long or short sleep or waking up unusually early;
- feeling tired or weak all the time;
- feeling of inferiority, guilt or hopelessness;
- feeling of irritability and restlessness;
- having difficulty with concentration, decision making or in memory;
- presence of recurrent thoughts of death and suicide.

Persons with unrecognized and untreated depression are at increased risk of suicide.

Alcoholism

For about a third of cases of suicide is found to have been dependent on alcohol. Up to 10% of people with alcohol dependence ended his life with suicide; for Bulgaria the percentage is higher - 16.0%. It was found that during the suicide act many persons have been under the influence of alcohol.

Traits of people with alcohol problems who commit suicide:

- have started to drink from a very young age;
- have consumed alcohol over a long period;
- drink intensive;
- are physically unhealthful
- feeling depressed;
- have problems in their personal lives;
- suffer due to present significant personal loss, such as separation from husband/and/or family, divorce or bereavement;
- are poorly presented in his work.

Schizophrenia. Around 10% of people with schizophrenia commit suicide. Schizophrenia is characterized by disturbances in thinking/delusion/, auditory and visual perception /hallucination/, movements /catatonic symptoms/, negative symptoms /emotional adjustment, lack of will/. There is a serious disorder of social functioning, of interpersonal relations, work, neglect of personal hygiene.

Neurological diseases

- **Epilepsy**
- **Multiple sclerosis**
- **Spinal cord or head injury**
- **Brain insultus**
- **Brain tumors**

Epilepsy.

The increased impulsivity, aggression and chronic disability, which establishes often in persons with epilepsy are the likely reasons for the increased risk of suicidal behaviour.

Spinal or head injuries and cerebral insults

The more serious the injuries and symptoms in strokes and tumors, so much is suicidal risk.

HIV/AIDS

Stigma, poor prognosis and nature of the illness increase the suicide risk of those infected with HIV. At the time of diagnosis, when the person has not received proper consultation after the test, suicidal risk is high.

Chronic diseases

- **Cancer**
- **Diabetes**
- **Diseases associated with chronic pain**

◆ **Difficulties in joints, vision and/or hearing about CANCER**

There are indications, that terminal illness (eg. Cancer) are associated with an increased risk of suicide. Suicide risk is highest among:

• men

• immediately after diagnosis (within five years) when the patient is undergoing chemotherapy.

Somatic-like disorders and **feeding disorders** (anorexia and bulimia) are also associated with suicidal behaviour.

SEXUAL DISORDERS

Risk factors of social environment

◆ **Unemployment/financial problems**
◆ **Social isolation**
◆ **Stress/distress**
◆ **Crisis situations**
◆ **Easy access to means for suicidal act**
◆ **Negative impact on the nearby environment**
◆ **Difficult access to health and other social services**
◆ **Stigma (in terms of mental disorders, suicidal behaviour, visits to a psychiatrist/psychologist)**

Unemployment

There is a very strong link between unemployment indicators and indicators of suicide, but the nature of this relationship is complex. The effect of unemployment is probably amplified by factors such as poverty, social deprivation, domestic difficulties and hopelessness. On the other hand, it is more likely that people with mental disorders to be unemployed than people in good mental health. In any case, should consider the significance of the difference in the duration of unemployment: the higher risk associated with recently occurred unemployment.

Stress

Majority of completed suicide have experienced three months previously stressful life events, such as:

• Interpersonal problems - eg. disputes with husband/wife, family, friends, loved ones;

• Rejection - eg. parting with family or friends;

• Losses - eg. financial loss, death of a close one;

• Professional and financial problems - eg. job loss, retirement, financial difficulties;

• Social changes eg. rapid political and economic change;

• Other stressful situations such as shame and fear of apportioning blame.

Easy access to methods for committing suicide and stressful life events have an important role in increasing the risk of suicide. Reducing access to the means of suicide is an effective suicide prevention strategy.

Psychological attitude of suicidal personality

Three features define the psychological attitude of suicidal patients:

1. Ambivalenence: Most people have mixed feelings about committing suicide. The desire to live and the desire to die fluctuate and are struggling with suicidal personality. There is a need to escape from the pain in life and at the same time there is a strong desire to live. Many suicidal people do not really want to die - they just are not happy that they live. If you receive support and their desire to live intensify, suicidal risk decreases.

2. Impulsivity: Suicide is also an impulsive act. Like any other impulses, the impulse to commit suicide is transient and lasts a few minutes or a few hours. It is triggered by negative daily events. By addressing these crises and playing for time, healthcare professionals can help reduce suicidal desire.

3. Rigidity: When a person is suicidal, their thinking, feelings and actions are limited. Such persons constantly think about suicide and are unable to perceive other ways to solve the problem.

Most suicidal individuals shared their suicidal thoughts and intentions. They often give signals and make statements about "wanting to die", "feeling of worthlessness," etc. All these calls for help should not be ignored.

How to identify suicidal person

Signals to be looking at the behaviour of the person or in her past:

1. Closed behaviour, inability to communicate with family and friends
2. Mental illness
3. Alcoholism
4. Anxiety or panic
5. Change personality, pointing to confusion, pessimism, depression or apathy
6. Change in eating habits and sleeping
7. Previous suicide attempt
8. Self-loathing, guilt, low self-esteem or sense of shame
9. A recent major loss - death, divorce , separation and more.

10. Family history of suicide

11. Sudden desire to settle personal affairs, writing a will and others.

12. Feeling of loneliness, helplessness, hopelessness

13. Farewell letter

14. Somatic disease

15. Repeated statements about death or suicide.

When working in primary health care have doubts about suicidal behaviour, you should consider the following factors:

• current mental state and thoughts about death and suicide;

• presence of a suicide plan - how prepared the person about it and within what period must be carried out suicidal act;

• having a support system of the person (family, friends, etc.).

The best way to tell if a person has suicidal thoughts, it is to be asked. This contradicts the popular belief that the conversation about suicide inspires people to do it. In fact, respondents are grateful and relieved that can talk openly about the problems and issues they face.

3.3 SUICIDOPREVENTION

Main objective of suicidoprevention is reducing the frequency of suicide attempts and deaths due to suicide.

Sub-objectives are:

1. Limiting the impact of the factors, determining the risk of suicide and suicidal behaviour.

2. Enhancement of protective factors.

3. Formation of social skills, adequate public protection.

The approaches are: high risk (clinical) and public health.

Successful suicidoprevention require application of a combination of these two approaches to achieve optimal effect.

The first approach is based on the full involvement of health services, improve diagnosis, timely identification of risk for suicidal behaviour and thus improve treatment, caring, monitoring and rehabilitation of psychiatric patients, persons who have committed suicide attempt and individuals in psychological distress with suicidal thoughts. This requires raising concern of health professionals in re-

Suicide risk: identification, assessment and action plan

Suicide risk	***Symptom***	***Assessment***	***Action***
0	*No distress*	-	-
1	*Emotional upset*	*Ask for suicidal thoughts*	*Listen to sympathy*
2	*Weak ideas for death*	*Ask for suicidal thoughts*	*Listen to sympathy*
3	*Weak suicidal thoughts*	*Rate intention (plan and method)*	*Use opportunities. Find support*
4	*Suicidal ideas but there is no mental illness*	*Rate intention (plan and method)*	*Uses opportunities Find support*
5	*Suicidal ideas* ***and*** *mental disorder* ***or*** *strong life stress*	*Rate intention (plan and method) Have a contract*	*Refer to psychiatrist*
6	*Suicidal ideas* ***and*** *mental disorder* ***or*** *strong life stress* ***or*** *agitation* ***and*** *previous experience*	*Stay with the patient (for to prevent the access to means)*	*Aim for hospitalization*

lation to suicidal behaviour change in their attitudes and taboos against suicidoprophylactic and mental illness.

The second public health approach, includes not only elements of the control for environment in terms of access to means of suicide, responsible media policy, but also changing attitudes and stigma of society towards mental illness and suicidoprevention, from here to healthcare professionals assisting in such problems (psychiatrists, psychologists, etc.). This implies increasing knowledge through health education on strengthening mental health, the role of acute and chronic stress, and the importance of protective factors and their involvement in crisis situations.

The primary suicidoprophylactic includes all activities for the prevention of suicide risk and suicidal behaviour, ie non-first suicide attempts and death by suicide. This implies priority implementation of public health approach. The activities are focused on:

1. Health education:

• Population;

• Students in medicine, psychology, pedagogy, etc.;

• Medical professionals from primary health care to the Ministry of Health, Ministry of Defense, Ministry of Interior, MLSP, etc .;

• Teachers, school counselors, school psychologists and nurses, command staff of Defense and Interior and others.

• Students, soldiers, Interior Ministry officials and others.

• Social workers

• Professionals from NGOs.

2. Implementation of programs for mental health promotion and creation of social skills among the population and among groups at increased risk.

3. Support the opening of persons with warning signs of suicidal behaviour.

4. Provide/facilitate access to relevant health, social and other services and specialists, to provide adequate assistance to persons in distress, crisis and others.

5. Creation and maintenance of crisis intervention services.

6. Disclosure and maintenance of telephone lines in confidence.

7. Restrict access to means of suicide.

Public health education should be aimed at achieving better awareness of mental health problems and raising concerns of society to self-aggresive behaviour. Along with increasing knowledge of risk factors, is essential to achieving knowledge about protective factors, with emphasis on those of psycho-social field. Topics here are: reduction of tension, stress management, building positive self and others.

Training of medical and other specialists from relevant departments of the Ministry of Health, Ministry of Defense, Ministry of Interior, Ministry of Education, MLSW to achieve the knowledge, skills and positive attitudes to prevent suicidal behaviour at individual and community level. It is necessary to overcome the fear, that a conversation on any suicidal intentions would cause necessarily suicidal action. Therefore the foreground efforts should be directed towards demythologization of the problem "suicide." Suicide should talk freely, as a natural outcome of the accumulation of stress and problems, as well as untimely disclosure of otherwise relatively easy to overcome crisis situations. Training includes: assessment of suicide risk, incl. early recognition of depression, post-traumatic disorders, sexual abuse, etc., and implementation of crisis intervention and presentation of psycho-social support.

The training of medical students, psychology, pedagogy and others, it is aimed at acquiring knowledge and skills in the field of mental health promotion, social relationships and suicidoprophylactic.

The training of students, soldiers, Interior Ministry officials and others, it has included the acquisition of knowledge and skills to achieve good mental health and social skills for coping with stress and crisis situations.

Training of Trainers included training for teachers, school counselors, command of the Ministry of Interior and Ministry of Defense for acquisition of knowledge and motivation for mental health promotion and achievement of social skills, appropriate for their communities, as well as the timely recognition of predictors of suicidal behaviour. The training of trainers includes training of psychiatrists who in turn train general practitioners and other medical specialists in mental health promotion and suicidoprophylactic.

Support for the opening of persons with warning signs of suicidal behaviour and the steps to be taken in case of risk for suicidal behaviour. This includes the timely diagnosis of subjects with depression and other psychiatric disorders, as well as persons with behavioural features, such as making a will, handing out expensive items or ambiguous or vague statements about the future. This includes the identification of persons with alcohol problems, drugs, socio-psychological problems.

The ensuring/facilitating access to relevant health, social and other services and specialists

to provide adequate assistance to persons in distress, a crisis, involves dissemination of information on existing services and specialists at national and regional/municipal level. The most important problem that is associated with the use of these services, is overcoming the existing stigma by changing attitudes towards suicidal behaviour, psychiatric services and mental illness. This applies also to the stigma, associated with visits to specialists, involved in suicidopreventive activities (doctors, psychologists, social workers, etc.).

Restricting access to means of suicide as a resource in the system of suicidoprophylactic based on these characteristics, determining the psychological attitude of suicidal patients: ambivalence, impulsiveness and rigidity. This applies above all to the most common method of suicide attempt - self-poisoning. This in turn requires statutory regulation of sales, respectively prescription of barbiturates, tranquilizers and other drugs which pose a real or potential possibility of withdrawing one's own life. Established upward trend in the use of firearms, especially young men, requires the application of appropriate prevention activities among conscripts and personnel to the Ministry of Defense and Ministry of Interior.

The secondary suicidoprophylactic includes diagnostic and therapeutic activities and interventions for timely and adequate take care of suicides in order to save their lives and ensure rapid and optimal recovery (physical and mental) immediately after suicidal experience. They can be summarized as follows:

- Emergency and emergency assistance, including life-saving interventions in intensive toxicological, surgical, neurosurgery, trauma, orthopedic and oth. compartments.
- Psychological and at need psychiatric interventions to get out of the acute phase.
- Conduct adequate therapeutic procedures, both in terms of the impact on the used method (poisoning, liver damage, bone damage, etc.), and in relation to any accompanying illness (cancer, psychosis, diabetes, AIDS, addictions and more.).

It should be in mind that suicides are free to leave the health facility whenever they want, or to refuse to accept, many of the so-called "mild" cases do. Therefore the aim is to achieve so-called "informed consent" of suicide for follow-up and implementation of medical and psychological interventions.

Tertiary suicidoprophylactic among activities prevent subsequent suicide attempt and correction/ compensation of long-term consequences and complications of suicidal action and limit the possible disability, includes activities of tolerant re-socialization, i.e. acceptance of suicide back into the social environment (family, work, friendly). This includes activities for risk assessment for subsequent experience.

Parasuicides[1] are population at increased risk for suicide attempt, they are the population group that is well demarcated from the rest of the population. In determing of persistent another topical issue such as abuse of alcohol, drugs, medication, they should focus on units to care for persons with such problems.

REFERENCES

1. Assessment Program for sanitary enlightenments in area of mental health. Copenhagen, VOD, 1975, 50. (in russ.)

2. Health Act. SG. 70/2004, Ch. Five Mental Health, Sect. I Protection of Mental Health, 54-58. (in bul.)

3. **Herring, Ch.** Mental Health. In: Occupational Medicine, Ed. J. La Dou, N. Y., 1987, 179-186.

4. **Hodgson R., T. Abbasi, J. Clarkson.** Effective mental health promotion: a literature review. Hlth. Educ. J., 1996, 55, 54-74.

5. **Milenkov, K.** Basics of psychohygiene and psychological treatment. In: Manual of Psychiatry, ed. Chr. Christozov. S., Med. and phys., item 1, 1987, 216-223. (in bul.)

6. **Milenkov, K., L. Tsoneva-Pentcheva.** On suicide in Bulgaria and basic issues of suicidoprevention. Modern medicine 1, 1994, p. 3-8. (in bul.)

7. **Mulder, J. D.** Attempted Suicide: Implications for the General Practitioner. . In Attempted Suicide in Europe. ed. by A.J.F.M. Kerkhof, A. Schmidke, U. Bille-Brahe et.all., DSWO Press, Leiden University, The Netherlands 1994, p. 279-286.

8. **Naydenov, T.** Why and how committed suicide bularians. S., Super 7, 1992, p. 60. (in bul.)

9. Preventive medicine and public health, ed. **Cassens B. J.**, Mental Health/Mental RetardationHerring C. L., 180-200, J. Wiley/Sons, N. Y. 1987, p. 358.

10. Priorities for collabouration with countries of Central and Eastern Europe in the field of mental health, Copenhagen, WHO, 1991,170.

11. S**chmidke, A., U. Bille-Brahe, A. Kerhof et all.** Sociodemographic chararacterisitcs of suicide attempters in Europe. In Attempted Suicide in Europe. ed. by A.J.F.M. Kerkhof, A. Schmidke, U. Bille-Brahe et.all., DSWO Press, Leiden University, The Netherlands, 1999, p. 231-243.

12. **Stancheva-Popkostadinova, V.** Psychohygiene and psychoprophylactic treatment. University Press "Neophyte Rilski", Blagoevgrad, 2004, p. 203. (in bul.)

13. **Tsolova, G., St. Zlatarev.** Road transport accidents in the European Region, Social Medicine, 2002, 3, p. 28-31. (in bul.)

14. **Tsoneva-Pentcheva L.** Prevention program for suicidoprophylactic in Bulgaria. Condition and prospects. in Vol. Prevention of suicide in period of transition - opportunities and difficulties, ed. Military Publishing House, Sofia, 2000, p. 7-21. (in bul.)

15. **Tsoneva-Pentcheva, L.** Suicide Prevention Program in Bulgaria - Mental Health Reforms, vol. 5, 2000, p 16 -18.

16. WHO - Approaches to stress management in the community setting - EUR/ICP/PSF 028,

17. WHO - EURO Multicentre study on parasuicide - EUR/ICP/PSF 018, 1993.

18. WHO Changing paterns in suicide behaviour - EURO Reports and studies N 74, 1982, ICP/MNH 036 (1).

19. WHO. Preventing Suicide: a resource for primary health care workers. Mental and behavioural disorders. WHO. Geneva.2000, p. 21

4. DOCTORS - RISK FACTORS FOR MENTAL HEALTH, SUICIDES AND PSYCHICAL DISORDERS. R. Nikolova

Stress and depression

Doctors as a professional group are threatened in a considerable degree of development of the syndrome of burnout, phenomena of addiction and suicide, than other professional groups. The high workload and extended operating time serve as indicators of growth in the profession. But doctors are often highly away from health advices that give to their patients. Burnout syndrome is nowhere as prevalent as in the healthcare system. Long before it became known that concept, in the 70s in hospitals in the United States saw the first studies vicious circle of excessive work and of the influence of their own as well as foreign overload.

Workplace stress and syndrome burnout is the focus of attention of the authors of a number of research studies over the past two decades (in previous studies on emergency physicians, focus is not to measure the stress level, but to define "career contribution" and the level, to which doctors from emergency planning for reach to practice this specialty).

In a study of emergency physicians in Los Angeles indicated that 60% give information about the medium to high emotional exhaustion rate and 78% medium to high depersonalization.

The data also indicate that there are some differences in the sexes - women indicate higher levels of stress and depression than men. It is noted that women experience more load in their social life and often fall into role conflict, by trying to balance the requirements of his career with the demands of home. In addition to the professional stress women also experience stress related to discrimination in the workplace. Some studies, however, show that married individuals experience less stress than no married.

American Medical Association (AMA) provides that every year due to retirement, death or withdrawal from practice, of the system will withdraw about 3% doctors. Currently this rate is 12% - 4 times more. These data are even worse if you consider the years of practice for doctors of emergency. AMA believes that years of practice (on average) for 35 years should be 33-36, and 50 year old physician practice is 19 to 22.2 years.

The results indicate that stress and depression in doctors, and especially at emergency physicians are more prevalent than in other specialties. Moreover, the percentage of physicians who plan to leave their specialty within one year was significantly higher than in other medical specialties. In the same way it is with those who think to leave in the next 5 or 10 years.

Almost all doctors operate longer than the rest of the population. Work in shifts of 24 hours or more proof of the load and psychological endurance in the profession. Representative survey of the Austrian Medical Association reported average weekly working time of 59 hours. Every sixth doctor was with more than a hundred hours weekly working time. As time consuming is considered primarily responsible for the management, documentation and treatment. "Quality and quantity" of load may lead to burnout. It could be said that to some extent, pediatricians and obstetricians because of the frequent positive experiences at work are almost "immune" from this syndrome. On the opposite site are oncologists and psychiatrists who are more at risk from the effects of the workload. Doctors in leadership positions are less affected by longer working hours than those, exposed for prolonged periods during bad guide, department. Frequent night duties act as a risk factor for clinicians, in general practitioners risk factor is missing contact with colleagues.

The workload in the profession offset by a significant part of doctors by smoking, alcohol and/or taking psychopharmaceuticals. Health regulations that give for their patients, they do not always apply to ourselves. If they do not feel well, resorting to "self."

Unlike the attendants, that in burnout change their profession or leave work, doctors often suffer long.

In highly committed to their work, but exhausted doctors observed that mostly men - doctors, reducing the level of emotionality and they can not relieve their feelings into words during psychotherapy. Communication, especially dealing with conflicts in such cases failed. The idea that only patients are ill, placed doctors a certain distance from their own state and they do not take seriously the warning signals. Burnout - syndrome often accompanies them with alcohol or medicine addiction, and/or with the two dependencies. Many are working to failure and exhaustion, before agreeing to help.

Suicide

Suicides at physicians is often underrated problem. The Royal College of Physicians presents in 1995 data on suicides of doctors in the UK, indicating elevated double and even data showing that physicians in the number of suicides compared to that in the general population is three to four times higher. In most studies are indication as 28 to 40 cases per 100,000 doctors, compared with 12.3 cases in the general population. This phenomenon is examined

from the 60s of last century, but there are still many open questions, for example depending on age. There are conflicting results whether different medical specialties show different suicide rate.

In summary it can be said that suicides are carried out in all medical groups, no matter practitioner or a specialist, rural doctor or university professor. Often statistical suicides in large groups (practitioners, internists or surgeons) are more often than focusing on smaller groups (dermatologists), because the output data are different. In many trials, data so that psychiatrists have shown the highest suicide rate, and pediatricians - lowest suicide rate. These statements have not been confirmed as the results of the meta-analysis showed no statistically significant differences in the risk of suicide depending on the specialty.

The causes of suicide are of different types and nature no doubt this applies both to doctors and to the entire population - a larger percentage of suicides are carried out on the basis of existing mental illness, such as in addictive disorder, affective disorder, psychosis or incurable illness. But it is also found that problems relating to adaptation, conflict relationships and suicide attempts in the past, to increase the risk of committing suicide.

Despite the presence of mental illness in professional practice and activity there are factors causing suicide. Here are assigned, system isolation and criticism from colleagues. Also reproachs, unfavourable course of medical treatment or financial needs in the clinic or practice can lead to suicidal thoughts or to such acts.

Dependence

Increased risk of dependency has long been known in the professional group of doctors, but they develop in them a lot of hidden, due to their social situation and work associated with increased contactability, processes of protection and suppression. This leads to extended development of the dependence and often ends with suicide.

Alcohol dependence. Increasing relevance acquires spontaneous and uncontrollable alcohol-related lifestyle. The role of physicians as an example for society in terms of their way of life and as experts in prevention of diseases associated with alcohol dependence is a major.

In a survey on subject of the American Medical Association (AMA) in 9600 doctors, but about 6% of doctors admit to abuse alcohol at some point in their life. In connection with problem drinking among doctors is so broad range of the number of doctors who have such a problem: 6-8% in the US and 12-16% at Norway and Finland.

With increased risk are men - doctors over 40 years from Finland and around the age of 45 in Norway. This result seems surprising considering that the background of the general population (at least in Finland, Norway and Germany) older people drink less. This is explained by the fact that younger doctors emphasize the dangers of alcohol, leading to the realization of the risk of excessive consumption.

There is also a good opportunity to protect doctors from dangerous use of alcohol because doctors as a professional group tend prevention, including programs for refuse of alcohol addiction, more than the rest of society.

Medicine dependence. Since doctors have access to drugs, known long ago that drug dependence in the professional group of doctors is common. Studies have found that doctors use 50 percent over the comparable year trend of taking benzodiazepine of the total population, but it should be noted that regular use can not be put on a par with drug addiction.

Drug dependency. There is no reliable data, but the US has been found in recent years increasing dependence on opiates by doctors.

Nicotine dependence. Nicotine in doctors is the second most common addiction after in alcohol, in this, however, in a lesser extent it is known to smoking among physicians than their dependence on other addictive substances. Nicotine dependence, however, is lower than for the general population.

Doctors with addiction in Germany few reported occupational difficulties. A small number of them is prohibited medical practice or were warned about dismissal.

Psychical disorders

Mental symptoms such as depression or burnout syndrome grew significantly based on the specific stressor factors characteristic to the medical profession.

Data on the development of burnout syndrome as a state of chronic emotional exhaustion, mental fatigue, depersonalization and reduced performance show that more than a quarter of doctors are at risk of burnout or already experienced similar complaints. Affected doctors suffer from emotional exhaustion as a result of continuing professional activity. Such complaints are manifested also in dissatisfaction with work and life in general.

Factorial depending on symptom of withdrawal or distancing develops in higher percent rate for doctors in hospitals. Undetermined is the influence of age on factors exhaustion. It is highly influence the duration of weekly working time on fatigue factors.

Doctors as a professional group usually diagnose and treat themselves and when they need help not use ordinary programs for health care, and seek ad-

vice from colleagues. Doctors generally reported more depressive symptoms and their emotional malaise is often complicated by excessive intake of drugs.

Similar ailments, along with other mental and psychiatric problems, require psychiatric and psychological treatment. Untreated mental health problems affect negatively the quality of work of the physician, problems with patients, health services and society as a whole. Avoiding professional medical attention by doctors is the result of various causes - the problem is considered minor, reluctant to take the role of a patient, lack of confidence in psychiatry or psychiatrist.

REFERENCES

1. BMA - British Medical Association. Morbidity and Mortality of the Medical profession. London: British Medical Association; 1993.

2. **Calnan M., Wainwright D., Forsythe M., Wall B., Almond S.** Mental health and stress in the workplace: the case of general practice in the UK. Soc Sci Med, 2001, 52, 4, 499-507.

3. **Harrison D, Chick J.** Trends in alcoholism among male doctors in Scotland. Addiction. 1994, 89, 12, 1613-7.

4. **Keller K., Koenig W.** Management of stress and prevention of burnout in emergency physicians. Ann Emerg Med, 1989, 18, 79-84.

5. **Levine R., Bryant S.** The Depressed Physician: A Different Kind of Impairment. Hospital Physician, 2000, 2, S. 67-86.

6. **Loffler S.** Die Krankheiten der Heiler. Heureka 5. http://www.falter.at/eureka/archiv/03_5/14.php, 2003.

7. **Mäulen B.** Suizide bei Ärzten. Münchner Medizinische Wochenzeitschrift, 2002, 144.

8. **Nikolova R.,** Assessment of functional status of employees of specialized hospital for physiotherapy and rehabilitation. Scripta Periodica, Vol. X, 2007, 4, 38-42.

9. **Nikolova R., Tsacheva N. Vukov M.** Investigation of autonomic cardiovascular regulation in workload. Scripta Periodica. Medical Review. 2003, 2, 36-48.

10. **Ramirez A., Graham J., Richards M., Cull A., Gregory M.** Mental health of hospital consultants: the effect of stress and satisfaction at work. Lancet, 1996, 8, S. 724-728.

11. **Silverman M.** Physicians and suicide. In: Goldman, L. (Hrsg.) The handbook of physicianhealth. American Medical Association, Chicago, 2000.

12. **Tőyry S., Kujala S., Juntunen j., Kalimo R., Luhtala R., Seuri M., Husman K.** Self-reported health, illness, and self-café among Finnish physicians: a national survey. Arch Fam Med, 2000, 9, 10791085.

13. **Tyssen R., Vaglum P.** Mental health problems among young doctors: an updated review of prospective studies. Harv Rev Psychiatry, 2002, 10: 154-165.

K. Ljubomirova

13 PERSONAL HYGIENE, HEALTH EDUCATION AND BEHAVIOUR

Personal hygiene is a part of general hygiene, which develops scientific rules and norms of life, associated with maintaining and enhancing the health of individuals by observing certain hygiene requirements and a healthy lifestyle. Compliance with basic hygiene rules of privacy are also attached to the preservation of public health. The personal hygiene of workers in healthcare, public nutrition, water, education and other fields dependent health of the majority of the population. From compliance with certain standards and rules for a healthy life depends to a large extent and prevention of a number of social significant diseases - gastrointestinal, cardiovascular, hypertension, diabetes, obesity.

1. HEALTH CULTURE AND BEHAVIOUR

According to WHO (epidemiological studies in the US and Western Europe in recent decades), health status of the population is determined in 50% of the conditions and lifestyle, in 20% of the state of the environment, 20% of the genetic factors and about 10% of the organization in the healthcare of the population. Proceeding from this, health prevention should be focused on the following areas:

1. Promoting a healthy lifestyle.
2. Optimization of the living environment.
3. Antenatal prevention of genetically transmitted diseases.
4. Modern healthcare of the population with preventive focus.

Crucial to the health of the population are the first two areas, but until the condition of the living environment is a global environmental problem and generally hygienic, the way of life is a problem of the individual.

Large-scale studies of American authors on the etiology of health in humans lived to 80-85 years in good health and well-preserved performance, allowed to formulate the following rules that **characterize a healthy lifestyle**:

1. Regular 7-8 hours of sleep daily.
2. Rational nutrition with a maximum variety of food products without overfeeding.
3. A daily breakfast.
4. Maintain a normal body weight.
5. Optimum exercise, best combined with hardening treatments.
6. Complete abstinence from smoking and drugs.
7. Avoid alcohol and drugs abuse.

Regime of work and rest. It is determined by daily alternating sleep, work, rest, meals and other activities in a particular sequence and rhythm. If these activities are repeated daily in the same rhythm builds life dynamic stereotype. It is a system of conditional reflex connections for optimal performance of these activities, with minimum energy consumption. For a full night sleep is considered lasting 7-8 hours, beginning at 22 hour. The optimal setting for sleep include quiet, moderately warm room with fresh air. Dinner should be taken at least 1.5-2 hours before bedtime. The food for dinner should be light without irritating spices and exciting the nervous system agents.

Labour activity should be performed on work places with optimal environmental conditions. Particular attention required characteristic of many modern professions mental-neurosensory work associated with high risk of tension, stress and immobilization. In this type of work it is important for proper rotation of the activity and breaks. Daily, weekly and annual rest must be active in engaging systems and organs no participating in the labour process.

Rational nutrition is extremely important in the whole regimen of life. Compliance with the type of metabolism and physical activity for person could increase efficiency and prevent a number of chronic social diseases leading to early disability and no working capacity.

Alcohol abuse and smoking are totally incompatible with healthy lifestyle. Applied in recent years, legislative measures to restrict or ban smoking in public places will help to reduce the risk of harmful health effects both in smokers and in people exposed to passive smoke.

2. PHYSICAL ACTIVITY AND HARDENING. SEXUAL HYGIENE

Everyday life of modern man is characterized by low physical activity and related adverse health effects. According to some studies between 9 and 16% of deaths in the United States are due to diseases caused by immobilization, and a sedentary lifestyle. In Europe, approximately 37% of men have low physical activity. If this rate is reduced to 25%, of deaths will decrease by 3-6%. Persons who since childhood have occupy with physical exercise have a more massive and less brittle bones and rarely suffer from osteoporosis in adulthood. Women who before menopause increase their physical activity for more than one year have reliably increase bone density and reduce the risk of bone fractures.

Physical activity and healthy feeding are some of the most important factors for a full life. People who are physically active, less likely to suffer from chronic diseases - coronary heart disease, high blood pressure, stroke, osteoporosis, non-insulin dependent diabetes. Regular exercise assisting the immune system and reduces the risk of colon cancer, improving mood and self-esteem, have beneficial effects on metabolism.

Physical activity does not mean only exercising, various kinds of sports. These are all types of physical activity: walking, housework, gardening, dancing. Increasing physical activity is achieved by changing the sedentary lifestyle with daily exercise.

Recommended 20-30 min of aerobic exercises three or more times a week and exercises, loading muscles - at least 2 times a week. If it is not possible to implement this scheme, has positive health effects moderate physical activity of 30 minutes, no less than 5 times a week. In the event that it can not exercise every day, some days can be given longer load, but total weekly need to collect at least 150 minutes of physical work.

With physical exercise should be gradual, to choose sports that pleasure, be exercised in such a time of day, that is comfortable and match the rhythm of life of this man. Exercise should be regular and after their completion recovery period should last no more than 10 min, otherwise the body is overloaded.

Whatever the purpose of physical activity - reducing weight, fight stress or just maintain good health, exercise is a good approach. They have become part of everyday life of modern man.

Adults should spend a week in 2000-3000 kcal through sports. Achieved by walking, cycling, jogging or other types of intensive exercise. All this will lead to weight control and strengthen the legs, shoulders and entire body.

Engage in physical activity are especially important to health in connection with the advent of more and more professions, associated with prolonged computer work. Computing is accompanied by static tension of a limited number of muscles, mainly for maintenance of working posture. It takes place against the background of limited physical activity - hypokinesia. It is one of the global negative effects of scientific - technical revolution and is characteristic of so called "sitting professions".

Chronic hypokinesia caused primarily untraining of the cardiovascular and the musculoskeletal systems. Their capacity gradually decreases. Simultaneously, hypokinesia potentiate the development of fatigue in the body.

In terms of hypokinesia tone of blood vessels declined. Blood flow in arteries and blood flow from the veins to the heart is impeded. The volume of circulating blood decreases. The functional reserve of the central and peripheral circulation becomes more limited. Lowered adaptive capacity of the cardiovascular system are a prerequisite for a number of disease states.

Hypokinesia causes dystrophy of the muscles, reduce muscle mass and strength, disturbances in phosphorous - calcium metabolism in bone tissue, generalized disorders in neuro-psychic and motor performance, in regulatory mechanisms, in the central nervous system, endocrine system and others.

Besides already described overall and visual fatigue in the body of people working with computers for a long time, arises and local dynamic and static fatigue. The first is due to work with the keyboard, and the second - because of fixed working posture.

Following prolonged sitting of non-ergonomic office chairs and poor posture appears tension of the cervical and dorsal muscles with subsequent pain. Fixed posture with forced position of the head, neck and upper limbs is a cause of various subjective complaints of discomfort and fatigue.

Disturbances in visual functions could reflect and negatively affect the functions of the brain. As a consequence are possible neuro- psychical and somatic disorders. Among programmers observed increased tendency to experience strong negative emotions, more frequent occurrence in them of neurasthenia and depressive reactions.

The observed changes usually occur during prolonged work with computer (daily, more than 2 hours). Episodic discontinue work may cause some subjective complaints, but not enough reasons to believe that it adversely affects health.

Hardening includes a system of actions aimed at

increasing resistance to sudden changes in weather conditions. Hardening is the best prophylactic against colds, starting from childhood and last a lifetime. Hardening is achieved through rational effects on the body of natural factors air, water, sun. The basic principles for the conduct of hardening are:

1. Graduability - gradual transition from weaker to stronger stimuli, gradually increase the time and intensity of the impact of relevant factors.

2. Systematic and continuity - hardening should start from an early age and continue without interruption throughout life. Upon termination of the impact of a factor for some time, hardening procedures must start over, as hardening reactions to this factor gradually reduced and sensitivity to it increases.

3. Complexity - the application of a variety hardening factors and procedures in complex, since in this way the impact on the body is stronger.

4. Individual approach - hardening procedures must be performed under medical control, which takes into account the age peculiarities of the organism, functional capabilities, the individual reactivity and health.

Ignorance of basic rules of hardening, poses serious health risks and may have the opposite of the desired effect.

Air is the most mild factor, at which starts hardening. Air baths can be made at any time of the year, outdoors in the summer or in well-ventilated areas during the winter. Hardening baths with air starts when the air temperature about 20 °C for 10-15 minutes initially, rising to 1.5 to 2 hours. The duration is adjusted depending on the response of the organism. The intensive trembling, signals the excessive length of the air bath.

Hardening of water is done by rubbing body parts with a cloth moistened with lukewarm water, by pouring with water on parts of the body or the whole body for 1 -2 minutes, or cool shower. The water temperature should first be 20-22°C and gradually decreases. Bathing in open water swimming is strongly hardening effect as using a complex of factors: temperature and pressure of water, air, solar radiation, vigorous movements in swimming. Even stronger impact has so-called contrast hardening - alternating Finnish bathroom with dry hot air and bathing in ice water. This procedure, however, should be used with caution in people with cardiovascular disease.

Sunbathing are another type hardening procedure. It is best to take place in the morning hours - from 8 to 11 hours and in the afternoon after 16 hours, in order to avoid strong exposure to ultraviolet radiation and heat.

Required at time outdoors, especially sea and mountain, is the use of sunscreen cream with the size of UV filters, tailored to skin type (light, dark). This is necessary to prevent early (redness, burning) and late prejudicial effects (pigmentation, cancer) of ultraviolet radiation.

Sexual hygiene* is a part of personal hygiene and consider all matters related to normal sexual activity of man. The latter is a natural manifestation of every mature and healthy individual. They largely depend on self-esteem, health and performance of the individual. In various disturbances in sexual activity they are violating the physical, mental and social well-being of the individual. This puts the normal sexual activity of a mature man as a mandatory element of a healthy lifestyle, providing full health.

The scope of sexual hygiene includes a number of issues related to:

1. Hygiene of genitals.
2. Hygiene of sex life.
3. Antenatal hygiene.
4. Sexual hygiene in different ages.
5. Prevention of some factors damaging the reproductive system.
6. Prevention of unwanted pregnancy.
7. Prevention of diseases transmitted sexually.

Antenatal hygiene consider issues, connected with of conceiving a healthy and viable fetus. It is particularly important at the moment of conception the couple be in good health and not be subjected to any toxic effects.

Onset of menstruation and ejaculation shows that there has been sexual maturity, but that does not mean that the girl and the young man reached his full body maturity. This occurs much later: the girls to 17-18 years and in adolescents - at 19-21 years of age. Sexual activity among young people should be initiated after their complete physical and mental maturation. Appears to be a period of several years during which the young person experiencing sexual needs, but should refrain. Often as a physiological substitute for sexual activity during puberty are nocturnal seminal emission (pollutions) in adolescents. In a number of cases and rarely girls resort to masturbation. It does not have any harmful effect on the body and psyche, as erroneously thought until recently.

Bulgarian boys and girls begin to communicate sexually usually after 16-17 years of age. Due to low sexual culture, however, Bulgaria is among the leading countries in the world in frequency of artificially interrupted pregnancy. This shows that our youth know very little about how to protect themselves from

* B. Popov

unwanted pregnancy. Surveys in Bulgaria show that only 8-10% of children receive the necessary knowledge about the intimate lives of their parents and 20-30% of their teachers. The remaining 50% learn these "truths" of their friends, classmates and from direct observations on the life of their surroundings.

Hygiene of sex organs is an element of hygiene of the body and is a condition for a healthy sexual life. External sex organs are associated with urinary tract and are therefore exposed to contamination. Moreover, they are delayed of so-called smegma, formed by urine, sweat and skin flakes. When it does not wash away, it becomes a nutrient medium for micro-organisms, which cause inflammation of the mucosa of the urethra, and when sexual intercourse is possible to transmit and the partner. Therefore requires regular washing in both sexes without soap, which irritates the delicate mucosa of genitals. The washings of the vagina are not necessary due to irritation. Not recommended the use of intimate deodorants, due to irritation of the spirit they ingredient.

During menstruation are advised to abstain from sexual intercourse because of the real danger of infecting both the woman and the man. In pregnancy due to the risk of infection in the generative roads, coitus should be stopped 4-6 weeks before and after birth.

In no event should not plan the days and hours of sexual intercourse, but normally it is done spontaneously, naturally, by mutual desire. Frequent intercourse without a corresponding attitude and necessity, so-called forced coitus is a non-physiological as soon leads to nervousness than to discharge. From the hygienic point of view there is no age limit up to be sexually active.

Currently there are'nt any standards for frequency of intercourse. The measure is created from each pair, in accordance with individual sexual needs. Even in ancient times Hippocrates recommended normal sexual intercourse to 2 times a week. Usually, most women want intercourse less frequently than their husbands. In some marriages, sexuality is a major cause of disputes. Most often the man became rude and irritable if his wife refuses sexual intercourse. Of course, in any case must be taken into compromise to maintain sexual harmony in the family.

Women experiencing menopause around 50th year. Age reduction of sexual desire (libido) in women usually occurs after the 60th year. For men in the true sense no climax, but most of them age around 45-55 years experiencing a critical period in which they are unstable and have a sense of inferiority. The man after 50-55 th year potency decreases somewhat at the expense of libido. This conflict between reserved libido and decreased potency in some cases lead to a breach in the psyche of the man. The decrease in potency in the aging man is usually conditioned mental and not by age. In many cases, men remain preserved potency and after the 70th year.

An important element of the sexual hygiene is good knowledge of the normal ongoing intercourse. To be fully and completely satisfy the sexual needs of men and women, sexual intercourse should include four phases: excitement, plateau, orgasm and relaxation.

Phases described in the course of sexual intercourse with some partners are not always obtained, and some never achieve. In studies of authors in different countries found that in almost 50% of women rarely reach orgasm, while more men have serious problems with potency. Sexual disorders occur in three ways:

1. Sexual desire (libido) may be reduced or absent.

2. The performance of coitus be embarrassed or impossible.

3. Sexual satisfaction (orgasm) may be imperfect or not occur.

Libido disorders, and orgasm are mostly women, and interference in coitus - mostly men. The most common causes are psychogenic. In most cases it is a mental and physical strain, alcohol abuse, smoking, inexperience in sex and others. The best prevention of these disorders (they normally are not diseases) have a healthy lifestyle and regulated sexual activity.

3. HYGIENE OF SKIN AND ITS APPENDAGES

The skin is a complex organ that covers and shapes the body, protects the body from various external factors and ensure consistency of its internal environment (homeostasis).

As regards the external environment skin has a protective function. It protects the body from mechanical, physical, chemical action, prevents the penetration of biological agents (viruses, bacteria, fungi). Water-lipid layer protects the skin from the weather (dry, over moist), prevents the penetration of chemicals and acts bactericidal. For antibacterial action has importance acidity of the skin (pH 5.0-6.0), presence of saturated fatty acids C 8:0 - C 16:0 and dicarbonic fatty acids. The continuous peeling of the stratum corneum removed emptied microorganisms.

Other important factors of the skin are: thermoregulation, sensory, secretory, immunological, hormonal.

Skin and its appendages (nails, hair) are subject to

various external adverse effects such as temperature, humidity, air movement, sunlight, dust, microorganisms and other. Measures for their reduction or elimination and to improve the physiological functions of the skin are subject to personal hygiene. The means to be applied on the skin and its appendages with hygiene, safety and aesthetic purpose and resulting in improved her appearance are called cosmetic.

Skin hygiene. The exposed parts of the body that are exposed to dirt, dust, and settlement of various microorganisms should be washed every day with water and suitable soap. Frequent washing helps separation of microorganisms, dust and pollution and contributes to the normal elimination of horn cells. Slimy skin suits more often wash with cold hard water and soap, while dry is more gentle and sensitive of these procedures and requiring the use of indifferent greasy creams after washing. After washing or bath the skin should be dried well with a clean, soft cloth. The frequency of the baths depends on the dust and environmental pollution. More frequent should be washing your hands, feet and large folds.

Hygiene of hair. Better hygiene for hair of capilus supported when it is short and on beard - with of frequent shaving. Frequent dress hair with a suitable comb, cleansing of dirt, improves its oiliness and trophic skin. The washing of the hair should be performed 1-2 times per week. Frequent washing leads to increased seborrhea. Any color of hair hidden potential for sensitization and development of dermatitis.

Hygiene of nails. It involves regularly trimming their to height of the top of fingers and cleaning with brush to free edge when washing. Toe-nails should be cut in a straight line to avoid trauma to the lateral nail shaft when wearing tight shoes. Eponychium determines the smoothness of the nail plate and must not be cut.

Oral hygiene. Includes brushing with a toothbrush and toothpaste morning and evening, while retaining the food remains between the teeth after every meal. It is useful to use and the so-called mouthwash with antibacterial action and prevention of periodontal problems.

Besides water maintaining personal hygiene of skin and hair is done with different **detergents and cosmetics**. Detergents are substances to remove dirt from the surface of solids. The concept detergent derived from Latin. Deterge - cleansed, purified.

Soaps are sodium or potassium salt of stearic, oleic and other acids with the addition of filler and perfume compositions.

The washing effect of soap is explained by the surfactant character. Its molecule has a specific structure with one end is hydrophilic and the other - hydrophobic. Soap molecules are able to orient and adsorbed (retained) on the surface of contaminated objects and help to remove the dirt, as visible, as well, invisible - as radioactive substances, microorganisms and others. Since the middle of last century, because of a shortage of natural materials in bits requires the use of synthetic detergents. They are surfactants and other auxiliary additives.

In addition to cleaning, cosmetic products intended for perfuming, changing the appearance and/or correction of odors and/or protecting and maintaining healthy skin and its appendages.

Today, with the rapid development of the cosmetics industry, users daily come into contact with a large number of cosmetic products. The resulting health risk associated with the use of preservatives and perfume compositions, some of which are known for sensitizing properties (parabens, bronopol, formaldehyde, linalol, geraniol, etc.). So higher risk of developing allergies exist for consumers using often a large number of cosmetic products as well as those with atopic predisposition. Another health risk when using a large number of cosmetic products follow from the fact that some of them contain substances classified as category 3 mutagens and carcinogens (proven effect in animals and insufficient human data). Such substances may be contained in the hair dye (m-phenylenediamine, naphthalenediol), in perfumes, nail varnishes (phthalates) and products containing substances or combinations of substances which may lead to the formation of nitrosamines.

With the development of science and obtain information on the adverse health effects of exposure to certain substances, increases and legal restrictions on the use of such substances in cosmetic products.

4. HYGIENE OF CLOTHING AND SHOES

Purpose of **clothing** is to promote the normal course of thermoregulatory processes, to create favourable microclimate around the body, independent of the influence of external weather factors, to protect the skin from pollution by dust and pathogenic microorganisms, from direct action of the different types of radiation and mechanical injuries.

Depending on the different physiological characteristics of the organism, nature of work, the environmental conditions there are different types of clothing:

- Household clothes prepared for climate seasons and peculiarities of the time (winter, summer, to mid-latitudes, to the north, to the south);

- Children's clothing - lightweight, soft tissues, protect from cold in winter and overheating in summer;

- Professional clothing, consistent with working conditions, protecting from adverse and dangerous conditions (i.e. personal protective equipment);

- Sportswear - with different qualities depending on the types of sport (eg. swimming, athletics, high-altitude mountaineering, etc.) and the conditions of its use - race, training.

- Military clothing - with high requirements in terms of wear, easy cleaning, good absorbency, air permeability, retaining body heat and others. Different requirements here at parade wear, casual and work clothes, for pilots, sailors and other armed forces;

- Hospital clothing - for staff and patients, for surgical teams, working with sources of ionizing radiation, hospital clothing only once use and others.

The basic requirements for clothing are:

- Not to hinder the movements;
- Not to violate circulation and respiration;
- Not pressing internal organs;
- Is consistent with the conditions of the external environment;
- To be sustainable and not changing rapidly qualities when worn;
- To clean easy and well;
- Not be hampered dressing and undressing him.

The most important function of clothing is his involvement in regulating the body heat exchange with the environment. Between clothing and skin, there is an air layer, which is characterized by its microclimate, defining the status and nature of heat transfer. In order not to hinder the heat exchange, summer clothing should be free, a one- or double-layer and winter should be more tightly to the body, multilayer and to cover 90-95% of the surface.

The main characteristics of the tissues from which made clothing and that determine its hygiene importance are:

- thermal conductivity;
- air conductivity;
- absorbency;
- water capacity;
- transmission of radiant energy;
- lack of irritants.

Tissues with higher thermal conductivity are more suitable for hot months, but less - for cold weather. At thermal conductivity of air 1, thermal conductivity of woolen fabric is 6.1, and cotton and flax - 29.9. Air conductivity must be significant at high temperatures and minimal in cold and windy conditions. Absorbency of the tissue is determined by their ability to absorb water vapor from the outside air and underclothing space. Linen absorbency is a positive quality as it helps to absorb sweat from the body and to facilitate its evaporation, while for upper clothing it is undesirable.

Water capacity - in filling the pores with water tissues become more heat-conducting (water is 28 times more conductive than air) and cease to act as an insulator from the cold. Tissues with high evaporation rate of the water, for a longer time and a higher degree cooled body. With such properties are silk and linen fabrics as wool are low water capacity and slow evaporation. This makes them suitable for outerwear. Retention of body heat is supported by wearing warm gloves, wool scarf and hat. Staining of clothing is important for the absorption of visible and infrared rays. During the summer season are preferred clothing colored in bright colors, because they reflect the sun's rays and protect your body from overheating. During winter preferably dark clothes that absorb best heat rays from solar radiation.

Modern textile industry creates great choices of fabrics for clothing, and increasingly use artificial and synthetic fibers and their combination with natural. Artificial fibers in a number of physico-chemical and physico-mechanical properties are superior to natural. Their positive qualities are its high elasticity, resistance to deformation and laundry services, the impact of chemicals. They have higher air permeability. Along with this, however, synthetic fibers have a number of negative properties. Most polymeric materials accumulate high electrostatic charge (adhere to body, retain powders, etc.). Their low sorbtion properties limit their use of linen, some have a lipophilic properties and contribute to the retention of odors and difficult maintenance and laundry. Some of them are not sufficiently stable and produce initial products of synthesis. Furthermore, the polymers can migrate solvents, stabilizers, heat carriers, antielectrostatic preparations and products of their destruction. Some of these products, especially dyes are irritating and sensitizing effect.

Wearing clothing fouled by skin and dust, as significantly worsened his qualities - decrease air permeability, separated unpleasant odor, increased microflora. To avoid this, underwear should be changed daily and upper clothing to be cleaned regularly.

Hygiene requirements to the shoes: The shoes are designed to protect your feet from frostbite, immersion, injury, pollution and more. They contribute to the maintenance of normal form of the foot and its vaults. It is important for the statics of the body and movement. To fulfill its purpose, the shoes should be comfortable and made to measure of feet. Narrow and uncomfortable shoe prone to distortion

and deformation of foot, and cold weather can cause frostbite due to failure of the circulatory of legs.

The shape of the shoes must comply with anatomy-physiological peculiarities. The bones of the foot are arranged so as to form longitudinal and transverse vault. As a result, when walking foot rests on three points - the talus, the first and fifth metatarsal bones. This determines the springy of the foot and its periodic extension and shortening. When person with the full weight step of the foot, it shall be extended by 1-2 cm. The volume of the foot is changed in dependence on the temperature - especially in warm weather, because of the abundant blood supply in walking. These circumstances should be considered when choosing shoes, such as the internal volume and length of the soles should be slightly larger than the size and length of the foot.

Narrow shoes cause a number of other unpleasant consequences - incorrect position of the fingers (jam over each other)), formation of calluses, hemming and digging nails into the skin, creating conditions for the formation of deformities.

Of great importance are height, width and shape of the heel. The normal heel is with a height of about 2-3 cm. Such a heel contributes to the good springing foot in the longitudinal vault, of uniformly distribution of body weight on the entire foot. Excessive high heels alter the configuration of the foot, body weight carried mainly on the front of the fingers. This is unnatural and wrong, it requires a change of gait, bending the body when walking forward, reducing the step, associated with increasing fatigue, with deformed foot and modifying the configuration of the pelvic bones.

For hygienic value of the shoes are essential materials from which they are made. They should have good insulating properties, not to leak, be sufficiently permeable to air and are not hygroscopic. Leather shoes best satisfied those requirements, while those made of rubber and plastic sweating and closed feet in warm season because of its small air permeability and cold them in winter because of its higher thermal conductivity.

REFERENCES

1. **Bloomfield SF, Stanwell-Smith R. Crevel RWR, Pickup J.** Too clean, or not too clean: the Hygiene Hypothesis and home hygiene. Clinical and Experimental Allergy 2006; 36: 402-25.

2. Choice Framework for local policies and procedures 01-04: decontamination of linen for health and social care 2012 consultation draft. UK Department of Healthhttps: //www.gov.uk/government/uploads/system/ uploads / attachment_data / file / 148538 / CFPP_01-04_Social_care_Final.pdf.

3. **Curtis V,** Cairncross S (2003). "Effect of washing hands with soap on diarrhea risk in the community: a systematic review". Lancet Infectious Diseases 3 (5): 275-81. doi: 10.1016 / S1473-3099 (03) 00606-6. PMID 12726975.

4. Decree № 36 of the MH, SG. 101/2005 on the requirements to cosmetic products. (in bul.)

5. **Durmishev L.,** Dermatology and Venereology. Med. and phys., Sofia, 2001, 207 p. (in bul.)

6. Ecology and Health. ed. **F. Kaloyanova K. Basmadjieva, M. Popov.** Med. and phys., Sofia, 1985, 220 p. (in bul.)

7. Instruction № 34 of MH on the hygiene of sports buildings and equipment - Section V Hygiene requirements for equipment SG b82 / 1975, amended and supplemented 1984, 2002 (in bul.)

8. **Kolesov E.** Discourses on sex education. Sofia, i.p., 1988, 152 p. (in bul.)

9. **Molchanova, L.** Mode of life and health. Sov. health prot., 1990, 49, 25-30. (in russ.)

10. Ordinance on specific requirements for the placing on the market of detergents SG. 62/2004 (in bul.)

11. **Ouzounova St.** Clothing, fashion, hygiene. Med. and phys., Sofia, 1985, 70 p. (in bul.)

12. **Rumyantsev D. I., P. Vishnevskaya E. T. A. Kozlova.** General hygiene - Ch. XI Personal hygiene, 206-230; Moscow, Medicine, 1985, 432 p. (in russ.)

13. **Stankevich K., T. Bay** et al. Hygiene at using polymers. Kiev, Zdorovje, 1976, 143 p. (in russ.)

14. **Yordanova J., S. Yaneva, Bainova A.** Synthetic detergents in everyday life. Profizdat, Sofia, 1981, 109 p. (in bul.)

HYGIENE

VOLUME I

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EDITED BY

Prof. Dr. Dimitar Tsvetkov, DSci

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