OCCUPATIONAL HEALTH MANAGEMENT OF PESTICIDES INTOXICATIONS (A CASE REPORT)

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Summary. Pesticides use is related to risk of occupational intoxication during their production and application. The aim of the current publication is to present a case of a good occupational health practice in an enterprise involved in field application of pesticides. The health status of employees applying pesticides was investigated. Serum concentrations of liver enzymes and cholinesterase were determined. The results showed that because of the daily instructions of the employees and adequately chosen personal protective equipment, adverse health effects were not registered among the employees. The serum concentrations of the investigated indices (ASAT, ALAT and cholinesterase) were in the reference range in all samples. Health management of occupational intoxications is based on the good knowledge about the activities and safety use of pesticides, as well as the adequate personal equipment provided by the employers.

Key words: *pesticides, health risk, occupational intoxications, health and safety at work, prevention*

INTRODUCTION

Pesticides are chemical substances used in agricultural production to protect crops against pests. They help to achieve better quality and quantity of crops; however, they also are capable of causing occupational diseases in farmers [10].

The oldest known pesticides were natural organic matters such as pyrethrum, tobacco and petrol derivates. Later on, some non-organic substances were used (salts of arsenic, mercury, copper and zinc). The new era of pesticides has started with the investigation of the pesticides' properties of dichlorodiphenyltrichloroethane

(DDT) in 1939. Since then, numerous pesticides were synthesized. Nowadays, more than 60,000 formulations were produced out of 1,400 active substances.

According to their application pesticides are classified into 10 categories: insecticides, acaricides, nematodes, fungicides, herbicides, repellents, etc.

The chemical classification of pesticides accounts for more than 20 groups of substances: organophosphates, organochlorines, carbamates, dithiocarbamates, triazines, etc.

The most popular group is the group of organophosphates – 60-70% of all. Annually more than 20,000 tones are applied in Bulgaria. As a consequence – 83% of all diagnosed occupational intoxications were caused by organophosphate pesticides.

The main reasons for massive intoxications are: not obeying the terms of quarantine of a particular pesticide, disregarding safety and health rules, mistakes in application by plane.

Cases of acute pesticide poisoning (APP) account for significant morbidity and mortality worldwide, especially in the developing countries [6, 7]. There are no reliable estimates as to how many people per year suffer from pesticide-related health effects.

Studies in developed countries have demonstrated that the annual incidence rates of APP in agricultural workers are as much as 18.2 per 100,000 full time workers [2] .

Studies from developing areas in Central America (El Salvador and Nicaragua) have indicated an overall incidence rate of 35 per 100,000 for APP in the general population [5], and 17.8 per 100,000 occupationally-related APP in Thailand [4]. In Belize, it has been estimated that 17 pesticide poisonings per 100,000 residents and 4,142 preventable poisonings occur each year [9]. Previous research has demonstrated that reported occupational and non-intentional causes vary from 10% to 50% in developing countries [3]. The reason for this variation is unclear, but is likely contributed to an inconsistent recording methodology and lack of a standard case definition for an APP [3]. These variations may result in an underestimation of the true incidence of APP.

The occupational risk of intoxications exists for farmers and employees at enterprises for production of pesticides. Farmers could be exposed to pesticides while mixing, loading the pesticide, as well as while cleaning the equipment and disposing of empty containers. Other activities associated with exposure are sowing pesticide-preserved seeds, weeding and harvesting previously sprayed crops. During the first decades of using pesticides the main problem was the risk of acute intoxication among people occupationally exposed. With decrease in the toxicity of the pesticides, attention was turned to chronic intoxication and environmental contamination. Nowadays, the problem of diseases not immediately related to the toxic potential of pesticides gains increasing interest.

Prevention of adverse effects in the users requires actions to be undertaken in the pre-marketing and post-marketing phase of these products [8]. The pre-

marketing preventive actions are primary responsibility of industry and the public administration. The post-marketing preventive activities consist of the promotion of a proper risk management at the workplace. Such a management includes the risk assessment of the specific conditions of use, the adoption of proper work practices, and the health surveillance of the workers.

In regards to that, health and safety legislation in Bulgaria provides special requirements for safety use and application of pesticides. A system for advanced and current control on pesticides application and monitoring of the employees health exists.

The aim of the study was to present an example of a good occupational health practice in prevention of occupational intoxications with pesticides.

OBJECTIVES

An enterprise involved in the application of pesticides was investigated. The technology process and the pesticides used were studied. The existing risk assessment procedure and the adequacy of the risk management measures implemented into the enterprise were analyzed.

METHODOLOGY

The health status of employees working with pesticides was investigated.

The level of cholinesterase activity and the concentration of liver enzymes ASAT and ALAT were determined in blood samples.

RESULTS

The investigated enterprise was involved in pesticide field application. There were 10 employees – one agronomist (woman) and 9 men tractor drivers.

The age distribution of the employees was as followed:

– age group 25-35 years old – 3 employees

– age group 36-45 years old – 1 employee

– age group 45-55 years old – 5 employees.

The exposure to pesticide could be expected during mixing the active substances, loading the pesticide in the tractor container, as well as while cleaning the equipment and disposing of empty containers. The chronometry of the working activities showed that employees could be exposed to pesticides more than half of the working shift, i.e. more than 4 hours per day.

The analysis of the material safety data sheets and analytical certificates of the pesticides showed that the substances used belonged to the group of organophosphates. The main mechanisms of toxic effects are: binding to SH-groups; changes in enzyme's activity. Organophosphate pesticides influence cholinesterase through disturbing the hydrolysis of acetylcholine. This leads to accumulation of acetylcho-

line, i.e. endogenous intoxication arises. Signs of intoxication might be expected in decrease in enzyme's concentration more than 50% of the initial level.

According to the Bulgarian health and safety legislation the health status monitoring of employees working with such substances includes determination of liver enzymes and concentration of cholinesterase in blood samples of workers.

The results of the measurement of the concentration of liver enzymes are presented in Table 1.

Table 1. Concentrations of liver enzymes ALAT and ASAT in blood samples of investigated workers

Employee No	ASAT (0-45 U/l)	ALAT (0- 45 U/l)
1	31	56
2	21	16
3	21	22
4	22	26
5	16	17
6	30	33
7	11	10
8	44	25
9	20	23
10	25	19

It could be seen that the concentrations of liver enzymes were in the normal range – up to 45 U/l. Elevated levels were registered only in one worker who suffered from liver steatosis and obesity since childhood. A note for frequent monitoring of the liver function of that employee was given to the employer.

The results of the laboratory tests and serum concentrations of cholinesterase among the investigated employees were presented in Figure 1.

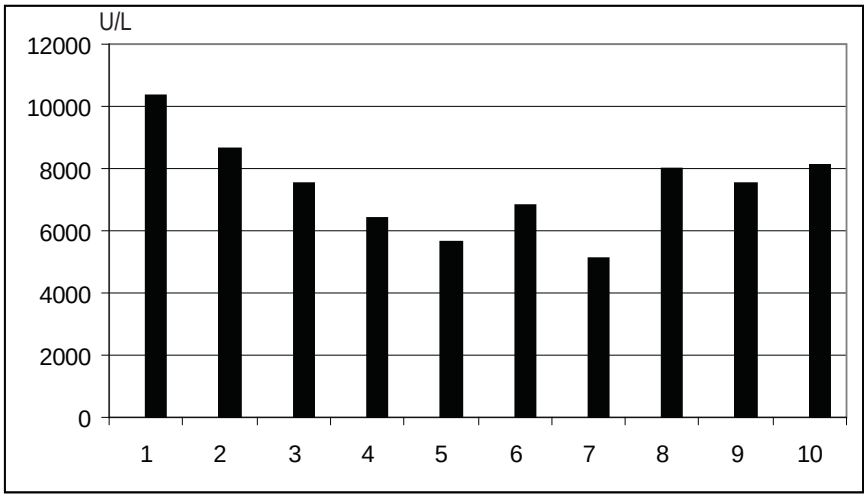

Fig. 1. Serum concentrations of cholinesterase among the employees working with organophosphates

The data of the laboratory tests showed that the concentrations of cholinesterase were in the reference range (3500-10 500 U/l) among all the employees. Follow-up monitoring of the concentrations was planned for the spring and summer seasons when an increase of the exposure was expected due to the specifity of the field work.

DISCUSSION AND CONCLUSION

In Bulgaria there are no precise and reliable statistics on the number of people occupationally exposed to and working at risk of intoxication with pesticides. Many cases of chronic intoxication might be missed because of misdiagnosis by health-care providers, lack of readily accessible health care in rural populations, exclusion of non-hospitalized cases and the fact that less severe cases of APP may not seek health care [1].

In order to prevent occupational intoxications due to chronic exposure, a good occupational practices and a contemporary health risk management must be implemented into enterprises producing pesticides, as well as involved in field application of pesticides.

The presented case report showed that though employees were exposed to organophosphates most of the working time, a good health management was performed in the enterprise. The main health risk reduction measures were: information about the risks of the applied pesticides, daily instructions of the employees for safety work, adequately chosen personal protective equipment, hygienic and disinfection means provided by the employer. The fulfillment of health monitoring of employees contribute to the early diagnostics of any adverse effects before intoxication develops.

REFFERENCE

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