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The Study of Risk Associated with Handling of Fertilizer in Workplace on Some Lipid and Hormone Parameters

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Abstract: The complex storage and distribution of agricultural fertilizers manufactured phosphate and nitrogen fertilizers operated by farmers to increase crop production and the national economy. Mineral fertilizers NPK contained nitrate, phosphate and potassium are manufactured under conditions of bad hygiene which workers are exposed to workplace by inhalation at several toxic agents such as phosphate and nitrate derivatives. In front these conditions, we focused on the study of risk associated with the handling of fertilizers at the NPK unit to determine their potential effects on some lipid and hormonal parameters. *A* study was conducted on 34 employees of the complex, especially exposed to nitrate and phosphate derivatives. The employers' group was divided into two groups according to age. Blood Take during the medical visit, be allowed for the determination of lipid parameters, prolactin and FSH. The results of the lipid parameters, prolactin and FSH are within physiological norms.

Key words: NPK Fertilizers · Workers · Risk · Lipid Parameters · Prolactin · FSH

INTRODUCTION

Farmers and gardeners have used fertilizer, such as manure, guano and even fish for thousands of years [1]. Generally, the history of fertilizer and development revolves around the discovery and invention of certain materials and key processes. These concern the fixation of nitrogen in industrial ammonia, search for suitable catalysts, synthesis of urea, sulfur, phosphate, potash minerals, sulfuric acid and phosphoric acid [2]. The first synthetic nitrogen fertilizer is calcium nitrate, made in 1903 from the nitric acid produced by the electric arc method. In 1842, Sir John Lawes presented a method of treating phosphate with sulfuric acid to produce superphosphate, made by treatment of bones with sulfuric acid which was the first fertilizer produced by chemical processes, an effective fertilizer and early modern industry fertilizers began. The potassium fertilizer industry began in Germany in 1861 [1].

Fertilizers are added to soils to supplement the supply of inorganic nutrients required for plant growth in amounts necessary to eliminate the deficiencies that limit profitable crop and livestock production. The three principal nutrients required for plant growth are nitrogen, phosphorus « as orthophosphate » and potassium [3]. The fertilizer industry, broadly defined, is concerned to produce and supply these three nutrients needed for plant growth, which are the primary nutrients NPK elements which together account for 90% of world fertilizer consumption [4].

In the complex storage and distribution of agricultural fertilizers, NPK unit workers produce mineral fertilizers NPK, these are typically nitrogen, phosphorus and potassium (NPK). Some fertilizers manufactured also contain « Micronutrients » [5, 6]. Common chemical constituents of NPK fertilizers include urea, phosphoric acid, potash, ammonium phosphate, potassium chloride and potassium sulfate [5, 6]. The blend of fertilizer manufactured is customized to the crop. The fertilizer is partially polymer coated to allow slow release over the first few months of growth.

NPK fertilizers are widely used in home gardens and in agriculture in many countries [7].

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Occupational exposure to fertilizer was not without health consequences [8]. Indeed, pollution problems threatening not only human lives but also animal [9] and vegetal [10].

Concerning the work on the plant fertilizers workers, it was recorded that a higher blood and urinary cadmium levels of 7.8 and 10 times, respectively, those in a control population [11]. By holding account that in the NPK fertilizer of the mass concentration (mg/ kg), heavy metals (toxic part) is lower compared with other fertilizer [12].

Health symptoms associated with fertilizer exposure have been studied in fertilizer manufacturing plants and in agriculture. In both of these settings fertilizer exposure has been associated with contact dermatitis and respiratory health effects [13, 14]. Exposure to fertilizer is most commonly associated with contact dermatitis, Rahman *et al*. [15] and occupational contact dermatitis has occurred in both industrial and agricultural settings. A case of severe contact dermatitis in fertilizer factory worker was attributed to sensitization from nickel and cadmium in the fertilizer dust, Zhang *et al*. [16] a farmer's acute reaction was attributed to calcium ammonium nitrate in a urea fertilizer used in his field. Zlateve *et al*. [13] Allergic reactions may also cause respiratory issues, rhinitis, gastrointestinal illness and eye symptoms [15].

This research aims to increase knowledge on exposure to mineral fertilizers and their effects on the health of workers in the NPK unit. The objectives of this research were:

To measure the effects of occupational exposure to mineral NPK fertilizer on lipid parameters, prolactin and FSH and compare the results of the parameters among workers with comparable standards and working populations unexposed.

MATERIALS AND METHODS

The study examined 34 workers of the NPK unit aged 30 to 50 years. The control group was selected from a Analytical laboratory of males with the same age bracket (Between 30 and 50 years) living mainly in non-industrial and non-agricultural region located in the other side of the Annaba city) and exercising trades of the school master or different administrative positions or unemployed.

Blood samples were taken from employers during the medical visit, which was made during the2010 year.

Biochemical parameters of the assay was done by a automate (Ilab 300 Plus).

However, the hormonal parameters was conducted by a automate (Beckman coulter (Access 2).

Statistical analysis: Statistical analyses were performed by *t*-Student using Minitab (version 15). Data are expressed as means ± standard deviation (SD).

RESULTS

Effect of Fertilizer on Lipid Parameters, Prolactin and FSH in Workers: In this present study, these parameters were measured to assess the effects of exposure to mineral fertilizers in workers of NPK unit on these parameters.

Assay of Lipids: We have found that the results obtained after the cholesterol and triglycerides assay consistent standards. However, we noted a highly significant increase in triglyceride levels in the group aged 41-50 years compared to the control. However, a very highly significant increase of cholesterol in the second group (Table 1).

Assay of Hormones: The results of hormonal parameters are summarized in (Table 2), comparing the results with the standards, it appears that there is no alteration. However we have noted a significant increase in prolactin in the group of workers aged 41-50 years compared to the control group and a very highly significant decrease in FSH in the group of workers aged 30 to 40 years compared to the control group.

Table 1: Serum Concentration of lipid parameters in workers (Average ± standard deviation)

Parameters	30-40 n=14	41-50 n=20	Control n=34	Standard
Triglycerides (mmol/L)	1,17±0,49	1,802±0,627**	1,179±0,276	<1,8
Cholesterol (mmol/L)	4,167±0,756	5,032±0,85***	3,812±0,57	<5,85

* (P < 0, 05); ** (P < 0,01); *** (P < 0,001): significant difference from the control group.

Table 2: Determination of prolactin and FSH in exposed workers according to age range (Average ± standard deviation)

Parameters	30-40 n=14	41-50 n=20	Control n=34	Standard
Prolactine µg/L	10,17±10,9	12,0±4,33*	31,68±1,74	3,28-19,68
FSH Ul/mL	3±1,34***	5,4±6,88	5,12±0,98	1-10

* (P < 0, 05); ** (P < 0, 01); *** (P < 0, 001): significant difference from the control group.

DISCUSSION

Many studies have highlighted the consequences of chemical assaults by pollutants in humans and animals. These works were first shown to the harmful impact of xenobiotics varies depending on the species, the substance of the physiological state, duration of exposure, exposure mode and the dose administered. Generally, assaults were accompanied by a simultaneous increase in the catabolism and anabolism of under the dependence neuro hormonal factors [17].

The results of lipid parameters show no anomaly despite chronic exposure of workers. These results are in perfect agreement with the study of Boukerche *et al*. [18] performed among workers in the same complex. Similar results were observed by Bonderf and Delemotte [19].

The results of lipid parameters may be explained by a good medical management within the company, either by developing adaptive system of the organism [18]. Of which protective precautions are applied at the storage complex and distribution of agricultural fertilizers especially after installation also filters. In addition, sanitations were severely available. In the visited unit had water to wash the body after work and hands during the day before meals.

The results of the prolactin and FSH eliminate the assumption of chronic industrial exposure to NPK fertilizer can act as disrupters on the axis of this hormones. In addition, up to now no research has studied the impact of nitrates on male fertility among workers. But there are experimental studies on the effect of nitrate in animals. This lack of research may be due to the belief that the nitrate ions and inorganic nitrites have little direct impact on physiological multicellular animals, particularly vertebrate [20].

Previous studies indicate that consumption of nitrates can affect sex hormones in animals acting as endocrine disruptors in rodents [20]. Extrapolation of these results to humans is not easy and even a direct comparison is difficult because of the physiological differences between the two species [21].

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