Study of The Effect of Fertilizers on Biochemical Parameters In The Workers of The Petrochemical Complex

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ABSTRACT

In order to evaluate the effect of the fertilizers NPK on healthy of employees in the work place. A study has been carried out on 34 workers of storage and distribution agricultural manures, exposed to fertilizers and phosphate and nitrate derivatives. The workers were divided into two groups according to age. Several biochemical parameters assay were measured. The obtained data reveal that it was no difference in the serum glucose level between the exposed and the control group. An increase in serum TGP and creatinine levels has been recorded in the exposed group as compared to the unexposed populations considered as control.

INTRODUCTION

According to the Environmental Protection Agency, most fertilizers contain about the same basic materials: nitrogen, potassium, phosphorus and sometimes other nutrients, like zinc, needed for healthy plant growth. Many people use fertilizers to give extra life to their lawn and garden, but few people consider the potential drawbacks of these fertilizers [1].

Extensive use of nitrogen fertilizer causes high nitrogen uptake in plants, resulting a high content of nitrate in food and drinking water [2, 3]. The main sources of nitrates contaminating groundwater and surface water are fertilizers [4].

At the University of Wisconsin, Madison, they discovered the effects of chemical fertilizers are compounded when mixed with a single pesticide. They discovered altered immune, endocrine and nervous system functions in mice, as well as influence on children’s and fetus's developing neurological, endocrine and immune systems. These influences “portend change in ability to learn and in patterns of aggression” [5].

One popular fertilizer, urea, produces ammonia emanation, contributes to acid rain, groundwater contamination and ozone depletion due to release of nitrous oxide by denitrification process. With its increased use and projections of future use, this problem may increase several fold in the coming decades.

Synthetic fertilizers can seriously deplete the nutritional content of foods, and direct contact or exposure to synthetic chemical fertilizers can kill infants or cause health problems in many adults. Studies show exposure to artificial lawn chemicals to an increased risk of cancer and other health problems in pets.

We will notice that an independent research group tested fertilizers from only 12 states for 22 toxic heavy metals and found that these fertilizers contained high levels of these toxic substances. Of the 29 fertilizers tested, some were major and popular brands. Lead, mercury, arsenic, cadmium, barium, chromium, nickel, beryllium, and dioxin can be pretty potent stuff [6].

The recycling of hazardous industrial wastes into fertilizers introduces several dozen toxic metals and chemicals into the nation's farm, lawn and garden soils, including such well-known toxic substances as lead and mercury. Many crops and plants extract these toxic metals from the soil, increasing the chance of impacts on human health as crops and plants enter the food supply chain [7].

Between 1950 and 1998, the global use of fertilizers has increased more than 10 times and more globally four times per person. In 1998, 137 million tons of fertilizers were used in the world [8].While in Algeria in
1999 used about 133 million tons after falling heavily from 1987 to 1998 and confirmed in 2000 to 155 million tons [9]. In 2010, chemical fertilizer use in Europe (EU-27) was as high as 10.4 Mt of nitrogen (N), 2.4 Mt of phosphate (P$_2$O$_5$) and 2.7 Mt of potash (K$_2$O). By 2019/2020, forecasters expect these fertilizer consumption figures to reach 10.8 Mt, 2.7 Mt and 3.2 Mt, respectively [10].

The manufacture of fertilizers is generally at a high temperature and high pressure, in the presence of several highly hazardous chemicals, dust and gases. These products are absorbed high in the airway [11]. Concerns regarding the health effects of occupational exposure to fertilizers have been raised by workers [12, 13, 14]. Exposure to fertilizer is most commonly associated with contact dermatitis and occupational contact dermatitis has occurred in both industrial and agricultural settings [15]. Tree planters have complained of skin rashes, nausea, headaches, nosebleeds, congestion, eye irritations and respiratory ailments when using powdered fertilizers [16, 14]. Tree planting veteran suffered from skin rash, blisters, headaches, runny nose and eyes, facial swelling, dizziness, nausea and respiratory illness; symptoms he attributed to a new tea bag fertilizer. This individual eventually had a workers’ compensation claim accepted on the basis that the worker’s condition (sinusitis) was a result of tree planting employment (Workers’ Compensation Appeal Tribunal, 2005) [17].

Several epidemiological studies have reported that occupational exposure to very high levels of nitrate in employees. But no study has confirmed that the nitrate has a carcinogenic effect especially stomach cancer [18].

Perhaps one of the scariest effects of chemical fertilizers is something called methemoglobinemia. In infants it is alternatively known as Blue Baby Syndrome. The risk most often occurs when infants are given formula reconstituted with nitrate contaminated water. The condition causes a decrease in oxygen in the blood and results in a blue-grey skin color, causes lethargy and/or irritability and can lead to coma or death. I've been unable to find whether the same risk exists for breastfeeding babies whose mothers drank contaminated water [19].

The effects of chemical fertilizers are not widely spoken about. This is partially because they are largely untested. We understand there is a risk of groundwater contamination and the environmental issues that brings, but we're still not entirely sure what it means for our own health.

So, extensive research conducted to date suggest that exposure to fertilizers not pose any major risk for employee health apart from primary pulmonary irritation before assigning some harmful effects to NPK fertilizers. The reason we were motivated to conduct this study to confirm the effect in workers after long-term exposure on biochemical parameters. In this context, the purpose of our work is the assessment of fertilizers handling risks in the workplace for workers.

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**MATERIALS AND METHODS**

The study examined 34 male workers aged 30 to 50 years. The control group was selected from an Analytical laboratory with the same age bracket (between 30 and 50 years) living mainly in non-industrial and non-agricultural region and exercising trades of the school master or different administrative positions or unemployed. Blood samples were taken from employers during the medical visit. Serum glucose, creatinine, TGO and TGP levels were measured as classic described methods.

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

**Results:**
**Effects of fertilizers on biochemical parameters:**
In this study, biochemical parameters were measured to assess the effects of exposure after fertilizers handling in NPK unit workers.

Table (1) illustrates all the recorded changes in the biochemical studied parameters. The obtained results after the assay of serum biochemical parameters in workers are all in the standards. However, a highly significant increase in the concentration of creatinine in both groups and a significant increase of TGP were noted in employees aged between 41-50 years compared to the control group.
**Discussion:**

The effects of chemical fertilizers are not widely spoken about. This is partially because they are largely untested. We understand there is a risk of groundwater contamination and the environmental issues that brings, but we're still not entirely sure what it means for our own health.

Many people use fertilizers to give extra life to their lawn and garden, but few people consider the potential drawbacks of these fertilizers. In an effort to be as environmentally conscious as possible, it is important to consider the potentially harmful effects of fertilizers as well as the benefits. Few studies have been carried out on the effect of the fertilizers on the health of workers in the place work [6].

Our data indicate that it was no difference in the serum glucose level between the exposed and the control group. These results are in agreement with the study of Boukerche [20]. Performed among workers in the same complex. This can be explained by a good medical management within the company, either by a development of organ system adaptive [20].

Highly significant increases of creatinine in both groups and significant increase of TGP in group aged between 41-50 years were noted in the employees exposed to the fertilizers 8 hours per day during many years. The similarly research on rats whose given daily doses of 200, 400 and 600 mg of NH₄NO₃ per kg for 3 weeks induced the same results [20].

Godson [21] found that there was an indication that the health effects such as skin disorders and respiratory tract infections were associated with exposure to high concentrations of the atmospheric pollutants.

**Table 1:** Determination of biochemical parameters in workers exposed according to their age (average ± standard deviation)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>41-50</th>
<th>30-40</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose g/L</td>
<td>0.966±0.064</td>
<td>1.116±0.064</td>
<td>0.966±0.148</td>
<td>0.75-1.15 g/L</td>
</tr>
<tr>
<td>Urea g/L</td>
<td>0.244±0.076</td>
<td>0.325±0.069</td>
<td>0.287±0.052</td>
<td>0.15-0.45 g/L</td>
</tr>
<tr>
<td>Creatinine mg/L</td>
<td>8.18±1.04</td>
<td>10.29±1.95</td>
<td>10.03±1.56**</td>
<td>7-14 mg/L</td>
</tr>
<tr>
<td>TGO (U/L)</td>
<td>19.70±1.57</td>
<td>18.60±2.84</td>
<td>18.29±2.58</td>
<td>5 - 40 U/L</td>
</tr>
<tr>
<td>TGP (U/L)</td>
<td>16.30±4.95</td>
<td>21.15±7.28*</td>
<td>19.21±9.00</td>
<td>5 - 35 U/L</td>
</tr>
</tbody>
</table>

* (P < 0.05); ** (P < 0.01); *** (P < 0.001): significant difference from the control group.

**Conclusion:**

It was concluded in the light of our results that the health effects such as perturbation in the biochemical parameters can be associated with exposure to high concentrations of the atmospheric pollutants and suspended particles in workplace.

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**REFERENCES**