

Some Biochemical and Hematological Parameters among Petroleum and Cement Factory workers in Sulaimaniyah City/ Kurdistan/ Iraq

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Abstract

The objective of the current research was to study any alteration in the biochemical and hematological parameters among exposed workers in Petroleum and Cement Factories located in the Bazian basin northwest Sulaimaniyah city, Iraq. We found a significant increase in the average BLL and serum iron values among cement and petroleum refining workers (11.3 µg/dL) and (173 µg/dL) successively. As well among the studied groups the workers at Mass CF had the highest BLL (15.5 µg/dL) and serum iron (216 µg/dL). An increase in the average values of serum creatinine and AST levels and a significant decline in mean values of ALP among the workers, while, no significant difference were found between other studied biochemical parameters. The hematological analysis revealed a significant increase in the values of RBC, HCT and MPV, in addition to, a decrease in MCHC. Oppositely, no significant differences were found between other blood cell parameters.

Keywords: Petroleum and Cement Factories toxic dusts and fumes. Blood lead, Iron biochemical and hematological parameters

1. Introduction

The workers at the cement and petroleum refining factories are continuously exposed to many hazardous toxic dusts and fumes. A hazard is something that has the potential to harm the health, safety and welfare of people at work. Examples of hazards that may be found in the workplace include noise, hazardous substances, unguarded power-driven machinery, working at height and stressful working conditions (e.g. the threat of violence) (Bryan Russell, 2012). The cement manufacturing industry is labour intensive and uses large scale and potentially hazardous manufacturing processes. The industry experiences accident rates that are high compared with some other manufacturing industries. There are a number of hazards inherent to the cement production process. Some examples for health like exposure to dust and high temperatures; contact with allergic substances; and noise exposure (Ian Marlowe and David Mansfield 2002). The petroleum refining process produces a host of pollutants—including fine particulate matter, sulphur dioxide (SO₂), nitrogen oxides (NO_x) and lead—from the combustion of various fuels in boilers, process heaters, engines and flares. A host of operations produce air emissions within the petroleum refining process; however, there are a few dominant sources. Petroleum refineries are also major sources of volatile organic compounds (VOCs), hazardous air pollutants (both organics and metals) and carbon monoxide (CO). These pollutants are not the focus of this report (Stappa and Alapco, 2006). Many research and study were done and focused on the evaluation of the workers' health by the workplace, and the effect on the environment around the workplace; like, a research done on workers of the lead-acid batteries department which shows that in occupational exposure to cadmium or lead, antioxidant potential of the body is disturbed, which is manifested by changes in both the concentration of trace elements and the activity of some enzymes (Wojczech Wasowicz, *et al*, 2001).

Also the factories like cement factory have effect on the environment around the factory for example; many soil samples were collected from south Jordan around the cement factory, where anthropogenic activities seem to be the responsible source of pollution for metals in urban soils (Omar A. Al-Khashman*, Reyad A. Shawabkeh, 2006), also by other work predictions of air pollutants (dust, SO₂, NO_x, Pb and CO) emitted from a cement plant (Bashar M. Al Smadi, *et al*, 2009).

The study of determine the prevalence of respiratory symptoms from occupational lung hazards among workers in industries of south Tehran (Mehdi Ghasemkhani, *et al* 2006), and in Nigeria where a study shows that occupational exposure to dust is still a major cause for manual stone quarrying is a means of earning a living (O C Ugbo, *et al* 2009). While in Nigeria and in the petroleum production factories, haemato-toxic implications

of exposure to petroleum fumes through inhalation in human subjects were investigated for male and female workers, were samples of blood were collected daily and subjected to haematological analysis, and the results shows that the petroleum fumes cause a reduction in haematological indices which worsens with prolonged exposure (A. M. Okoro, *et al* 2006). Another study focused on the determination of the levels of lead, cadmium, sodium and potassium in the blood of selected industrial workers, that the results revealed that workers and the residents of the neighboring communities are at the risk of lead poisoning to which they were exposed (Babalola O. O1* and Babajide S. O2, 2009).

2. Materials and Experiments

The current study started from April 2013 through August 2013. The study intended to find out the biochemical and hematological parameters among three major stations located in the Bazian basin northwest Sulaimaniyah city, Iraq. The stations were: Mass cement factory, Bazian cement factory and Bazian Oil refinery factory. They were designated as stations A, B and C successively. The methodology used in this study involved questionnaires' data gathering, as well as, collection, preparation, and storage of the blood samples. It also included the different laboratory procedures to investigate biochemical, haematological and BLL profile among occupationally exposed workers. The participants were given a prior insight about the aim of the study and the involvement was optional. Also, each of them received a copy of their results with some interpretation. The study sample included 32 randomly selected workers at the three stations located in Bazian basin. Their mean age was (34 ± 2) years with average serving of (4) years with average daily work of about 7-9 hours. The questionnaire for each subject was filled included, age, duration of work, safety measures, smoking habits and self-reported complains. Conversely, 21 individuals with average age of (32 ± 3) years from general population of Sulaimaniyah residents who almost have no history of being worked at cement or oil refining factories and matching the experimental group in age and sex were enrolled as a control group. Complete blood counts were obtained from the whole blood specimens at the same day of collection, using automated hematology analyzer from SWELAB, Sweden.

Serum Aspartate Transaminase (AST), alkaline phosphates (ALP), creatinine, albumin uric acid and triglyceride were analyzed by using KENZA 240 TX/ISE chemical auto analyzer, Bio Lab. France. While the blood lead and iron levels were obtained by using Inductively Coupled Plasma-Optical Emission Spectrometry, OPTIMA 2100DV from Perkin Elmer

Statistical Analysis

In the current study the statistical analysis used was included; independent-test to compare means. The data were analyzed by using the StatgraphicsPlus Version 4.0. The P-values less than 0.05 were considered significant.

3. Results and Discussion

The results of the present study exposed, a highly statistically significant increase (P -value= 0.00001) in the average BLL value among cement and oil refining workers ($11.3 \mu\text{g/dL}$), when compared to those of control group ($2.1 \mu\text{g/dL}$), as shown in Figure 1. Among the studied groups the workers at Mass CF had the highest BLL ($15.5 \mu\text{g/dL}$) compared to other studied groups (Bazian CF= $11.2 \mu\text{g/dL}$ and Bazian OF= $6.1 \mu\text{g/dL}$) The BLL distribution among both studied groups are presented in table 1. Also a statistically significant increase ($P < 0.05$) in the average serum iron levels were found among cement and petroleum refining workers ($173 \mu\text{g/dL}$) compared to those of normal controls, as shown in Figure 2. With Mass CF having the higher level among other studied groups ($216 \mu\text{g/dL}$). The overall elevated levels of both BLL and serum Iron in the three studied stations and especially among the Mass CF workers may indicate that they are much more exposed to cement factory toxic dusts and elements such as lead and excessive iron, as well as, the weakness of safety measures in that station, with taking to account the geographical confederations.

Regarding the biochemical parameters, we noted a significant increase ($P < 0.05$) in the values of serum creatinine, serum triglycerides and AST levels in addition to a significant decline ($P < 0.05$) in mean values of alkaline phosphates ALP among the workers. Whereas, no significant differences ($P > 0.05$) were found between the mean levels of the serum uric acid and Albumin levels. The significant higher serum creatinine perhaps suggests that are more susceptible to kidney overload and failure. While elevated AST and triglyceride levels and a decline in ALP may indicate the susceptibility to liver damage. (J.O.Ogunblijie and O.M Akinosun. 2011)

The data of hematological parameters are presented in table 2. The statistical analysis showed significant increases ($P < 0.05$) in the values of total red blood cell count (RBC), hematocrit value (HCT) and mean platelet volume (MPV) of the worker's blood in comparison to controls, as well as, a decrease ($P < 0.05$) in mean corpuscular hemoglobin concentration (MCHC). Oppositely, no significant differences were found between the,

haemoglobin (Hgb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), blood platelet count (PLT), total and differential white blood cells (WBC) .The elevated levels of serum iron may may affect the process of blood cell production by hemopoietic tissue and aslo disturb the process of hemostasis. (J.O.Ogunblijie and O.M Akinosun. 2011 and Solliway, B. M *et al* 1996).

Table 1.distributon of BLL values among workers and control group

BLL $\mu\text{g/dL}$	Control n (%)	Workers n (%)
<1	12(75)	0(0)
1-5	1(6.25)	5(15.6)
5-10	1(6.25)	6(18.7)
10-20	2(12.5)	21(65.6)

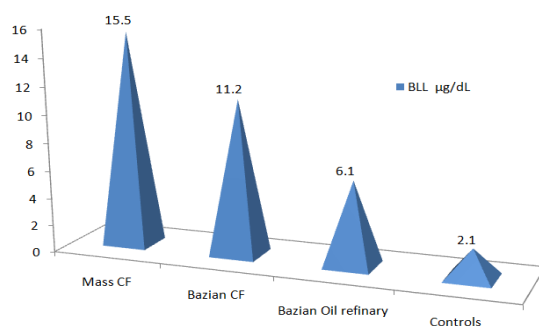


Figure 1. Average BLL values among studied groups

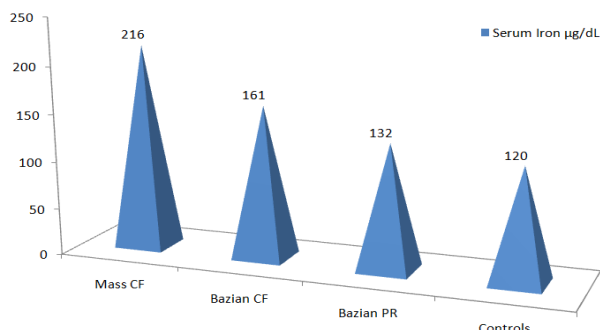


Figure 2. Average Serum Iron values among studied groups

Table 2. Average hematological among workers and control group

Parameters	Cement factory Workers(n=32)	Control(n=21)	p-value
Hgb g/dl	15.5	15	P>0.05
RBC 10 ¹² /L	5.7	5.1	P<0.05
HCT %	48	44	P<0.05
MCH pg	27.5	28	P>0.05
MCHC g/dl	32.8	34	P<0.05
TWBC 10 ⁹ /L	7.76	8.1	P>0.05
PLT 10 ⁹ /L	200	199	P>0.05
MPV fl	8.9	8	P<0.05
LYM %	35.8	35	P>0.05
GRA %	59.9	59.5	P>0.05
MID %	4.2	5.3	P>0.05

Table 3. Average biochemical parameters among workers and control group

Parameters	Cement factory Workers(n=32)	Control(n=21)	t-value	p-value
Uric acid mg/dL	4.7	4.9		P>0.05
Creatinine mg/dL	1.1	0.8		P<0.05
ALP IU/L	172	257		P<0.05
AST IU/L	16.6	34		P<0.05
Albumin mg/dL	4.4	4.5		P>0.05
Triglyceride mg/dL	203	115		P<0.05

4. Conclusion

- The blood of workers at cement and petroleum factories located in Bazian basin contained elevated levels of Lead and Iron indicating an increased occupational exposure.
- Elevated levels of serum creatinin, AST and triglycerides may suggest the sociability of the workers to kidney and liver damage.
- The workers had an elevated RBC, HCT and MPV with decreased MCHC. While, the rest of blood counts were found to be within normal limits.

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