University of Thi-Qar Journal of Science (UTsci)
ISSN Onlin:2709-0256, ISSN Print: 1991-8690 Volume (8), No.1

Impact of Benzene Exposure on The Hematological Parameters of Workers Fuel Stations in Thi-Qar Province

Salah Faiz Shnaa
Department of Biology/ College of Science/ University of Thi-Qar
Iraq
ss0343529@gmail.com

Majida Ghazi Magtooph
Department of Biology/ College of Science/ University of Thi-Qar
Iraq

***Abstract*— Benzene is one of the most toxic chemicals, it is very effective and causes widespread health problems for humans. Workers of stations are directly exposed to inhalation of a large amount of steam that is discharged from the tank into their breathing zone; causing to hematological toxicity. The danger of exposure to benzene lead to a negative and dangerous effect on human health. This study was designed to find out the negative impact of gasoline on the health of workers at gas stations of Nasiriyah city. The current study has included the collection of 90 male samples consisting of (60 samples from gas stations workers, and 30 samples from healthy people, far from any direct source of exposure to benzene as a control group). After that, a complete analysis of the blood image was performed using a whole hematology analyzer (Coulter) and The estimation of Lead (Pb) Concentration in serum by Flame Atomic Absorption Spectrometer (FAAS) of the workers and control groups.**

The results of current study showed According to age group : Workers had higher level of Hemoglobin (Hb), Hematocrit (HCT) and higher count of Monocyte (MONO), Red blood cells (RBC) and had lower counts of granulocytes (GRAN) compared to the control group.

According to smoking status Smokers have high levels of Hemoglobin (Hb) , Hematocrit (HCT) and high counts of Monocyte (MONO), Red blood cells (RBC) and Lymphocyte. While Platelet (PLT), Mean Platelet Volume (MPV), White blood cells (WBCs), and granulocytes (GRAN) counts decreased when compared to the control group. The study have not found significant differences with the rest of the blood parameters. The lead concentration also increases in the blood serum of fuel station workers increases with increasing age and increases in smoking workers.

***Keywords*— Benzene, Lead, Blood cells Effects**

I. Introduction

Monitoring occupational exposure to chemical matters is seriously needed for evaluating health hazards and providing suitable strategies for making safe work environment. Among the most toxic chemicals is gasoline that is strongly and causes related to wide spread of health problems in human (Al Jothery and T. Al- hassnwi, 2017). It's a complex petroleum product consists of mixture of aliphatic and aromatic chemicals, which are easily smelt by human due to their high volatility, its mainly of hydrocarbons including; benzene, xylene and toluene (Abubakar *et al.*, 2015;Smith *et al.*, 2016). Chemically, Benzene is the aromatic hydrocarbons composing of six carbon atoms connected as a ring with one atom of hydrogen (D 'andrea and Reddy, 2014). Several authors have reported that toxicity of gasoline comes mainly from benzene metabolites (Mitri *et al.*, 2015;Carbonari *et al.*, 2016). Once gasoline is inhaled, benzene vapors enter the lung, then passed to the blood stream and it goes to the liver, where three main phenolic metabolites of benzene are released including transient phenol, accumulated hydroquinone and catechol in relatively high concentrations (Knutsen *et al.*, 2013). Steinmaus and Smith have described a link between living in proximity to gasoline stations and incidence of leukemia (Steinmaus and Smith., 2017). While, occupational exposure to crude oil which containing benzene is closely related to immune dysfunction (Ahmed and Ahmed, 2015). Benzene hematotoxicity extended also to leucocytes, the primary protective line from infectious agents (Marques *et al.*, 2016).

Service station attendants and customers are directly exposed to inhaling a significant volume of the vapor discharged from the tank into their breathing zone; inhalation of fumes while refueling automobiles therefore becomes the main source of human exposure to gasoline (Ahmed, 2011). The danger of exposure to benzene is that it contains lead, which has a negative and dangerous effect on human health, among the most important risks of exposure to lead (Pb) are the effect on the immune system and hematological (Veslla *et al.*, 2008). The benzene appears as an intrinsic ingredient of cigarette and hence that the smokers tend to have more benzene in their bodies compared to non-smokers people (D 'andrea and

Reddy, 2014). It has been suggested that the harmful by the quantity of benzene exposure, way of absorption, duration time of exposure, smoking and age of exposed individual (Moro *et al*, 2015).

In our current study, the effect of benzene on the health of workers at fuel stations was evaluated and the extent of its effect on the hematological parameters and the immune system was evaluated, Also, knowing the effect of lead found in gasoline on workers' health compared to control.

II. MATERIAL AND METHODS

A. Subject and Study Design

About 5 ml of venous blood was obtained from workers and control and immediately divided into two parts. The first section contains 2 mL collected in the EDTA anticoagulant Tube to obtain a complete blood count (CBC) using a Whole Blood Analyzer Coulter (Emerald / Germany) for CBC determination including; (RBCs, Hb, PLT, HCT, MCV, MCH, MCHC, RDW, MPV and WBC). Whereas, 3 ml were placed in EDTA Tube for determination of serum lead (Pb) concentration by Atomic Absorption Spectroscopy (FAAS) of Agilent Technologies/USA. The method has been used in this study to measure lead concentration (Xueping and Ren, 2002).

B. Statistical Analysis

All data of the present study were analysed statistically by using Microsoft windows 7 Excel (version 2010) and SPSS version 22 (ANOVA and Leas Significant Difference LSD).

impacts results from benzene can be vary and constrained

III. RESULTS

A. Distribution of gas station and control workers according to age and smoking

This study was conducted on 60 male workers in the petrol stations of Thi-Qar Province, 30 people are away from exposure to any source of gasoline that represents the control group. The samples was taken from the fuel station and control station workers that were divided according to three ages categories. The first category starts from (20-30) years old, the second category starts from the ages of (31-40), years and the third category starts from the ages of more than 40 years. And The second division was according to status of smoking, The number of smokers in this study was 32 workers out of 60, while the control was completely non-smoking and non working in stations.

B. Count of Blood Cells for Workers and Control According to Age Groups

The count of blood cells are determine for all samples of as listed in Table (1). The results shows the highest count of WBC is in the third age group of workers with a mean 7.90 ± 2.9, compared with control. The results shows the highest count of RBC is in the second age group of workers with a mean 5.29 ± 0.64, compared with control. The results shows the highest count of PLT is in the second age group of workers with a mean 278.6 ± 49.9, compared with control. There are non-significant differences at $p \leq 0.05$ between WBC, while significant differences at $p \leq 0.05$ between RBC count, while non-significant differences at $p \leq 0.05$ between PLT count in the workers compared to their concentrations in the corresponding age of control.

Table(1):-Count of blood cells for workers and control according to age groups

Parameter / Groups		No	WBC $*10^3$M+SD	P. value	RBCs $*10^6$M+SD	P. value	PLT $* 10^3$ M+SD	P. value
Workers	20 -30 years	12	7.85 ± 1.5	0.15	5.26 ± 0.34	0.009	258.5 ± 66.3	0.48
Control		5	6.63 ± 1.6		4.67 ± 0.44		235.3 ± 41.2	
Workers	31-40 years	21	7.62 ± 2.5	0.32	5.29 ± 0.64	0.022	278.6 ± 49.9	0.61
Control		14	6.79 ± 1.8		4.80 ± 0.37		270.0 ± 38.7	
Workers	More than 40	27	7.90 ± 2.9	0.48	5.28 ± 0.62	0.10	216.9 ± 48.8	0.057
Control		11	7.02 ± 1.3		4.92 ± 0.52		251.6 ± 51.2	
Control		11	7.02 ± 1.3		4.92 ± 0.52		251.6 ± 51.2	

C. Percentage of Differential WBCs for Workers and Control According to Age Groups

The percentage of WBCs is determine for all samples of as listed in Table (2). The results shows the highest frequent count of LYM in the first age category of workers with a mean 38.0 ± 7.79, compared with control. The highest frequent count of MON is in the first ages category of workers with a mean 14.8 ± 7.8, while the lowest count of MON in the second ages category of control with mean 5.20 ± 1.9. The highest frequent count of GRAN was in the second age group of control with a mean 59.7 ± 10.1, while the lowest count of GRAN was in the first age group of workers with mean 49.5 ± 10.7. There are non-significant differences at $p \leq 0.05$ between LYM count, while significant differences at $p \leq 0.05$

between MON count, and significant differences at p ≤ 0.05 between GRAN count in second age group the workers compared to their concentrations in the corresponding age of healthy control.

Table (2):- Percentage of differential WBC for workers and control according to age groups

Parameters / Groups		No.	LYM% M+SD	P. value	MON %M+SD	P. value	GRAN %M+SD	P. value
Workers	20 - 30 years	12	38.0 ± 7.79	0.071	14.8 ± 7.8	0.035	49.5 ± 10.7	0.130
Control		5	30.2 ± 6.80		6.40 ± 2.4		58.3 ± 10.0	
Workers	31-40 years	21	35.9 ± 10.3	0.078	14.1 ± 6.0	0.001	49.7 ± 12.7	0.026
Control		14	29.8 ± 7.30		5.20 ± 1.9		59.7 ± 10.1	
Workers	More than 40	27	36.2 ± 9.10	0.320	10.4 ± 5.6	0.012	54.8 ± 12.4	0.930
Control		11	33.2 ± 5.48		5.69 ± 1.9		54.6 ± 6.30	

D. Levels of Hb, HCT, MCH, and MCV for Workers and Control According to Age Groups

The level of Hb, HCT, MCH, and MCV are determine for all samples of as listed in table (3). The results shows the highest level of Hb is in the first age group of workers with a mean 15.8 ± 1.0, compare with control. The results shows the highest level of HCT is in the first age group of workers with a mean 46.4 ± 2.1, compare with control. The results shows the highest count of MCH is in the first age group of workers with a mean 29.4 ± 1.5, while the lowest count of MCH in the first age group of control with mean 28.4 ± 1.0.

The results shows the highest count of MCV is in the first age group of workers with a mean 90.4 ± 6.8, while the lowest count of MCV in the third age group of workers with mean 86.2 ± 8.3.

These results also shows that there are significant differences at p ≤ 0.05 between Hb level, and significant differences at p ≤ 0.05 between HCT level, while non-significant differences at p ≤ 0.05 between MCH count, and non-significant differences at p ≤ 0.05 between MCV count in the workers compared to their concentrations in the corresponding ages of control in all groups of workers and control.

Table (3):- Levels of Hb, HCT, MCH, and MCV for workers and control according to age groups

Parameter / Groups		No.	Hb gm/dl M+ SD	P. value	HCT %M+SD	P. value	MCH pgM + SD	P. value	MCV fl M+SD	P. value
Workers	20 -30 years	12	15.8 ± 1.0	0.001	46.4 ± 2.1	0.005	29.4 ± 1.5	0.21	90.4 ± 6.8	0.47
Control		5	13.6 ± 1.1		41.5 ± 1.9		28.4 ± 1.0		88.0 ± 3.2	
Workers	31-40 years	21	15.6 ± 1.5	0.0001	45.9 ± 4.5	0.0051	29.3 ± 3.0	0.53	87.7 ± 7.4	0.65
Control		14	13.4 ± 0.9		41.6 ± 2.0		28.6 ± 3.4		86.6 ± 4.3	
Workers	More than 40	27	15.3 ± 1.2	0.006	44.8 ± 3.7	0.017	28.9 ± 2.4	0.75	86.2 ± 8.3	0.75
Control		11	14.0 ± 0.9		41.6 ± 3.2		28.5 ± 2.0		87.1 ± 7.2	

E. Level of MCHC and MPV for Workers and Control According to Age Groups

The level of MCHC and MPV are determine for all samples of as listed in Table (4). The results shows the highest count of MCHC is in the third age group of workers with a mean 33.8 ± 1.3, compare with control. The results shows the highest frequent count of MPV is in the third age group of control with a mean 9.09 ± 0.9, while the lowest count of MPV in the third age group of workers with mean 8.48 ± 0.8. These results also shows that there are non-significant differences at p ≤ 0.05 between MCHC count, and non-significant differences at p ≤ 0.05 between MPV count in the workers compare to their count in the corresponding age of healthy control in all groups of workers and healthy control.

Table (4):- Counts of MCHC and MPV for workers and control according to age groups

Parameter / Groups		No.	MCHC gm/dl M+SD	P. value	MPV fl M+SD	P. value
Workers	20 -30 years	12	32.7 ± 6.2	0.690	8.65 ± 1.0	0.48
Control		5	31.5 ± 1.9		8.98 ± 0.7	
Workers	31-40 years	21	33.5 ± 2.0	0.092	8.50 ± 1.6	0.32
Control		14	32.3 ± 1.5		8.98 ± 0.8	
Workers	More than 40	27	33.8 ± 1.3	0.037	8.48 ± 0.8	0.053
Control		11	32.6 ± 1.8		9.09 ± 0.9	

F. Level of Lead (Pb) for workers and control according to age groups

The level of lead (pb) is determine for all samples of as listed in Table (5). The results shows the highest concentration of Pb is in the third age group of workers with a mean 30.5 ± 6.5, while the lowest level of Pb in the first age group of control with mean 17.5 ± 3.2.
These results also shows that there are a significant differences at $p \leq 0.05$ between lead (Pb) level in the workers compare to their level in the corresponding age of control in all groups of workers and control.

Table (5):- Level of Lead (Pb) for workers and control according to age groups

Parameter / Groups		No.	Pb µg/l M+SD	P. value
Workers	20 -30 years	12	26.2 ± 8.2	0.039
Control		5	17.5 ± 3.2	
Workers	31 -40 years	21	27.6 ± 6.7	0.00003
Control		14	18.0 ± 1.9	
Workers	More than 40	27	30.5 ± 6.5	0.0002
Control		11	19.5 ± 2.5	

G. levels of Pb and Count of WBCs, LYM, MON and GRAN according to status of smoking

The level of lead (Pb) and count of (WBC, LYM%, MON% and GRAN%) are determine for all samples of as listed in Table (6). The results showed the highest frequent level of Pb is in the smoker group of workers with a mean 27.9 ± 7.5, while the lowest level of Pb in the control with mean 9.0 ± 0.8. The count of WBC is higher in the control group with mean 9 .0 ± 0.8, while the lowest count in the non-smoker group with mean 7.5 ± 2.0. The LYM% also increased in the smoker group with mean 36.8 ± 9.8, while the lowest count in the control group with mean 31.2 ± 6.6. The count of MON% increase significantly in the smoker group of workers with mean 14.5 ± 8.6, while the lowest count also in the control group with mean 5.54 ± 1.9. Finally the count of GRAN% increased significantly in the control group with mean 57.5 ± 8.78, while the lowest count in the smoker group of workers with mean 49.7 ± 13.9. These results also showed that there are a significant differences at $p \leq 0.05$ workers groups and control in the following parameters Pb, WBC, LYM%, MON% and GRAN% compare to their count in the corresponding smoking status of healthy control.

Table (6):- Levels of Pb and count of WBCs, LYM, MON and GRAN according to status of smoking

Parameters / Groups	Cases No.	Pb µg/l M+SD	WBC *10³ M+SD	LYM % M+SD	MON % M+SD	GRAN % M+SD
Smoker	32	27.9 ± 7.5	7.7 ± 2.2	36.8 ± 9.8	14.5 ± 8.6	49.7 ± 13.9
Non-smoker	28	18.9 ± 4.0	7.5 ± 2.0	36.1 ± 8.6	10.4 ± 4.3	54.6 ± 9.63
Control	30	9.00 ± 0.8	9.0 ± 0.8	31.2 ± 6.6	5.54 ± 1.9	57.5 ± 8.78
P. Value		0.0001	0.002	0.023	0.0001	0.023
LSD		0.33	0.12	0.54	0.37	0.71

H. Levels of Hematological parameters according to status of smoking

The level of Hematological parameters are determine for all samples of as listed in Table (6).The results shows the highest frequent count of RBC is in the smoker group of workers with a mean 5.4 ± 0.6, compare with control. The level of Hb is higher in the non-smoker group with mean 15.6 ± 0.9, while the lowest in the control with mean 13.7 ± 0.9. The HCT also increase in the smoker group with mean 46.4 ± 5.0, while the lowest level also in the control group with mean 41.7 ± 2.3. The results of the current study shows there are non-significant difference between workers groups and control in the following parameters MCV, MCH, and MCHC. The result also shows the count of PLT increased significantly in the non-smoker group with mean 264.7 ± 56.2, while the lowest count in the smoker group with mean 231.0 ± 58.2 . The count of MPV increase significantly in the control group with mean 9.0 ± 0.8, while the lowest count in the non-smoker group with mean 8.3 ± 0.9.

Table (7):- levels of Hb, HCT and count of RBCs, MCV, MCH, MCHC, PLT and MPV according to status of smoking

Parameters / Groups	Cases No.	RBCs*10⁶ M+SD	Hb gm/dl M+SD	HCT % M+SD	MCV fl M+SD	MCHpg M+SD	MCHC gm/dl M+SD	PLT *10³ M+SD	MPV fl M+SD
Smoker	32	5.4 ± 0.6	15.4 ± 1.2	46.4 ± 5.0	87.5 ± 9.5	28.8 ± 2.9	32.7 ± 3.8	231.0 ± 58.2	8.7 ± 1.3
Non-smoker	28	5.2 ± 0.5	15.6 ± 0.9	46.2 ± 2.9	87.6 ± 5.3	29.5 ± 0.4	34.3 ± 1.4	264.7 ± 56.2	8.3 ± 0.9
Control	30	4.8 ± 0.5	13.7 ± 0.9	41.7 ± 2.3	87.2 ± 5.2	28.5 ± 2.5	32.2 ± 1.7	256.6 ± 45.7	9.0 ± 0.8
P. Value		0.002	0.0001	0.0001	0.968	0.33	0. 08	0.043	0.041
LSD		1.06	2.35	0.25	Non-Sig	Non-Sig	Non-Sig	3.44	0.07

IV. Discussion

The current study was carried out to assess induced hematologic that was caused by continuous exposure to gasoline on the fuel station workers. In addition to measuring the lead concentration and its effect on the blood parameters (Weasel, 2010).

A. According to age groups

This study have showed that no significant differences were found in the parameters (Lymph., PLT, MCH, MCHC, MCV, WBC) among workers at fuel stations and control for all age groups as shown in Tables (1), (2), (3) and (4). This study is similar to the previous study conducted by (Al Jothery and Al- hassnwi, 2017), in Babil Province / Iraq, which are designed to assess the potential effects of exposure to benzene on the blood profile of fuel station workers and to compare them with office workers, 24 blood samples (the exposed group) and 14 other blood samples (not exposed to benzene) were collected from the public fuel stations, who confirmed that age has no effect on the above parameters.

This study also agreed with the study conducted by (Moro *et al.*, 2015), in Brazil of 60 workers and 28 control samples to know early changes in the blood and immune system of workers at fuel stations and found no effect of age on the above parameters. This study was inconsistent with the study (Ibrahim *et al*., 2014), which was conducted in the Department of Painting and Decoration at the Ceramic Factory in Egypt. The aim of this study was to find out the effect of benzene on the complete blood count, which found a difference in these parameters between workers exposed to benzene compared to the control group. The results of this study recorded no statistically significant differences in the census (MPV, PLT) between workers and controls according to age groups compared to their age concentrations in all groups, as shown in Tables (1) and (4). This study agrees with the previous study presented by (Swaen *et al.*, 2010), In the Netherlands, which compared 8,532 blood samples from fuel station workers with 12,173 control samples, and found that these parameters had no effect on exposure to gasoline. The reason may be due to their exposure to the same amount of gasoline, so the effect is similar. This study found statistically significant differences in blood parameters (RBC, HCT, and HGB) were high among workers at fuel stations compared to control as shown in Tables (1) and (3), and there were statistically significant differences at the level $p \leq 0.05$. among workers and control levels and for all groups. This is in agreement with the study conducted by (Al Jothery and Al- hassnwi, 2017). In Babil Province / Iraq, which was designed to assess the potential effects of exposure to benzene on the blood profile of workers at filling stations and to compare it with office workers, 24 blood samples (the exposed group) and 14 other blood samples (not exposed to benzene) were collected from the public patrol stations. Which confirmed that these parameters increase in workers at fuel stations compared with the control.

The reason for this increase in these parameters is due to the toxicity of benzene, which is a constant feature observed even at levels that were considered harmless to humans (Glass *et al.*, 2009), and since the main screening tool for the clinical evaluation of benzene toxicity is the complete blood count, including the blood cell count. Red blood cells, hemoglobin, and red blood cell markers as evidence of benzene toxicity on these parameters (Sahb, 2011;Okoro *et al.*, 2006). The current study also showed that there are statistically significant differences in the ratio of MONO% and GRAN% between workers at the fuel station compared to the control group, as shown in Table (2), and the existence of statistically significant differences at the level of $p \leq 0.05$ between the level of workers and the control for all according to age The results shown an increase in MONO% in fuel station workers compared to the control group, and at the same time we observe it decreases as the age of fuel station workers increases, while we notice a decrease in the number of GRAN% among workers and an increase in the control group.

This study agrees with a study (Ray *et al.*, 2007), in Kolkata (Previously Calcutta), in East India 25 workers and 35 people who were not exposed to benzene were used, and his study revealed that exposure to benzene leads to changes in the blood and immunity and the cause of high MONO%. It is the first line of protection for white blood cells that increases with increased hematological toxicity of benzene while the reason for the decrease in GRAN% in workers is due to a decrease in hematopoietic stem cells and thus reduces the ability of stromal cells to support the formation of granulocytes.

According to smoking status exposure to benzene has a potential effect on the effect of hemodynamic changes among smokers who work at fuel stations (Al Jothery and Al- hassnwi, 2017). The number of smokers in this study was 32 out of 60, while the control was completely free of smokers. Our current study showed no significant differences in the parameters (MCHC, MCH, and MCV). The present study showed that statistically significant differences were found in the parameters (RBC, LYM%, MON%, HCT and HGB).

The results indicated that these criteria increased significantly for smokers compared to the control group. We did not find statistically significant changes between smokers and non-smokers workers that can be attributed to the same level of environmental pollution from gasoline as we observe it in tables (6) and (7). The result was consistent with the results of other studies conducted by (Sahb, 2011), which was conducted in Baghdad. To assess the blood changes of fuel station workers through inhaling the volatile part of gasoline. And it was found that smoking was closely related to an increase in the number of these criteria. Our study also agreed with (Uzma, 2008), conducted in India to assess occupational exposure to gasoline on fuel fillers, 42 workers were examined, and its study recorded an increase in (LYM%, MON% RBC, HCT and HGB). Our results are also in agreement with the study he presented (Nieters *et al*, 2006). In Germany, tobacco consumption and cancer risk found these standards high.

This study contrasted with the study (Ibrahim, 2014) that he conducted in Egypt on 81 workers and 83 people as a control group, which found that there was a decrease in the levels of blood elements (LYM%, MON% RBC, HCT and HGB). The reason for the increase is that exposure to benzene has the ability to stimulate blood in smokers working at petrol stations. The current study showed a significant decrease in the number (WBC, GRAN%, and MPV) in smoking workers compared to control and non-smoking workers. This study agreed with (Ibrahim, 2014). As well as with the study he conducted (Moro *et al.*, 2015). To assess immunological changes due to benzene and found that it resulted in decreased (WBC, GRAN%, and MPV). Our study disagreed with (Adienbo and Nwafor, 2010), this study was conducted in Nigeria to find out the effect of exposure to benzene on workers in filling stations and found elevations in levels of (WBC, GRAN%, MPV). The reason for the elevation of these parameters is the synergistic effect of smoking with exposure to benzene.

The current results showed a significant reduction in the platelet count (PLT) of smoking workers only, while they did not affect non-smokers and control workers. Our study is consistent with (Al Jothery and T. Al-hassnwi, 2017). The cause of a low platelet count (PLT) to form the condition, that is, a lack of white blood cells, may interfere with normal blood clotting and thus increase the likelihood of bleeding.

Smoking indirectly affects platelet formation by mediating oxidative stress. Cigarette smoking has been found to contain hundreds of chemical molecules (including benzene) that in turn stimulate oxidative stress between different tissues [(Agarwal, 2005);(Rao, 2016)]. Certainly, platelet function and the coagulation process will be negatively affected by increased ROS levels as well as decreased regulation in antioxidant levels, leading to increased oxidative stress (Freedman, 2008). Consequently, exposure to gasoline vapor and cigarette smoking can be serious factors that reduce regulation of platelet production (Muhammad, and New Mexico, 2012). We deduce from this study the fact that cigarette smoking is the main source of exposure to benzene, and it is estimated that 7900 micrograms of gasoline in the air per day is equivalent to smoking 20 cigarettes per day (Rao, 2016).

B. Heavy Metal Lead (Pb)

Many heavy metals such as lead (Pb), was often implicated in human poisoning (Lidsky and Schneider, 2003). Heavy metals become toxic when they are not metabolized by the body and accumulate in the soft tissues. Their toxicity can result in damage central nervous, blood parameter and many organs (Bachanek *et al.*, 2000; Mortada *et al.*, 2001). Lead (Pb) is a toxic metal even in low concentrations, it is a dangerous metal for humans and fuel consumption is the main source of environmental emissions and releases (Pacyna and Pacyna, 2001). The results of the current study indicate that blood lead (Pb) levels (18.9-31.7 Mg/L) significantly higher among fuel station workers compared to control groups (9.0-19.5 Mg/L) were higher than global limits (Laura *et al.*, 2008). Therefore, there are statistically significant differences between the lead (Pb) concentration in the serum of fuel station workers and its concentration in control. In the current study, the level of lead (Pb) in the blood of fuel station workers was measured on two axes in terms of age and smoking, and its comparison with the control group as follows:-

1) Level of Lead (Pb) for workers and control according to age groups

In the current study, 60 fuel station workers were measured, divided into three categories according to age. The results showed that the largest level of lead in the third age group of workers, while the lowest amount of lead in the first age group. These results also showed a statistically significant difference at $p \leq 0.05$ between Pb in the number of workers compared to their number at the corresponding age for health monitoring in all categories of workers and health monitoring.

The current study showed that the lead level increases with increasing age, as we see it in Table (5), so we notice that the level of lead percentage in workers who are over (40) years old is higher than other groups and that the level of lead percentage in workers who are (20-30) years is less than level.

This confirms that the workers of the petrol stations with the highest ages are more exposed to lead than others. Our study agrees with the study presented by (Cornelis *et al.*, 1995) in Britain, the International Union of Pure and Applied Chemistry, and found that lead is a heavy metal with a long half-life in men and its concentration in the human body increases with increasing age.

The reason is that heavy metals Lead (Pb) accumulate because they are not degradable, which makes them store over time in various body tissues such as bones, liver, spleen, kidneys, hair, nails, teeth, and the central nervous system. This explains the high lead concentration with age in the current study sample.

2) levels of Lead (Pb) according to status of smoking

The results showed that the highest amount of lead is in the group of smoker workers compare with control as shown in table (6). These results also showed a statistically significant difference at $p \leq 0.05$ Among smokers and non-smokers. This study showed that smokers are more exposed to gasoline than non-smoking workers, as well as more than control groups. This proves that smoking has a severe effect in increasing the percentage of lead in the blood of fuel station workers.This study is fully consistent with the one he conducted with (Muhammad and Sirwan, 2014). In the study conducted in Iraq, Sulaymaniyah Governorate, on knowledge of Hematological and Biochemical changes and their correlation with lead levels in the blood of fuel station workers. Which was found that there is a significant increase in the level of lead among smoking workers compared with non-smokers of workers and control workers. In addition, the clinical symptoms were more severe when compared to non-smoking workers. Because inhaling gasoline and cigarette smoke together may have effects on lead accumulation pathways in the body (Grandjean and Hanne, 1981). It can be said that cigarette smoke contains lead (Pb) and most minerals (Bernhard *et al.*, 2005).

References

Abubakar, M.B.; Abdullah, W.Z.; Sulaiman, S.A. and Ang, B.S. (2015). The Effects of Exposure to Petrol Vapors on Growth, Hematological Parameters and Oxidative Markers in Sprague-Dawley Male Rats. *The Malaysian journal of medical sciences: MJMS*, *22*(1): 23-31.

Adienbo, O.M. and Nwafor, A. (2010). Effect of Prolong Exposure to Gas Flaring on some Hematological Parameters of Humans in the Niger Delta Region of Nigeria. *Journal of Applied Sciences and Environmental Management*, *14*(1):13-15.

Agarwal, R. (2005). Smoking, oxidative stress and inflammation: Impact on resting energy expenditure in diabetic nephropathy. *BMC nephrology*, *6*(1), 13,(1-9).

Ahmed, A.A. and Ahmed, S.M. (2015). Exposure of gasoline professionals to leaded gasoline in Asyut governorate. *International Journal of Basic and Applied Sciences*,*4*(2),200-205.

Ahmed, F.A. (2011). Toxicology and human health effects following exposure to oxygenated gasoline. *Toxicology letters*,123(2-3), 89-113.

Al Jothery, A. H. T. and T. Al- hassnwi, A. (2017). Changes in the hematological profile among workers at patrol stations in Babil Province/Iraq. *Mesopotamia Environmental journal*, *3*(4), 25-32.

Bachanek, T.; Staroslawska, E.; Wolanska, E. and Jarmolinska, K. (2000). Heavy metal poisoning in glass worker characterized by severe. *Annals of Agricultural and Environmental Medicine*: *AAEM.*, 7(1),51-53.

Bernhard, D.; Rossmann, A. and Wick, G. (2005). Metals in Cigarette Smoke. *IUBMB Life, 57*(12), 805 –809.

Carbonari, D.; Chiarella, P.; Mansi, A.; Pigini, D.; Iavicoli, S. and Tranfo G. (2016). Biomarkers of susceptibility following benzene exposure: influence of genetic polymorphisms on benzene metabolism and health effects. *Biomarker Medicine, 10*(2),145-163.

Cezar-Vaz, M.R. ; Rocha, L.P.; Bonow, C.A. ; Santos da Silva, M.R.; Vaz, J.C. and Cardoso, L.S. (2012). Risk perception and occupational accident: A study of gas station workers in Southern Brazil. *International Journal of Environmental Research and Public Health, 9*(7), 2362–2377.

Cornelis, R.; Heinzow, B.; Herber, R. F. M.; Christensen, J. M.; Paulsen4, M. ; Sabbion E.; Templeto, D. M.; Thomassen,Y.; Vahter, M. and Vesterberg, O. (1995). International Union of Pure and Applied Chemistry. *Pure and Application Chemistry.* Vol. *67*, No. 8-9, pp. 1575-1608.

D 'andrea, M.A. and Reddy, G.K.(2014). Hematological and hepatic alterations in nonsmoking residents exposed to benzene following a flaring incident at the British petroleum plant in Texas City. *Environ Heal*. 2014;13:1–8.

Freedman, J.E. (2008). Oxidative stress and platelets. *Arteriosclerosis, thrombosis, and vascular biology*, *28*(3),11–16.

Glass, D.C.; Gray, C.N.; Jolley, D.J.; Gibbons, C.; Sim, M. R and Frits- chi, L. (2003). Leukemia risk associated with low-level of benzene exposure. *Epidemiology*, *14* (7), 569–577.

Grandjean, P.; Niels, B.P. and Hanne, H. (1981). Influence of smoking and alcohol on blood lead levels. Int. *Arch Occup Environ health. 48*(8), pp.391-397.

Haysa, S.M.; Pyattb, D.W.; Kirmand, C.R. and Aylwarde, L.L. (2012). Biomonitoring Equivalents for benzene. *Regul Toxicol Pharmacol*, *62*(1), 62–73.

Ibrahim, K.S.; Amer, N. M.; El-Dossuky, E. A. ;Emara, A. M.; El-Fattah, A.;El Samei, M. and AbdShahy, E. M. (2014). Hematological effect of benzene exposure with emphasis of muconic acid as a biomarker. *Am. Journal Indust. Med ,30*(5), 467-474**.**

Knutsen, J.S.; Kerger, B.D. and Finley, B. (2013). A calibrated human PBPK model for benzene inhalation with urinary bladder and bone marrow compartments. *Risk Anal*,*33*(7),1237-1251.

Lidsky, T.I and Schneider J.S. (2003). Lead neurotoxicity in children: basic mechanisms and clinical correlates. *Brain*,*126*(1), 5-19.

Laura, S.; Advisor-Dr, C. C. (2008). Determination of heavy metals in whole blood using inductively-coupled plasma-mass spectrometry: A comparison of microwave and dilution techniques. *The Big M 4*(2008), 75-83**.**

Marques, R.E.; Marques, P.E.; Guabiraba, R. and Teixeira M.M. (2016). Exploring the Homeostatic and sensory roles of the immune system. *Frontiers in Immunology*, Mar.*7*(125),1-7.

Mitri, S.; Fonseca, A.S.; Otero, U.B.; Tabalipa, M.M.; Moreira, J.C. and Sarcinelli, P.N. (2015). Metabolic Polymorphisms and Clinical Findings Related to Benzene Poisoning Detected in Exposed Brazilian Gas-Station Workers. *Int. J. Environ. Res. Public Health* 2015, *12*(7), 8434-8447.

Mohammad, N. M. A. (2012). Relationship between exposure to petrol products and the trace metal status , liver toxicity and hematological markers in gasoline filling workers in Sulaimania city. *Journal of Environmental and Occupational Health*, *1*(1), 6-11.

Mohammed, Sirwan (2014). Hematological, Biochemical and Blood Lead Level Profile among Gasoline Exposed Station Workers in Sulaimaniya City. ARO-*The Scientific Journal of Koya University* ,*2*(1),6-11.

Mortada, W.I.; Sobh, M.A.; El-Defrawy, M.M. and Farahat S.E. (2001). Study of lead exposure from automobile exhaust as a risk for nephro toxicity among traffic policemen. *American journal of nephrology*, *21*(4), 274-279.

Nieters, A.; Cornillon, J. and Mariat, C. (2006). Tobacco and alcohol consumption and risk of lymphoma: results of a population-based case-control study in Germany. *International Journal of Cancer,118* (2):422-430.

Okor, A.M.; Ani, E. J.; Ibu, J.O. and Pogomeh, B.A. (2006). Effect of petroleum products in halation on some hematological indices of fuel attendants in calabar metropolis Nigeria. *Nigerian Journal of Physiological Sciences*,*21*(1-2), 71-75.

Pacyna, J.M. and Pacyna, E.G. (2001). An assessment of global and regional emissions of trace metals to the atmosphere from anthropogenic sources worldwide. *Environmental Reviews, 9*(4): 269-298.

Ray, M.R.; Roychoudhury, S.; Mukherjee, S. and Lahiri, T. (2007) .Occupational benzene exposure from vehicular sources in India and its effect on hematology, lymphocyte subsets and platelet P-select in expression. *Toxicology and Industrial Health ,23* (4), 167–175.

Rao, P.; Ande, A.; Sinha, N.; Kumar, A. and Kumar, S. (2016). Effects of Cigarette Smoke Condensate on Oxidative Stress, Apoptotic Cell Death, and HIV Replication in Human Monocytic Cells. *PLoS One*, *11*(5), 155-791.

Rom, W.N. (2007). Environmental and Occupational Exposures , Organic Chemicals , Benzene, Environmental and Occupational Medicine, 4th Edition; 2007:1123-1129.

Sahb, A.A.A. (2011). Hematological assessment of gasoline exposure among petrol filling workers in Baghdad. *Journal Fac Med Baghdad*, *53*(4), 396–400.

Smith, M. T.; Guyton, K.Z.; Gibbons C. F.; Fritz, J. M. ; Portier, C. J. ; Rusyn, I.; DeMarini, D.M.; Caldwell, J. C.; Kavlock, R.J.; Lambert, P. F. ; Hecht, S. S.; Bucher, J. R. ; Stewart, B. W. ; Baan, R. A.; Cogliano, V. J. and Straif, K. (2016). Key Characteristics of Carcinogens as a Basis for Organizing Data on Mechanisms of Carcinogenesis. *Environ Health Perspect*, *124*(6),713-21.

Steinmaus, C. and Smith M. T. (2017). Proximity to Gasoline Stations and Childhood Leukemia. *American Journal of Epidemiology*, *185*(1), 5-7.

Swaen, G.M.; van Amelsvoort, L.; Twisk, J.J.; Verstraeten, E.; Slootweg, R.;Collins, J.J. and Burns, C.J. (2010). Low level occupational benzene exposure and hematological parameters. *Chemico-biological interactions*, *184*(1-2), 94-100.

Uzma, N.; David, M. A. and Reddy, V.D. (2008). Impact of Organic Solvents and the Physiological Function in petrol Filling workers. *International journal of environmental research and public health*, *5*(3), 139-146.

Weisel, C.P. (2010). Benzene exposure: An overview of monitoring methods and their findings. *Chemico-biological interactions*, *184*(1-2), 58-66**.**

Veslla, B. ; Darko, N. ; Srdjan, K. and Dino, T. (2008). Extreme gastric dilation cased by chronic lead Poisoning : a case report. *World Journal of Gastroenterology: WJG*, *14*(16), 2599-2601.

Xueping, J.I. and Ren, J. (2002). Determination of copper and zinc in serum by derivative atomic absorption spectrometry using the microsampling technique .*Analyst*, *127*(3), 416- 419.