OCCUPATIONAL WORKERS EXPOSURE TO LEAD COMPARED TO A PREVIOUS STUDY CONDUCTED IN 2010 IN DOHUK CITY- KURDISTAN, IRAQ.

[1]ALI H. AL-DOSKY, [2]PROF, SHUKRIYIA SH.AL-OGAILI,[3]JWAN HASAN HUSSEIN

[1]Assistant Prof, University of Duhok, College of Medicine, Email: Ali.shan@uod.ac Phone number: 07504458584

[2]Alfrat Al-Awsat University, Institute of Kufa, drshalq@yahoo.com

[3]Assistant Lecturer and Researcher, at Polytechnic University Duhok, jwan2205@gmail.com

ABSTRACT

Background:

Although the toxicity of lead has been known for thousands of years, lead remains one of the most common environmental hazards for humane. There are many sources of lead exposure, such as soil contaminated from years of leaded gasoline use, lead dust accidentally brought home from parents' workplaces and hobby areas, lead in plumbing, and some imported products and traditional remedies. Elevated levels of blood lead occurring during the first years of life. Exposure to lead among workers in our country is in the field of work, and that the most work sites in which lead has accumulated are industrial areas, especially works that are used in oil products, All these places are polluted with lead and increase in the percentage of lead among workers, this to be public health problem

Objective: *This study aimed to determine levels and nature of lead of occupational workers exposure to lead after 10 year to the previous study conducted in 2010 in Duhok city, Kurdistan, Iraq.*

Material and Methods: *A cross – sectional study design was conducted on 520 workers exposure to lead to determine the level & Natural of lead exposure. Workers. The study was conducted between 1 October 2022 and 1 Jan 2023.*

The samples were male workers age range from 10 to 64 years. The workers were chosen as a convenient sample so that nearly equal number of workers from each area included: Gasoline power generators (n=120) .Industrial urban area (n=100), Traffic policeman (n=100), Petrol failing station (n=100), Petrol storage (n=50) and Battery repairing workshop (n=50).

Pre-tested questionnaire was designed to obtain information on age, residence, current occupation job period in year, and current history of cigarette smoking.. Blood lead level was analyzed by flame atomic absorption spectrophotometer (AAS), Perkin Elmer Using a standardized procedure published by the company. Dust lead level was analyzed using the lead test kit (ABOTE × ENTERPRISES limited Ontario and a NOM).

Results

The mean blood lead values among the sample was 19.0 ug/dl, with a standard error of 0.58 and range of 8.2 to 62.6.Of the 520 individuals tested, 59.0% subjects had blood lead level of 10 – 25 ug/dl, while 27.0% of these subjects had blood lead level 25 – 50 ug/dl and 5% had blood lead level > 50 ug/dl .The mean blood lead levels of the battery repairing workers (47.3 ug/dl) was significantly higher (P< 0.001; for all) compared to the gasoline power generator workers, petrol station, traffic policemen, petrol storage, and general work in industrial urban area who had mean blood lead levels of 16.5 ug/dl, 19.7 ug/dl , 11.5 ug/dl, and 14.4 ug/dl; respectively .A statistically-significant relationship was found between blood lead levels and age , amount of cigarettes smoked and dust lead level.

Conclusion

The conclude from this study the percentage of the lead in the blood may increase in the all group within study, duo to the large occurring in all aspects of life in Duhok governorate, where the number of generator increase from 370 in 2011 to 1500 in 2022 an so on the number of petrol stations multiplied dozens of time and so on the number of luxury cars, the number of cars, and

the number of the building ,the multiplicity of industrial places ,as well as the population , all of this leads to an increase in the pollution and an increase in the percentage of lead among workers in this field.

Keywords; *- blood, lead, exposure, workers*

INTRODUCTION

Much of the inorganic lead found in the environment originated from the combustion of fuels that contain organic lead additives. Some inorganic lead salts are also commonly used as pigments in paints. Although lead in residential paints has been restricted since 1973, it is still allowed at much higher levels in industrial paints. The greatest use of metallic lead is storage batteries. Metallic lead is also found in lead solders, pipes, construction materials, dyes and wood preservatives.(1) In the United States over the past twenty years, blood lead levels have decreased significantly, primarily as a result of the removal of lead from gasoline. Yet, disproportionately higher numbers of elevated blood lead levels are found in urban minority residents across all. socioeconomic levels, an observation that has been evident for many years (2) This elevated incidence in the minorities may be because low income and minority status are associated with living in older or deteriorating housing, or in an area with a high prevalence of lead-contaminated soil and dust.(3) Once absorbed, lead is distributed in the body in three main compartments: bone, soft tissue and blood. Traditional measures of lead include only one compartment, the blood, in which 99% of the lead is bound to red blood cells. The half-life of lead in blood is approximately 30 days.(4) The plasma lead, i.e., circulating lead that is unbound to red blood cells, may be more biologically
available and or relevant to target organ toxicity. The second compartment, soft tissue, where most of the adverse effects of lead occur, includes the kidney, brain, liver and bone marrow. The third and largest compartment is the bone which represents an accumulating reservoir containing approximately 95% of the body burden of lead in adults (5). Thus blood lead, the clinical measure of lead that is most widely used to assess lead exposure reflects only a fraction of the body burden of lead; furthermore, it represents a fraction that has only recently been absorbed.(6) To present further evidence of industry conducted unpublished epidemiologic studies of lead smelter/refinery workers and health outcomes. Historical research relying on primary sources such as internal industry documents and published studies. ASARCO smelter/refinery workers were studied in the early 1980s and found to have increased risk of lung cancer and stroke in one study, but not in another. Because occupational lead exposure is an on-going concern for US and overseas workers, all epidemiologic studies should be made available to evaluate and update occupational health and safety standards (7). Furthermore, both occupational and environmental exposures have remained a serious problem in many developing and industrializing countries (8). However, considering that there are still many vehicles using leaded petrol, it is possible to find high lead levels in the general population in areas of heavy traffic. In addition, an important source of the metal is air contamination caused by the gasoline power generators and industrial activates which of large number distributed in most areas of Duhok city. The aim of this study was to determine the degree of lead exposure in a sample of occupationally –exposed workers in attempt to ascertain the nature of this exposure.

MATERIALS AND METHOD

Study design: - A cross – sectional study design was conducted on 520 workers exposed to lead in Duhok city. The study was conducted between 1 October 2022 and 1 Jan 2023. Workers of six main occupations were collected from different areas. They were all male with age range of 10 to 64 years. The workers were chosen as a convenient sample so that nearly equal number of workers from each of the five occupations was included in the sample. They were 120 gasoline power generator workers collected from those working in gasoline generators and distributed in all districts of the city, the traffic policeman (n=100) collected from traffic policemen working in down town streets, the workers in petrol filing stations (n=100) collated from petrol filling stations distributed in different part of Duhok city, general industrial workers(n=100) engaged in different

occupation such as car repairing , painting and other industrial related facilities, while the remainder were 50 petrol storage workers working in the main petrol storage bankers and 50 battery repairing workers mainly from battery shops located in the center of the city.

Methods - Lead exposure has been identified on the determination of blood lead and dust lead levels. The highest value proposed by (10) for lead exposure in children is < 10 ug/dl and < 25 ug/dl in adults being the most conservative was selected for this study as the cutoff for high blood lead concentration. Dust lead level > 5 ppm was considered as a cutoff value for low level of lead exposure whereas a level of < 25 ppm indicated high level of lead exposure to check environmental lead exposure.

RESULTS

Blood lead levels:

Mean blood lead value in the sample was 19.0ug/dl with a standard deviation of 7.9ug/dl and a maximum of 62.6ug/dl (Table 1). The mean blood lead levels of the battery repairing workers (47.3 ug/dl) was significantly higher (P< 0.001; for all) compared to the gasoline power generator workers, petrol station, traffic policemen, petrol storage, and general industrial workers who had mean blood lead levels of 19.7 ug/dl, 11.6 ug/dl, 14.4 ug/dl, and 19.8 ug/dl; respectively. Considering only the occupational hazard, there was 59.0% of the occupational workers had blood lead level 10 – 25 ug/dl, while 27% of these workers had blood lead level 25 – 50 ug/dl and 5.0% had blood lead level> 50 ug/dl (Table 2). differences were observed in blood lead levels among the different periods of work in current job(i.e. 27% of workers with duration of work in current job< 10years had blood lead level >25 ug/dl compared to 9% of workers with duration of work in current job >10 years at the same blood lead, P<0.001). In the sample (Table 3), blood lead levels in older age groups (30.0$\pm$ 18.6 ug/dl) were significantly differ from those of younger age group (8.0$\pm$2.5 ug/dl), (P<0.001). Blood lead levels showed a linear relationship with age i.e. the older the individual, the higher the blood lead values.

Table 4 shows Blood lead levels according to the amount of cigarettes smoked (average/day) ; which were higher in cigarettes smoking group, the difference was statically significance (p<0.001).

Discussion

As it was expected and from the results obtained, the level of lead has increased by the large percentage in the last ten years in Duhok Governorate, especially among the workers in this study and in the areas which they work.

the general population is exposed is the combustion of leaded petrol, but other possible source, such as industrial contamination can be considered in areas with less air contamination For many reasons, the workers of Duhok city have a probable incidence of over-exposure to the metal. However, considering that there are large numbers of vehicles and electrical generators coinciding with the widespread use of leaded petrol, it is possible to find high lead levels among general population in areas of heavy traffic and crowd. Also, the geographical location of the city between two mountains and location of general industrial workshops within the border of Duhok municipality may suggest high levels of exposure (10). It is necessary to indicate the degree of lead so that it can be compared with international standards .Notwithstanding, the results of our study showed mean blood lead levels of the study sample of 19.0 ug/dl, which are below the currently accepted toxicity threshold 25 ug/dl.(11) . Other studies conducted in different parts of Iraq obtained higher results with mean blood lead levels of around 23.7ug/dl. These values were markedly higher than ours, probably due to the origin of their sample which was taken mainly from battery workers. In this study, there were 300(59 %)of workers who had the blood lead higher than10 ug/dl. Among this group, 147(27%) workers had higher blood lead level than25 ug/dl, and the 25 (5%) workers had higher blood lead level than 50 ug/dl, which most of them were battery workers. Our results, in comparison, reflect a low blood lead levels; for example, none of the policemen had blood lead level more than 25 ug/dl and the mean was slightly lower (11.6 ug/dl) (12).

With respect to blood lead-related factors, our results overall show higher values in workers with the heavy lead dust working area. Other studies concur with this observation of higher values in

working areas with greater occupational contamination by the metal (13).Results obtained for intoxication prevalence are similar, since a greater prevalence was observed in workers in the area with dust lead level of 25 ppm (60.9%).. A statistically-significant relationship is found, however, between blood lead and age; higher blood lead levels are observed in older workers who have been exposed to higher lead contamination levels. We found a tendency towards increased blood lead values with the increase in average cigarettes smoking (14). The main route of lead absorption may be through inhalation, however, inadequate hand- and face-washing and unrestricted smoking and eating at the workplace may result in high lead exposure. Table 6 shows that the comparison between the two studies in 2010 and 2022, as the percentage of lead in the six group with the study in 2010 is respectively (11.5,14.2,8.4,40.0,10.1,13.8 ug/dl). The results in 2022 is respectively (11.5,19.7,11.6,47.3,14.4,19.8 ug/dl).

Our study has demonstrated elevated blood lead levels in battery repairing workers for whom the safety control measures should be apply first. Whereas in the reminder of workers, this study indicates that lead exposure does not constitute a great health problem if occupationally –exposed workers considered, since levels found are below those deemed toxic and the prevalence of intoxication is similar to that reported in other studies. The initial preferred medical test to determine the amount of lead in an individual's body is a blood lead level test. This test measures the most recent exposures to lead, not long-term exposure. If high blood levels are identified through the blood level test, a complete physical examination should be conducted to best assess the effects of lead exposure upon the body. Preferably, this exam should be performed by an occupational physician. Such an exam will determine the degree of lead poisoning and functional damage to the body (15). Lead poisoning is preventable through the development of controls at the workplace. In cases where a worker has been overexposed to lead, exposure should be stopped and controls should be introduced to prevent any recurrence. In instances where workers have been severely exposed, medical treatment known as chelation can be given to help the body get rid of the lead. The most common chelating agents are calcium disodium versanate or versine (Ca Na(2) EDTA), penicillamine, and British anti-Lewisite (BAL). Since chelation treatment may have harmful side effects, treatment should only be administered by proper medical personnel in a hospital/clinical setting. Lead should be kept out of the air you breathe. Lead usually enters the air as a fume or dust. Fumes are tiny particulates that boil-off when lead is heated. Lead dust/particulates may be formed during carding, grinding, filing, and lead removal operations. Also, a fine film of lead sub-oxide dust can form on the surface of molten lead (16). This nearly invisible dust can get into the air whenever the surface is agitated. Further, lead dust may gather upon work surfaces during the performance of lead servicing/maintenance/removal work. In these cases, surfaces/materials upon which lead dust has settled should be thoroughly cleaned and lead contaminated materials properly disposed of (17).

Recommendation

1-Educational program for workers about risk of lead physically and who to decrease from body

2-To emphasize on a collaborative work between ministry of health &Environment and ministry of higher education and scientific research to include this problem in curriculum to increase awareness between student

3-Used different mass media to stimulate public awareness about risk of lead and area found it.

Table 1: Blood lead levels according to type of occupation.

Type of occupation	Blood lead concentration (ug/dl)					
	n	Mean	SD	SE	Range	P(ANOVA trend)
Gasoline power generators	120	16.5	6.1	0.55	8.2-24.2	<0.001
Petrol station	100	19.7	4.8	0.48	10.7-25.4	
Traffic policemen	100	11.6	3.0	0.30	8.0-18.0	
Battery repairing	50	47.3	10.9	1.5	25.7-62.6	

Petrol storage	50	14.4	4.2	0.61	11.5-28.0	
General industrial work	100	19.8	6.8	0.68	14.0-33.1	
Total	520	19.0	7.9	0.58	8.2-62.6	

Table2: Distribution of the sample by blood lead level range,(n (%)).

Blood lead range ug/dl	< 5.0	5.0 – 10.0	>10.0 – 25	>25 – 50	50 +
Gasoline power generators	-	5(4.1)	80(80)	35(19.9)	-
Petrol station	-	8(8.0)	70(70.0)	22(22)	-
Traffic policemen	-	15(15.0)	65(65.0)	20(20)	-
Battery repairing	-	-	15(15.0)	20(20.0)	15(15.0)
Petrol storage	-	-	20(20.0)	20(20)	10(10)
General Industrial work area	-	20(20.0)	50(53.0)	30(30.0)	-
Total	-	48(9)	300(59)	147(27)	25(5)

Table 3: Blood lead levels according to age of occupational sample (n=520).

	Blood lead concentration (ug/dl)					
Age(years)	n	Mean	SD	SE	Range	P(ANOVA trend)
						<0.001
10-16	18	8.0	2.5	0.57	(5.8 – 10.9)	
17-29	269	15.1	7.3	0.44	(7.7 - 38.8)	
30-39	158	20.9	10.1	0.80	(13 - 48.6)	
40+	75	30.6	18.2	2.1	(14.4- 59.7)	
Total	520	19.0	7.9	0.58	(8.2 - 62.6)	

Table4: Blood lead levels according to cigarettes smoking (n=520)

Smoking categories (Average/day)	n	Mean	SD	SE	Range	P(ANOVA trend)
passive smoking	203	11.3	7.3	0.50	6.2-43.3	<0.001
Active smoking include Half a pack or less <10)	97	17.7	3.7	0.37	8.7-22.0	
On pack (20)	109	23.9	11.0	0.51	11.0-57.7	
> one pack	111	32.3	11.8	2.29	12.2-62.3	

Table 5: Blood lead levels according to the average dust lead levels in the working area.

Dust lead level (ppm)	Blood lead concentration (ug/dl)					
	n	Mean	SD	SE	Range	P (ANOVA trend)
(1-5)	13	7.2	1.0	0.06	(6.2 - 10.9)	
(10)	178	12.4	3.0	0.13	(9.2 - 28.5)	<0.001
(25)	317	22.1	10.5	0.95	(15.4 - 56.4)	
>50	12	52.9	14.0	4.0	(32.2 - 63.4)	

Table 6: Blood lead levels according to compares between 2010 and 2022

Type of occupation	Blood lead concentration (ug/dl)in 2010				Blood lead concentration (ug/dl) in2022					
	n	Mean	SD	SE	Range	Mean	SD	SE	Range	P(ANOVA trend)
Gasoline power generators	120	11.5	4.3	0.39	3.2-19.2	16.5	6.1	0.55	8.2-24.2	0.001<
Petrol station	100	14.2	3.5	0.35	5.4-19.9	19.7	4.8	0.48	10.7-25.4	
Traffic policemen	100	8.4	2.2	0.22	4.8-14.8	11.6	3	0.3	8.0-18.0	
Battery repairing	50	40	9.3	1.31	18.4-55.3	47.3	10.9	1.5	25.7-62.6	
Petrol storage	50	10.1	3	0.43	7.2-23.7	14.4	4.2	0.61	11.5-28.0	
General industrial work	100	13.8	4.8	0.48	8.0-27.1	19.8	6.8	0.68	14.0-33.1	
Total	520	14.5	6.2	0.43	3.2-55.3	19	7.9	0.58	8.2-62.6	

REFERENCES

[1] *Fourth Report on Human Exposure to Environmental Chemicals, Updated Tables, January 2019. Centers for Disease Control and Prevention; US Department of Health and Human Services, Washington, DC 2019.*

[2] *National Toxicology Program. Health effects of low-level lead evaluation. Research Triangle Park, NC: US Department of Health and Human Services; 2012. Available at: http://ntp.niehs.nih.gov/pubhealth/hat/noms/lead/index.html (Accessed on November 15, 2021).*

[3] *Sullivan M. More evidence of unpublished industry studies of lead smelter/refinery workers. Int J Occup Environ Health 2015; 21:308.*

[4] *Lanphear BP, Rauch S, Auinger P, et al. Low-level lead exposure and mortality in US adults: a population-based cohort study. Lancet Public Health 2018; 3:e177.*

[5] *ABLES Data Summaries. Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/niosh/topics/ables/data.html (Accessed on November 15, 2021).*

[6] *Alarcon WA, State Adult Blood Lead Epidemiology and Surveillance (ABLES) Program Investigators. Elevated Blood Lead Levels Among Employed Adults - United States, 1994-2013. MMWR Morb Mortal Wkly Rep 2016; 63:59.*

[7] *Centers for Disease Control and Prevention (CDC). Potential risk for lead exposure in dental offices. MMWR Morb Mortal Wkly Rep 2001; 50:873.*

[8] *WHO. Environmental lead exposure: a public health problem of global dimensions. Bulletin of the World Health Organization 2000;78(9): 1068-1077*

[9] *Cheevaporn V.,Norramit P. Tanaka K. Trend in lead content of airborne particles and mass of PM10 in the Metropolitan Bankok . Journal of health Science 2004; 50(1):86-91.*

[10] *Al-Dosky · 2012 · Cited by 10 — A cross-sectional study was made of blood lead levels of 820 individuals and of dust and of air lead levels in urban, suburban and rural residential areas. Mean ...*

[11] *Lanphear BP, Dietrich K, Auinger P, Cox C. Cognitive deficits associated with blood lead concentrations <10 µg/dL in US children and adolescents. Public Health Rep. 2000;115:521-529. [PMC free article] [PubMed] [Google Scholar]*

[12] *Forte G., Madeddu R., Tolu P., Asara Y., Marchal J.A., Bocca B. Reference intervals for blood Cd and Pb in the general population of Sardinia (Italy). Int J Hyg Envir Heal, 2011; 214(2): 102-109.*

[13] *S Nakhaee · 2019 · Cited by 13 — This exploratory investigation aimed to measure blood lead levels and associated risk factors in exposed workers in Iran, and to derive ...*

[14] *L Han · 2018 · Cited by 31 — In summary, we found that BLL was positively associated with SBP and DBP and with the morbidity of hypertension in occupational populations with.*

[15] *Markowitz M. Lead poisoning. In: Kliegman RM, St. Geme JW, Blum NJ, Shah SS, Tasker RC, Wilson KM, eds. Nelson Textbook of Pediatrics. 21st ed. Philadelphia, PA: Elsevier; 2020:chap 739.*

[16] akthithasan K, Lévy P, Poupon J, Garnier R. A comparative study of edetate calcium disodium and dimercaptosuccinic acid in the treatment of lead poisoning in adults. Clin Toxicol (Phila). 2018 Nov;56(11):1143-1149. [PubMed]

[17] *Centers for Disease Control and Prevention. "Blood Lead Levels in Children." (Page last reviewed: May 28, 2020).* https://www.cdc.gov/nceh/lead/prevention/blood-leadlevels.htm (Accessed June 23rd, 2020)