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# ASSESSMENT OF BLOOD LEAD LEVELS AND ASSOCIATED RISK FACTORS AND OUTCOME OF LEAD POISONING AMONG A SAMPLE IN BAQUBAH CITY.

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## ABSTRACT

***Background***: Lead poisoning and occupational lead exposure remains a serious problem despite awareness of its adverse health effects in the world. The present study aimed to compute lead concentration and risk factors in adults (traffic policemen, taxi drivers and generators workers), to evaluate the effect of exposure to environmental lead among study samples, and to signify the relationship between the blood lead levels and among study sample, some socio-demographic characteristics of subject such as (age, residency, duration of work), and between blood lead levels and general information such as(smoking). Comparison between cases and controls in some variables such as (protective measures and past medical history).

***Subject and methods:*** A case control study has been designed for a sample of subjects consists of (264) adult men, aged between (20-60) years divided into two groups, (132) in each group. The first group represent the adults men (cases group), including traffic policemen, taxi drivers and generators workers, while the second group represent the controls group which included volunteered healthy adults men. The study has been conducted in Baqubah City from 1st December 2016 to the end of 30th June 2017. Data were collected using questionnaire throughout interview technique for all adult men. Blood lead level was measured by Atomic Absorption Spectrophotometer. ***Results:*** The findings revealed that the higher mean blood lead levels in cases (generators workers) 28.43 µg/dl and lower in traffic policeman 20.43µg/dl and the lowest in taxi driver 19.45µg/dl. Mean of blood lead levels in controls 12.35µg/dl, also the results revealed that there is a significant difference between

Mean blood lead levels and study samples (cases and controls), each groups of cases (generator workers, taxi drivers, traffic policeman), age, duration of work and smoking, the comparison between cases and controls in (protective measures, and past medical history). The study demonstrated variation between blood lead levels and residency. There was also a different variation in the comparison between the cases and controls group in some variable in different distributions. ***Conclusions and Recommendation:*** The increase in the lead in the air and environment of Baqubah City is due to the presence of lead in petroleum in addition to its other uses which led to air and environment pollution which reflected its effect on the occupations. The study recommended that health authorities tighten supervision and provide minimum occupational safety measures, improving procedures of health risk assessment; removing lead from petrol as soon as is practicable, educational programs of heavy metals and their effects, especially lead. Oblige occupations, especially generators workers, traffic police and taxi drivers, to use protective mask to protect their respiratory system and minimize inhalation of air pollution by lead during work and conduct a comprehensive study of Iraq to determine the natural value of lead that can be adopted as a real value for health and occupational safety in Iraq.

**KEYWORDS:** Blood Lead Levels, Lead Poisoning, Baqubah City, Iraq.

## INTRODUCTION

Lead Poisoning is one of the oldest occupational hazards in the world and it is the one of most significant prevalent occupational and environmental current health issues. Inhalation of lead, poor personal hygiene, and ingestion of lead – contaminated water and food conducted as contributes to the exposure of adults category which is the most widely exposed to lead at places to work.[1] However, several studies have considered, according to a biological point of view, lead as a nonessential trace element and has no any biological function. Lead exposure is correlated with toxic effects such as: neurological, reproductive, gastrointestinal, hematopoietic, and renal system.[2] Through the digestive and / or respiratory tract Pb accesses the body then absorbed by blood. About 99% of Pb in blood is bund with erythrocytes and the residuum distributed in the plasma.[3] The main source for adults exposure of lead occur in places of work, where the lead exposure may include gasoline, paint, smelters, fuel used for heating, battery recycling factories, some glazed ceramics, and some Asian cosmetics.[4] Cars, buses, and trucks consider as source of pollution, when engines burn fuels like gasoline or diesel, large amounts of chemicals produced and emitted

in engine exhaust. Additionally, some of gasoline used by engines vaporizes into air without having burned, this produces pollution as well.[5]

Lead is a non – essential trace element for human and has a toxic potential for the biological systems. High level of lead causes adverse effects on many system of body including neurological like mental retardation, learning and behavioral abnormalities and others containing reproductive, gastrointestinal, hematopoietic and renal systems.[6] In recent years, there has been increasing interest in reviews concluded that early life exposure of lead has late – life neurodegenerative effect in old age.[7]

Exposure of lead has been related to multiple health effects and damages to most physiological human system. However, among occupationally exposed individuals, effects of lead can be observed in gastrointestinal symptomatology, anemia, cardiovascular diseases, hearing loss, nervous system (nerve conductive effects, on behavior, and cognition) reproductive system, genotoxicity, and carcinogenicity.[8]

The Occupational Safety and Health Administration (OSHA) lead standards about occupations should remove from lead exposure when repeat screening blood lead levels within 3 months and the result are equal to or more than 30 µg/dl and allow them to return to work only when BLLs lower than 20 µg/dl.[9]

The blood lead level may be increased after occupational exposure especially in developing countries due to absence of personal productive equipment's, poor education, lack of personal hygiene, and under nutrition.[10] In general, as observed from prior studies that a lot of occupations are the high risk categories for the adverse health effect of pollution, compared to general population, and also occupational studies on workers personnel help us to understand the effects of vehicular pollution and its specific adverse effect due to the opportunity for defined exposures measurements.[11] Although, there were many studies and researches in Iraq about surveys few of them focused on environmental pollution from oil industry activities. There have been relatively few recent studies on a small numbers of areas by Iraqi researchers on environmental pollution in Iraqi governorates especially in some industrial areas.[12]

Number of questions have been raised about safety of prolonged usage of lead in petrol in Iraq because of lead exposure estimated to 0.6% of global burden disease, with highest

burden in developing region.[13] Recently, increase in use of lead in petrol (gasoline), paint and plumbing have resulted in fundamental rise in lead levels in blood.[14]

**Objective of the study:** To determine blood lead levels, risk factors for lead poisoning among a sample and to evaluate the effect of exposure to environmental lead on traffic policemen and taxi driver addition to generators on generators workers.

## MATERIALS AND METHODS

**Study Design:** Implementation of the case-control design from the first of December, 2016 to 30th of June, 2017 in order to achieve the objective of the present study.

**Setting of the study:** The data were collected from Baqubah Center in Diyala Governorate which is called orange city in Iraq. It is located to the northeast of the Baghdad city (capital of Iraq). The investigation were carried out in Medical City Directorate, Poisoning Consultation Center for all samples collected.

**Subjects of the study** The subjects of the study consisted of (264) adult men who are divided into two groups, cases (132) of the traffic policemen, taxi drivers and generators workers and controls (132) of apparently healthy subjects.

**Data collection and method**: The data collection have been conducted during a period of 3 months extending from the first of December, 2016 to the twenty-eighth of February, 2017, Five milliliters of venous blood were collected from each subject by venipuncture by using dry disposable plastic syringe. the blood sample put in EDTA tubes and then put in ice box transport for measuring the blood lead level. The time sequence of data collection was 4hours per day (9 a.m. to 1 p.m.). Blood test elements at the Poisoning Consultation Center / City of Medicine - Baghdad by atomic flame atomic absorption spectrophotometer (NOVA 300). Hallow cathode lamp used for lead absorption is measured in fuel - rich flame in order to obtain maximum sensitivity. Taking the supernatant by using adjustable micropipettes with disposable tips and put it in a dry, plastic plain tube for lead examination with atomic absorption spectrometry device. Using standardized procedure / stock standard (1000 µg / ml) was used to make working standard, (10,20,30 µg/dl) and a calibration curve was done. Samples, controls and standard were directly aspirated into air – acetylene flame where the lead hallow cathode lamp was used at a wave length of 283.2nm. The toxic or action blood lead level is ≥ 25 µg / dl.[15] In poisoning consultation center - Iraq, toxic or action blood lead level considered in value ≥ 25 µg / dl.

**Statistical Analysis**: Data were present in simple measures of mean, standard deviation, using independent student t-test for difference between two means (ANOVA) while dennett test to compare between groups. While different percentage (qualitative data) from different groups and from controls group were tested using Chi-square test. Statistical significance was considered whenever the P- value was equal or less than 0.05.

## RESULTS

Table 1. shows distribution of BLLs (µg/dl) among study sample (cases and controls) according to age groups, the highest BLLs in generators workers aged between **50-59** years **(30.8333 ± 4.44597µg/dl) and less BLLs between 20-29 years (26.3571 ± 3.60784µg/dl).** traffic policeman highest BLLs between **40-49** years **(21.3750 ± 2.97309 µg/dl)** and less BLLs between **20-29** years **(19.0833 ± 2.42930 µg/dl)**. The taxi drivers highest BLLs between **50-59** years **(21.7500 ± 3.84522 µg/dl)** and less BLLs between **30-39** years **(18.7857 ± 1.96815 µg/dl)**. While mean±sd of BLLs by age in controls group **(12.3485 ± 2.12217 µg/dl)**, and shows highly significant difference between cases and controls according to age groups (**p= 0.0001**).

**Table 1: The distribution of BLLs (µg/dl) among study sample (cases and controls) according to age groups.**

| Study sample | Age (years) | Mean (µg/dl) | Std.Deviation | No. |
|---|---|---|---|---|
| Generator Workers | 20-29 | 26.3571 | 3.60784 | 14 |
| | 30-39 | 29.0769 | 4.15254 | 13 |
| | 40-49 | 29.0000 | 4.24264 | 11 |
| | 50-59 | 30.8333 | 4.44597 | 6 |
| | **Total** | **28.4318** | **4.20076** | **44** |
| Traffic Policemen | 20-29 | 19.1667 | 2.75791 | 12 |
| | 30-39 | 20.3636 | 1.36182 | 11 |
| | 40-49 | 21.3750 | 2.97309 | 8 |
| | 50-59 | 21.0769 | 2.81252 | 13 |
| | **Total** | **20.4318** | **2.60052** | **44** |
| Taxi Drivers | 20-29 | 19.0833 | 2.42930 | 12 |
| | 30-39 | 18.7857 | 1.96815 | 14 |
| | 40-49 | 19.0000 | 1.94365 | 10 |
| | 50-59 | 21.7500 | 3.84522 | 8 |
| | **Total** | **19.4545** | **2.66288** | **44** |
| Controls Group | 20-29 | 12.2333 | 1.92414 | 30 |
| | 30-39 | 12.0976 | 2.35377 | 41 |
| | 40-49 | 12.6250 | 1.95707 | 40 |
| | 50-59 | 12.4762 | 2.29388 | 21 |
| | **Total** | **12.3485** | **2.12217** | **132** |

**F=414.801 df=3 P= 0.0001**

Regarding residency non-significant difference were seen between blood lead levels and cases and controls (**p= 0.082**).

**Table 2: The distribution of BLLs (µg/dl) among study sample (cases and controls) according to residency.**

| Residence | Study Group | No. | Mean(µg/dl) | Std. Deviation(µg/dl) | ANOVA test |
|---|---|---|---|---|---|
| **Urban** | **cases** | 93 | 22.75 | 4.83 | F test=3.04 P.Value =0.082 |
| | **controls** | 107 | 12.30 | 2.12 | |
| | **Total** | 200 | 17.17 | 6.36 | |
| **Rural** | **cases** | 39 | 22.82 | 5.95 | |
| | **controls** | 25 | 12.52 | 2.16 | |
| | **Total** | 64 | 18.79 | 6.98 | |
| **Total** | **cases** | **132** | **22.77** | **5.16** | |
| | **controls** | **132** | **12.35** | **2.12** | |

Table 3. shows distribution of blood lead levels (µg/dl) among study sample according to duration of work in work place, high significant difference were seen in cases and controls for those with 5-10 years' work (**P= 0.0001**), for those with >10 years work (**P= 0.0001**) and for those with <5 years work (**P= 0.0001**).

**Table 3: The distribution of BLLs (µg/dl) among study sample (case & control) according to duration of work in work place.**

| Duration of work | Cases | Controls | t. test | P. value |
|---|---|---|---|---|
| | Mean±SD(µg/dl) | Mean±SD(µg/dl) | | |
| <5 years | 20.88±4.40 | 13.21±2.42 | **21.46** | 0.0001* |
| 5-10 years | 22.10±5.20 | 12.40±2.40 | | 0.0001* |
| >10 years | 23.38±5.22 | 12.18±1.93 | | 0.0001* |
| **Total** | **22.78±5.17** | **12.35±2.12** | | |

Regarding blood lead levels significance difference (p= 0.0001) were found between cases (generation workers Mean±SD = **28.43±4.20 µg/dl**, traffic policeman Mean±SD = **20.43± 2.60 µg/dl** and taxi driver Mean±SD = **19.45±2.66 µg/dl**) and controls group (Mean±SD = **12.35±2.12 µg/dl**). (Table 4).

**Table 4: The distribution of blood lead levels (µg/dl) among study group (case & controls).**

| Study sample | No. | Mean (µg/dl) | Std. deviation | 95% Confidence Interval for Mean | | Minimum | Maximum | ANOVA test |
|---|---|---|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound | | | |
| Generator Workers | 44 | 28.43 | 4.20 | 27.15 | 29.71 | 21.00 | 36.00 | F test= 414.801 P.Value=0.0001* |
| Traffic Policemen | 44 | 20.43 | 2.60 | 19.64 | 21.22 | 16.00 | 26.00 | |
| Taxi Drivers | 44 | 19.45 | 2.66 | 18.64 | 20.26 | 15.00 | 26.00 | |
| Controls Group | 132 | 12.35 | 2.12 | 11.98 | 12.71 | 9.00 | 17.00 | |
| **Total** | **264** | **17.56** | **6.54** | **16.76** | **18.35** | **9.00** | **36.00** | |

Regarding smoking cigarette significant difference were seen between BLLs and cases and controls (**p= 0.002**). (Table 5).

**Table 5: The distribution of BLLs (µg/dl) among study sample (cases and controls) according to smoking cigarette.**

| Smoking | Study Group | No. | Mean (µg/dl) | Std. Deviation(µg/dl) | ANOVA test |
|---|---|---|---|---|---|
| **no** | **cases** | 58 | 22.06 | 5.21 | F test =10.04 P.Value = 0.002* |
| | **controls** | 75 | 11.87 | 1.81 | |
| **yes** | **cases** | 74 | 23.32 | 5.08 | |
| | **controls** | 57 | 12.98 | 2.34 | |
| **Total** | **cases** | 132 | 22.77 | 5.16 | |
| | **controls** | 132 | 12.35 | 2.12 | |

Table 6. shows distribution of cases and controls according to protective measures. shows between the cases and controls a significant difference in wear protection mask (**p= 0.009**), eating or drinking by the work area (**p= 0.0001**), washing hands before eating (**p= 0.0001**), laundering of work clothes after work (**p= 0.0001**), eating in clean area (**p= 0.0001**), having knowledge about lead poisoning (**p= 0.0001**) and having previous lead tests (**p= 0.0001**), and not shown a significant difference in taking a bath after work (**p= 0.081**).

**Table 6: The distribution of study sample (cases & controls) according to protective measures.**

| Protective Measures | | cases | | control | | Total | | P.Value |
|---|---|---|---|---|---|---|---|---|
| | | No.=132 | % | No.=132 | % | No.=264 | % | |
| Difficult to wear protection mask | no | 49 | 37.12 | 62 | 46.97 | 145 | 54.92 | 0.009* |
| | yes | 83 | 62.88 | 70 | 53.03 | 119 | 45.08 | |
| Eating or drinking in the work area | no | 23 | 17.42 | 76 | 57.58 | 99 | 37.50 | 0.0001* |
| | yes | 109 | 82.58 | 56 | 42.42 | 165 | 62.50 | |
| Washing hands before eating | no | 64 | 48.48 | 20 | 15.15 | 84 | 31.82 | 0.0001* |
| | yes | 68 | 51.52 | 112 | 84.85 | 180 | 68.18 | |
| Laundering of work clothes after work | no | 17 | 12.88 | 84 | 63.64 | 101 | 38.26 | 0.0001* |
| | yes | 115 | 87.12 | 48 | 36.36 | 163 | 61.74 | |
| Eating in clean area | no | 30 | 22.73 | 9 | 6.82 | 39 | 14.77 | 0.0001* |
| | yes | 102 | 77.27 | 123 | 93.18 | 225 | 85.23 | |
| Taking a bath after work | no | 33 | 25.00 | 46 | 34.85 | 79 | 29.92 | 0.081* |
| | yes | 99 | 75.00 | 86 | 65.15 | 185 | 70.08 | |
| Having knowledge about lead poisoning | no | 10 | 7.58 | 49 | 37.12 | 59 | 22.35 | 0.0001* |
| | yes | 122 | 92.42 | 83 | 62.88 | 205 | 77.65 | |
| Having previous lead tests | no | 117 | 88.64 | 132 | 100.00 | 249 | 94.32 | 0.0001* |
| | yes | 15 | 11.36 | 0 | .00 | 15 | 5.68 | |

Table 7. shows distribution of cases and controls according to past medical history, most cases and controls were past medical history a significant difference in hypertension (**p= 0.0001**), kidney disease (**p= 0. 001**), anemia (**p= 0.01**), heart disease (**p= 0.030**), lung disease (**p= 0.003**) and diabetes (**p= 0.0001**), and non-significant in asthma (**p= 0.249**) and gout (**p= 0.316**).

**Table 7: The distribution of study sample (case & control) according to past medical history.**

| Past medical history | | cases | | controls | | Total | | P.Value |
|---|---|---|---|---|---|---|---|---|
| | | No.= 132 | % | No.=132 | % | No.=264 | % | |
| Hypertension | no | 115 | 87.12 | 132 | 100 | 247 | 93.56 | 0.0001* |
| | yes | 17 | 12.88 | 0 | 100 | 17 | 6.44 | |
| Kidney disease | no | 120 | 90.91 | 132 | 100 | 252 | 95.45 | 0. 001* |
| | yes | 12 | 9.09 | 0 | 100 | 12 | 4.55 | |
| Anemia | no | 126 | 95.45 | 132 | 100 | 258 | 97.73 | 0.01* |
| | yes | 6 | 4.55 | 0 | 100 | 6 | 2.27 | |
| Heart disease | no | 127 | 96.21 | 132 | 100 | 259 | 98.11 | 0.030* |
| | yes | 5 | 3.79 | 0 | 100 | 5 | 1.89 | |
| Asthma | no | 130 | 98.48 | 132 | 100 | 262 | 99.24 | 0.249 |
| | yes | 2 | 1.52 | 0 | 100 | 2 | 0.76 | |
| Lung disease | no | 122 | 92.42 | 132 | 100 | 254 | 96.21 | 0.003* |
| | yes | 10 | 7.58 | 0 | 100 | 10 | 3.79 | |
| Gout | no | 131 | 99.24 | 132 | 100 | 263 | 99.62 | 0.316 |
| | yes | 1 | .76 | 0 | 100 | 1 | 0.38 | |
| Diabetes | no | 118 | 89.39 | 132 | 100 | 250 | 94.70 | *0.0001 |
| | yes | 14 | 10.61 | 0 | 100 | 14 | 5.30 | |

## DISCUSSION

**Sociodemographic Characteristics: Age:** Likewise previous researchers reported that lead was highly significantly accumulated with increasing age.[16] However, in current study, highly significant difference was observed at older age among study groups (cases & controls) as it has been found that there was higher variations in the mean of blood lead levels among different age groups with the highest level being in the age group (40-49 years) and (50 -59 years) with highly statistical significance. That agrees with above study. lead used as a faulty building block in place of calcium, these lead to accumulation and binding of Pb to bone over time.[17] This probably explain this results the age an important factor in increasing the accumulation of lead. **Residence:** Non-significant difference was found between the lead level of subjects living in rural and urban areas because the populations were selected in central areas of Baqubah to assess the average exposure and any specific source of the pollutant. The main sources of Pb exposure for the general population was airborne particulate (smoke included). These findings agreed well with the fact that environmental lead pollution is a major problem in our country, Beside the leaded gasoline, which was considered the major source of environmental inorganic lead exposure, this results agrees with findings of other local studies in Kurdistan region-Iraq[18] and other studies in Pakistan.[19] **Duration of Work:** In the current study which showed significant difference in duration of work in work place between cases and controls especially for those with more than 10 years' work. A similar type of results were obtained in Baghdad - an Iraqi study[20] and Hilla City-Iraqi study[21] on lead, may be due to absence of the protective measures, not taking breaks during work shifts or there is no job rotation among workers. **Smoking cigarette:** The lead in the smoke of a cigarette is taken by respiration, smoking which causes lead intake by these route is a risk factor for lead poisoning.[22] The precise sources and mechanisms of the observed overexposure of smokers remain controversial. Possible explanations could be the facilitated transportation of airborne lead into the lungs by smoke particles.[23] **Regarding risk factors:** Among all participants in this study the mean BLLs value in cases were 22.77 µg/dL. This value is much lower than the mean BLLs of the non-occupationally exposed individuals reported in Baghdad City / Iraq 24.53 µg/dL[20] and also in various type of male workers in Hilla city/ Iraq 23.50 µg/dL[21], However, one the most important reason for the relatively high level of lead in blood sample of people was that the high concentrations of Pb in the air. In Kirkuk city-Iraq, the level of atmospheric lead was 956.8 µg/m³ in 2011*.[24] This value is much higher than the mean BLLs of the general population reported in Basrah / Iraq 11.20 µg/dL[25], this may be due to low occupational

exposure, while in Duhok-province/ Iraq that measured during the year 2011 which was 7.3 µg/dL also was very lower from our study[18], this may be due to the origin of their sample which were taken mainly from rural and suburban regions and the nature of their geographical area as well as the low occupational exposure. Among all participants in this study the mean BLLs value in controls group were 12.349 µg/dL. This value is lower than the mean BLLs of the occupationally non exposed comparison group reported in Hilla City/ Iraq 13.02 µg/dL[21], and higher than the mean BLLs of the controls group reported in Al-Najaf - province / Iraq 10.7 µg/dL.[26] **Regarding Protective measures:** Most of the occupationally and workers have no idea about the toxic effects of lead that they exposed to; as our result, they pay little attention to protecting themselves, mask usage is important due to its protective properties for respiratory system against dust, poison gas, and vapors.[27] The fact that in the present study, approximately 2/3 of the study sample have difficult to wear protection mask and only 1/3 not have difficult to wear mask, indicates inadequate awareness on this issue. Although, high significant difference was found in our study, which differ with the previous study on wearing the mask for workers while working in Turkey.[28] The BLLs and air lead levels were higher in developing nations, that given the absence of monitoring and regulation in some countries, Research may be the only viable option for improving working conditions and preventing environmental pollution.[29] So in our study was high significant difference in eating and washing hands before eating between cases and controls, that is agrees with findings of other study in Iran[30], this may be due to eating in areas exposed to the city with its lead-contaminated areas or forgetting to wash your hands before eating. Although the knowledge that they need to know how to protection from lead poisoning, but a few of them go to regular health checkup and knowledge about effect of lead. Regular checkups save lives even when there is no specific problem, since the absence of disagreeable symptoms does not necessarily guarantee that one is in good health. Some studies have also shown decreased mortality in people who undergo regular medical checkup.[31] Our study showed that the level of knowledge with regard to lead poisoning among the study sample found a significant difference between cases and controls and that similar results were obtained in a study in Nepal on the level of knowledge of lead poisoning between traffic police[32], this may be due to the lack of health education about the problems and risks of lead. **Past medical history**: Prolonged and high level of lead exposure particularly of occupational exposure, that affects gastrointestinal, hematopoietic, nervous, renal, and reproductive system and may cause occurrence of various diseases.[1] In our study is found high significant difference in hypertension, anemia, heart disease,that were similar in

previous locally study in Hilla city- Iraq[20] and also in Turkey.[28] Kidney disease has been found to have a large significant difference as well as diabetes, which is similar to the previous study on the relationship between lead levels, diabetes, hypertension and renal function in the United States.[3] lead pollution may contribute in pathogenesis of pulmonary cancers, asthma, COPD however, there is not confident result in this regard yet.[25] Epidemiological studies suggests that lead may play a role in causing asthma as the incidence of asthma in workers exposed to lead that live in high levels of lead pollution places is increased[6], So our study results found a high significant difference in lung disease as well as we found low significant difference in asthma, which agrees with previous study about pulmonary function tests in lead exposed workers in Iran.[30] In our study not shown significant difference in gout, which disagree with previous study on the effects of lead exposure in Turkey.[33] From above may be we prove that chronic exposure to lead contributes as a risk factor to pathogens.

## CONCLUSIONS

The blood lead levels among cases study was 22.77 µg/dL while among controls study was 12.349 µg/dL, significant difference between cases and controls was higher than countries surrounding our country. Significant difference between group cases study (generator workers, traffic policeman and taxi drivers) and blood lead levels. it is clear to us that the increase in the lead in the air and environment of Baqubah City is due to the presence of lead in petroleum in addition to its other uses which led to air and environment pollution which reflected its effect on the occupations.

**Recommendations:** The study recommends the following: Health authorities tighten supervision and provide minimum occupational safety measures, and Improving procedures of health risk assessment. Improving identification of populations at high risk of exposure on the basis of monitoring systems and promotion of understanding and awareness of exposure to lead. Increase educational programs of heavy metals and their effects, especially lead. Oblige occupations, especially generators workers, traffic police and taxi drivers, to use protective mask to protect their respiratory system and minimize inhalation of air pollution by lead during work. Environmental monitoring departments continuously monitor and measure the lead ratio in air and soil, in addition to following up the application of occupational safety rules in most occupations and employees. Conduct a comprehensive study of Iraq to

determine the natural value of lead that can be adopted as a real value for health and occupational safety in Iraq.

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