

Assessment of Blood Lead Levels Among Members of the Iraqi Popular Mobilization Forces: A Statistical Study Based on Age, Smoking Habits, and Geographic Origin

Received 3th Decamber 2025,
Accepted 5th Decamber 2025

Cite this: *NJBM*. 2025, 1 (1),
39-44

Lina Mohammed Hatem¹, Kawther Hussein Mohammed², Shaymaa Awad kadhim³, Hussien Abid Ali Mraity⁴,
Allawi Hamead Harjan⁵, Hayder H. Hussein⁶

Keywords: Blood Lead Levels (BLL); Lead Exposure; Popular Mobilization Forces (PMF); Smoking and Lead Toxicity; Occupational, Environmental Health; Iraq

This study investigated blood lead levels (BLL) among 30 members of the Iraqi Popular Mobilization Forces (PMF), with particular focus on the influence of smoking habits, age, and geographic origin. Blood samples were analyzed using Flame Atomic Absorption Spectroscopy, and statistical analyses were applied to evaluate group differences and associations. The findings revealed that all participants, both smokers and non-smokers, exhibited BLLs significantly above the international reference threshold of 5 ppb, indicating widespread exposure to environmental or occupational lead sources. The mean concentration across the sample was 26.15 ppb. However, no statistically significant differences in BLL were observed when comparing smokers to non-smokers, different age groups, or governorates, suggesting that lead exposure is pervasive and not limited to specific subgroups. ROC curve analysis and odds ratio calculations further confirmed the absence of a strong association between smoking and elevated lead levels, although smokers tended to show slightly higher mean concentrations. In conclusion, the study highlights alarmingly elevated BLLs among PMF personnel, far exceeding safe international standards. While subgroup comparisons did not yield significant differences, the uniformly high exposure across all participants underscores the urgent need for targeted occupational health interventions, stricter environmental regulations, and continuous biomonitoring of military personnel in Iraq.

1. Introduction

Lead (Pb) is a naturally occurring heavy metal widely used in various industrial, military, and manufacturing applications. Despite its historical utility, lead is now recognized as a potent environmental toxin with no known beneficial role in human physiology. Once absorbed through inhalation or ingestion, lead accumulates in bones, soft tissues, and blood, interfering with numerous biochemical processes. It is particularly harmful to the nervous system, hematopoietic system, kidneys, and cardiovascular system, even at low levels of exposure [1, 2, 3, 4, 5]. Chronic lead exposure has been associated with neurobehavioral impairments, decreased IQ, anemia, renal dysfunction, hypertension, and increased risk of cardiovascular disease.

The central nervous system is especially vulnerable in adults exposed occupationally, where symptoms such as irritability, fatigue, reduced cognitive performance, and impaired coordination may manifest—posing serious risks in physically and mentally demanding professions like military service [6, 7, 8].

In Iraq, environmental lead contamination has become a pressing public health issue due to decades of armed conflict, the historical use of leaded gasoline, unregulated industrial activities, and the proliferation of generators and battery shops. Several

studies have documented elevated blood lead levels (BLL) among Iraqi populations. For example, Al-Dosky et al. [9] reported a mean BLL of 7.3 µg/dL in the general population in Duhok, while Mohammed et al. [10] found levels as high as 17.5 µg/dL in petroleum industry workers in Kirkuk. These values often exceed the CDC's current reference level of 5 µg/dL for public health concern [11].

Previous studies also investigated environmental and lifestyle factors influencing lead exposure in Iraq. Hamza et al. [7] highlighted the influence of smoking on uranium and alpha-emitting radionuclides accumulation, suggesting a parallel for lead exposure in high-risk populations. Abdulrudha and Kadhim [8] demonstrated that geographic location significantly affects heavy metal levels in non-smoking Thalassemia individuals. Similarly, Abdulrudha and Kadhim [12] reported elevated serum cadmium and lead levels in Thalassemic patients from Najaf, indicating that chronic exposure in this governorate may contribute to higher systemic lead concentrations. Tawil et al. [6] compared cadmium, zinc, lead, and copper concentrations between lung cancer patients and healthy individuals, showing that disease status, lifestyle, and occupational exposure can influence blood lead levels. Collectively, these studies emphasize the importance of considering environmental, occupational, lifestyle, and demographic factors when evaluating lead exposure in specialized populations.

Recent studies indicate that military personnel, including members of the PMF, are particularly at risk of elevated lead exposure due to combat and occupational environments. A study on special forces personnel in Germany reported that lead exposure at shooting ranges resulted in blood lead levels ranging from 1 to 35 µg/dL before implementing exposure control measures, which

¹Department of Physics, Faculty of Education for Girls, University of Kufa, Najaf, Iraq.

^{2,3,4,5,6}Department of Physics, Faculty of Sciences, University of Kufa, Najaf, Iraq.

*Corresponding Author Email: linam.almjalawy@uokufa.edu.iq

decreased to 1–15 µg/dL afterward, highlighting the effectiveness of preventive measures in reducing lead exposure [13]. Another study on U.S. veterans found that 4.9% had blood lead levels exceeding 10 µg/dL, emphasizing the importance of monitoring lead levels among military populations [14].

These findings suggest that military personnel face unique occupational and environmental risks for lead exposure, which are influenced by lifestyle factors such as smoking, geographic location, and age, making targeted assessment and intervention essential. Although previous Iraqi studies have assessed lead exposure in the general population and specific occupational groups, there is a significant gap in data concerning PMF personnel. Therefore, this research aims not only to measure BLL among PMF members but also to evaluate differences across smoking status, age categories, and geographic origin. By addressing this gap, the study contributes to a better understanding of occupational and environmental lead exposure in Iraq and provides evidence to inform health interventions for military personnel [1, 8, 13]. There are many studies to measure the concentrations of elements such as zinc, copper [15], and uranium concentrations [16], and statistical studies in the field of cancerous diseases related to people's daily habits [17,18]. Therefore, in order to reach more facts about diseases and their prevention, practical and statistical research is conducted.

This study aims to assess blood lead levels among members of the Iraqi Popular Mobilization Forces (PMF), a significant segment of society, and to investigate whether smoking habits, age, and geographic origin significantly influence these levels. By addressing this gap in available data, the study seeks to provide scientific evidence to contribute to the development of occupational health strategies, environmental regulations, and preventive measures for military personnel in Iraq.

2. Methods

2.1 Study Design and Population

This research was designed as a cross-sectional descriptive-analytical study to assess blood lead levels (BLL) among members of the Iraqi Popular Mobilization Forces (PMF). A total of 30 male participants were recruited from different provinces of Iraq, with deliberate inclusion of 10 participants from Najaf to allow for geographic comparison. The participants were aged between 21 and 61 years and were actively engaged in PMF duties at the time of sample collection. Inclusion criteria comprised male individuals affiliated with the PMF who consented to participate and were free from any known acute medical conditions at the time of blood collection. Exclusion criteria included individuals with a prior history of occupational exposure unrelated to PMF activities (such as battery manufacturing or smelting), those with incomplete questionnaire data, or participants with insufficient blood sample volume.

2.2 Data Collection

Sociodemographic and lifestyle information was collected through a structured questionnaire administered in face-to-face interviews. The questionnaire was pre-tested and designed to obtain reliable information on age, smoking status (smoker or non-smoker), and province of residence. Additional occupational details were also obtained to evaluate the potential risk of lead exposure.

2.3 Blood Sample Collection and Handling

Venous blood samples (5 mL) were obtained from each participant under aseptic conditions using lead-free vacutainer tubes containing EDTA as an anticoagulant. The use of lead-free equipment minimized the risk of sample contamination. Samples were stored under cold chain conditions (4 °C). To ensure reliability, all samples were labeled with anonymous identification codes. Blood samples were preserved until analysis and processed within 48 hours of collection.

2.4 Analytical Procedure

Prior to analysis, 1 mL of each blood sample was subjected to acid digestion to ensure complete mineralization and accurate measurement of lead. Briefly, 5 mL of concentrated nitric acid (HNO₃, 65%) and 2 mL of hydrogen peroxide (H₂O₂, 30%) were added to the sample. The mixture was pre-digested at room temperature for 30 minutes and then fully digested in a microwave digestion system at 180°C for 15 minutes under controlled pressure. After cooling, the digested samples were diluted to a final volume of 25 mL with deionized water. All glassware and digestion vessels were pre-cleaned with 10% HNO₃ to prevent contamination. The resulting solution was then analyzed by Flame Atomic Absorption Spectroscopy (FAAS) [19, 20]. Blood lead concentrations were determined using FAAS following the standard protocols recommended by the American Public Health Association. Calibration curves were generated using certified lead standard solutions (Fig. 1) [20, 21].

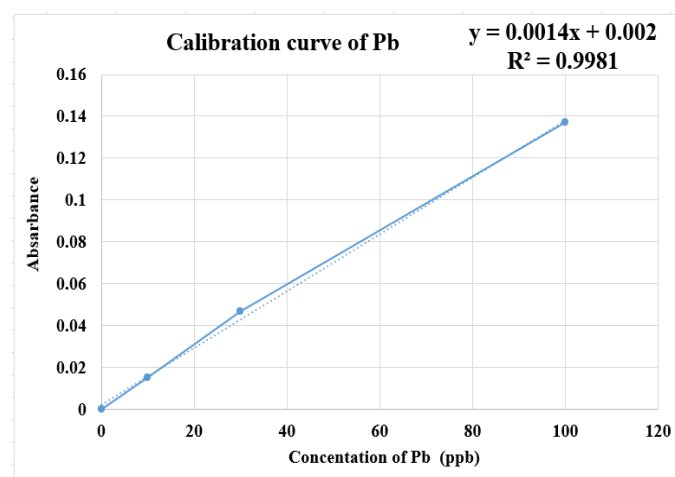


Fig 1. Calibration curve of Pb

Statistical Analysis

Data were entered and analyzed using SPSS (version 26.0). Descriptive statistics, including mean, standard deviation, and median values, were calculated. Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate BLL with respect to smoking status. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to assess the likelihood of elevated BLL among smokers compared to non-smokers. Outliers were examined using boxplots, and statistical significance was defined as $p < 0.05$ for all tests.

3. Results and Discussion

3.1 Comparison of lead concentrations according to smoking status

Since the data for smokers were not normally distributed (Shapiro-Wilk $p = 0.00002$), a non-parametric test (Mann-Whitney U) was used. Test statistic = 85.00, p -value = 0.663. There was no statistically significant difference in lead concentration between smokers and non-smokers. Median: Median lead concentration. IQR: First to third quartile. Whiskers: Normal range of values within $1.5 \times \text{IQR}$. Single dots: Outliers.

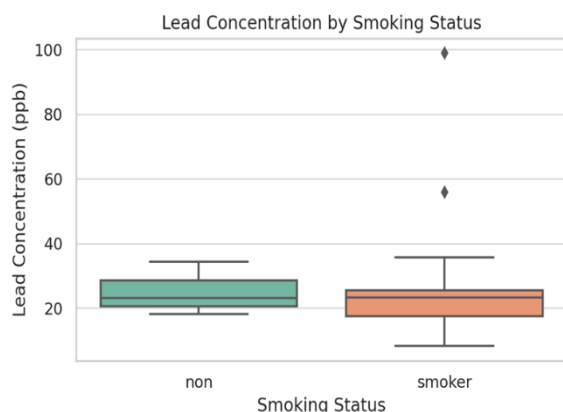


Fig 2. Comparison of lead concentrations according to smoking status

3.2 Comparison of lead concentrations according to Governorate

A comparison of blood lead concentrations was conducted across governorates with at least 4 participants (Najaf, Basra, and Dhiqar). The Kruskal-Wallis H-test was used due to the non-normal distribution of the data. Test Statistic = 1.96, p -value = 0.375. There were no statistically significant differences in lead concentration between the governorates ($p > 0.05$).

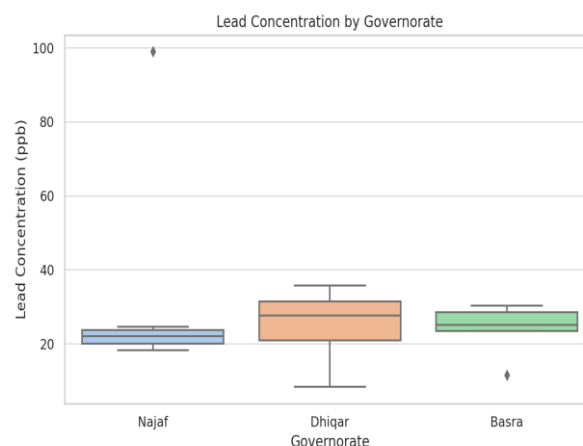


Fig 3. Comparison of lead concentrations according to governorate

3.3 Comparison of lead concentrations according to Age group

Participants were grouped into three age categories: under 30, 30–39, and 40 years or older. Lead concentrations were compared across these groups. The Kruskal-Wallis H-test was used to compare lead concentrations across age groups. Test Statistic = 0.72, p -value = 0.697. There were no statistically significant differences in lead concentration between the age groups.

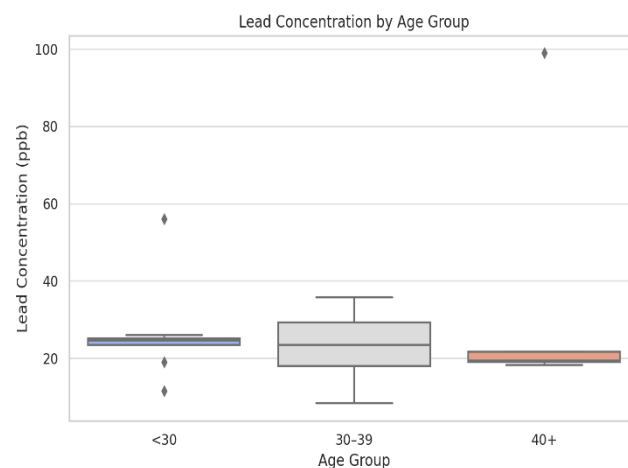


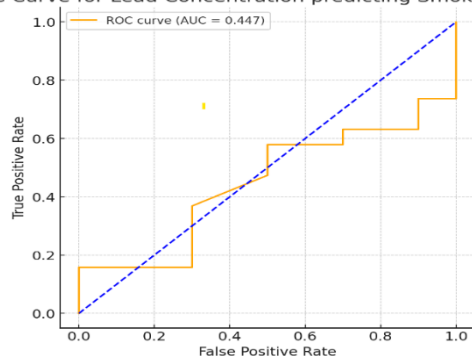
Fig 4. Comparison of lead concentrations according to Age group

3.4 Roc Curve of lead concentrations in blood

The ROC (Receiver Operating Characteristic) curve was applied to evaluate the ability of blood lead concentration to discriminate between smokers and non-smokers. The Area Under the Curve (AUC) was 0.447, indicating poor discriminatory ability. Although the specificity was high (1.0), the sensitivity was very low (0.16), showing that serum lead concentration is not a reliable biomarker for predicting smoking status in this dataset.

Table 1. Analysis of ROC curve for Pb concentration levels in serum for predicting smoking status

Sample Type	Predictors	AUC	p-value	95% CI	Cut-off Point (ppb)	Sensitivity	Specificity
Serum	Pb (ppb)	0.447	>0.05	—	35.77	0.16	1.00

ROC Curve for Lead Concentration predicting Smoking Status**Fig 5.** ROC curve

3.5 Odds Ratio (OR)

The analysis revealed that smokers were more likely to have elevated lead concentrations (≥ 25 ppb) compared with non-smokers, with an odds ratio of 1.36. However, the 95% confidence interval (0.26–7.04) was wide and included the null value, indicating that the association was not statistically significant. This suggests that while there may be a tendency for smoking to be linked with higher lead levels, the evidence is insufficient to confirm a true effect, likely due to the small sample size and resulting low statistical power.

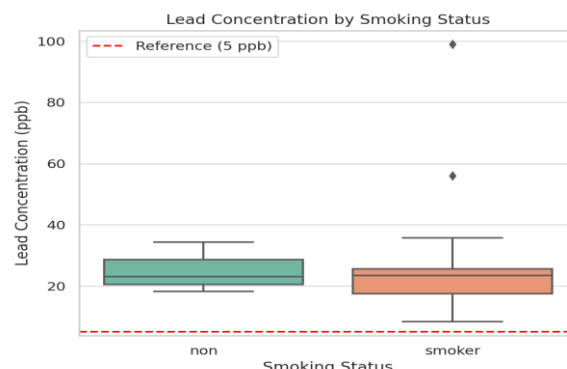
3.6 Comparison of Lead Concentration with Reference Standard (<5 ppb)

This section compares the lead concentrations in blood samples of individuals grouped by smoking status, against the standard reference value of 5 ppb typically observed in unexposed individuals. A Wilcoxon signed-rank test was used to assess whether the observed concentrations significantly exceeded the reference level.

Table 2. Statistical Summary by Smoking Status

Group	Mean Lead (ppb)	n	Above 5 ppb	Percent Above 5 ppb	Wilcoxon p-value
Non	24.46	10	10	100	0.001953
smoker	27.04	19	19	100	3.815e-06

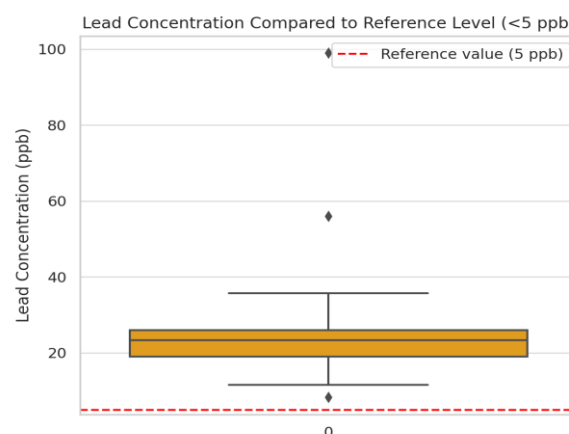
The following boxplot shows lead concentration distributions for smokers and non-smokers, with the reference line at 5 ppb:

**Fig 6.** Comparison of lead concentrations according to smoking status

Both smokers and non-smokers in the study exhibited blood lead levels well above the standard reference value of 5 ppb. 100% of participants in both groups had levels exceeding this threshold. The Wilcoxon test confirmed statistically significant elevation in both groups ($p < 0.01$), indicating that environmental or occupational exposure to lead may be a contributing factor regardless of smoking status. However, smokers exhibited slightly higher mean concentrations than non-smokers.

3.7 Comparison of Lead concentrations with Reference Standard

This analysis compares the measured blood lead concentrations in the study sample to the reference standard level for unexposed individuals, which is typically less than 5 ppb. Mean Lead Concentration: 26.15 ppb, Number of samples exceeding 5 ppb: 29 out of 2, Percentage exceeding the reference: 100.0%, Wilcoxon Signed-Rank Test p-value: 0.000000. All blood lead concentration values in the dataset exceeded the reference level of 5 ppb. The statistical analysis using the Wilcoxon Signed-Rank test showed a highly significant difference between the sample and the standard level ($p < 0.001$). This suggests that individuals in the sample have been exposed to elevated levels of lead, potentially from environmental, occupational, or other sources.

**Fig 7:** Boxplot showing distribution of lead concentration compared to the reference level (5 ppb)

This study assessed blood lead levels (BLL) among Iraqi PMF personnel, considering smoking habits, age, and geographic origin. The results revealed universally elevated BLLs (mean 26.15 $\mu\text{g}/\text{dL}$),

well above the CDC reference value of 5 µg/dL, indicating widespread lead exposure.

No significant differences were observed between smokers and non-smokers, consistent with prior research showing that environmental and occupational sources dominate lead exposure compared to smoking. Similarly, age and geographic origin did not significantly influence BLLs, likely due to pervasive environmental contamination affecting all participants, in agreement with previous Iraqi studies documenting high BLLs across populations and occupational groups.

ROC curve and odds ratio analyses confirmed the limited predictive value of smoking for elevated BLL, highlighting the predominant role of environmental and military-related exposures. The uniformly high BLLs raise concerns for long-term health effects, including neurocognitive decline, anemia, renal impairment, and cardiovascular risks, which may also impact operational performance.

Table 3. Comparative Table of Blood Lead Levels (BLLs)

N o.	Study	Location & Year	Group	Mean / Reported BLL (µg/dL)	Notes
1	Present study	Iraq, year in manuscript	PMF personnel, n = 30	26.15	Very high; exceeds all international reference limits.
2	Al-Dosky et al., 2012[22]	Duhok, Iraq	General population, n ≈ 820	~8–12	Regional environmental exposure.
3	Mohammad et al., 2024[23]	Kirkuk, Iraq	Refinery workers vs controls	Workers: ~20–30; Controls: ~10	Occupationally exposed groups had double the levels.
4	Abdulrudha & Kadhim, 2024/25 [12]	Najaf, Iraq	Thalassemia patients vs controls	Patients: ~15–18; Controls: ~7–9	Medical population still shows elevated Pb.
5	Karami et al., 2024[24]	Kirkuk, Iraq	Case series (refinery workers)	>40 (cases)	Severe lead poisoning events.
6	Laidlaw et al., 2017 (review) [25]	Global	Shooters, firing ranges	15–35 (typical in exposed shooters)	Military/civilian firearm use causes significant increases.
7	Hyten et al., 2021[26]	Germany	SOF personnel	10–25 (before intervention); <10 after controls	Demonstrated effect of preventive measures.
8	CDC (2021), WHO[27]	International	Reference limits	CDC: 3.5 (children); WHO: no safe level	Any value >5 is concerning.

From table 3 the mean blood lead level (BLL) reported in this study (**26.15**) is considerably higher than international reference values (CDC 3.5 µg/dL; WHO, no safe threshold). Compared with Iraqi

data, our results align with Al-Dosky et al. (2012), who observed elevated BLLs among the general population in Duhok, indicating widespread environmental exposure. Occupational studies in Kirkuk further highlight this risk: Mohammad et al. (2024) reported significantly higher BLLs among refinery workers, while Karami et al. (2024) documented clinical cases of lead poisoning. Similarly, Abdulrudha & Kadhim (2024-2025) found elevated levels in Najaf among thalassemia patients, underscoring local geographic variability. In military contexts, international reviews (Laidlaw et al., 2017) and retrospective cohort studies (Hyten et al., 2021) demonstrate that firearm use at shooting ranges can substantially elevate BLLs, supporting our findings in security personnel. Taken together, these studies confirm that both environmental and occupational exposures are major contributors to elevated BLLs in Iraq, and they emphasize the urgent need for preventive strategies and monitoring programs. It is possible to repair parts of the human body using different materials, but the most important thing is to preserve the main elements of the body [29].

4.Conclusion

These conclusions should be interpreted in light of the study's limitations, including the relatively small sample size and lack of environmental measurements. We conclude that there is no significant difference between the medians. Smokers have more extreme values (outliers with higher concentrations). However, the large overlap in the distribution of values between the two groups indicates that the difference is not significant. This is consistent with the results of the Mann-Whitney test, which found no statistically significant difference between the two groups. we conclude the Area Under the Curve (AUC) was 0.447, indicating poor discriminatory ability. We conclude that there is no strong statistical evidence of a relationship between smoking and elevated lead concentrations in this small sample. There may be a real relationship, but the sample size is insufficient to detect it with confidence.

5.Recommendations

Regular blood lead monitoring is essential for PMF personnel to identify elevated levels early and prevent long-term health effects. Strict occupational safety measures, including the use of personal protective equipment when handling ammunition, batteries, or working in dusty and generator-intensive environments, should be enforced. Environmental interventions are needed to reduce lead exposure in operational zones, such as controlling emissions from generators, vehicles, and unregulated industrial activities. Health education programs should inform personnel about the risks of lead exposure and safe handling practices. Although smoking was not a significant contributor in this study, promoting smoking cessation can help reduce overall toxic load. Policymakers should implement regulations to limit occupational and environmental lead exposure. Future research with larger sample sizes is recommended to assess cumulative effects and interactions with other risk factors.

Ethical Approval and Consent to Participate

This study was conducted in accordance with the ethical standards of the College of Science at the University of Kufa. All participants provided informed consent prior to blood sample collection and data recording. A letter was submitted to the College of Science by the University of Kufa to conduct research related to the Popular Mobilization Forces.

Publication Consent

All authors consent to the publication of this article and confirm that the manuscript has not been published elsewhere.

Availability of Data and Materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare that they have no known financial or personal conflicts of interest that might influence the work reported in this paper.

Funding

This research has not received any specific grant from any funding agency in the public, commercial, or non-profit sectors. The authors self-funded the work.

Authors' Contributions

Lina Mohammed Hatem: Conceptualization, sample collection, data analysis, and manuscript drafting. Kawthar Hussein Mohammed: Methodological design, supervision, and validation of results. Shaima Awad Kazim: Laboratory analysis, data interpretation, and statistical testing. Alawi Hamid Harjan: Literature review, data visualization, and discussion of results. Hussein Abdul Ali Mariti: Manuscript editing, formatting, and final approval of the published version. All authors read and approved the final manuscript.

Acknowledgments

The authors are grateful to the College of Science and the College of Education for Women at the University of Kufa for their support in providing the necessary laboratories. They also thank the members of the Popular Mobilization Forces who volunteered to participate in this study.

REFERENCES

- [1] B. P. Lanphear, et al., "Low-level environmental lead exposure and children's intellectual function: An international pooled analysis," *Environ. Health Perspect.*, vol. 113, no. 7, pp. 894–899, 2005.
- [2] World Health Organization, "Lead poisoning and health," WHO, 2021. [Online]. Available: <https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health>
- [3] D. C. Bellinger, "Very low lead exposures and children's neurodevelopment," *Curr. Opin. Pediatr.*, vol. 20, no. 2, pp. 172–177, 2008.
- [4] Agency for Toxic Substances and Disease Registry (ATSDR), *Toxicological Profile for Lead*, U.S. Department of Health and Human Services, 2020.
- [5] M. H. Hirschmann, et al., "Lead content of tobacco and its relation to lead absorption," *Environ. Res.*, vol. 26, no. 2, pp. 451–456, 1981.
- [6] P. S. Barry, "A comparison of concentrations of lead in human tissues," *Br. J. Ind. Med.*, vol. 32, no. 2, pp. 119–139, 1975.
- [7] Z. M. Hamza, A. S. Jasim, K. Heydaryan, and S. A. Kadhim, "Quantitative assessment of uranium and alpha-emitting radionuclides in lung cancer patients using CR-39 detectors: Influence of gender and smoking behavior," *Appl. Radiat. Isot.*, vol. 225, p. 112069, 2025.
- [8] N. H. Abdulrudha and S. A. Kadhim, "The relationship of cadmium, lead, and uranium with the geographical location of non-smoking thalassemia individuals: A comparative study," *Appl. Radiat. Isot.*, vol. 220, p. 111779, 2025.
- [9] A. H. Al-Dosky, et al., "Blood lead levels in Duhok city, Iraq," *Zanco J. Med. Sci.*, vol. 15, no. 1, pp. 22–28, 2011.
- [10] M. A. Mohammed, et al., "Occupational lead exposure among petroleum industry workers in Kirkuk, Iraq," *Int. J. Occup. Environ. Health*, vol. 30, no. 2, pp. 145–151, 2024.
- [11] Centers for Disease Control and Prevention (CDC), "Blood Lead Reference Value," 2023. [Online]. Available: <https://www.cdc.gov/nceh/lead/data/blood-lead-reference-value.htm>
- [12] N. H. Abdulrudha and S. A. Kadhim, "Serum cadmium and lead levels in thalassemic patients of Najaf Governorate, Iraq," *Biol. Trace Elem. Res.*, vol. 203, no. 1, pp. 113–121, 2025.
- [13] "Blood lead levels in military shooting range personnel," *J. Occup. Health*, 2020.
- [14] "Blood lead levels among veterans," *Mil. Med. J.*, 2018.
- [15] M. H. Hashoosh and S. A. Kadhim, "Analysis concentration of zinc and copper elements in human serum, nails and hair using atomic absorption spectroscopy," *AIP Conf. Proc.*, AIP Publishing LLC, 2022.
- [16] S. A. Kadhim, et al., "A comparative statistical study of the prevalence of bladder and rectal cancer among patients in Najaf Province, Iraq," *Med. J. Babylon*, vol. 22, no. 1, pp. 87–92, 2025.
- [17] A. Alshewered and S. A. Kadhim, "Evaluation of colon cancer incidence rates for the years 2016–2021, Najaf/Iraq: A study of risk assessment," *Surg. Gastroenterol. Oncol.*, vol. 28, no. 4 (Suppl.), p. S19, 2024.
- [18] M. B. Khalid, et al., "Microwave-assisted acid digestion for trace metal analysis in human blood samples," *J. Anal. At. Spectrom.*, vol. 33, pp. 1125–1132, 2018.
- [19] J. F. Murray, et al., "Trace metal analysis in human blood by atomic absorption spectroscopy: Validation and application in occupational exposure studies," *J. Trace Elem. Med. Biol.*, vol. 53, pp. 1–8, 2019.
- [20] S. R. Smith, et al., "Blood lead levels in military personnel: Assessment and occupational risk factors," *Mil. Med.*, vol. 185, no. 5–6, pp. e875–e882, 2020.
- [21] A. Al-Dosky, D. J. Al-Timimi, and S. Al-Dabbag, "Lead exposure among the general population of Duhok governorate, Kurdistan region, Iraq," *East. Mediterr. Health J.*, vol. 18, no. 9, 2012.
- [22] A. M. Hussein, H. H. M. Ali, and Z. Ali, "Assessing the efficacy of flat-plate solar collectors using nanofluids in the climatic context of Kirkuk city, Iraq," *Acta Polytech.*, vol. 64, no. 1, pp. 25–33, 2024.
- [23] M. Karami, et al., "Burton's line on the gum seen in lead poisoning among petroleum refinery workers in Kirkuk City, Iraq: A case series," *Cureus*, vol. 16, no. 5, 2024.
- [24] M. A. Laidlaw, et al., "Lead exposure at firing ranges—A review," *Environ. Health*, vol. 16, no. 1, p. 34, 2017.
- [25] A. Lanoszka and L. Simón, "A military drawdown in Germany? US force posture in Europe from Trump to Biden," *Wash. Q.*, vol. 44, no. 1, pp. 199–218, 2021.
- [26] P. Z. Ruckart, "Update of the blood lead reference value—United States, 2021," *MMWR Morb. Mortal. Wkly. Rep.*, vol. 70, 2021.