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Research Article

Measuring Lead Levels in The Blood of Workers in Filling Stations and Maintenance of Generators for Different People Age Groups

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Abstract:

A study examining lead concentrations in gas stations found a significant difference between workers and non-workers. Workers at gas stations, including those in generator maintenance, were found to have higher lead concentrations than non-workers. The concentrations ranged from 9.621 to 14.801 ppm at the unit filling gasoline station (Basra petrol) to 10.831 to 15.02 ppm at the Morgan filling gasoline station (Samawa gasoline).

The lower limits of lead concentrations were 9.267 and 13.542 ppm at Abu Ajaj filling station. The concentrations of lead in the blood of workers servicing gasoline-powered generators ranged from 9.821 to 13.82 ppm, while those in residential areas had concentrations between 10.01 and 13.524 ppm. The World Health Organization has set standards for lead concentrations in the blood, with permissible limits of 10 parts per million. The study highlights the need for increased awareness and regulation of lead exposure in gas stations.

Keywords: Gasoline stations, Morgan, Samawa gasoline, Basra petrol and Ajaj station.

Introduction

For over fifty years, environmental lead exposure has been the subject of extensive research; however, fresh research on the harmful consequences at even extremely low exposure levels keeps the issue of human exposure to lead in the environment an ongoing public health concern. Teeth and bones contain over 90% of the total amount of lead in the body. The erythrocytes contain 95% of the lead in the blood, making them the most reliable sign of an individual's exposure. [1].

The most harmful material is benzoene. Benzene exposure over an extended period raises the threat of leukemia and a plastic Human Anemia, even at low doses. Human carcinogenicity has been assigned to benzene (IARC Group 1)[2]. Staffed by attendants, cashiers, and fuel loading personnel, gasoline stations can be found in a variety of locations, such as next to convenience stores and car washes [3]. Fuel pump attendants may be exposed to BTEX (benzene, toluene, ethylbenzene, and xylene), of which benzene is the most hazardous to humans [4]. The human body may absorb volatile organic compounds (VOCs) through the skin, ingestion, and inhalation [5]. Inhalation is the most frequent method of occupational exposure to chemical fumes, putting workers at gas stations worldwide in danger [6].

Globally, A million tons of lead were added to the fuel over the course of the last century [7]. As a result, there is a lead poisoning epidemic that has affected individuals all over the world, resulting in millions of early deaths, health problems, and cognitive decline. The addition of lead to motor fuels in the form of tetraethyl lead in 1922 marked the start of this epidemic. Following World War II, it quickened and reached its zenith in the 1970s and 1980s. The primary health implications in children include neurodevelopmental damage with IQ loss, reduced attention span, dyslexia, attention deficit/hyperactivity disorder, school failure, and increased future risk for drug misuse, criminal conduct, and imprisonment [8]. Adult health implications include stroke, cardiovascular disease, hypertension, neurobehavioral damage, and early mortality [9]. We now know that there is no safe amount of lead [10].

In the 1920s, five workers at a refinery in USA, who had been exposed to tetraethyl lead at work suffered from acute neuropsychiatric illness, with eighty percent of the workers impacted experiencing convulsions., it became clear that adding lead to gasoline posed serious risks. Nevertheless, these cautions went unheeded, and lead was once again added to gasoline after a short production halt [11]. Lead was added to motor fuels in almost every country in the world during its highest usage in the 1970s and 1980s [12].

Urban areas and areas near roads were found to have higher lead levels [13]. According to geochemical research done deep in the Arctic, there has been an unparalleled raise in lead the Greenland ice cap's atmospheric deposition [14]. Studies on lead deposition in Alpine glaciers have more recently verified these findings [15].With a halflife of 20–25 years, lead is a cumulative toxicant that is 90%–95% stored in bone and recirculated from there [16, 17].

Red blood cells carry 99 percent of blood lead, which is indicative of recent exposure within the last two months as well as the quantity of lead released and recycled from bone stores [16]. Age-related increases in lead levels are seen in both blood and bone [17, 18]. According to seasonality [17], hormones, and other endogenous and external stimuli affecting the balance between bone production and resorption bone lead is related to blood lead [17, 18] and accounts for about 20% of the variation in blood lead. When environmental [19] or occupational [16] lead exposure declines, blood lead levels lag behind, which is explained by recirculating lead from bone.

Lead is a very hazardous, non-essential metal that has cumulative effects on human health and the environment. Lead poisoning may be caused by a number of things, including tainted food, water, air, workplaces, and more [20]. When lead attaches itself to donor atoms of functional groups from different biomolecules (enzymes), it enters the body and passes through the bloodstream to the others body organs where it has harmful impacts [21]. The most prevalent biomarker of directly exposed to this dangerous metal, blood lead level cause significant abnormalities in blood parameters.[22].

The present study's aim is to evaluate toxicological risks for workers who are exposed to lead in their work environment (work in fuel stations (gasoline), in addition to taxi drivers and workers working in repair shops for gasoline-powered electric generators). and compare them with the blood of healthy people who are not exposed to fuel (the control group), and find out the health effects to which they were exposed, recorded, and monitored.

Materials and Methods

Study population

The most accurate method for determining the extent of exposure to all environmental and lifestyle-related sources of contamination is blood lead level monitoring. In this regard, An efficient tool for environmental law enforcement and health protection is the Human Biomonitoring Commission (HBM) [23].

In order to conduct the study, blood samples from the control group, taxi drivers, employees of gasoline-powered electric generator repair shops, and employees of fuel stations were monitored for lead and biological markers between 2023 and 2024.

There were sixty workers in the exposed group, all of whom were men. They were all between the ages of 25 and 45, and they had all worked in the metal processing sector for at least a year. All ten workers in the control group were male, all belonged to the same age groups, and none of them had any exposure to lead.

Collecting, evaluating, and storing blood samples

5–6 mL of blood were drawn via venipuncture following skin cleaning with 70% alcohol, and the samples were placed in sodium heparin-treated vacuette tubes for trace element analysis [24]. After collection, the samples were delivered to the lab and stored at 4–8 °C in a portable isothermal bag with ice packs. They were separated and kept in polypropylene tubes that had been previously cleaned with 10% HNO_3 at -20 °C until examination once they arrived at the lab. [25].

Chemical examination

The analysis of blood lead concentrations was conducted in clean-room settings that met ISO 6 air quality standards, had differential pressures, regulated temperatures, and were appropriate for handling trace element concentrations.

The instrument utilized was a Perkin Elmer ELAN DRC-e ICPMS. The device was calibrated using matrix-matched calibration standards for lead concentrations ranging from 0 to 250 µg/L. Quantitative blood lead values (m/z 208) were obtained by utilizing a calibration curve.

Blood samples were homogenized by gently mixing them, and after that, they were slightly diluted (1:50) in a liquid solution containing 1% (v/v) of tetramethylammonium hydroxide (TMAH), 10% (v/v) of propanol, 0.05% (v/v) of triton X-100, and 0.05% (v/v) of EDTA.

Statistical analysis

The Spss software presents the the mean (mean ± standard deviation) of all the samples in each group and t-tests (independent samples), linear regression, and correlation analysis are used to assess the statistics. At $p < 0.05$, statistical significance was established.

Result

Globally, leaded gasoline is regarded as a significant contributor to lead exposure. Since 1976, more than 50 countries have given up using lead in gasoline, and several more are preparing to follow suit in the coming years [26].

The investigation's findings indicated that, In contrast to the group under control, the workers at gasoline stations possessed the highest concentrations of lead, followed by those who operate and maintain generators in residential neighborhoods. Taxi drivers had the lowest levels of lead concentration. Figures 1 to 10.

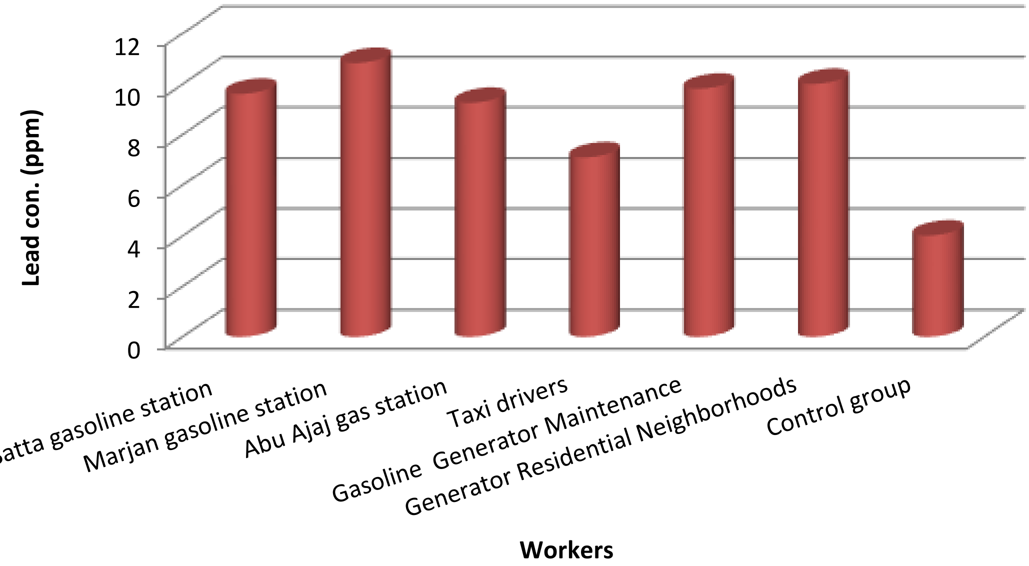

Figure 1: Lead Concentration in the blood of workers in different work sites for the ages 25- 27 years.

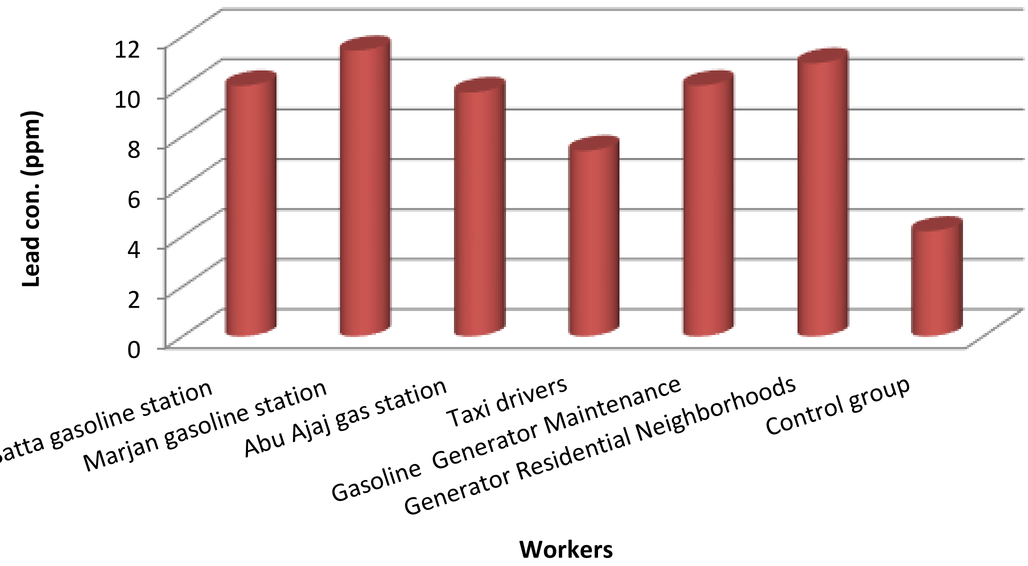

Figure 2: Lead Concentration in the blood of workers in different work sites for the ages 27- 29 years.

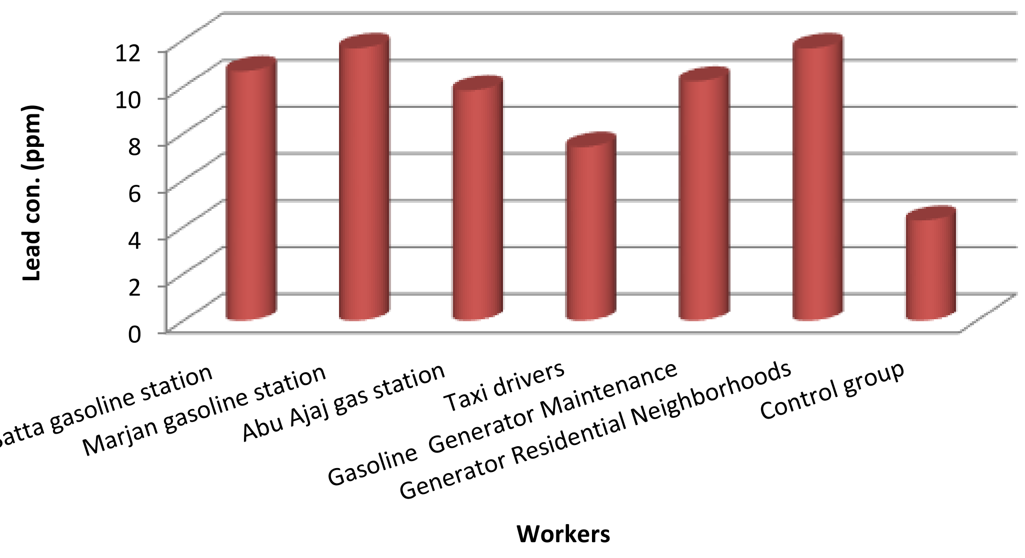

Figure 3: Lead Concentration in the blood of workers in different work sites for the ages 29- 31 years.

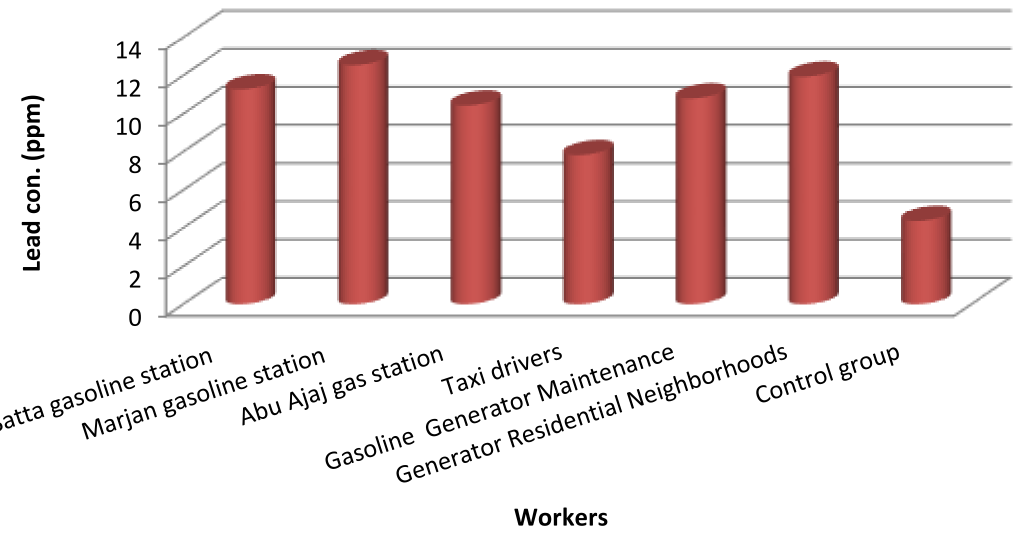

Figure 4: Lead Concentration in the blood of workers in different work sites for the ages 31- 33 years.

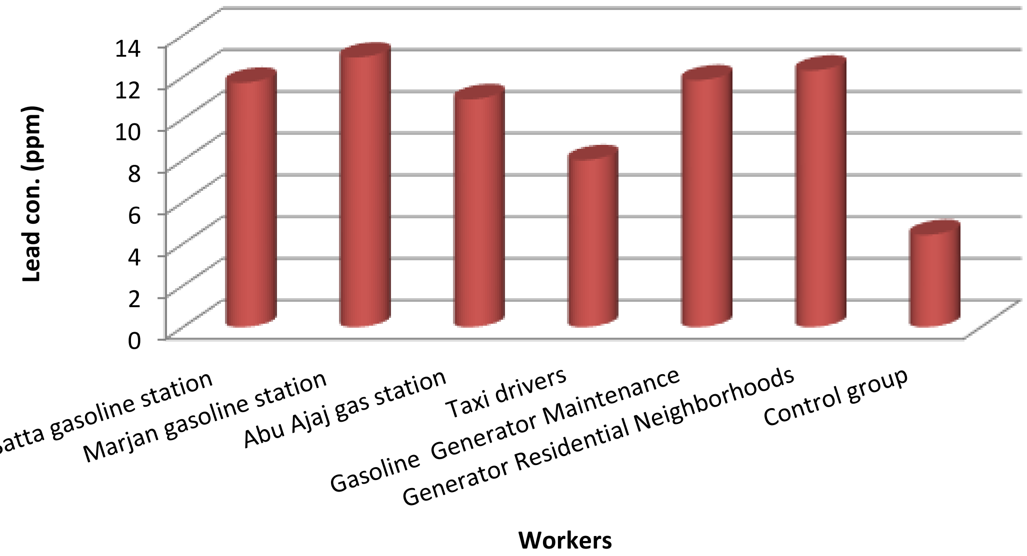

Figure 5: Lead Concentration in the blood of workers in different work sites for the ages 33- 35 years.

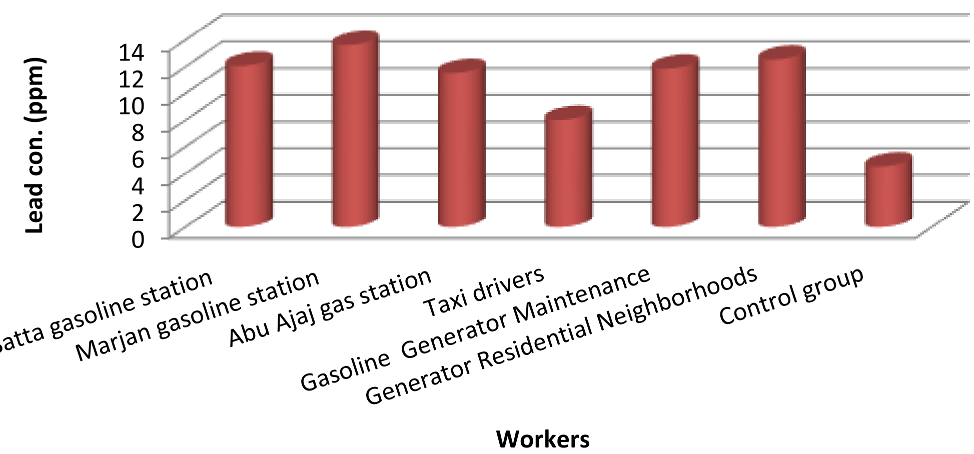

Figure 6: Lead Concentration in the blood of workers in different work sites for the ages 35- 37 years.

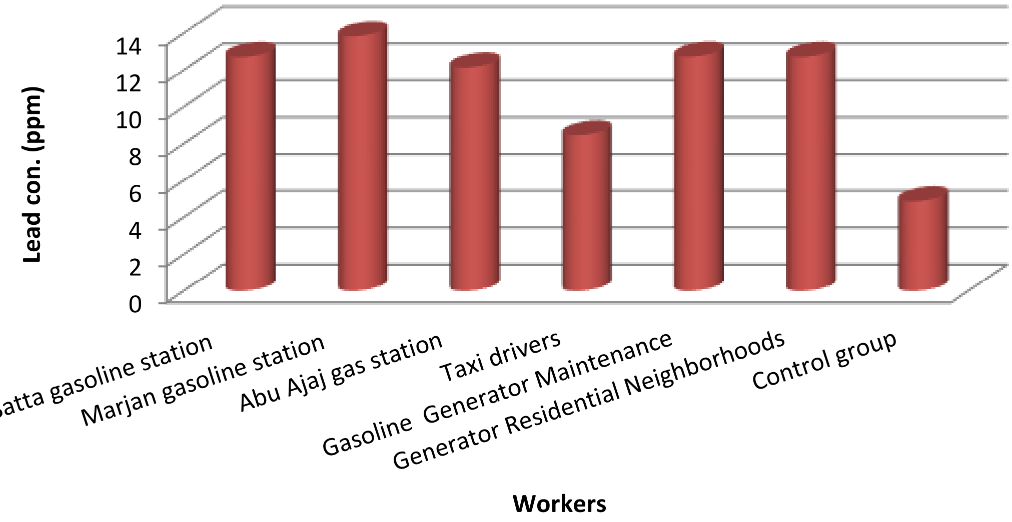

Figure 7: Lead Concentration in the blood of workers in different work sites for the ages 37- 39 years.

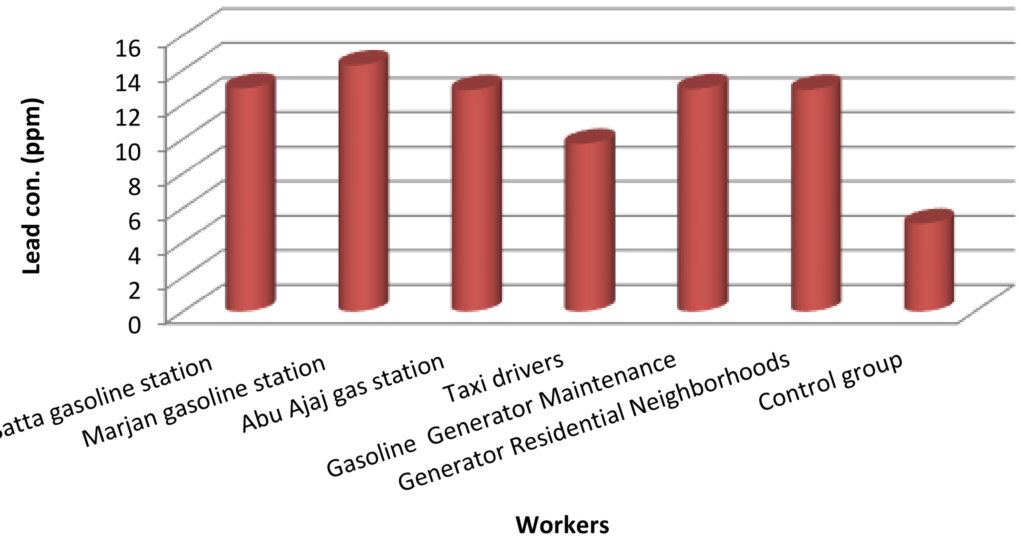

Figure 8: Lead Concentration in the blood of workers in different work sites for the ages 39- 41 years.

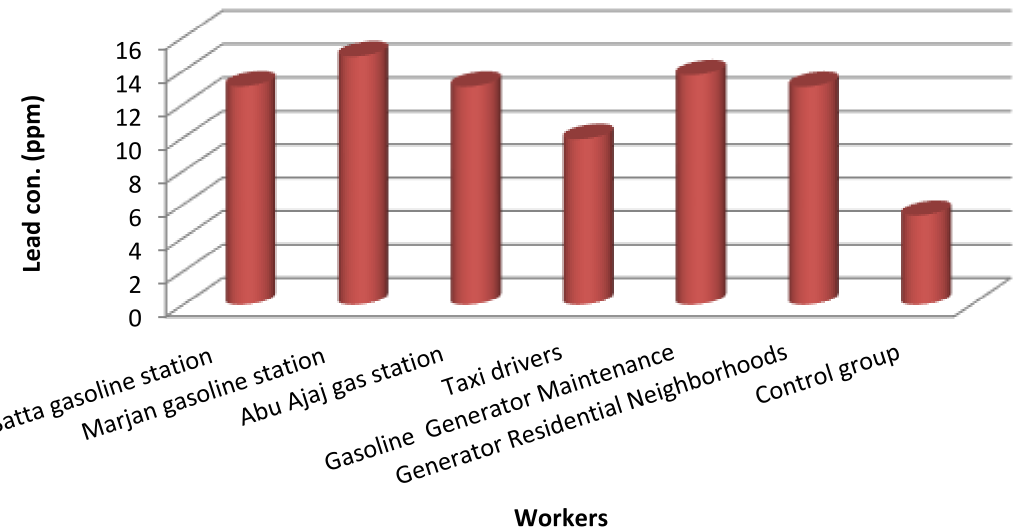

Figure 9: Lead Concentration in the blood of workers in different work sites for the ages 41- 43 years.

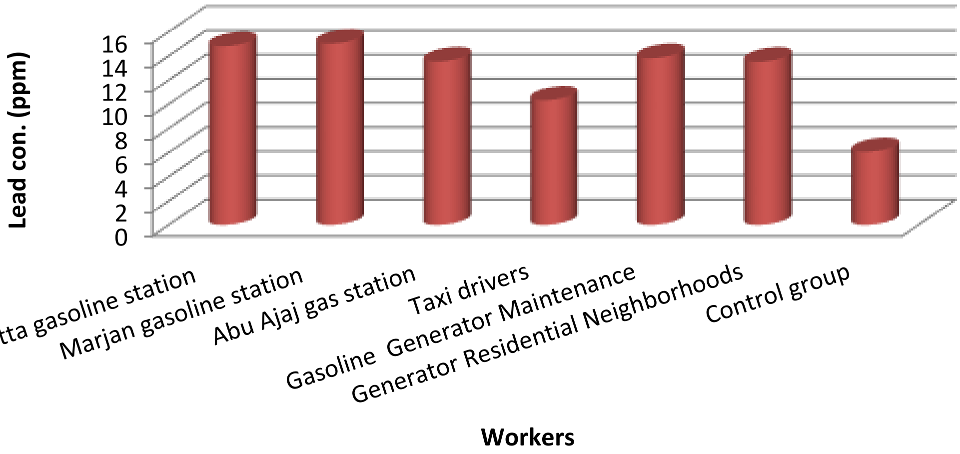

Figure 10: Lead Concentration in the blood of workers in different work sites for the ages 43- 45 years.

Note// A direct significant correlation at the probability level of $P \leq 0.05$

The figures above showed the difference average in lead concentrations among workers based on their ages, as older workers had higher lead levels than younger workers. It was discovered that as the age group advanced, lead concentrations in the blood progressively rose. The statistical analysis results demonstrate that, at the $P<0.05$ probability level, there is a substantial positive link between the blood lead levels of the workers in the various groups under investigation and their age groups. Figure 11.

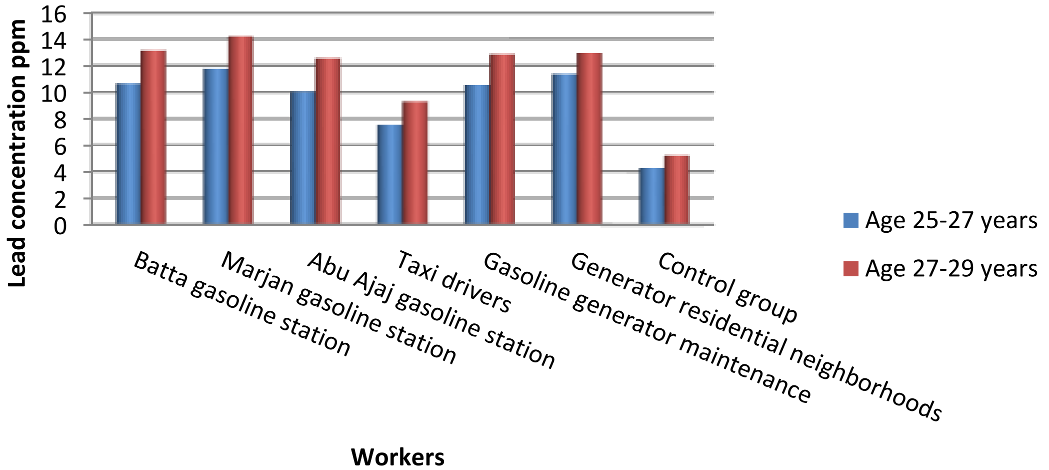

Figure 11: The difference average in lead concentrations among workers based on their ages

Furthermore, based on the type of gasoline the station uses, the study's findings demonstrated that the lead concentrations of workers in gasoline stations vary. Figure 12.

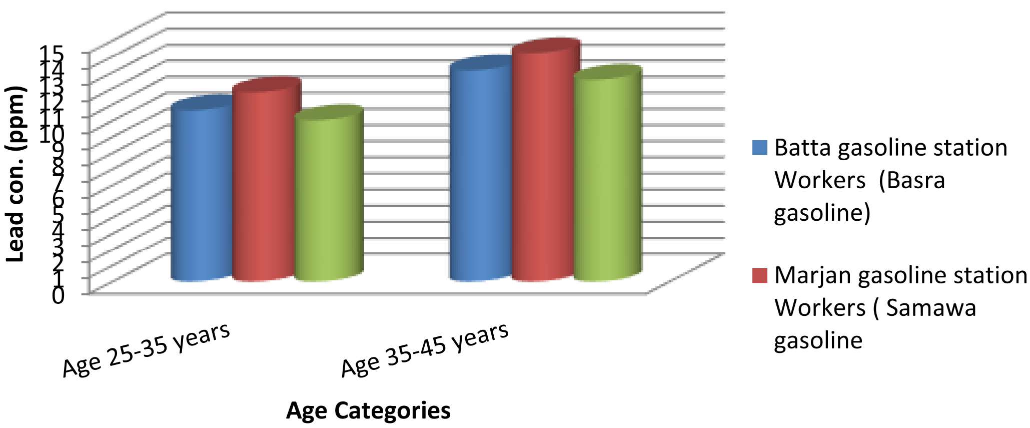

Figure 12: Lead concentration average depends on the type of gasoline among gasoline station workers.

Discussion

Globally, leaded gasoline is regarded as a significant contributor to lead exposure. Since 1976, more than 50 countries have given up using lead in gasoline, and more are preparing to follow suit in the coming years [27].

The burning of gasoline additives containing lead is by far the largest source of lead emitted into the environment. This source accounted for more than 90% of the projected lead emissions in the US in 1968 [28]. The automotive industry continues to be the primary source of dynamic lead emissions into the environment. Regarding the impacts of environmental lead pollution on human lead levels, the majority of research, monitoring, and control efforts have focused on specific routes of exposure, such as combustion-inhalation or combustion-air-soil deposition-ingestion [28, 29]. instead of showing how biological responses and environmental causes are related. This method has not always been applied to research that shows a correlation between blood lead levels and proximity to roads or traffic volume.

The addition of lead to gasoline has disastrous effects on world health. Millions of children experienced neurodevelopmental impairment, including reduced IQ and disturbed conduct, and millions of adults experienced neurobehavioral deficits, early adult mortality from cardiovascular and renal illness, and significant economic losses [30].

Tetraethyllead use in cars has been estimated to release a certain distribution of products [31]. About twenty-four percent is left in the automobile, and the rest is released into the environment, where the wind picks it up or carries it away. Of the lead that was initially eaten, 26% is left in the ambient air and 50% is deposited. It is currently unknown how much lead moves through each of the several channels quantitatively. The data suggests that blood lead levels rise at soil lead levels between 500 and 1,000 ppm, and at most, there is a positive correlation between blood and air lead levels, although the precise functional link between the two has not yet been determined. According to current estimates, for every unit increase in air lead concentration of 1 ug/m3, blood lead levels rise by 1 to 2 ug/100 ml. Furthermore, given a twofold rise in soil lead levels, the mean percent increases in blood lead levels range from 3 to 6 [29].

Regarding soft tissue, lead possesses a 50-day half-life and in the circulation, 25 days. One year after leaded gasoline was phased out, we observed a statistically significant drop in lead levels in the blood. A amount of lead in the blood of 10 μg/dL is a threshold that signals the need for environmental intervention [32]. The best way to determine actual, recent, or past continuous exposure to this hazardous metal is to measure blood lead levels [33].

Lead has both neurotoxic and vasoconstrictive effects in the blood, which means that even at low blood levels, In addition to altering blood parameter values, it can have nephrotoxic effects and certain enzyme activity [34]. Employees in the industry sector have blood lead levels that are significantly greater than those of the other people. The most likely reason is that workers in a previous industries spend more time outside than those in the service industry. It is true that there is a recognized link between blood lead levels and air lead levels [35]. The Stromberg et.al., (2008). One further thing to think about is the usage of tools or supplies that may contain lead traces in the building, agriculture, or industrial sectors.

The results of this study confirm the findings of earlier research [36], showing that blood lead levels positively correlate with age. This highlights the resultant effectsof exposure to lead and the need to lower contact with the environment. According to Wittmers (1988), lead concentrations in bones Linear increase with age but decreased at the 40 to 55 years of age due to an increase in calcium requirements and subsequently increased rates of cumulative lead release [37]. Of the lead in blood, the skeleton contributes between 40% and 70% [38], and several studies have demonstrated that there is a notable release of lead into the bone during times of increased mineral loss and bone turnover, such as menopause, osteoporosis, and hormone imbalances related to the thyroid and parathyroid [39]. For the purpose of comparing results from different HBM programs, it is believed that age group similarity is significant.

Numerous studies, such as those conducted in Thailand that evaluated benzene-related health risks [40] and looked at factors influencing the population of gas station laborers [41], are consistent with the current study.

Previous foreign studies have looked at lead levels in the blood of gas station employees; lead levels in the ambient air of Sri Lanka have also been studied; related studies have looked at gas station attendants in Brazil [42] and petrol pump station workers in Iran [43]. Furthermore, studies conducted in Portugal discovered elevated levels of lead exposure in locals living close to gas stations [44], and in Malaysia, exposure to lead was connected to negative health outcomes for gas attendants [45].

Many researchers, including Thomas et al. [46], have shown that cutting lead out of gasoline has been a very successful way to lower lead levels in the population. Previous studies have also demonstrated a link between a decrease in The quantity of lead in workers' blood and a decrease in the level of lead in gasoline. These findings demonstrate the long-lasting decline in blood lead levels that resulted from the removal of lead from gasoline and the fact that more than two generations of children have now benefited from the lead removal's health advantages.

The general population's blood lead concentrations have been steadily declining over the past few decades, because industrialized countries have reduced their leaded gasoline usage and, to a lesser degree, industrial emissions control [47].

Conclusions

1- The workers at gasoline stations had the highest levels of lead concentration.

2- Taxi drivers had the lowest levels of lead concentration.
3- Older workers had higher lead levels than younger workers. It was found that lead concentrations in the blood gradually increased with the advancement of the age group.
4- The lead concentrations of workers in gasoline stations vary based on the type of gasoline the station uses.

Recommendations

1- increased professional and public awareness of the dangers of low-level lead exposure and the banning of lead from gasoline.
2- Develop strategies to help employees reduce exposure to lead in gasoline.
3- Gradual elimination of leaded gasoline.
4- gradually phase out leaded gasoline.
5- Employers must provide their employees with appropriate personal protective equipment, check regularly to ensure they are wearing it, and strongly encourage employees to pay attention to their own hygiene. Employees must also take appropriate rest periods and days off to reduce their exposure to lead.

Conflict of interest

This work is not connected to any conflicts of interest.

Contribution of authors

We affirm that the author listed in this article completed this work, and the authors will be responsible for any liabilities arising from claims relating to the information in this article.

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