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THE EFFECT OF LEAD ON DUST AND NON-SMOKING WORKERS IN SOME GAS STATIONS IN KIRKUK GOVERNORATE

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Abstract

This study was completed in the city of Kirkuk, where the study of environmental pollution with the element lead in a number of government gas stations in the province of Kirkuk, which has a lot of cars gathering to refuel, causing an increase in the proportions of pollutants coming out of car exhaust, including lead. This work studied five sites, namely: Andalusia gas station, Al-Mutwra gas station, Baba Karkar gas station and Uqba bin Nafi gas station. The fifth and final site is the control site in the Domiz area in the south of the province. The study sampled the ground of these stations (dust), and measuring the concentration of lead in them and measuring some chemical factors of the soil for a period of six months, a sample every month, starting from November 2022 until April 2023. Then, the blood samples from some workers in those stations for non-smokers were collected and the element lead in those samples was examined. In addition, its effect on some of the blood parameters was studied by calculating the concentration of lead and some tests for the blood of people working in gas stations and from people who do not work in them (control group). The results of lead in dust showed that the highest rate was (21.3 ± 0.41) ppm in the first station (Andalusia), while the lowest concentration of lead in dust was recorded in the second station (Al-Mutwra) by (18.41 ± 0.42) ppm, and the average concentration of the control area was (15.7 ± 0.38) ppm. The results of the studied blood standards, which included the eight tests: HGB, PLT, and Pb, showed a low significant difference at the level of ($P \leq 0.05$) in the average hemoglobin levels by (15.51 ± 2.12). The results did not show significant differences in the average platelet levels (PLT). The highest concentration of lead in non-smoking station workers was (30.45 ± 1.42) ppm and the lowest concentration was (27.3 ± 1.64) ppm, while in the control group the concentration of lead was (14.9 ± 1.03) ppm.

Keywords: Gas stations, Hemoglobin, Lead, Hematological parameters.

1- Introduction

Environmental pollution is the negative change resulting from harmful chemicals that affect the health of living organisms living in this environment. This pollution results from chemicals emitted by factories into the air or pollution of river water from the dumping of industrial waste, organic chemicals, and solid waste(Pandey & Tiwari, 2021). Heavy metals are those with a density of 6 g / cm or more, and are naturally present in the soil and have mineral properties such as flexibility, conductivity, stability, etc. The toxicity of heavy metals depends on their ability to acquire electrons. Therefore, all the heavy metals are toxic in their high concentrations, and the toxicity of these metals in the organism is affected by environmental factors such as the acid function, chemical composition and ionic state of the element and ability of the element to conduct covalent bonds with other metals. This is because most of the heavy metals change their movement in the base soils.(John et al., 2020). Lead (pb) is one of the heavy metals, with a molecular weight of 207.2 grams / mol, and is found in nature in an impure form associated with other metals such as the element cadmium. It is toxic, as it is found everywhere in the environment and excessive exposure to it leads to many health problems(Schileo & Grancini, 2021). The most prevalent compounds in nature are lead monoxide, red lead, lead dioxide, lead acetate, lead sulfide, lead arsenate and lead tetra ethylene. Lead and its compounds are widely used in industries, entering the manufacture of gasoline, pesticides, phosphate fertilizers, batteries, rubber, dyes and letters of old printing presses, as well as in printer inks and bullets(Al-Maliki et al., 2021).

2- Materials and methods of work

2.1 Site of the experiment

The study was conducted in the city of Kirkuk, which is located in northern Iraq, 240 km north of the capital Baghdad.In terms of astronomical location, the province is located at the intersection of latitude -35 ^{0}28 north of the equator with longitude -44 ^{0}23 east of Grenish(Al-Azzawi, 2005), and is bordered to the west by the Hamrin mountain range. It is considered one of the oil rich cities in Iraq, the area of the province is 9679 km2 . The study area included five sites, four of which are gas stations, as these sites were chosen because they are contaminated with heavy metals (especially lead) that are issued from the exhaust of cars that come to refuel continuously because they are government stations that operate on a daily basis and for long periods of time, and the fifth site to control away from these sites in order to be less affected by the causes of pollution mentioned. These sites are:

1- The first site (Andalusia gas station / located in Rahim Oh, north of Kirkuk Governorate)
2- The second site (the Al-Mutwra gas station / located on the municipality street in the center of Kirkuk)
3- The third site (Baba Karkar gas station / located on Baghdad Road south of central Kirkuk)
4- The fourth site (Uqba bin Nafi station / located on Baghdad Road south of Kirkuk)
5- The fifth site (control site) Domiz area, south of Kirkuk Governorate

2-2 - Design of the experiment: -

First: - Dust samples were collected at the mentioned stations, for 6 months from November of the year 2022 until April 2023, where the concentrations of the lead element were then examined in all samples
Second: - Blood samples were taken from some workers in gas stations in Kirkuk and then the concentration of lead element in those samples was explored. Its effect on some blood parameters was reported. The samples were divided into two categories:
The first category: - people working inside the stations aged (20-54) years and their number was (30 people) who have a service ranging between (0-15) years, where these ages were selected according to the years of service (for non-smokers).
The second category: - the control group, is the random samples were selected from separate areas and the same ages were chosen from 20-50 and their number was (30) and compared with the first category to find out the moral differences between them.

2.3 Dust sample collection

Dust samples were collected from the floor of the stations using a soft brush and then the samples were placed in sterile plastic bags and were collected from the same point for one site at the rate of one repeater per month. The samples were then digested and transported to the central laboratories / Tikrit University to measure the percentage of lead (Page, 1982)

2.4 Studied environmental traits

2.4.3 Measurement of lead concentration in dust

The digested soil samples were placed in single-use cans and the tube of the Atomic Absorption Spectrometer was placed in these samples. The results appeared directly, where this test was conducted at the University of Tikrit \ Central Laboratories

2.5 Studied physiological traits

2.5.1 Complete Blood Count (CBC)

The total number of hemoglobin (HGB) and platelets (PLT) was calculated by the Swedish-origin Auti analyzer hematology called ALFA Swelab, which works on the principle of cellular counting of various types of blood cells in an automatic way through the mechanism of the scanner in the device. The diameters and sizes of the cells are different to the extent that their ability to pass light will also vary. A capillary aspirator tube is passed through the EDTA tube and presses the start button, the device draws 10µl of blood and after one minute the device shows the result on the screen.

2.5.2 Estimation of blood lead level:

The blood drawn by (3 ml) was placed in test tubes containing an anticoagulant EDTA tube to measure the lead element in Baghdad / Medical City Department / Toxicology Department. The tubes were placed in the device for the dismantling of blood components KAHN_SHAKER (TKA_226) with vibratory movement for 30 minutes, which works to break down the blood components. After that the blood was discharged into ordinary tubes called Plane and 2.5 ml of weak Trichloroacetic acid (TCA) was added and mixed well with wooden sticks inside the tube itself. Then, the tube entered the German-made UNIVERSAL 16 A centrifuge for 10 minutes at a speed of 3000 rpm(Haraguchi et al., 1991; Wilson et al., 1972). A clear transparent solution was obtained and read directly by the atomic absorption spectrophotometer (FLAME).

3. Results and discussion

Environmental outcomes

3.1 Concentration of lead in plant dust

Table (1) shows a significant increase at the level of ($p \leq 0.05$) in the concentration of lead for dust of study stations compared to the control area. The first station recorded the highest concentration in April by (25.4) parts per million and the lowest concentration in February by (17.3) parts per million, and the second station recorded the highest concentration in April by (23.8) parts per million and the lowest concentration in February by (14.9) parts per million. The third station recorded the highest concentration in April by (26.2) parts in million and the lowest concentration was in February by (14.7) parts per million. Also, the fourth station had highest concentration in April by (24.2) parts per million and the lowest concentration in February (16.7) parts per million, while the control area was the highest in April by

(18.9) parts per million and the lowest concentration in February by (11.3) parts per million.

Table (1) Lead concentrations in station dust during the study months

Stations / Month	First stop (Andalusia)	Second stop (Developer)	Third stop (Baba Karkar)	Fourth stop (Uqba bin Nafi)	Control zone	Mean ± SD
November	23.9	19.2	19.7	20.9	17.3	20.2 ± 0.36
December	21.8	17.3	18.4	19.3	15.7	18.5 ± 0.35
January	19.5	15.7	16.9	18.5	14.9	17.1 ± 0.32
February	17.3	14.9	14.7	16.7	11.3	14.98 ± 0.36
March	20.3	19.6	20.4	21.5	16.2	19.6 ± 0.33
Nissan	25.4	23.8	26.2	24.2	18.9	23.7 ± 0.39
Mean ± SD	21.3± 0.41	18.41± 0.42	19.38± 0.47	20.18± 0.38	15.71±0.38	19.1 ± 0.34
P-Value	<0.001	0.007	0.006	<0.001		

Physiological results

3-2- Hemoglobin (HGB)

Table (2) indicates that there were no significant differences in hemoglobin rates in the non-smoking study groups compared to the control group. The highest value of hemoglobin was in the first group (0-5 years exposure) with an average age of (23±1.09 years) by (14.36± 1.91 mg/dl) while the lowest value was recorded among the control group (13.47±1.41 gm/dl. The results of the current study contradicted with Fadel et al. (2013) who pointed out that exposure to fumes containing heavy metals, including lead, has an effect on blood variables, including hemoglobinemia, so smoking may have a greater effect than lead on the level of hemoglobinemia.

3.3 Platelets (PLT)

It is also noted in Table (2) that there were no significant differences in the total number of platelets in the blood of non-smoking station workers compared to the control group. The highest value of platelets was recorded in the first category with an average age of (23±1.09 years) by (247.3±24.94 L / 9ˆ10) and the second category with an average age (33.78±1.42 years) was recorded by (196±11.69 L / 9ˆ10). The third group with an average age of (49.45±0.63 years) scored (228.55±8.28 L/9ˆ10) while the control group recorded (210.77± 20.98 L / 9ˆ10).

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3.4 Lead (pb)

The results of the study in Table (2) showed a significant increase in the concentrations of lead in the blood of non-smoking workers compared to the control group. The third group had an average age of (49.45±0.63 years) which is the highest concentration of lead by (30.45±1.42) ppm, followed by the second group with an average age of (33.78±1.42 years) by (28.78±1.44) ppm. Then, the first group with an average age of (23±1.09 years) by (27.3±1.64) ppm, while the control group recorded a concentration of (14.9). ±1.03) ppm

Table (2) Average Levels of Some Variables between Working and Non-Smoking Gas Stations

Variables \ Categories	Non-working (n=30)	The first category of employees (0-5 Years) (n=10)	The second category of employees (10-5 years) (n=10)	The third category of employees (over 10 years old) (n=10)	P-Value ≤0.05
Age(year)	45.2 ± 0.68	23 ± 1.09	33.78 ± 1.42	49.45 ± 0.63	0.001 S
HGB(g/dL)	13.47 ± 1.41	14.36 ± 1.91	13.81 ± 2.56	14.16 ± 1.65	0.067 NS
PLT(10^9/L)	210.77± 20.98	247.3 ± 24.94	196 ± 11.69	228.55 ± 8.28	0.495 NS
Pb(ppm)	14.9 ± 1.03	27.3 ± 1.64	28.78 ± 1.44	30.45 ± 1.42	<0.001 S

Discussion

The mean rise of lead in gas stations may be attributed in general to the large movement of cars and the resulting pollution, as well as the lack of vegetation. The reason for the high concentration of lead in April and not other months may be the large number of dust storms. In addition, the decrease in its concentration in February may be caused by rain that washes dust from surfaces.

The results of this study agreed with the study of Rashid and Mansour (2013) who studied the estimation of soil pollution at the University of Technology with lead metal using a flame atomic absorption spectrometer. Their results showed a high concentration of lead in some samples such as the electrical engineering cafeteria pool

(4.50 mg/L), the university communication tower (3.88 mg/L) and the university presidency door (3.75 mg/L).

This increase may be attributed to the large number of entry and exit of wheels, especially those that run on gasoline fuel, because they contain lead additives. It also agreed with Al-Aqidi (2020), who studied the concentration of lead in the dust of gas stations, whose study showed a significant increase for all stations compared to the control station.

Also, high hemoglobin may be due to the continuous exposure to carbon monoxide gas CO resulting from the incomplete combustion of fuel, as hemoglobin binds to CO gas and has a double affinity by 250 times compared to oxygen gas. This causes an acute lack of oxygen and thus stimulates the body to manufacture hemoglobin to compensate for the lack of oxygen gas levels, which causes high hemoglobin blood(Rose et al., 2017). The results of the present study contradicted Fadel et al. (2013) in that the exposure to fumes containing heavy metals, including lead, has an effect on blood variables, including hemoglobinemia.

The results of the current study agreed with the study conducted by Al-Khazraji (2018) for workers of different categories, as he noted that there were no significant differences between the averages according to the results of the test by the multi-range Dunkin' method. He also noted that the averages of the three working groups were very close and amounted to (278×10, 279× 10, 280 × 10 S3/µl) for workers in industry, agriculture and hospitals respectively. In addition, the average number of platelets was high for the student group (control group) (300.880 × 10/µl).

High lead is thought to cause a decrease in the concentration of copper and iron, which are essential metals for humans (Al-Obeidi et al., 2015). The results of the current study confirmed what Mahdi (2019) stated that the individual smokers working in environments contain the sources of lead emissions that are more concentrated in the blood element. It also agreed with the results of the study conducted by(Al-Shammari & Al-Tamimi, 2012), which indicated that the concentration of lead in the blood of workers in industrial atmospheres increased cumulatively with increasing years of exposure. Yet, the results of the current study did not agree with the findings of Al-Wahishi (2011) who reported that the exposure of citizens, including dealers or those exposed to lead, to environmental pollutants may be the cause of the removal of lead metal, as well as work periods. They are a specific time of a number of hours with no additional working hours, which reduces the duration of daily direct exposure to lead. Together, these factors helped eliminate accumulated lead and contributed to the return of cells to normal.

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