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THE VITAL ACCUMULATION OF SOME HEAVY METALS IN THE BLOOD SERUM OF INDUSTRIAL ZONE WORKERS IN MOSUL CITY

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Abstract

All the elements are likely to be toxic, but there are some elements necessary for human life. Heavy metals become toxic when they are not metabolized by the human body as they accumulate in soft tissue. These elements enter the human body By air, food, water, or absorbed by the skin when it is found in direct contact with the human body, either in industrial or agricultural operations.

In this study, Heavy metals such as (Pb, Ni, Co, Fe, Cu, Zn) are measured In the blood serum of 20 workers in the two industrial areas (Okab Valley) in the western area of Mosul city and (Al-Karama) which lies on the eastern area of the city. It was compared with the control uniform age group of (20) people from Mosul university, the area which is Far away from the industrial areas and all its activities. Elements were measured by using an atomic absorption (flame) spectrometer.

The results indicated that there are high significant increase of $P<0.001$ in the serum of the workers who are in the industrial areas compared with the control group. The samples of the industrial workers group were classified according to (age, smoking, working period), and their impact on the concentration of measured elements have been studied. The analysis shows that there weren't significant differences between these classifications ($P>0.05$). There weren't any significant differences between the age groups (1-29) and (30-57) besides and there were no significant differences between the smokers and the non-smokers. As well as for the period of occupational exposure (1-19) and (20-39) years, any significant differences were observed.

The purpose of the study is to check the impact of the heavy metals on the workers' health in the industrial areas who are in the direct contact with it.

Keywords: Heavy metals, Environmental pollution, industry Area.

Introduction

Environmental pollution is accelerating as a result of the excessive use of natural resources, development of industrial chemical industries, and congestion (Monkiewicz and Geringer, 1998).

The industrial development and expansion of use chemical compounds in various industrial areas leads to the spreading of heavy elements in the environment (Goyer, 1995). Toxic compounds emitted into the air changes the natural concentration of elements in the environment as well as those in the human body. Many workers in the industrial areas exposes the risks of heavy metals. The level of the concentration as well as other elements reflects of the chemical condition of the body.

The specific balance of any element in the body depends on a particular mechanism as well as the organ the element found in and also in association with the various biological fluids in the body such as serum, urine, feces, plasma blood, which are considered as an indicators of a healthy body and a suitable lead for diagnosing any disease (Rizk and Sky-peck, 1984).

The human body needs about 72 elements including very small amounts of heavy metals Such as (Cu, Zn, Cr, Mo, Mn, Co.). Most elements are toxic if it is found in a high- concentration such as Pb.[4].it also considers as a biological pollutant with a big deal because of its biological toxicity (Bin, 1994; Dowd *et al.*, 1994).

These chemical elements have been linked to a number of health issues faces the human for example, a person with a liver disease, the continued exposure to these elements rises the harmful to this organ. The effect of the heavy metals is to interfere with the conformation of the protein in the body and with enzymes functions (Tamara *et al.*, 2007).

Lead, found in the environment as a result of mining and manufacturing processes. It's considered as one of the pollutants where it hasn't any physiological significance (Mañay *et al.*, 2008). It is considered to be one of a very dangerous heavy metals even with small amounts that enter the human body by inhaling the polluted dust caused by burning waste or burning the oil derivatives contained in it. Or through contaminated food such as fish from high concentrations due to industrial pollution. Whereas Lead, also enters into the installation of drinking water pipeline.

Most of Lead is removed from our bodies by excreted it with urine, but there is still a risk that it will accumulate in the body, especially in children, which causes damage to the nervous system and mental retardation due to its accumulation. Symptoms of lead poisoning in adults include: muscle weakness, headache, abdominal pain, anemia (Jackson, 2005).

The Estimation of the level of lead in blood is considered as one of the important tests to detect the infection of the poisoning and especially for the industrial workers and children living in residential areas. In adults, lead is less than 20 µg/dL in the blood. Adult people who are exposed to lead have a content of about 40 micrograms/dL in the blood. The Treatment becomes necessary if the lead concentration is increased by 60 µg/dL in the blood (Woolf *et al.*, 2007).

Cobalt is considered essential for human body in small amounts. It is involved in the conformation of vitamin B12 and forms an important factor in its formation. If the individual is exposed to high levels of it, it causes health problems such as inflammation of the lungs and asthma, which leads to cancer. He found that industrial workers who were exposed to cobalt suffer from cancer. The levels allowed in the blood are 0.1-0.5 micrograms dL (Kosiorek and Wasikowska, 2019).

Zinc is a basic element in human body but its increase leads to toxicity (Fosmire, 1990). High doses of the extraposes with a range of 300 mg daily result in twice the body immunity (Medical Arts Group, 1998-2000). Persons who are at risk of high zinc ores are paint workers, metal workers, cosmetics. The risk of zinc infection is often associated with symptoms of leg pain. Zinc concentration in serum can detect poisoning by it (Hayes and Martin, 1994).

Iron, a key element in the human body and the most abundant in biological systems. But, its increase in limit leads to death, especially in children under 6 years of age Toxicity also depends on its concentration in the body. Its toxicity is easily absorbed by the digestive system (Alberts, 2006).

Nickel is a low-metal element, with only 10 mg in body quantity. Most vital nickel functions are still unknown. However, RNA has an important role in protein-building.

Nickel absorption is considered weak by the digestive system. The daily intake should be at least 50-100 micrograms and not more than 500 micrograms. In children, the amount must not exceed 200 micrograms between 1-3 years and 300 micrograms between 4-8 years of age.

Nickel overflow is associated with many toxic side effects, such as allergic and digestive disorders and colitis in epithelial work, and can cause lung cancer. Poisoning occurs with a carbonyl-carcinogenic inhalation that is found in the cigarette smoke, car exhaust, and industrial waste (Landolph, 2017).

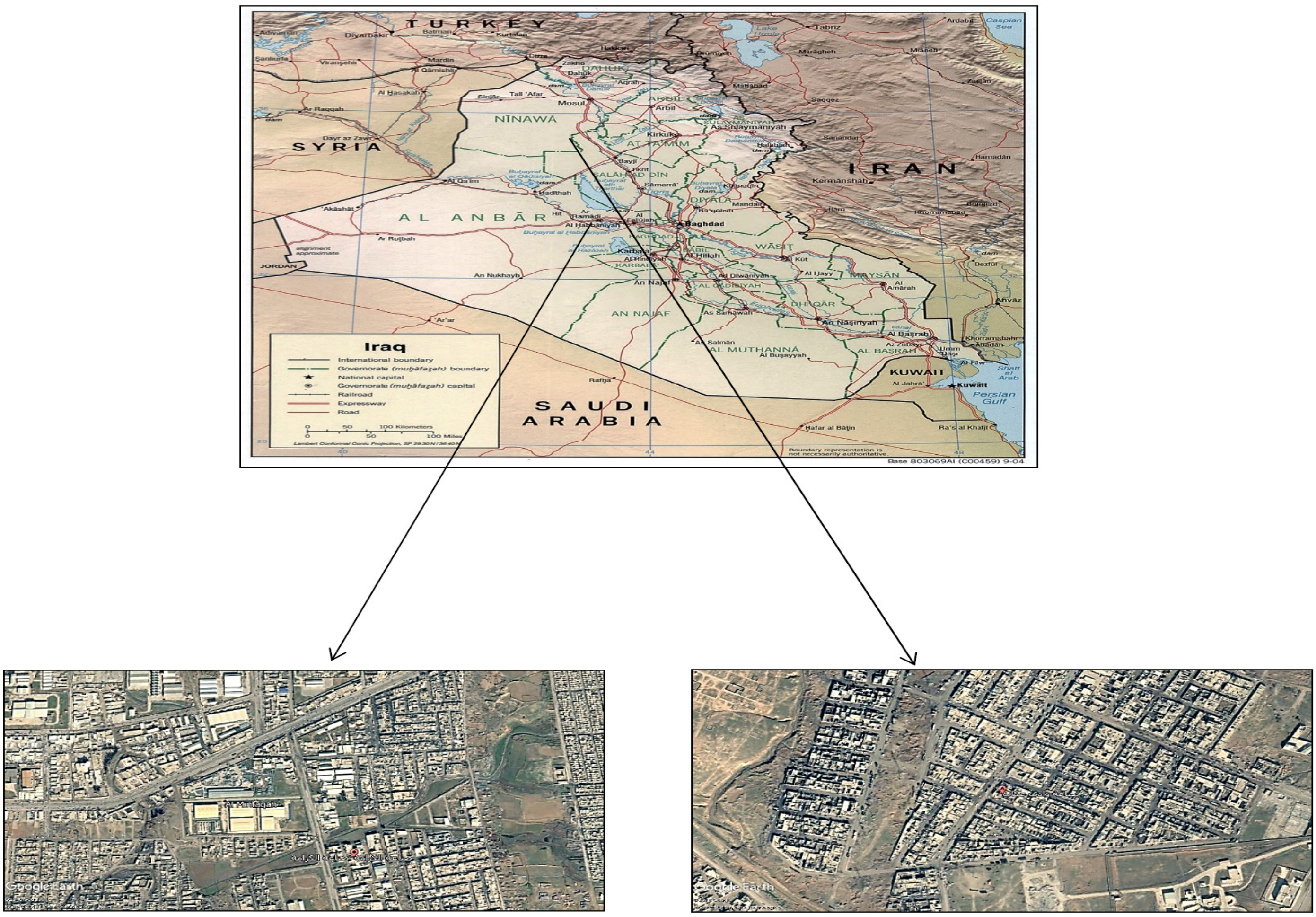
Copper is also a key element of the human body and at the same time toxic element. Exposure to high concentration of it causes Wilson's disease (bloody dyes), Alzheimer's disease, which results from the contamination of drinking water by its copper-based transport tubes where copper is deposited in the acidic medium. In addition to the EPA, the allowable concentration in drinking water, estimated at 1.3 milligrams/liter, have been identified (Brewer, 2007).

This study aims to determine the levels of the elements Concentrations of (Pb, Ni, Co, Fe, Cu, Zn) In the industrial zones' blood serum and compare them with workers at Mosul University (not exposed to industrial activities).

Materials and Methods

Study Area

The study area is the city of Mosul, which is located in the north-western part of Iraq, between the longitude of 41°-44° and the latitude of 35°-37°. In particular, the two main industrial areas of the city are the manufacture of the Wadi Okab on the right side (the western part) and the Karama on the left side (the eastern part) (Figure 1).



AL-Karama Industry Okab Industry

Fig. 1: Location of Study Area.

Study Design

The blood samples were taken from (20) industrial agents in a random manner and from two main areas, namely the manufacture of the Wadi Okab (right side) and the Karama (left side) industry. In addition to taking blood samples from (20) people as a control group working at Mosul University and without a history of industrial activity. The control group is not different from the group of workers in terms of gender and age groups (Eck and Wilson, 1989).

Survey for region

A questionnaire form was created for workers in industrial zones and control groups where it included (age, gender, number of years spent at work, smoking cases) (Tower, 2010).

Blood samples

Samples were collected on 14-10-2019 from 10 a.m. to 4 p.m. samples were taken from 20 workers in (plastic recycling plant, mechanics, car thighs). 20 samples were taken of those working at Mosul University as a control group. 5 mL of vein has been withdrawn and placed into a test tube with information for each person. They were transferred to the laboratory and separated by centrifuge at 4,000 rpm for 15 minutes, then isolated serum samples and kept samples at -4 until analyzed. The serum samples were then diluted by 5:1 with ions-free water. The Atomic Absorption (flame) device was used to estimate the heaviest elements in the serum. (Figure 3,4).

Fig. 2: Preparing samples

Fig. 3: Measure Elements.

Statistical analysis

The data is analyzed with some statistical processes by SPSS in its copy 16 and expressed in the mean ± Standard Deviation (SD). The value of 0.05 was considered to indicate the existence of statistically significant differences.

Results and Discussion

The results show that there is a clear mental difference of (P<0.001) for elements (Zn, Cu, Fe, Co) and (P< 0.002) for (Ni) element. There is a clear increase in the mix of elements measured in the industrial workers' serum from the control group (Table 1) and (Figure 2).

Table 1: Determination of heavy metals in Area of workers & controls groups

Elements	Grouping	N	Mean ± SD (ppm)	p-Value
Pb	Workers Control	20 20	1.2850 ± 0.56872 0.6095 ± 0.61500	p<0.001
Ni	Workers Control	20 20	0.9490 ± 0.46871 0.4845 ± 0.43351	p<0.002
Co	Workers Control	20 20	0.7590 ± 0.49120 0.3235 ± 0.17709	p<0.001
Fe	Workers Control	20 20	3.1500 ± 0.67082 2.3000 ± 0.80131	p<0.001
Cu	Workers Control	20 20	1.4050 ± 0.51654 0.9170 ± 0.32988	p<0.001
Zn	Workers Control	20 20	1.6915 ± 0.46263 1.2305 ± 0.36772	p<0.001

P< 0.05 Significant P> 0.05 No significant

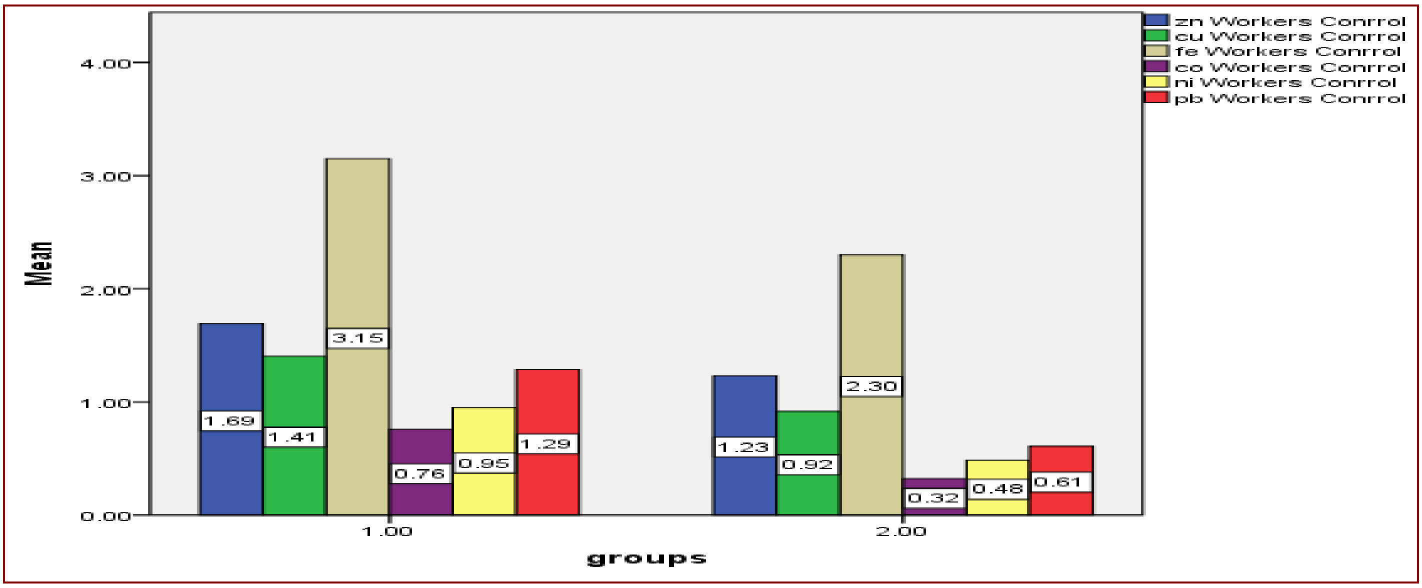


Fig. 4: Compare the mean of heavy metals between workers & controls groups

The group of industrial workers has been classified into groups according to (age groups, smokers and non-smokers, occupational exposure period). The results were shown by age groups (1-29) years and (30-57) years to lack significant moral differences (Table 2) and (Figure 3).

Table 2: Determination of heavy metals between two ageing group of workers.

Elements	Age grouping	N	Mean ± SD (ppm)	p- Value
Pb	(1-29) (30-57)	10 10	0.9500 ± 0.66542 1.5200 ± 0.52662	p>0.05
Ni	(1-29) (30-57)	10 10	0.7430 ± 0.72406 1.2700 ± 0.59264	p>0.05
Co	(1-29) (30-57)	10 10	0.9910 ± 0.34854 1.5600 ± 0.49710	p>0.05
Fe	(1-29) (30-57)	10 10	2.5700 ± 0.68646 3.3000 ± 0.58689	p>0.05
Cu	(1-29) (30-57)	10 10	1.1000 ± 0.31623 1.7000 ± 0.67495	p>0.05
Zn	(1-29) (30-57)	10 10	1.1800 ± 0.38239 1.6350 ± 0.55680	p>0.05

P< 0.05 Significant P> 0.05 No significant

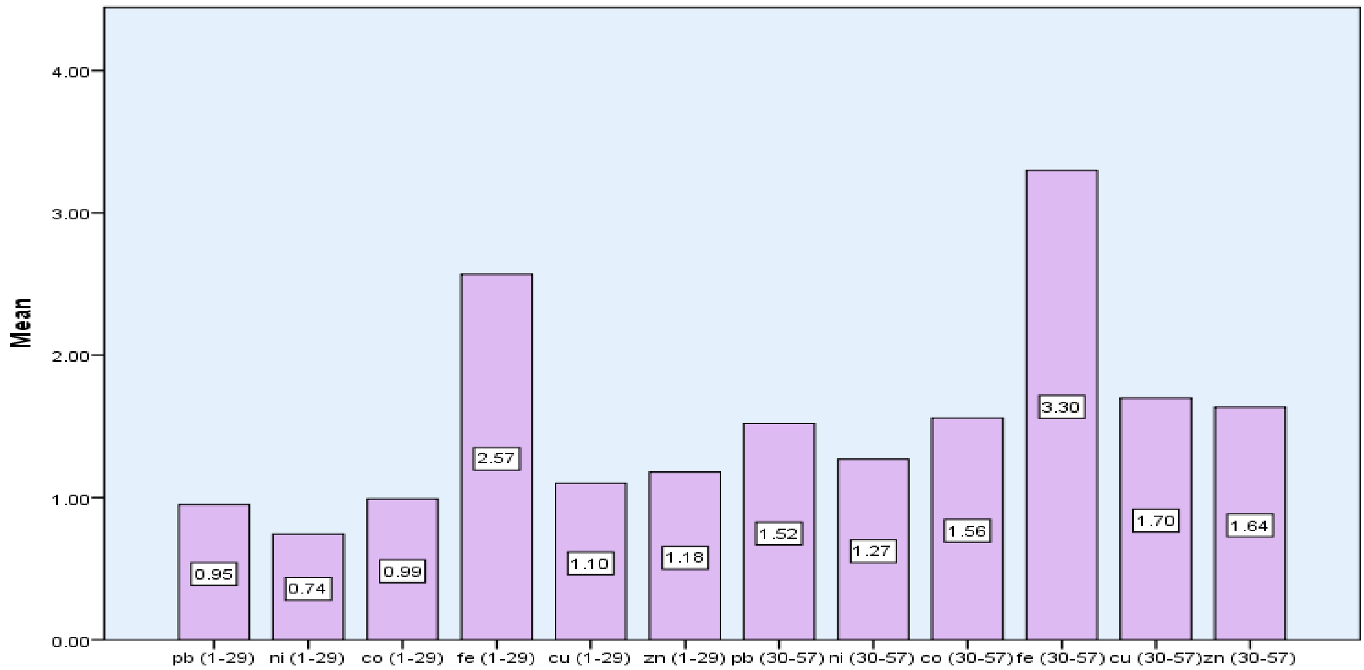


Fig. 5 : Determination of heavy metals between two ageing group of workers.

For the smokers and non-smokers category of the industrial workers' group, the results showed that there were no significant differences between the two categories for the measured elements (table 3) and (Figure 4).

Table 3: Determination of heavy metals between smokers & non-smokers of workers

Elements	Smoking	N	Mean ± SD (ppm)	p- Value
Pb	Smokers Non -Smokers	10 10	0.9800 ± 0.69889 1.7100 ± 0.77667	P> 0.05
Ni	Smokers Non -Smokers	10 10	1.0700 ± 0.62725 1.6600 ± 0.53166	P> 0.05
Co	Smokers Non -Smokers	10 10	0.1760 ± 0.28202 0.7370 ± 0.63603	P> 0.05
Fe	Smokers Non -Smokers	10 10	1.7500 ± 0.46726 2.3650 ± 0.72113	P> 0.05
Cu	Smokers Non -Smokers	10 10	0.3700 ± 0.33931 0.9440 ± 0.29481	P> 0.05
Zn	Smokers Non -Smokers	10 10	0.6720 ± 0.60135 1.6500 ± 0.38079	P> 0.05

P< 0.05 Significant P> 0.05 No significant

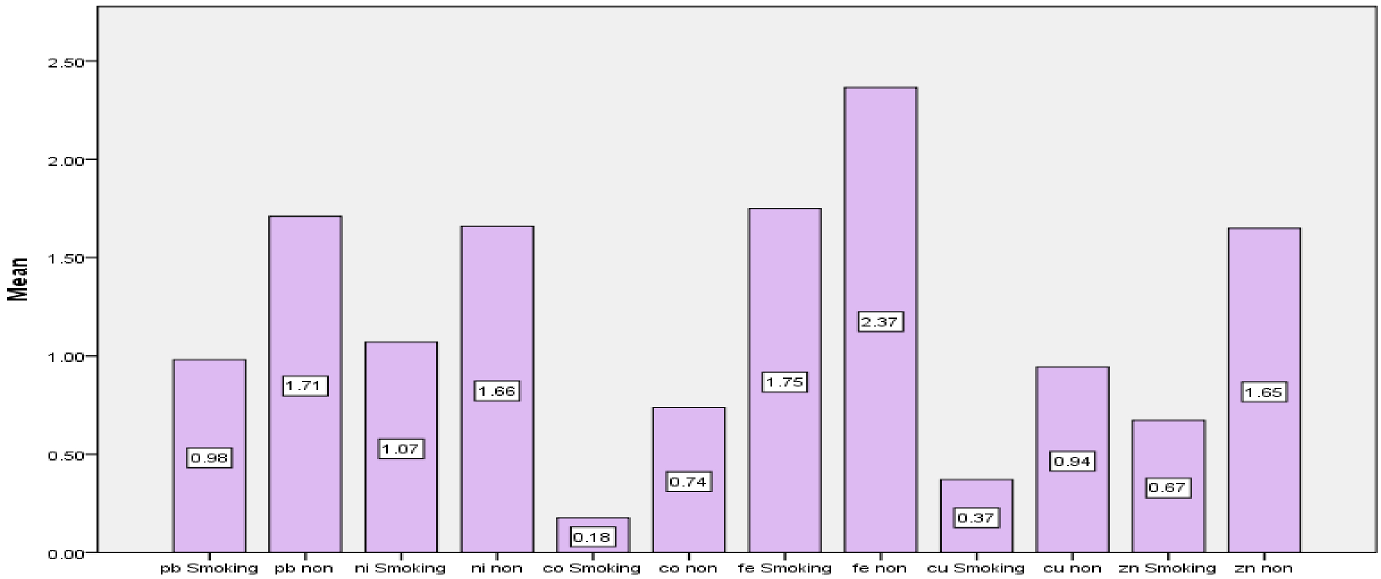


Fig. 6 : Compare the arithmetic mean of heavy elements between smokers & non-smokers of workers.

Regarding to the occupational exposure period category (1-19) and (20-39) years for the industrial group and for all measured elements, the results showed that there were no significant differences. (Table 4) and (Figure **5**).

Table 4: Determination of heavy metals between workers depending on period of work

Elements	Period of Working (year)	N	Mean ± SD (ppm)	p-Value
Pb	(1-19) (20-39)	10 10	0.9800 ± 0.69889 1.6000 ± 0.52281	P> 0.05
Ni	(1-19) (20-39)	10 10	1.0700 ± 0.62725 1.7500 ± 0.35355	P> 0.05
Co	(1-19) (20-39	10 10	1.000 ± 0.69602 1.8300 ± 0.23594	P> 0.05
Fe	(1-19) (20-39(	10 10	1.2100 ± 0.66575 1.9500 ± 0.64334	P> 0.05
Cu	(1-19) (20-39)	10 10	0.94000 ± 0.45509 1.1100 ± 0.43830	P> 0.05
Zn	(1-19) (20-39)	10 10	0.9800 ± 0.64601 1.6800 ± 0.49171	P> 0.05

Significant P<0.05 P> 0.05 No significant

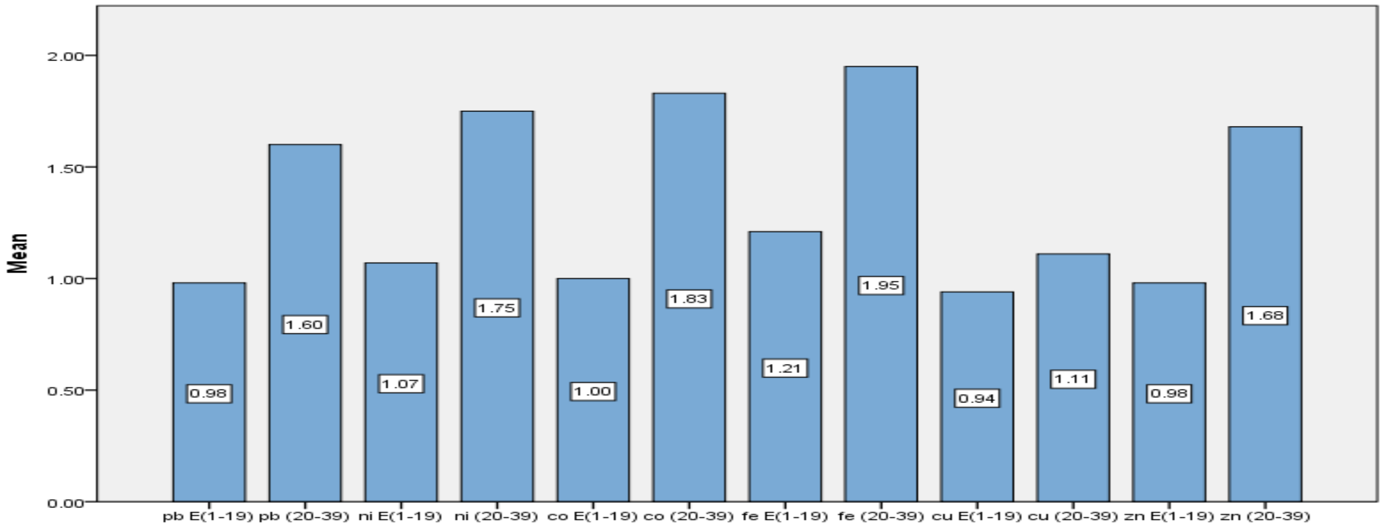


Fig. 7 : Compare the arithmetic mean of heavy metals between workers depending on period of work.

All heavy metals are toxic and the human body needs special transport and metabolic mechanisms to dismantle these elements and do not harm the body. Humans are at risk of these elements and their toxicity because of environmental pollution which affects on water, air, soil, or direct handling of some of the occupations that produce these elements. Some of these elements are useful to humans with low concentration, but their risk is in their high variety, which may sometimes cause body morbidity and death (Eck and Wilson, 1989).

The toxicity of heavy metals occurs when they build up in soft tissue of the body and are not metabolic. The human body enters through food, water, air, or by absorption by the skin when directly contact is made with it in agricultural environments and industrial areas that are the general path of exposure of adults to the risk of these elements (Eck and Wilson, 1989).

Environmental pollution poses a health threat to the entire world. The concentration of heavy metals in serum above 1 µg/L indicates that there are potential environments to which the individual is exposed and the concentration above 5 µg/L indicates that toxic substances already exist (Tower, 2010).

The results of the study indicate a high increase in the concentration of heavy metals in the blood of workers in industrial areas (paint workers, mechanics, plastic recycling workers, blacksmiths) For those who do not work in this field. In the future, this may cause serious health and general environment problems. The Iraqi environment is contaminated with heavy metals, especially in industrial places, where its members are exposed to many dangers of these elements, which cause many health problems.

Current workplaces in industrial zones are unsafe for workers or their families. Professionals and workers need more secure support by providing and introducing other alternatives in less polluted and safer industrial processes. More heavy metals risk awareness workshops are also required for its harm to the general environment.

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