Measuring the Concentration of Heavy Elements in Blood of Workers in Fuel Stations in Dhi Qar Governorate

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Abstract. This study was designed to measure the concentration of some heavy metals (Copper, Zinc, Iron and Lead) in blood serum of workers in filling stations in the center of Dhi Qar governorate in southern Iraq; Ten samples were selected from a group of workers ranging ages from (19 to 54 years), and had (1 to 11 years) work experience, some of them are smokers and others are not. The study included employment from Al-Raya and Mansouriya stations and also included people work at other places to be control for the study. Measurements were done in laboratories of the Faculty of Sciences, Dhi Qar University. Results statistically showed that concentrations of the four metals among workers in fuel stations are higher than those in the control, and the concentrations in blood of smokers are higher than in non-smokers workers, the study also confirmed that differences in ages percentages between workers groups where found.  

Keywords: Heavy Metals; fuel stations; Trace Elements; Dhi Qar; Smokers.

1. Introduction:

Trace elements that are present in tissues as very small quantities mean that they are classified as toxic and non-toxic. They can be classified according to their importance in body to essential and non-essential elements. They can also be classified according to their presence in body as major and minor elements (Underwooder, 1977). Iron is very necessary element "comparing with other trace elements. It is important for its role in tissue growth, hemoglobin, cellular respiration, and synthesis of enzymes which are important in process of building and growth in order to sustain functions of various body cells (Guyton, 1986). Lead is a toxic and hazardous element to human health. It enters human body by inhalation of lead compounds in air coming from exhaust of cars, factories and laboratories, as well as enters through food or drugs that lead inters in their composition (Moore, 1977, Kunkel, 1986). Zinc is necessary for many enzymatic reactions, synthesis of proteins and entering in composition of many enzymes such as Alcohol dehydrogenase, lactic dehydrogenize and Carboxy peptidase (Murray et al., 2000, Cousins, 1985). Zinc poisoning is caused by inhalation of zinc oxide and digestion of large quantities of zinc salts (Gossel and Bricker, 1984). Copper, as iron, is necessary for blood forming and body need to produce a number of enzymes containing Cytochrome oxidant. It also helps in bones building, blood cells forming and hemoglobin (vural et at., 2003). The lack of copper leads to general weakness, osteoporosis, anemia and diarrhea (Medowell, 1992; Dunne, 1990, Johnson and Fisher, 1998).
Aims of the study:

1- Determination of concentration of heavy metals (iron, copper, zinc, lead) in blood serum for workers in gas stations.
2- Knowing the difference between smokers and non smokers according to different concentration of heavy metals in blood serum.
3- Knowing the difference between workers ages according to different concentration of heavy metals in blood serum.

2. Materials and Methods

2.1. Study Area

Study was conducted from (Al-Raya, Mansouriya stations) located in crowded street with cars causing high amounts of Pollutants in the center of Dhi Qar province in southern Iraq (Figure 1).

2.2. Sampling Collection

Thirty blood samples were collected from workers at gas stations, 15 samples from (Raya and Mansouriya stations) and the other from people does not work in any stations, they are considered as control. The study take in consideration the work period, wither they are smokers or not and aged between (19- 54) years.

Five ml of blood sample was obtained, collected in test tubes and placed in centrifuge until (Universal/ Germany) the separation done at 4000rpm. This separation for blood serum is necessary to estimate the studied minerals.

2.3. Digestion of serum

2 ml of Nitric acid (70%) and 1 ml of Perochloric acid (70%) were added to (0.5) ml of serum in a Pyrex tube then heated the compound with a water path on a hot plate at 160Cº for one hour and cooled, finally completed to 10 ml with (30%) Hydrochloric acid (Xueping and Rexy, 2002).

2.4. Estimation of heavy metals

Estimation of heavy metals by Flame Atomic Absorption Spectrophotometer (FAAS- Phoenix 986 AA United kingdom -UK.) was done according to procedure of manufacturer.

3. Results:

3.1. Concentration of heavy metals in serum

The rates of concentrations of heavy metals under study were placed in (Table 1). Present study found that the average values of heavy metal concentrations varied between the stations workers and the control, former recorded higher values of heavy metal concentrations than the lateral. Results data showed that the iron element reached the highest value, it was (118.2) ppm, while the Pb reached the lowest value, it was (0.20) ppm in stations workers blood. Comparing with the control the Fe also reached the highest value, it was (78.01) ppm; while the Cu reached the lowest value, it was (0.01) ppm.
Table (1): Average of heavy metals and standard deviation in blood serum of workers at the stations under study

| Heavy metals | mean ± SD (workers in fuel stations) | mean ± SD (control) |
|--------------|--------------------------------------|---------------------|
| Fe           | 118.2 ± 9.03                         | 78.01 ± 15.01       |
| Cu           | 0.062 ± 0.001                         | 0.01 ± 0.001        |
| Zn           | 0.96 ± 3.01                           | ND                  |
| Pb           | 0.20 ± 0.02                           | 0.02 ± 0.001        |

ND: Not Valid

3.2. Concentration of heavy metals in workers blood serum according to work experience:

Values of heavy metals concentration are classified into three groups according to duration of employment; group 1 include work period (1-3) years, group 2 include work period (4-7) years and group 3 include work period (8-11) years. (Table 2).

The Fe recorded the highest values in all groups, it was (200.01, 265.20, 299.30) ppm respectively; while the Cu recorded the lowest values in all groups, it was (0.013, 0.017, 0.022) ppm respectively.

Table (2): Relationship between concentration of heavy metals and standard deviation in serum of workers at the station according to work experience

| Group No. | Work Period (years) | Pb ± SD | Zn ± SD | Cu ± SD | Fe ± SD | Pb ± SD | Zn ± SD | Cu ± SD | Fe ± SD |
|-----------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1         | 1-3                 | 0.130±0.03 | 200.01±10.01 | 0.013±0.01 | 0.057±0.01 |
| 2         | 4-7                 | 0.150±0.05 | 265.20±12.13 | 0.017±0.002 | 0.118±0.09 |
| 3         | 8-11                | 0.178±0.06 | 299.30±13.22 | 0.022±0.001 | 0.120±0.10 |

3.3. Relationship between concentration of heavy metals and smoking:

The heavy metals concentrations in blood serum for smokers and non-smoker's workers in fuel stations were placed in Table (3).

The Fe values were the highest in serum blood of both smokers and non-smokers, it was (113.01) ppm and (35.35) ppm respectively; While the Cu concentrations were the lowest, it was (0.006) ppm and (0.02) ppm respectively too.

Table (3) Concentration of heavy metals and standard deviation in blood serum of smokers and non-smokers workers

| Groups       | Pb ± SD | Fe ± SD | Cu ± SD | Zn ± SD |
|--------------|---------|---------|---------|---------|
| Smokers      | 0.100±5.01 | 113.01±4.01 | 0.006±0.001 | 0.105±0.02 |
| Non smokers  | 0.99±0.41  | 35.35±6.00  | 0.02±0.001  | 0.135±0.07  |

3.4. Concentration of heavy elements and age:

The study chose workers aged between (19-54) years, which are the normal age of employment at fuel station in Iraq. The study classified the samples in to three groups; group 1 include workers aged (19-30) years, group 2 include workers aged (31-42) and group 3 include workers aged (43-54) years.
Fe concentration was the highest in group 1 it was (0.78) ppm; while Zn concentrations were the highest in both group 2 and group 3; they were (0.55) ppm and (0.66) ppm respectively. Otherwise the Cu concentration was the lowest in group 1 and 3, while the Pb concentration was the lowest in group 2.

Table (4): Relationship between concentration of heavy metals and standard deviation in station workers’ serum according to age

| Groups | years | Pb ± SD | Fe ± SD | Cu ± SD | Zn ± SD |
|--------|-------|---------|---------|---------|---------|
| 1      | 19-30 | 0.02± 0.001 | 0.78± 0.10 | 0.006± 0.003 | 0.30± 0.01 |
| 2      | 31-42 | 0.040± 0.02 | 0.106± 0.2 | 0.08± 0.01 | 0.55± 0.20 |
| 3      | 43-54 | 0.120± 0.07 | 0.197± 0.41 | 0.020± 0.01 | 0.66± 0.06 |

4. Discussion

Lead

The concentration of lead was higher in workers blood in gas stations compared with control. This agreed with many studies that show people working in crowded places with cars suffer from lead high levels in blood compared to those who work far away. It was found that level of lead in blood of workers in fuel stations was (0.20) while level of control was (0.02). There is observed difference in concentration levels indicating increase of lead in fuel station workers from the control. This is attributed to the remnants generated of fuel stations from combustion processes containing a percentage of lead which enter body by inhalation and lead to an increase ratio of lead according to time and place. Difference between smokers and nonsmokers and periods of exposure and that the concentration of lead in the serum of healthy people is less than (0.001 ppm). Lead is a non-essential metal and is toxic to humans even at low concentrations and can cause many biologic effects, lead is a danger to enzyme and fuel consumption is the main source for lead emissions. Lead in workers blood serum in fuel stations have high levels compared to control because of direct exposure to lead. But reasons for lead decrease in smokers are due to that most cigarettes do not contain the lead element in tobacco. Lacks of safety conditions such as masks for workers are one of the causes of lead rise.

Copper

Study results confirmed the presence of high level of copper in workers blood serum in fuel station than in control. Natural copper value is 0.011 which is agreed with level of copper in control is (0.011). Copper is necessary for humans because it works as an enzyme in some reactions. Small amounts of copper must be absorbed every day and high levels of copper can be harmful and can cause nausea, diarrhea and vomiting. High doses of copper can cause damage to the liver and kidneys and cause death (HPA, 2010). Results noted that there was small difference in copper level workers of fuel stations and control.

Iron

Iron concentration was increased in blood serum of fuel stations workers to (118.2). Although iron is basic metal for body, direct exposure and high amounts of iron cause dangers and damage to human health. Some studies suggest that colon cancer can be caused by large amounts of iron. Main cause of iron increase is car fuel combustion, direct inhalation of iron, cars and smoke. The increase of iron is confirmed for workers at the gas stations than in control. It is noted that iron level in smokers has
reached (113.01). This increase may be due to the fact that smoking may affect the red blood cells, which may cause breakdown of blood cells and iron exit in blood stream. It is known that iron combines with the globulin to be hemoglobin and may be the main cause of increased concentrations of iron in smokers.

**Zinc**

Results showed that zinc ratio in fuel stations workers was 0.96, while no zinc value was recorded in control. Zinc is similar to copper in body because it acts as an enzyme cofactor in some reactions, zinc can be analyzed for zinc chloride, causing damage to stomach lining because of its high degree of acidity. Zinc level in smokers has decreased because smoking has stimulated the enzymatic reactions in which zinc acts as enzyme cofactor, which led to its association with enzymes and reduction of concentrations in blood stream.

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