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DETERMINATION OF SOME HEAVY METALS IN THE BLOOD AND MILK OF NURSING MOTHERS: A COMPARATIVE STUDY BETWEENWASIT AND NAJAF PROVINCES

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ABSTRACT

The present study aims to measure some heavy metals (copper, cadmium, cobalt and lead) in the blood and a sample of milk in nursing mothers in Wasit and Najaf, and those concentrations the two provinces were compared. Seventy seven samples were collected of milk divided by (37 samples of Wasit province and 40 samples of Najaf province), and identical other of blood samples divided by (37 samples of Wasit province and 40 samples of Najaf province) of the General Hospital of the districts (The Martyr Dr. Feiroz Hospital, Alasri district of the health center, in Wasit province, and (Zahra Teaching Hospital, the health center of Muslim bin Aqeel (p), the health center for Abasiya) in the province of Najaf, in the period between July and August and September of 2014. The results showed that there is a disparity in the presence of these elements in the blood and milk of breastfeeding mother's. As it turns out that there are clear differences between the two groups subjected to study in both provinces, as the highest percentage of the concentration of elements was recorded in Wasit compared to Najaf. The highest concentrations of the elements copper and cobalt (11.4, 2.19) µg/dl, were recorded respectively, in the blood of mothers in Wasit province, while the highest concentrations of the element copper (1.18) µg /dl, in the milk of mothers in Wasit province, and lower concentration of element in Najaf province recorded (6.37) µg/dl. It appeared there is a positive correlation between blood and milk to mothers for copper, cadmium and counterproductive for cobalt and lead. The average age in the province of Najaf is 25 years old while in Wasit province, 27 years old and the height of the mothers had an average of 158 cm in Wasit and156 cm in Najaf, while the average weight is 66 kg in Najaf and 63 kg in Wasit. The ages of mothers that are younger than 25 years recorded a significant increase in copper concentrate and cobalt in the blood while the ages of the mothers that are older than 25 years, recorded a slight increase in most elements in the mother milk and the highest value was recorded in the copper concentration and was 8.28 µg /dl. However, the lowest value was 0.53µg /dlin cadmium. The present study conclude The mean concentration of heavy metals in human milk and blood of lactating women aged ≥ 25 years was higher than that in women aged < 25 years .

Keyword: Heavy Metals, Blood, Milk, Nursing Mothers, Najaf

INTRODUCTION

Living organisms require varying amounts of heavy metals. Iron, cobalt, copper, manganese, molybdenum, and zinc are required by humans[1]. The increase in heavy metal pollution in the ecosystem is because of various human and natural activities[2]. These activities include dumping of wastes, unintentional and process spillages, use of agricultural pesticides and related chemicals, movement of contaminants into a fertile land as vapors, by mobilization of soil, or as dust, or dispersal of sewage mire. All these sources contribute towards contamination of the environment[3].During the past years Iraq environment was exposed to the pollutants as a result of wars, an increase in industrial, agricultural and

commercial activities, unregulated population facilities increase, sewage flows and the wrong style in treatment and recycling waste , including remnants of war[4],and producing and refining oil that supplied various kinds of pollutants to environment and that at the end up to the aquatic environment which form danger to living organisms when they enter the food chain and accumulate in the aquatic bodies and down-to-human[5-6]. Human milk is an important source of nutrition for infants because it contains a lot of nutrition substances. Beside the nutrition, the human milk gives important immune and growth factors to infants to support their healthy life. In these aspects, it is thought that human milk is superior to formula milk to infant feeding. However if mothers are exposed to harmful environmental pollutants, these pollutants may contaminate human milk and then transfer to infants by milk feeding[7].Dietary sources of breast milk serve as primary sources of calories and nutrients in infants. Human breast milk is recommended as the exclusive food for the first six months of life, and continuing, along with safe, nutritious complementary foods, up through two years[8].During lactation, the composition of milk of mammals is subject to rapid changes, upon which milk becomes an ideal food for an infant. These changes refer both to macro- and microelements as well as the quantity and quality of protein and lipid substances and saccharines[9].This study is looking into the proposed effects of some environmental pollutants on breast milk. It was conducted to achieve the following aims-

1. Determination of some heavy metals levels in human milk and blood of nursing mothers.
2. Comparative study between Wasit and Najaf provinces.
3. Study the relationship between heavy metal, blood and milk of human.

EXPERIMENITAL

Martial and Methods

The present study was carried out in the period between July, August and September of 2014, to measure some heavy metals (copper, cadmium, cobalt and lead) in the blood and a sample of milk in nursing mothers in Wasit and Najaf, and those concentrations of the two provinces were compared. Seventy seven samples were collected of milk divided by (37 samples of Wasit province and 40 samples of Najaf province), and other identical of blood samples were divided by (37 samples of Wasit province and 40 samples of Najaf province) of the General Hospital of the districts (The Martyr Dr. Feiroz Hospital, Alasri district of the health center, in Wasit province, and (Zahra Teaching Hospital, the Health Center of Muslim bin Aqeel (p), the Health Center of Abasiya) in the province of Najaf. A 5 ml, blood samples were collected using disposable syringes intravenously. The blood was placed in sterile vacuum tube (free of anticoagulant) and allowed to coagulate at room temperature and centrifuged at 3000 rpm for 10 min for separation of serum. Human milk samples were collected from lactating females by manual suckling in the morning and then after 2 hours with the help of Lady health worker. The lactating females provided 10 mL of milk directly into clean polyethylene plastic bottles. All the samples were frozen immediately after collection and stored at 4 ºC until completion of analysis. Samples were analyzed for heavy metals using atomic absorption spectrophotometer (Shimadzo 6300 AA. Japan) in the Faculty of Pharmacy, Kufa University. The method used to measure the elements in milk[10] and in blood[11].

Statistical analysis

Descriptive data were presented as a mean values ±standard deviation correlation. One-way ANOVA test was used for further statistical analyses. The value $P<0.05$was considered statistically significant. All statistics were done using the excel computer 2007.

RESULTS AND DISCUSSION

Blood and milk samples from 77 nursing mothers were analyzed. Of these, 52 % were younger than 25 years, 48 % were older than 25 years (Figure- 1).Figure-2 shows clear increase in concentration of all study elements in blood of mothers younger than 25 years are higher than the ones over 25 years, while Figure- 3shows in increase concentration of lead and copper elements in milk of younger than 25 years higher than older than 25 years. High concentrations of Co and Cu were observed in blood samples as compared to milk of nursing mothers while high concentrations of Pb and Cd were observed in milk

samples as compared to blood of nursing mothers (Figure-4). Table-1 presents the mean, median, maximum and minimum elements concentrations in milk and blood of the women studied in Wasit province, and Table-2 presents the mean, median, maximum and minimum elements concentrations in milk and blood of the women studied in Najaf province. It shows increase of the mean of lead concentration in blood in Najaf is more than of Wasit province while the mean of the other elements concentration in blood and milk in Wasit provinces more than of Najaf province. Figure-5 and 6 show the copper element concentration is higher than other elements in milk and blood of nursing mother. Weight and height of nursing mothers arithmetically (mean, ±standard deviation, median, maximum and minimum values)of Wasit and Najaf provinces show in Table- 5 mean ±standard deviation of weight in Wasit are 63±10.11 maximum value 90 kg ,while in Najaf province mean ±standard deviation of weight are 66 ±13.5 in maximum value is 105 kg so mean ±standard deviation of length in Wasit are 158±6.4 maximum value 172 cm while in Najaf province mean ±standard deviation of length are 156 ±4.9 in maximum value is 165 cm Table-3 .Table-4shows relation of elements concentrations in the blood and milk of nursing mothers from Wasit and Najaf provinces that there is significant difference positive and negative relations between elements ,weight and height in blood and milk of nursing mothers. Detection of heavy metals in blood maybe important to determine the proportion of exposure, but it does not reflect the full amount in the bodyproportion[12]. The current study is part of the survey monitoring for the levels of heavy metals (lead, cadmium, copper and cobalt) in blood and milk of nursing mothers in the two provinces in Iraq(Wasit and Najaf). Metal concentrations can be used in blood as an indicator of biological through which we can monitor the exposure of nursing mothers to harmful metals and thus determine the risks and their impact on the health of the mother and her children. The results of the study show increase in concentration of all study elements in blood of younger than 25 years higher than in the ones older than 25 years, while increase concentration is noticed in lead and copper elements in milk mothers of younger than 25 years higher than in the one solder than 25 years .This result differs with what concluded[13-14].They found that the percentage of the concentration of lead in the blood is a direct relation to the age of mothers, when mothers aged between (25-20 years) are the lowest and the highest percentage in the mother older than 35.The current study shows the presence of cadmium in the milk of some mothers and blood of others and this is possibly attributed to the exposure of mothers to sources of cadmium, which are absorbed through the digestive or respiratory tract then linked to cadmium in blood[15]. These result agree with the study of [16] which concluded that cadmium found in the blood of some mothers. It turns out that in the current study, the percentage of mothers in whose blood cadmium resides in Wasit province, higher than what is reported in Najaf province, perhaps due to the impact of environmental factors surrounding the mother. As shown by the results of the current study that the level of concentration of cadmium milk of mothers in the city of Najaf was higher compared to Wasit province, it became clear that the concentration of cadmium in blood and milk of some mothers is higher than the allowed limit. Where the limit for the concentration of cadmium in the blood of non-smokers ranges from (0.04 to 0.1) µg / dL[17] and has cadmium levels in adult human blood with little exposure to less than 1 ug / dl. The concentration in breast milk and milk of Cows is less than 1 microgram[18]. The present study showed that the level of cadmium concentration in the blood of some mother's milk was higher than some mothers in the province of Wasit. Conversely, in the province of Najaf cadmium concentration in milk of some mothers was higher than the blood of others and this is attributable- to the difference in the quality and spread of the habit of smoking in some families and containing food of copper stop the effect of cadmium damper of acids and bases phosphate in the liver and kidneys. The absorption of cadmium, at least in the jejunum, ileum, liver and kidney by about 66%, 21%, and11% respectively.[19] and will decrease the effect of cadmium at increasing the level of selenium as a result of the formation of selenium - cadmium[20]. The current study revealed the presence of lead element in the blood of some of mothers and their breast milk samples and the absence for others blood samples. Perhaps due to the mothers high exposure to sources of lead who absorbed through the respiratory or digestive system or the skin[21-22] after that lead associated with red blood cells[23]andthe blood contents 3% of lead in the body, and 5% of it is stored in the soft tissue, and most of the amount of lead (90-95%) is stored in the bone. And a biological half-life is 3-6 weeks in the blood [24], and this result agrees with the study of [16 and 25]who found the lead in

the blood of some mothers and their children. The present study shows an increase in the percentage of mothers whose blood and milk have lead, in Wasit and Najaf provinces. Perhaps this was due to the increased traffic in the two provinces which resulted in increase in lead concentration ratio by air of the two provinces due to emission of benzene [26] where Iraq so far uses gasoline containing a high percentage of lead up to 0.42 g / l, and traffic density and increase the number of cars in the previous years after 2003. In addition there are other sources of exposure to lead in Iraq include: various medicines herbal and traditional treatments such as henna and incense. Results show that the ratio of the number of mothers who found copper in blood was 100% in the Wasit and Najaf provinces , while the concentration of copper element of the blood of mothers in Wasit province, was 12.03µg /dl and 9.08µg /dl in the Najaf province , and the level of concentration of copper in milk of nursing mothers was 7.06µg /dl in the Najaf province while 13.45µg /dl in Wasit province due to the use of farmers for chemicals such as fertilizers, pesticides and fungicides containing copper and sterilizers element such as copper sulfate and mineral additions for a poultry diet[27], and there are rich sources of copper include shellfish and other seafood, beef, meat (especially liver), and vegetable-s dark green leafy and enriched cereals, nuts, sunflower seeds , green olives, avocados, dried beans, chocolate, cocoa, and black pepper [28-29]. It turns out that of the current study and the concentration ratio of the number of mothers whose breast milk and blood have cobalt in Wasit province, higher than reported in the province of Najaf, perhaps due to air pollution Wasit province, more than the province of Najaf because cobalt can enters the body when you breathe in air that contains dust and cobalt, and also water and food consumed contains cobalt, and the skin comes into contact with materials containing cobalt. If the body breathes in air that contains dust and cobalt, the amount of cobalt inhaled can remain in the lungs it depends on the size and amount of dust, which is then absorbed into the blood and depends on how the particles melt atoms. If the particles melt easily, it is easier to cobalt move into the blood of particles in the lungs. Results show that the level of cobalt element on centration in blood of mothers in the Najaf province is (0.0 and 4.84) µg /dl while in Wasit province was (0.00- 3.92) µg /dl and a higher level of cobalt element concentration in milk lactating mothers was 3.79µg /dl in Najaf province while 2.87µg /dl in Wasit province. Cobalt is beneficial to humans because it is part of vitamin B12, which is essential to maintain human health. It is also used (0.16 to 1.0) mg cobalt / kg of body weight as a treatment for anemia (less than normal number of red blood cells), including pregnant women. Cobalt also increases the production of red blood cells in healthy people, while people who suffer from anemia are treated with up to 1 mg cobalt / kg, or in pregnant women suffer from anemia treated with 0.6 mg cobalt / kg. In other words, it is possible that the increase is a result of taking treatment contain cobalt during pregnancy.

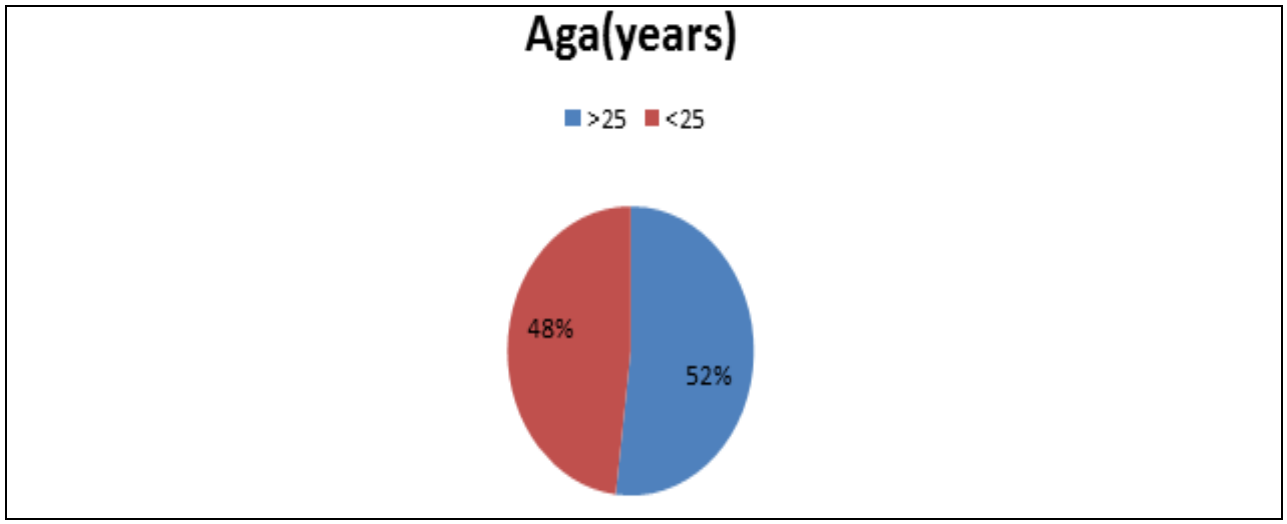

Fig.-1: Percentage of nursing Mothers (≤25, > 25) in region study

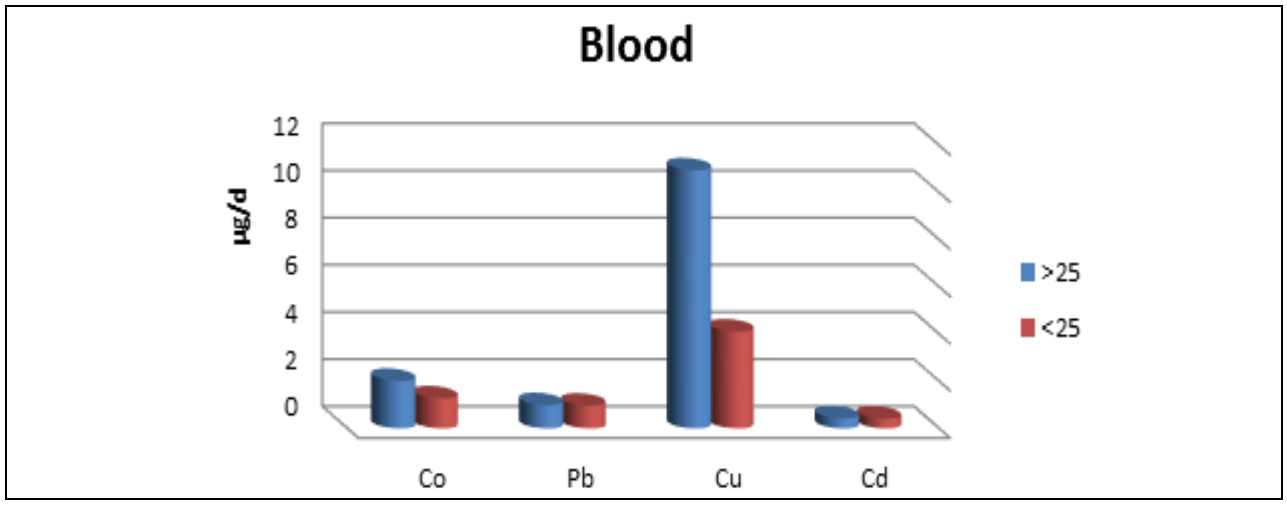

Fig.-2: Mean concentration of elements in blood of nursing Mothers (≤25, > 25) in region study

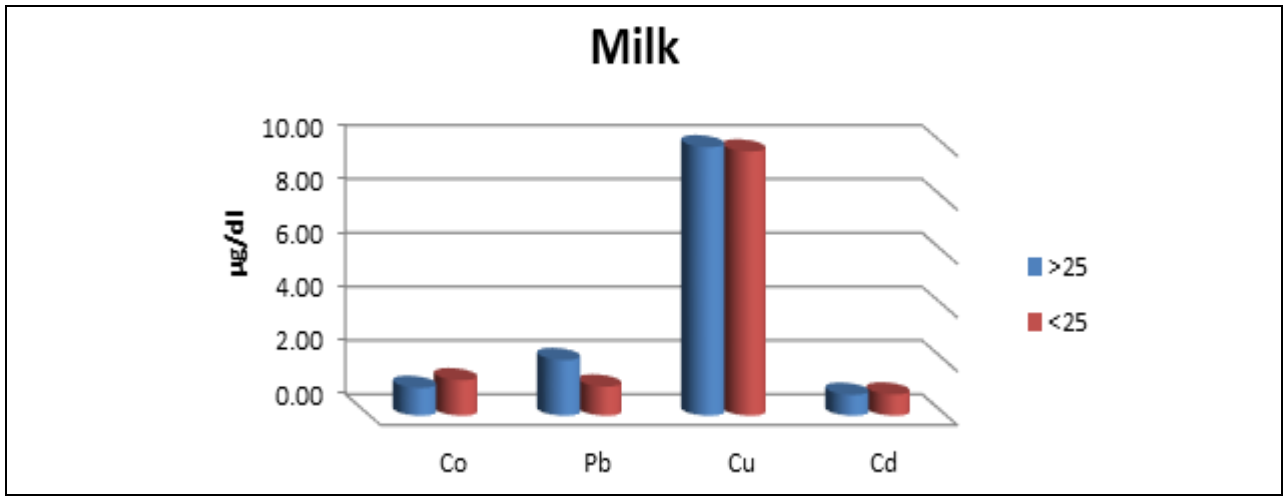

Fig. - 3: Mean concentration of elements in milk of nursing Mothers (≤25, > 25) in region study

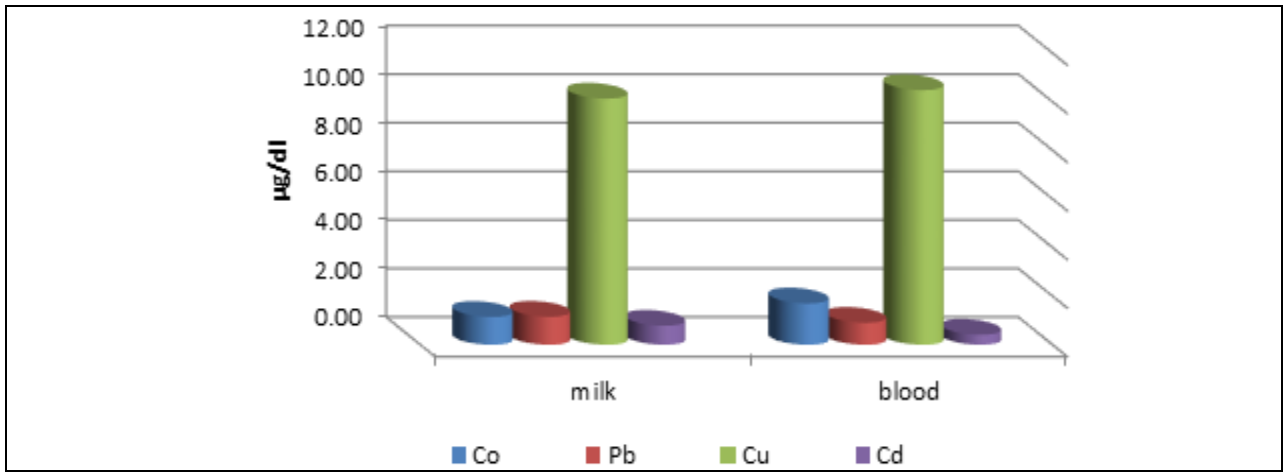

Fig. - 4: Mean concentration of elements in Milk and blood of nursing Mothers in regions study

Table- 1: Statistical analysis of elements concentrations in the blood and milk of 77nursing mothers from Wasit province

Variable Blood (µg/dl)	mean ± SD	median	maximum	minimum
Co	2.15± 0.81	2.19	3.92	0.00
Pb	0.71± 0.57	0.68	2.2	0.00
Cu	12.03±4.04	11.53	27	5.18
Cd	0.57± 0.37	0.50	1.48	0.00
Milk(µg/dl)				
Co	1.25±0.73	1.28	2.87	0.00
Pb	1.39±0.97	1.36	3.94	0.00
Cu	13.45±7.03	11.87	31.04	3.17
Cd	0.52± 0.74	0.35	3.62	0.00

Table- 2: Statistical analysis of elements concentrations in the blood and milk of 77nursing mothers from Najaf province

Variable Blood (µg/dl)	mean ± SD	median	maximum	Minimum
Co	1.3±1.23	1.19	4.84	0.00
Pb	1.08±0.88	0.84	2.70	0.00
Cu	9.08±2.4	8.69	12.12	5.1
Cd	0.27± 0.35	0.12	1.42	0.00
Milk(µg/dl)				
Co	1.05±1.04	0.85	3.79	0.00
Pb	0.94±0.8	0.89	3.51	0.00
Cu	7.06 ±4.52	6.37	21.05	0.47
Cd	1.03 ±1.06	0.72	5.42	0.00

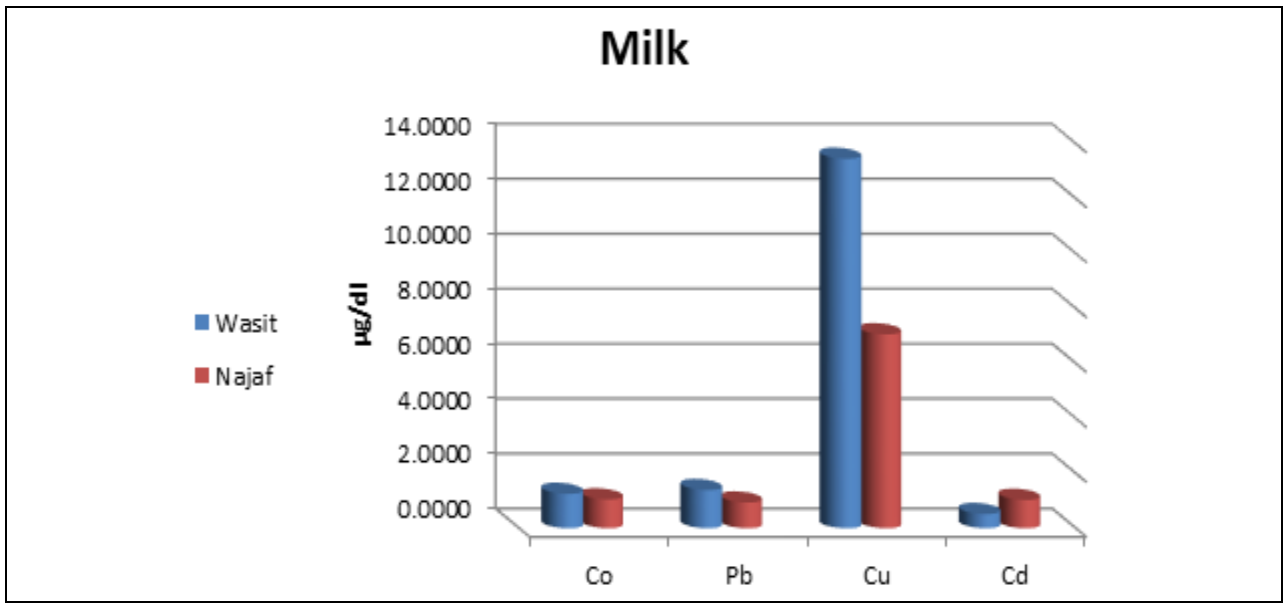

Fig. -5: Mean elements concentration in milk of Wasit and Najaf provinces.

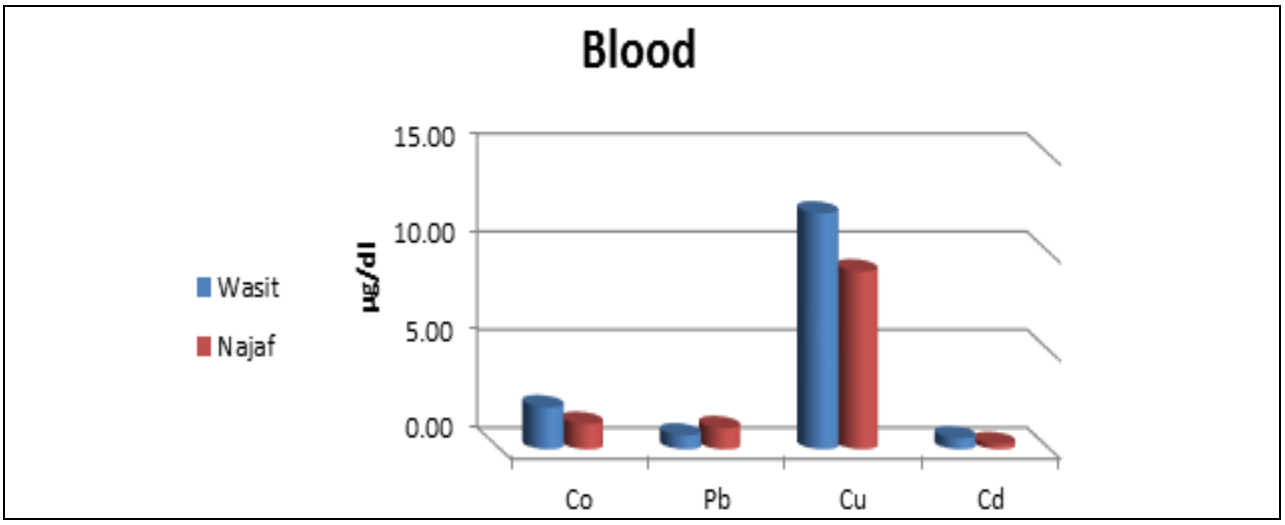

Fig. -6: Mean elements concentration in blood of Wasit and Najaf provinces.

Table- 3: Weight and Length of nursing mothers (n = 77; arithmetic mean, ±standard deviation, median, maximum and minimum values) of Wasit and Najaf provinces.

		Mean ± SD	Median	Maximum	Minimum
Wasit	Weight	63±10.11	60	90	49
	Length	158±6.4	159	172	133
Najaf	Weight	66 ±13.5	65.5	105	44
	Length	156 ±4.9	157	165	145

Table-4: Relation of elements concentrations in the blood and milk of 77nursing mothers from Wasit and Najaf provinces.

	Blood				Milk				Weight	Length
Blood	Co	Pb	Cu	Cd	Co	Pb	Cu	Cd		
Co		-0.29	0.23	0.18	0.24	0.19	0.29	0.09	-0.02	0.17
Pb	-0.29		-0.27	-0.15	-0.06	-0.16	-0.06	0.04	0.08	0.07
Cu	0.23	-0.27		0.14	0.07	0.08	0.19	-0.14	0.02	0.04
Cd	0.18	-0.15	0.14		0.12	0.12	0.17	0.09	-0.06	0.28
Milk										
Co	0.24	-0.06	0.07	0.12		-0.01	0.18	0.01	-0.10	0.06
Pb	0.19	-0.16	0.08	0.12	-0.01		0.18	0.00	0.00	0.25
Cu	0.29	-0.06	0.19	0.17	0.18	0.26		-0.13	-0.03	-0.04
Cd	0.09	0.04	-0.14	0.09	0.01	0.00	-0.13		- 0.06	0.04
Weight	-0.02	0.08	-0.03	-0.06	-0.10	0.00	0.02	-0.06		0.14
Length	0.17	0.07	0.04	0.28	0.06	0.25	-0.04	0.14	0.10	

CONCLUSION

The present study concludes that the mean concentration of heavy metals(copper, cadmium, cobalt and lead) in milk and blood of lactating women aged 25 years or younger, was higher than that in women aged older than 25 years .The mean of lead concentration in blood of Najaf mothers is higher than those of Waist's, while the mean of concentrations of the other elements in blood and milk in Wasit mothers are higher than those of Najaf's .For both provinces, high concentrations of Co and Cu were observed in blood samples as compared to milk of nursing mothers while high concentrations of Pb and Cd were observed in milk samples as compared to blood of nursing mothers.

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