

## LEVELS OF SOME TRACE METALS IN THE HUMAN HEAD HAIR AT DIWANIYA CITY

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### Abstract

Levels of some trace metals (copper, iron, zinc and lead) were determined in the head hair of 50 people living at Diwaniya City (south of Iraq). The people were divided into groups according to the age, sex, job, and living location. Mean levels were 0.53, 13.63, 4.8 and 0.368 ppm for copper, iron, zinc and lead respectively.

There is negative correlation were found between lead and other studied metals. The levels of lead are higher in males, free workers, people living near the main street of the city, and people aged between 31- 40 years.

### الخلاصة

قيست مستويات بعض الفلزات النزرة وهي النحاس والرصاص والحديد والخراسين في شعر الرأس لحوالي 50 شخص يعيشون في مدينة الديوانية (جنوب العراق). تم تقسيم الأشخاص إلى مجاميع اعتماداً على العمر والجنس ونوع العمل وموقع السكن. وجد أن المستويات الوسطية للنحاس والحديد والزنك والرصاص هي 0.53, 13.63, 4.8, 0.368 جزء من المليون (ppm) على التوالي.

بينت النتائج وجود ترابط سلبي بين الرصاص و الفلزات المدروسة الأخرى. كما تبين ارتفاع مستوى الرصاص في شعر الرأس لدى الذكور والأشخاص الذين يعيشون بالقرب من الشوارع الرئيسية في المدينة والذين أعمارهم بين (31---40) سنة والذين يعملون في الأعمال حرة.

### Introduction

The heavy metals such as lead , mercury , cadmium, aluminum , nickel ,and copper are can be found the air, water and food chain , as long as with other toxic metals .Heavy metals causing mineral imbalance which can lead to many diseases in human and animals such as hyperglycemia , hyperactivity , headaches , hypertension cancer and arthritis <sup>(1,2)</sup> . Only a hair analysis can reveal the upset of mineral balance, so the analysis of blood and human head hair represents method for measuring the content of heavy metals and minerals <sup>(3,4)</sup> ; which provide useful information on nutrition <sup>(5,6)</sup> . The major sources of heavy metals is chemical pollution by agribusiness, industry, public dumping of toxic household wastes in landfills. The exposure to heavy metals from soil , paints , drinking water , food , fertilizer , auto and industrial emissions , ammunition (shot and bullets) , bathtubs ( cast iron , porcelain , steel ) , batteries , canned foods , ceramics , dust , foods grown around in dustrial areas , gasoline , hair dyes <sup>(1,2 , 7-12)</sup> .

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The studies showed that exposure to toxic metals may account for over 20 % of learning disabilities , 20 % of all strokes and heart attacks , and over 40 % of all birth defects in some areas <sup>(1,13)</sup> and it has been found that heavy metals affect chemical transmission in the brain and the peripheral and central nervous system <sup>(14, 15)</sup> . High lead , copper , manganese or mercury levels have been found to be associated with attention deficit hyperactivity disorder , memory deficits , impulsivity , anger , aggression and criminality <sup>(16)</sup> . The lead and other toxic metals are retained in bone and astroglial cells in the brains , uptake during fetal development and behavior <sup>(1)</sup> . The lead and other toxic metals may come from combustion emissions are accumulate in inland water body <sup>(17, 18)</sup> and are widespread in sediments , plants , shellfish and other organisms <sup>(19,22)</sup> . High levels of copper and zinc were measured in a population of newborns and their mothers <sup>(23)</sup> , also , toxic metals and the resulting mineral imbalances have been found to be a major cause of depression and mood disorders including schizophrenia and mania <sup>(24)</sup> .

The mineral intake is reflected in higher concentration in the hair was demonstrated in a study of thousand of Iraqi peasants , whose diet contained grain heavily treated with fungicides contained methyl mercury through 7<sup>th</sup> decade of past century <sup>(25,26)</sup> . Mercury accumulate was found in hair and tissues and food chain in the united states since 1999 in the young children and women <sup>(27)</sup> .

The aim of this study is to measure the trace elements including copper , lead , iron , and zinc in human head hair at AL-Diwaniya city and detect the relationship of trace elements levels with age , Job , living location , and sex of study samples as well as the correlation between lead levels and levels of other trace metals that studied .

### Statistical analysis

The data were analyzed by using correlation measures taking  $P \leq 0.05$  as the lowest limit of significance between lead and independent variables.

### Materials and Methods

The people selected in the present study were chosen in different age, sex (males and females), job, and living location; 50 human were chosen to measure some trace metals ( iron, lead, zinc, and copper ) in their head hair. The groups were in different knowledge levels.

The people were divided into groups according to the nature of their job ( students, 15; industrial workers, 10; free workers,7; teachers, 10; peasants, 8 ); sex ( 35 males, 15 females ); age ( 6---10,7; 11---20, 12; 21---30, 11; 31---41, 10; 40---50, 10 ); and living location ( near the main street, 16; far the main street, 34 ). The essential information of the people under study were recorded during the collection head hair samples.

The collected samples of hair were cut close to the scalp in the sub occipital area of the head (about 1 to 2 cm ) after ascertaining that no coloring agent had been used. The hair samples were washed twice, first with acetone and then with double-distilled water.

After heating for 30 min at a temperature of 50-80°C, hair samples were digested with 1:1 perchloric acid and nitric acid mixture<sup>(28)</sup>. Hair samples were measured by using Shimadzu Back model scientific 210 OGP atomic absorption spectrophotometer. A blank solution and standard curve were obtained during the measuring the four metals.

## Results and Discussion

It is knowing that metals such as iron and zinc called essential elements which have biological importance, but metal such copper consider as trace essential element because the body needs it in trace quantity. The essential and trace essential metals contribute in composition of many enzymes and molecules that have biological activity. The lead metal hasn't biological importance and hence it called poison metal.

The problem of pollution by lead metal is one of important environmental problems which attribute to long half of lead which may be approach to several decades, also lead metal accumulating in bones and hair which replace with calcium in bones<sup>(28-31)</sup>.

Table (1) shows the mean levels of lead, copper, zinc, and iron in head hair according to the age, sex, living location, and kind of job. The results show that the level of lead in head hair of human aged between 31-40 years are higher than the other age ranges, and the levels of head hair lead are higher in males than females; in addition lead levels of head hair in persons living near the main streets of the city are higher than others living far from the main streets, as well as the levels of lead in head hair of free workers are higher than humans work in the other jobs. All of these results may be due to those peoples all the time under the continuous exposure to the lead emissions<sup>(2)</sup>.

Lead level of head hair showed no correlation to age, sex, living location, and job ( $r=0.133, 0.27, 0.054$ , and  $0.177$  respectively) ( $p \leq 0.05$ ). The only parameters that showed a significant negative correlation with lead level of head hair are copper, zinc, and iron ( $r=-0.332, -0.294$ , and  $-0.552$  respectively) ( $p \leq 0.05$ ) as indicated in table 2.

The results show that as lead levels of head hair increase, the levels of zinc, copper, and iron are decreased, so that iron, zinc and copper deficiencies, which can be caused by exposure to toxic metals such as lead, increase metal toxicities and supplementation can reduce toxicities, but they can also be toxic if levels are too high<sup>(2)</sup>.

Table (1): Concentration of trace metals in human head hair according to the age, sex, living location, and kind of the job in Diwaniya

| Variables                      | Cu, ppm           | Fe, ppm             | Pb, ppm           | Zn, ppm           |
|--------------------------------|-------------------|---------------------|-------------------|-------------------|
|                                | Mean $\pm$ SD     | Mean $\pm$ SD       | Mean $\pm$ SD     | Mean $\pm$ SD     |
| Age                            |                   | 15.68 $\pm$ 14.267  |                   | 4.62 $\pm$ 1.116  |
| 6-----10 no: 7                 | 0.38 $\pm$ 0.311  | 10.233 $\pm$ 9.072  | 0.34 $\pm$ 0.391  | 4.633 $\pm$ 0.87  |
| 11-----20 no: 12               | 0.466 $\pm$ 0.321 | 18.625 $\pm$ 15.037 | 0.3 $\pm$ 0.173   | 4.55 $\pm$ 1.98   |
| 21-----30 no: 11               | 0.6 $\pm$ 0.346   | 12.92 $\pm$ 10.949  | 0.35 $\pm$ 0.3    | 5.24 $\pm$ 0.702  |
| 31-----40 no: 10               | 0.72 $\pm$ 0.363  | 10.36 $\pm$ 7.838   | 0.42 $\pm$ 0.109  | 4.84 $\pm$ 0.944  |
| 41-----50 no: 10               | 0.54 $\pm$ 0.32   |                     | 0.4 $\pm$ 0.282   |                   |
| Sex                            | 0.2 $\pm$ 0.223   | 8.84 $\pm$ 6.232    | 0.46 $\pm$ 0.328  | 4 $\pm$ 0.6       |
| Males no: 35                   | 0.635 $\pm$ 0.297 | 15.047 $\pm$ 11.962 | 0.341 $\pm$ 0.231 | 5.035 $\pm$ 1.11  |
| Females no: 15                 |                   |                     |                   |                   |
| Living Location                | 0.742 $\pm$ 0.207 | 13.728 $\pm$ 11.878 | 0.371 $\pm$ 0.228 | 5.085 $\pm$ 0.524 |
| Near the main street<br>no: 16 | 0.415 $\pm$ 0.355 | 12.707 $\pm$ 9.758  | 0.346 $\pm$ 0.236 | 4.546 $\pm$ 1.322 |
| Far the main street<br>no: 34  |                   |                     |                   |                   |
| Kind of the Job                | 0.357 $\pm$ 0.325 | 15.571 $\pm$ 11.726 | 0.314 $\pm$ 0.333 | 4.657 $\pm$ 1.037 |
| Students no: 15                | 0.6 $\pm$ 0.707   | 16.75 $\pm$ 20.576  | 0.385 $\pm$ 0.211 | 4.75 $\pm$ 1.909  |
| Industrial workers<br>no: 10   | 0.714 $\pm$ 0.273 | 12.028 $\pm$ 11.098 | 0.45 $\pm$ 0.07   | 5.271 $\pm$ 0.512 |
| Free workers no: 7             | 0.666 $\pm$ 0.152 | 19.166 $\pm$ 9.562  | 0.35 $\pm$ 0.07   | 5.233 $\pm$ 0.642 |
| Teachers no: 10                | 0.35 $\pm$ 0.353  | 6.35 $\pm$ 7.141    | 0.233 $\pm$ 0.115 | 2.95 $\pm$ 1.909  |
| Peasants no: 8                 |                   |                     |                   |                   |

Table (2): Correlation of various parameters with head lead.

| Parameters             | Correlation coefficient<br>r | P-Value |
|------------------------|------------------------------|---------|
| Lead / Age             | 0.133                        | NS      |
| Lead / Sex             | 0.272                        | NS      |
| Lead / Living location | 0.054                        | NS      |
| Lead / kind of the job | 0.177                        | NS      |
| Lead / Copper          | -0.332                       | 0.05    |
| Lead / Iron            | - 0.552                      | 0.05    |
| Lead / Zinc            | -0.294                       | 0.05    |

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