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Assessment of Important Trace Elements in Jordanian Adult Females and Males by Using Atomic Absorption Spectrophotometer

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Abstract: The human body requires certain minerals for the overall health and proper functioning of the organ systems. The essential trace elements were very important for human life, which their imbalance in blood leads to very dangerous diseases (Zn, Cu, Fe, Cr, Se, Co, Mn and Mg). The purpose of this study was to evaluate the concentrations of Zinc, Copper, Iron, Magnesium, Chromium, Selenium, Cobalt and Manganese in serum of healthy adult females and males in Jordan. Serum levels of Zn, Cu, Fe, Mg, Cr, Se, Co, Mn and Mg were determined by flame and flameless atomic absorption spectrophotometer. Blood have been collected from1000 men and 1000 women apparently healthy Jordanian people aged 20-70 years. The mean concentration of zinc was between (0.96-1.02 and 0.8-1.02 µg/mL) in men and women, respectively. The concentration of zinc was slightly increased with ages. The mean values of copper were between (1.38-1.72 µg/mL), there is no significance deficiency in all ages and sexes. The average mean values of Fe were found to be (1.28-1.62 µg/mL) for men and (1.12-1.57 µg/mL) for women, with a deficiency of 5.9% in men and 8.5% in women. The chromium mean in men were between (0.04-0.055 µg/mL) with a deficiency of 43.06%, while in women were between (0.041-0.049 µg/mL), with a deficiency of 40.28%. The concentration of magnesium in blood serum was between 14.2-16.1 µg/mL for men and 14.3-16.3 µg/mL for women. The mean selenium concentrations in all healthy volunteers were in the range of 85-100 ng/mL for men and 82-99 ng/ml for women. The lowest levels of Se were shown in old people. The adult serum Co values were 0-34 ng/mL for men and 0-35 ng/mL for women. The cobalt deficiency was about 17% in men and women. The level of serum Manganese was 14-19 ng/mL for men and 11-15 ng/mL for women, it was noted that the level of Mn in men was higher than in women for all ages. The Mg concentrations of serum were 14.10±3.3 and 14.89±3.3 µg/mL for men and women. On the basis of this study finding and those of other reports, trace elements deficiency may contribute to diets and diseases through its significant effects on various organs parameters. It seems that the estimation of serum or plasma trace elements may help in investigation and treatment of some diseases in both males and females.

Key words: Zinc, copper, iron, magnesium, chromium, selenium, cobalt, manganese

INTRODUCTION

Trace elements play an important role in human health and disease. Trace elements participate in tissue, cellular and sub-cellular function. These include immune-regulation by both humoral and cellular mechanism, nerve conduction, muscle contraction, membrane potential regulation and mitochondrial activity, among others (Agget and Devis, 1983; Golden, 1982). Although these trace elements constitute a relatively small amount of the total body tissues, they are essential to many vital processes. Increased interest in the biological aspects of metals has come with the establishing of sophisticated instruments, industrial revolution and exposure of men to metals in an occupational setting and the recognition of toxic states. Since last decade there are number of research project which are under way to investigate the effect of metals and their levels in the body fluids and wherever possible, the effects on health. Because the level of trace elements in blood vary considerably between global population (Buxadear and Farre-Rovira, 1986; Chawla *et al*., 1982) and the normal ranges for typical populations was different. So it is clear that ranges of trace elements in blood for normal population would have to be established for the regions, which help for further work to proceed. The main object of the present study is to investigate the level of trace elements in blood of Jordanian population. The biological role of trace elements, especially Copper, Zinc and Iron in different pathologic conditions has been extensively investigated in many diseases (Naser *et al*., 2009). Zinc is a component of more than 200 different enzyme system functions that included in most events such as immunity and cell division (Tudor *et al*., 2005). Zinc is a cofactor for the antioxidant enzyme Superoxide Dismutase (SOD) and also involved in carbohydrate and

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protein metabolism (Al-Numair, 2006). Zinc deficiency affects host defense in a variety of ways. It results in decreased phagocytes and leads to a reduced numbers of circulating T-cells, therefore reduced tuberculin reactivity, at least in animals (Karyadi *et al*., 2000). Copper is an essential trace element involved in the metabolism of several key enzymes including cytochrome oxidase of the mitochondrial electron transport and cytosolic superoxide dismutase (Adewumi *et al*., 2007). Moreover, 60% of copper in the blood is tightly bounded to a Copper-Zinc dependent enzyme known as superoxide dismutase(Cu/Zn/SOD) which is a powerful anti-oxidant (Maybauer *et al*., 2006). Iron also is the most important essential trace elements in transporting of oxition via hemoglobin in the red blood cells. Iron also intervenes in the constitution of enzymatic systems such a catalase, peroxidase and cytochromes that play an essential role in cellular respiratory mechanisms, especially in the mitochondrial respiratory channel (Inocent *et al*., 2008).

Literature surveys show that some trace elements such as chromium (Cr), magnesium (Mg), zinc (Zn), manganese (Mn) and selenium (Se) play an important role in insulin action, including activation of insulin receptor sites (Esfahani *et al*., 2011), serving as cofactors or components for enzyme systems involved in glucose metabolism (Murry *et al*., 2000), increasing insulin sensitivity and acting as antioxidants preventing tissue peroxidation. Alternatively, homeostasis of trace elements can be disrupted by diabetes mellitus (DM) (Esfahani *et al*., 2011; Zagar *et al*., 2002). Deficiencies of certain minerals such as Mg, Zn and Cr predispose to glucose intolerance and promote the development of diabetic complications such as retinopathy, thrombosis and hypertension (Esfahani *et al*., 2011; Serdar *et al*., 2009), impaired repair of tissues and wound healing (Esfahani *et al*., 2011; Bahijri, 2001) and diabetic angiopathy (Esfahani *et al*., 2011). Reduction of trace element stores might be responsible for various adverse clinical effects even with normal serum trace element concentration (Serdar *et al*., 2009).

Mn plays an important role in a number of physiologic processes and as a constituent of some enzymes and an activator of different enzymes (Nicoloff *et al*., 2004). These Mn activated enzymes and play an important role in the metabolism of carbohydrates, amino acids and cholesterol. Mn deficiency has been observed in a number of animal species. Signs of Mn deficiency include impaired growth, impaired reproductive function, skeletal abnormalities, impaired glucose tolerance and altered carbohydrate and lipid metabolism. In humans, demonstration of Mn deficiency syndrome has been less clear (Nicoloff *et al*., 2004). Deficiency of Mn or low levels of Mn in blood or tissue has been associated with several chronic diseases like osteoporosis, epilepsy and DM (Nicoloff *et al*., 2004).

The trace element Cr increases insulin binding to cells by increasing insulin receptor numbers and it may lead to increased insulin sensitivity, glucose utilization and beta-cell sensitivity (Clegg *et al*., 1982).

MATERIALS AND METHODS

Two thousand females and males were divided into five groups according to their age groups. Groups ranged from age 20-30, 31-40, 41-50, 51-60 and over 60 years. The study was conducted over a period of 1 year on the employees of Zarqa University College and Hospitals in Jordan. These subjects were students, teachers, laboratory staff and office staff, patients who visited the hospital was included in the study, people have been in documentaries from different socioeconomic groups and living in different Jordan areas. A detailed questionnaire was filled out and collected by individuals in which general information about identity, personal history, consumption of food and beverages, health status etc. Sampling was carried out during one year (2012). Ten mililitter of blood sample was taken from the antecubital vein of each volunteer.

Standards, samples and blank for estimation of copper, zinc iron, chromium, selenium and, magnesium, manganese, were aspirated into a Shimadzu, Japan 6000 Atomic Absorbtion Spectrophotometer, equipped with graphite furnace. The temperature programming for the heated graphite atomization analysis was set as described in literature. The flow of purge gas and the volume of sample injected were selected according to the analyte concentration in order to obtain a response in the linear or non-linear calibration range. Results were expressed as Mean±S.D. The means of findings were statistically evaluated by Student t-test and analysis of Variance (ANOVA) (Zar, 1974).

RESULTS AND DISCUSSION

Trace elements are involved in metabolic processes and oxidation-reduction reactions in the central nervous system and could have a possible effect on cognitive function. The relationship between trace elements measured in individual biological samples and cognitive function in an elderly population had not been investigated extensively. A deficiency of any nutrient is said to be due to the low levels of specific nutrients in the body. These low levels can occur if there is fewer intakes of foods rich in that nutrient or if the body fails to store the nutrient and expels it in large amounts.

The results obtained from the estimation of Zinc, Iron, Copper, Magnesium, Cobalt, Selenium, Manganese and Chromium in the blood samples are given in the Table 1-27. The normal ranges for each metal in blood of female and male groups as slightly different and no significant difference of all cases of Iron, Copper and Magnesium, Cobalt, Selenium, Manganese and Chromium concentrations. In present study, the blood

Table 1: Zinc concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.42-1.92	0.99±0.19	125	21.66
31-40	250	0.40-1.94	1.11±0.18	95	26.54
41-50	200	0.39-2.33	1,05±0.14	60	30.2
51-60	150	0.48-1.65	0.95±0.19	14	23.15
Over 60	50	0.45-1.55	0.96±0.15	5	25.17
Mean	1000			299	22.85

DV: deficient volunteers, Def.: Deficiency

Table 2: Zinc concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.40-1.80	0.88±0.21	60	25.67
31-40	250	0.39-1.75	1.09±0.23	53	18.1
41-50	200	0.36-1.82	0.87±0.19	11	22.09
51-60	150	0.39-1.73	0.84±0.17	6	20.14
Over 60	50	0.37-1.50	0.81±0.23	2	20.07
Mean	1000			132	18.92

DV: deficient volunteers, Def.: Deficiency

Table 3: Comparison of Zn concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) µg/mL	Female (mean) µg/mL	p-value
20-30	0.97±0.17	0.88±0.16	≤0.00
131-40	1.09±0.10	1.05±0.20	n.s
41-50	1.00±0.17	0.87±0.18	>0.05
51-60	0.94±0.23	0.84±0.17	>0.05
Over 60	0.97±0.15	0.82±0.20	>0.05

Table 4: Iron concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.60-1.83	1.26±0.24	40	6.9
31-40	250	0.63-2.09	1.42±0.29	20	5.4
41-50	200	0.54-2.17	1.43±0.40	10	5.2
51-60	150	0.61-2.28	1.59±0.46	5	3.6
Over 60	50	0.70-2.09	1.40±0.28	1	8.1
Mean	1000			76	6

DV: deficient volunteers, Def.: Deficiency

Table 5: Iron concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.62-1.60	1.14±0.28	40	10.9
31-40	250	0.61-1.85	1.36±0.33	12	4.7
41-50	200	0.55-1.93	1.39±0.41	5	10.2
51-60	150	0.60-2.05	1.55±0.35	2	7
Over 60	50	0.72-2.11	1.35±0.27	1	9.8
Mean	1000			60	8.9

DV: deficient volunteers, Def.: Deficiency

Table 6: Comparison of Iron concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) (µg/mL)	Female (mean) (µg/mL)	p-value
20-30	1.26±0.27	1.11±0.27	n.s
31-40	1.42±0.30	1.35±0.33	n.s
41-50	1.47±0.40	1.42±0.44	n.s
51-60	1.59±0.46	1.55±0.35	>0.05
Over 60	1.44±0.30	1.36±0.30	<0.05

Table 7: Copper concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.70-2.2	1.50±0.47	1	0.17
31-40	250	0.57-2.3	1.61±0.35	2	0.43
41-50	200	0.52-2.9	1.65±0.40	6	0.6
51-60	150	0.55-3.0	1.68±0.38	8	0.25
Over 60	50	0.75-4.1	1.78±0.60	1	0.14
Mean	1000			18	1.3

DV: deficient volunteers, Def.: Deficiency

Table 8: Copper concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.60-2.2	1.36±0.36	Nil	
31-40	250	0.53-2.1	1.57±0.33	Nil	
41-50	200	0.55-2.7	1.63±0.29	3	0.44
51-60	150	0.51-3.0	1.67±0.50	1	0.15
Over 60	50	0.76-4.3	1.74±0.42	Nil	
Mean	1000				0.54

DV: deficient volunteers, Def.: Deficiency

Table 9: Comparison of copper concentrations in blood serum of both sexes'adult healthy volunteers

Age	Male (Mean) (µg mL^{-1})	Female (mean) (µg mL^{-1})	p-value
20-30	1.54±0.47	1.37±0.37	<0.05
31-40	1.58±0.35	1.62±0.39	n.s
41-50	1.60±0.40	1.67±0.26	n.s
51-60	1.74±0.40	1.73±0.50	n.s
Over 60	1.78±0.61	1.68±0.41	n.s

Table 10: Magnesium concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	8.5- 24	15.20±2.3	81	13.5
31-40	250	8.2- 21	16.11±2.1	43	12.4
41-50	200	8.0-20	14.56±3.5	30	16.1
51-60	150	7.9-25	15.22±2.4	120	12.6
Over 60	50	8.2-22	14.25±3.3	1	4.2
Mean	1000		n.s	17	13.4

DV: deficient volunteers, Def.: Deficiency

samples were used without sex difference, both male and female subjects were used because previous studies showed that normally the difference of trace metals between the sexes was no significant (Chawla *et al.*, 1982; Buxadadearas and Farre-Rovira, 1985; Satoh and Yazawa, 1978).

The zinc concentrations were similar with advance ages until 60 year and then decreased for adults in both sexes over 60 years (Table 1-3). The result observed that 350 adults out of 1000 have deficiency in zinc level which below 0.5 µg/mL. This might be due to chelating agents such as phytate, oxalate and phosphate which are found in quite large amount in Jordanian foods such as protein in cereals and dried food with zinc and iron which lead to decrease their absorption (Vohra *et al.*, 2003, Casey *et al.*, 2004). Zinc deficiency resulting in growth retardation hypogonadism, immune dysfunction

Table 11: Magnesium concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	8.5-22	14.1±2.7	45	12.5
31-40	250	8.3-19	15.5±2.8	33	12.5
41-50	200	7.9-20	16.5±2.3	12	22.3
51-60	150	7.1-22	15.7±3.3	2	6.7
Over 60	50	7.5-20	14.6±3.2	2	10.3
Mean	1000		n.s	92	12.6

DV: deficient volunteers, Def.: Deficiency

Table 12: Comparison of Magnesium concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) (µg/mL)	Female (Mean) (µg/mL)	p-value
20-30	15.20±4.1	14.29±2.5	n.s
31-40	16.14±3.3	15.58±2.8	n.s
41-50	14.33±3.5	16.33±2.3	n.s
51-60	15.61±2.4	15.84±3.5	n.s
Over 60	14.10±3.3	14.89±3.3	n.s

P.N: Deficiency considered below 10 µg/m

Table 13: Cobalt concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0-36	21±9	94	16.34
31-40	250	0-25	23±10	64	17.25
41-50	200	0-29	21±12	37	17.53
51-60	150	0-28	22±14	20	18.31
Over 60	50	0-35	28±16	5	24.11
Mean	1000		n.s	220	17.82

DV: deficient volunteers, Def.: Deficiency

Table 14: Cobalt concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0-33	22±7	60	16.83
31-40	250	0-25	18±8	42	15.4
41-50	200	0-27	17±12	9	16.1
51-60	150	0-26	16±9	8	23.35
Over 60	50	0-21	15±6	1	10.2
Mean	1000		n.s	120	16.32

DV: deficient volunteers, Def.: Deficiency

Table 15: Comparison of cobalt concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) (µg/mL)	Female (Mean) (µg/mL)	p-value
20-30	22±9	21±8	n.s
31-40	23±11	19±9	n.s
41-50	21±10	18±11	n.s
51-60	22±15	17±8	n.s
Over 60	28±14	14±7	n.s

P.N: Deficiency considered for some values were not detected or below 7 ng/mL

Table 17: Selenium concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	60-153	99.0±36	95	27.1
31-40	250	55-153	87.3±27	71	27.3
41-50	200	54-162	91.5±32	12	24
51-60	150	54-156	99.2±31	8	26.6
Over 60	50	57-148	82.0±20	2	20
Mean	1000		n.s	188	26.85

DV: deficient volunteers, Def.: Deficiency

Table 18: Comparison of selenium concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) (ng mL^{-1})	Female (Mean) (ng mL^{-1})	p-value
20-30	100±22	99.0±36	n.s
31-40	95±3	87.3±27	n.s
41-50	91±36	91.5±32	n.s
51-60	92±34	99.2±31	n.s
Over 60	85±27	82.0±20	n.s

Table 19: Manganese concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn D	Def. (%)
20-30	350	0-20	16±3.0	80	13.7
31-40	250	0-29	17±2.1	60	16.6
41-50	200	0-30	19±3.1	30	15
51-60	150	0-28	15±1.9	12	8.5
Over 60	50	0-35	14±3.6	1	4
Mean	1000		n.s	183	14.02

DV: deficient volunteers, Def.: Deficiency

Table 20: Manganese concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0-16.6	11±3.1	79	22.5
31-40	250	0-18.0	14±2.9	44	16.9
41-50	200	0-17.0	15±2.6	12	24
51-60	150	0-15.8	13±2.1	5	16.6
Over 60	50	0-14.0	12±1.9	2	20
Mean	1000		n.s	142	20.28

DV: deficient volunteers, Def.: Deficiency

Table 21: Comparison of Manganese concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) (µg/mL)	Female (Mean) (µg/mL)	p-value
20-30	16±3.0	11±3.1	<0.05
31-40	17±2.1	14±2.9	n.s
41-50	19±3.1	15±2.6	n.s
51-60	15±1.9	13±2.1	n.s
Over 60	14±3.6	12±1.9	n.s

(Prasad, 2009) and cognitive impairment affects nearly 2 billion subjects in the developing world (Prasad, 2009). High phytate content of the cereal proteins consumed in the developing world, results in decreased availability of zinc for absorption Zinc deficiency are a general feature of infections illness including leprosy (Sheskin *et al*., 1981), breast cancer (Ma *et al*., 1994), tumor cancer (Prasad *et al*., 2008a). It's reported that Zn effect on the treatment of chronic hepatitis C patients with interferon and ribavirin (Koo *et al*., 2005) also they reported that the cell mediated immune function (interlukin-1) production by mononuclear cells, natural cell killer activity and interlukin-1 B-production by mononuclear cells are zinc dependent (Prasad *et al*., 2008b).

Serum magnesium levels were measured in all groups of volunteers, the results were observed that the levels

Table 22: Chromium concentrations in male blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.015-0.081	0.055±0.021	206	35.51
31-40	250	0.021-0.079	0.045±0.019	176	48.88
41-50	200	0.010-0.081	0.051±0.018	101	50.5
51-60	150	0.010-0.069	0.050±0.019	67	47.8
Over 60	50	0.010-0.068	0.043±0.020	12	48
Mean	1000			562	43.06

DV: deficient volunteers, Def.: Deficiency

Table 23: Chromium concentrations in female blood serum of various healthy volunteers

Age	No.	Range (µg/mL)	Mean±SD	No. of Zn DV	Def. (%)
20-30	350	0.011-0.080	0.049±0.016	160	45.7
31-40	250	0.010-0.077	0.043±0.017	80	30.76
41-50	200	0.010-0.062	0.041±0.010	21	42
51-60	150	0.010-0.067	0.048±0.021	18	60
Over 60	50	0.010-0.051	0.042±0.020	3	40
Mean	1000			282	40.28

DV: deficient volunteers, Def.: Deficiency

Table 24: Comparison of Chromium concentrations in blood serum of both sexes' adult healthy volunteers

Age	Male (Mean) (µg/mL)	Female (Mean) (µg/mL)	p-value
20-30	0.055±0.021	0.049±0.016	n.s
31-40	0.045±0.019	0.043±0.017	n.s
41-50	0.051±0.018	0.041±0.010	n.s
51-60	0.050±0.019	0.048±0.021	n.s
Over 60	0.043±0.020	0.042±0.020	n.s

P.N: Deficiency considered when chromium level at 0.01 µg/mL

of Mg were deficient in both sexes about 13% less than normal level. Abnormal levels of magnesium are most frequently seen in conditions or diseases that cause impaired or excessive excretion of magnesium by the kidneys or that because impaired absorption in the intestines. Since a low magnesium level can, over time, cause persistently low calcium and potassium levels, it may be checked to help diagnose problems with calcium, potassium, phosphorus and parathyroid hormone-another component of calcium regulation.

Chromium is essential for normal glucose tolerance and carbohydrate metabolism; it acts as cofactor for the initiation of periphery insulin action or receptor cell membrane. Cr deficiency has been associated with vascular of diabetes mellitus and atherosclerosis diseases (Masood *et al*., 2009). It was reported that the risk factors of cholesterol, fatty acids, impaired glucose tolerance and aortic plaques increased by Cr deficiency, for that reason, Cr supplementation is necessary to get positive balance by using Cr-complexes rather than ionic salts for both oral and parental administration.

Serum Se levels of volunteers groups are summarized in Table 16-18. It can be seen that the concentration of Se in healthy group varied from 53-160 ng/mL with a mean values from 87.3 to 99.0, it was noted that the serum Se content slightly decreased with ages. The recent studies found that the effect of dietary Se on acute colorectal mucosal nucleotoxity induces by several carcinogensis (Nelson *et al*., 1996). Selenium has a protective effect in the initiation phase of carcingensis. It was reported that the Se deficiency has been associated with cancer risk in several organs. This association was investigated in resplasia of colorectum. Low level of Se found in older age may depend on the nutritional habits in this age group and due to higher significant activity of CSH-Px in the older group, a significant Se deficiency in blood children with phenylketonuria (PKU) and maple syrup urine disease (MSUD), Se concentration in whole blood as well as GSP-Px activity in RBC and plasma reach normal activity and simultaneous decrease lipid peroxides in plasma was observed, after supplement the patients with yeast rich selenium (Frank Jochum *et al*., 1999).

The Cobalt levels were determined as show in Table 13-15, the mean values of Co was between 0-34 ng/mL. Co has been inferred to play a role in immune reactions, a primary role in cerebral vascular accident and infection.

Manganese (Mn) is a trace mineral that is present in tiny amounts in the body. It is found mostly in bones, the liver, kidneys and pancreas. Manganese helps the body form connective tissue, bones, blood clotting factors and sex hormones. It also plays a role in fat and carbohydrate metabolism, calcium absorption and blood sugar regulation. Manganese is also necessary for normal brain and nerve function. Manganese is a component of the antioxidant enzyme superoxide dismutase (SOD), which helps fight free radicals. Free radicals occur naturally in the body but can damage cell membranes and DNA (Hori *et al*., 2000). They may play a role in aging, as well as the development of a number of health conditions, including heart disease and cancer. Antioxidants, such as SOD, can help neutralize free radicals and reduce or even help prevent some of the damage they cause. Low levels of manganese in the body can contribute to infertility, bone malformation, weakness and seizures and excessive physical stress.

However, too much manganese in the diet could lead to high levels of manganese in the body tissues. Abnormal concentrations of manganese in the brain, especially in the basal ganglia, are associated with neurological disorders similar to Parkinson's disease (Claus Henn *et al*., 2010). Early life manganese exposure at high levels, or low levels, may impact neurodevelopment. Elevated manganese is also associated with poor cognitive performance in school children (Claus Henn *et al*., 2010).

Copper Concentrations and Iron for all volunteers in five groups aged between 20-70 years were shown in

Table 4-9. The levels of copper were higher than the values reported by Gao *et al.* (2008), he found that mean copper level in sample (0.65 mg/L) is also lower than the mean serum copper level reported in normal participants (0.86 mg/L) and Alzheimer's patients (1.16 mg/L) reported in a case-control study (Squitti *et al.*, 2002). There were reports of a positive relationship between cognitive function and dietary intake of zinc and iron in healthy elderly adults (Ortega *et al.*, 1997), but no associations were found when zinc and iron were measured in drinking water (Jacqmin *et al.*, 1994; Jacqmin-Gadda *et al.*, 1996). Dietary copper intake in persons with high saturated and trans-fat was found to be a risk factor for cognitive decline (Morris *et al.*, 2006).

Conclusion: Recent study indicated that minerals may play a significant role against a variety of degenerative diseases. They may also prevent and reduce injury from environmental pollutants. This study suggested that numerous minerals, when in proper balance with one another, may be performing important non-classical biochemical functions especially important to age-related health problems. While getting a sufficient amount of trace elements will contribute to overall health and wellness, deficiency of any single trace element can cause a host of problems for a person's health. Some trace element (Zn, Cu, Fe, Se, Cr, Co, Mn and Mg) deficiencies in Jordanian people are due to their poor diets.

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