Relations of Trace and Major Elements with Cardiovascular Diseases

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Abstract

Back ground and objective: Considerable research has been directed towards the associations between Zn,Cu, Mg & the incidence of CVD in 40 patients aged 45–67 y of both sexes,the objectives of this study were to measure the levels of selected parameters in patients group and compared with 25 apparently healthy adults as a control group , furthermore , compared between patient groups MI N= 20 ,HT N = 20, find –out the sex effect,   in addition, evaluate the correlation between these elements.

METHODS: This study was performed at College of Pharmacy/ Hawler Medical University in period between 15/1/2010 - 30/10/2010 the studied parameters were measured by atomic absorption spectrophotometer in Baghdad /Ministry of Science and Technology /Department Researches of Chemistry.

RESULTS : The results of the patients group were Zn=0.54 ug/ml±0.13,Cu= 0.78ug/ml ±030 ,Mg=11.67±2.12 as compared with the control group ,their results were Zn= 0.745 ± 0.14 ,Cu= 0.96± 0.004, Mg= 18 ±3.The results of this study were statistically significantly decreased in patients group as compared with the control group $P<0.001$.

CONCLUSIONS: There were a statistical significant decrease in the studied parameters in patient groups as compared with the control group $P<0.001$.

KEY WORDS: cardio vascular diseases , zinc, copper ,magnesium

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20   20   40

(67- 45)   .

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/   , 2010/10/30- 2010/1/15

Atomic Absorption spectrophotometer

: $Cu = 0.78 \pm 0.3$, $Mg = 11.67 \pm 2.12$ $Zn = 0.54 \pm 0.13$ ug/ml ,

$Mg = 18 \pm 3$, $Cu = 0.96 \pm 0.004$, $Zn = 0.745 \pm 0.14$.

$P < 0.001$.

Introduction

Studies on trace elements are of particular importance at present time since man –made alterations of the environments through the use of fertilizers ,food additives ,food processing and through industrial pollution of air and water may bring about changes in the mineral balance and as consequence ,changes in some biological functions. It is well established that several trace elements are of great importance in a number of biological process and their deficiency are related with a number of clinical disorders. Zinc is an important metallo- coenzyme, about 300 enzymes in the human body have been shown to be containing Zinc[1] that participate in variety of metabolic processes. Zinc also function as an antioxidant. Many

investigators demonstrated that Zinc deficiency was associated with angina, CVD, obesity, diabetes [2].Other investigators [3]and[4] who published that Cu is an antioxidant nutrient for CV health[5].Recently, other publisher[6]2010 found that ,heart failure improved by supplement containing Cu, Cu restriction lead to increase cholesterol level[7],elevate blood pressure[8] ,impair glucose tolerance[9.].All enzymes known to depend on Cu for activity are oxidative[10].Cardiac disturbances are well known to be associated with Mg deficiency. Patching et al[2]reported that, Mg deficiency is related to MI. In addition,Cappuccio[11],Mizushima[12] have published that, inadequate intake of Mg has been related to develop HT. Furthermore, Mg is used to treat MI .Martin etal[.13]and DeCarli etal[.14]who also found that low Mg status is common in elderly patients with arterial fibrillation and heart failure. Leddingham and Raine[15]suggested that Mg depletion may occur with the use of diuretics in patients with CVD.

AIMS OF THE STUDY:

The aims of this study were to assess the changes in serum levels of Zn,Cu ,Mg in patients with CVD in comparing with the control group, and to find –out the sex effect on the serum levels of the previous parameters in patients group. Furthermore, compared the levels of previous parameters in the studied groups MI and hypertension HT, in addition ,to determine the correlation between serum values of Zn ,Cu ,Mg in patient groups.

MATERIAL AND METHODS :

A total of 40 patients were enrolled in present study. The patients were divided into two groups 20 patients with HT and the other 20 had MI. In addition, 25 healthy adults as a control group the mean age> 45 years .The exclusion criteria diabetic patients, cancer , muscular disease, kidney stone, growth failure by depending on the personal, clinical, and biochemical data to prevent the overlapping or interfering with the results of the present study because these diseases also have serum trace elements disturbances.

METHODS:

Serum concentration of Zn ,Cu and Mg ions were measured by flame atomic absorption spectrophotometer.

RESULTS:

As shown in the table**,**the serum mean values of Zn ,Cu ,Mg in patients group No.=40 were 0.54 ug/ml±0.13,0.78ug/ml ±030,11.67±2.12 respectively.

Table : Comparison between serum Zinc ,Copper and Magnesium levels in different studied groups .

Group	Serum mean value ± SD			
	Zinc µg/ml	Copper µg/ml	Magnesium µg/ml	P value
Control n= 25	0.74±0.14	0.96±0.004	18±3	
Patients with CVD n= 40	0.54±0.13	0.78±0.30	11.67±2.12	< 0.001
Patients with HT n = 20	0.63±0.11	1.01±0.23	13.45±1.14	< 0.001
Patients with MI n= 20	0.44±0.06	0.53±0.08	9.88±1.10	
Females with HT n=5	0.62 ±0.08	0.86 ± 0.07	13 ±1.22	0.741 (Zn)
Males with HT n=15	0.64 ±0.13	1.07 ± 0.25	13.6 ±1.12	0.091(Cu) 0.324(Mg)
Females with MI n=5	0.48 ± 0.13	0.58 ± 0.12	10 ±1.31	0.12 (Zn) 0.12(Cu)
Males with MI n= 15	0.43 ±0.02	0.52 ± 0.05	9.84 ±1.07	0.79 (Mg)

This table also showed the mean ±SD value of serum Zn , Cu ,and Mg in patients with HT No.=20group were 0.63 ± 0.11, 1.01±0.23 ,13.45±1.14 respectively ,and the mean ±SD value of serum Zn ,Cu ,and Mg in patients with MI   N=20 group were 0.44±SD 0.06 , 0.53±SD0.08   ,   9.88±SD   ,   respectively. Furthermore   ,the mean (±SD) serum levels of Zn in HT and MI groups were 0.63±0.12, 0.44 ±0.07 respectively, from the statistical analysis ,this table showed that there were highly significant differences between these two studied groups, whereas   , the mean ±SD serum levels of Cu in HT and MI groups were 1.02 ± 0.23 ,0.54 ± 0.08 respectively, the same table showed that ,there were statistically highly significant differences between these two groups, while , in case of the mean ±SD serum levels of Mg in HT and MI   groups   were13.45±1.15 ,9.88± 1.1 respectively,   similarly   ,   there   were statistically highly significant differences between these two groups ,as shown in the table.

In addition ,the mean ±SD serum levels of Zn in females and males with HT were 0.6 ±0.08 , 0.64 ± 0.13 respectively ,while .the mean ±SD serum levels of Cu in females and males with HT were0.86   ±   0.07,1.07± 0.25,and the mean ±SD serum levels of Mg

in female and male patients with HT were 13.0 ±1.22 ,13.6 ± 1.12 respectively .T-test revealed that there were no statistical significant differences between two sex groups, or there were no sex effects on these variables $p > 0.05$.

Moreover ,the mean ±SD serum levels of Zn in females and males with MI were 0.48 ± 0.13 , 0.43   ± 0.02 respectively, while the mean ±SD serum levels of Cu in females and males with MI were 0.58± 0.12 ,0.52 ± 0.05 and the mean ±SD serum levels of Mg in female and male in patients with MI were 10 ±1.31 ,9.84 ±1.07respectively.T-test revealed that there were no statistical   significant differences between females and males, or there were no sex effect on these variables P> 0.05.

Correlation Coefficient :

The   correlation   coefficient(r) was calculated   as   a   measure   of   association between different variables. These figures (1,2,3) revealed the values of correlation coefficient (r) between different studied parameters .
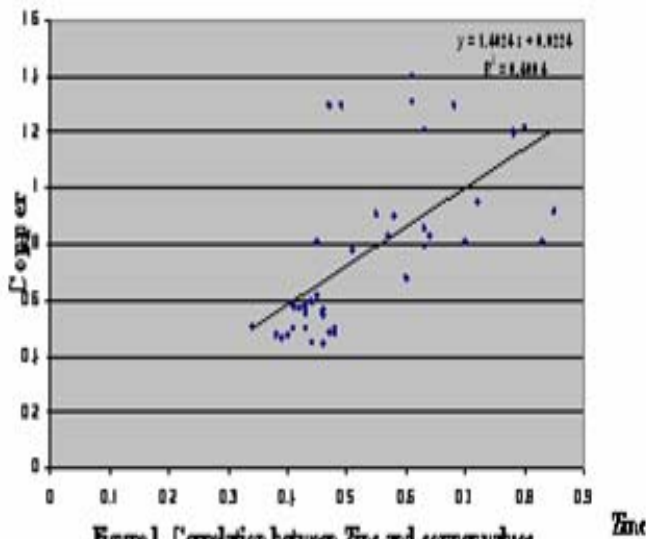
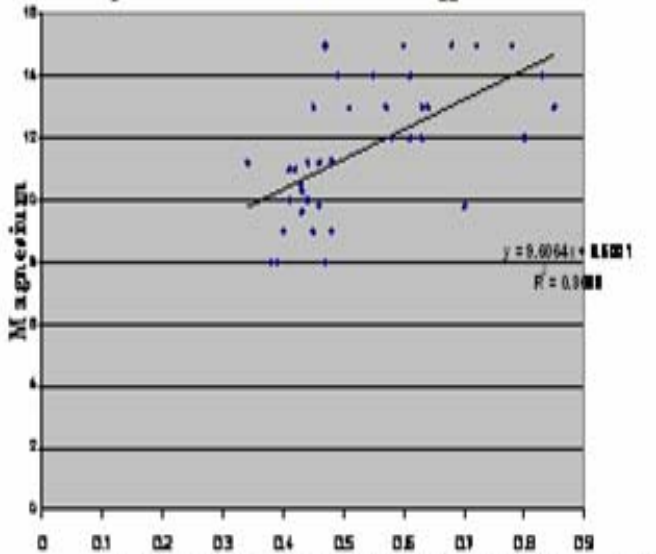Figure 1. Correlation between Zinc and copper values

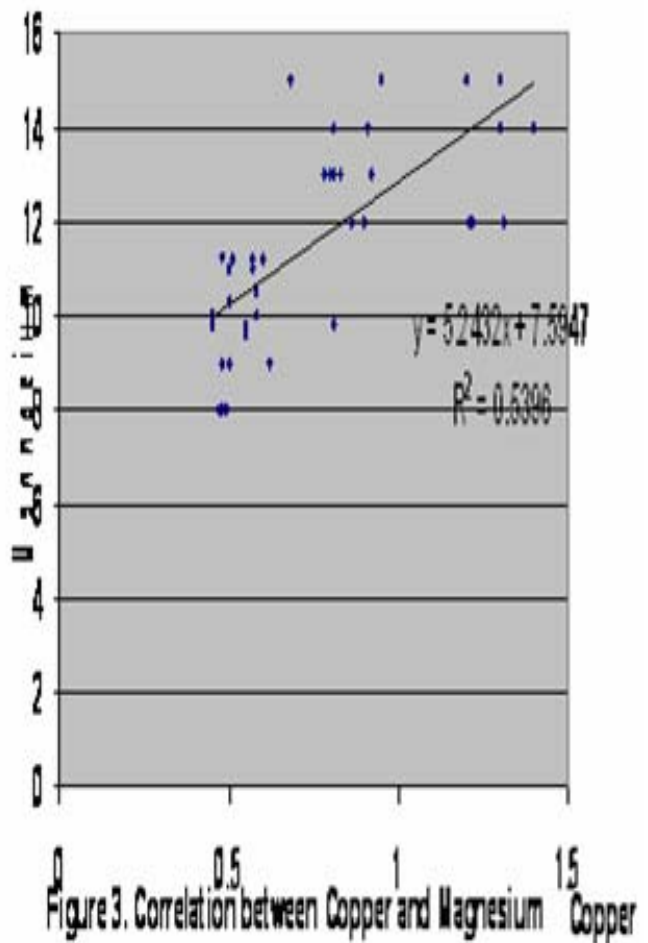Figure 2. Correlation between Zinc and Magnesium

Figure 3. Correlation between Copper and Magnesium

decreased studied parameters as compared with control group. The aim of our study was to investigate the relationship between the serum levels of Zn,Cu,Mg in patients with CVD as compared with the control group. In

DISCUSSION:

This study was performed on the basis of the existing hypothesis that the patients with CVD had statistically significantly

deficiency to the HT. Duk et al[17] reported that ,the serum level of zinc was statistically significantly decreased in patients with HT as compared with the control group $p < 0.01$, accordingly this results was inconsistent with the result of the current study. In addition, Bergomi et al[18] and other publishers found an inverse correlation between the level of Cu and HT which was in-agreement with result of the current study. Furthermore, our findings support the hypothesis that, the level of Zn,Cu,Mg were significantly decreased in patients with MI as compared with control group, these results were in accordance with the results reported by Wang et al[19] who published that, patients with MI had significantly lower serum of Cu as compared with control group. Moreover, these findings support the hypothesis that decreased serum level of Cu was associated with increased risk to develop CVD because Cu is an antioxidant nutrient and it is important for CV health .The explanation of decreased serum Cu level in patients with CVD, because of, as mentioned before Cu play an important role in regulation of oxidative free radicals and it's deficiency lead to increase the ability for peroxidation of lipoprotein[10] ,in addition, Cu deficiency lead to increase in plasma cholesterol[7] which is well known that cholesterol is considered as a risk factor for CHD. In addition, hypomagnesemia should be considered as a factor in hyperlipidemia[20] which is well

agreement with our hypothesis, as shown in the table ,we recently reported that, the mean serum level of Zn,Cu,Mg were significantly decreased in patients with CVD as compared with control group $p < 0.001$. It is well known the relationship between zinc deficiency and cardiovascular diseases[2]. Gregere etal[16] reported that, trace elements deficiency are common in the elderly, low trace elements are correlated with intake of CV medication. Trace elements are deficient in elderly due to poor diets or medications, poor absorption ,chronic disease, vitamin B_6 deficiency which is needed for Zn absorption .The patients of the present study considered as an older adults and the mean age > 45years. It is very well known that older adults are at greater risk for nutritional deficiencies due to physiologic changes associated with aging, acute and chronic illnesses ,prescription, and functional decline, environmental and social difficulties in addition to low income faced by older peoples that may interfere with inadequate dietary intake. Risk for poor nutritional status is also related to a decreased efficiency of the GIT like chewing swallowing, digesting, and absorbing that occurs in some elderly people. In addition, Iraq has a hot climate that increases the loss of many trace elements with sweat such as Zn,Cu,Mg and affecting the levels of these trace elements in body causing a relative diseases. On the basis of knowledge concerning the relationships of zinc

the differences between the studied groups regarding the serum levels of Zn,Cu,Mg, as shown in the table from the statistical analysis there were a statistically highly significantly decreased in the serum level of Zn ,Cu,Mg in patients with MI as compared with HT group.Our own carefully review of the scientific literatures identified that the published prospective studies did not support any association between HT and MI regarding our parameters.To the best of our knowledge, no data were available or have been published on the possible direct association between the studied groups. The explanation for this statistical significant decrease in the serum mean levels of Zn ,Cu,Mg in patients with MI group as compared with HT group, we thought, on the basis of the literature review, the degree of decreased in these studied parameters depend on degree of the lesion or cells damaged because these elements play a vital role in growth, health and maintenance of human body cells and as mentioned in previous studies Cu deficiency lead to abnormal cardiac histology and cell structure Klevay et al.[27].The last aim of this study was to determine the correlation between serum values of Zn ,Cu ,Mg in patient group. In these figures (1,2,3,) Zn showed a significant positive correlation with serum Cu value r = 0.4004 ,p<0.05,while the correlation between Zn and Mg, the figure revealed a significant positive correlation r=0.3688,p<0.05

known it is considered a risk factor for developing CVD. Our findings support the hypothesis that low-serum Mg was linked with the clinical condition associated with HT, accordingly, the data reported by Barbour etal.[21],Mizushima etal.[22]and many investigators[23,24] were in accordance with our data showed statistically significant low-serum Mg13.45± 1.15 in patients with HT as compared with the control group13± 3, P<0.05.Similarly,the studies which were published by Swain et al[25]and Dacey et.al.[26] including that the patients with MI had significantly low serum level of Mg, these results were accordance with the results of current study, that was established in MI group had significantly low level of serum Mg as compared with the control group Mg 9.88 ± 1.1,18 ±3respectively. Moreover, in the same study, the additional aim, was to demonstrate the sex effect on the previous parameters, t –test was used to check the differences between the males& females. There were no significant differences detected between males and females P>0.05.In our study the lack of sex effect was due to the fact that all of the studied patients and control were above the age of 45 years and the old age possibly diminished the association of hormonal effect on these parameters. The other aim of this study was to find out the differences between the studied groups. To our knowledge, no data have been published

prospective studies do not support any association between HT and MI. regarding the studied parameters and in order to fill this lack of knowledge, we have to study the relation between these two studied groups on large number of population.

meanwhile, there was a significant positive correlation between Cu and Mg r = 0.5396 ,$p < 0.05$.

CONCLUSSION :

In light of the reported data, there were a significant decrease in the level of serum Zn,Cu and Mg in patients with CVD as compared with control group.

RECOMMENDATION:

Further studies on large No. of population are needed to validate our findings .Scientific literatures identified that the published

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