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Trace Elements Levels In Patients With Some Different Parasitic Infections

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الملخص

الهدف : لتقييم المستوى المصلي للزنك ،النحاس والحديد نسبة الى الاصابة بامراض طفيلية مختلفة.

الطرق : اجريت هذة الدراسة خلال الاشهر التسعة الاولى من 2007 في البصرة ، جنوب العراق. جمعت نماذج دم من 230 شخص واعمارهم من 1 - 65 سنة . كان 100 نموذج من مرضى من مرضى مصابين بامراض طفيلية مختلفة (35 مريض بداء المقوسات ، 32مريض باللشمانيا ،24 مريض بالزحار الاميبي و9مرضى بالجارد يا) بينما 130 نموذج المتبقي كانوا افراد إصحاء واستخدموا لمجموعةالسيطرة . تم قياس مقدار الامتصاص لكل نموذج مصلي بواسطة جهاز قياس طيف الامتصاص الذري اللهبي .

النتائج : لوحظ انخفاض في مستوى الزنك المصلي في مجموعة المرضى بالمقارنة مع مجموعة السيطرة ($p < 0.001$) ، بينما ازدادمستوى النحاس والحديد المصلي في مجموعة المرضى عنه في مجموعة السيطرة ($p < 0.001$). بينما لم تلاحظ فروقات معنوية في مستوى المعادن النادرة بتأثير الجنس او العمر .

الاستنتاجات : تؤدي الاصابة الطفيلية الى قلة مستوى الزنك المصلي في الدم فأن المريض يستعمل السوبر اوكساييد دسميزتيز للسيطرة على الانتاج العالي من نمط فاعلية الاوكسجين.

Abstract

Objective: To evaluate serum levels of zinc, copper and iron in regard to some different parasitic diseases.

Method: A case-control study was carried out during the first 9 months of 2007 in Basrah , Southern Iraq . Blood samples were collected from 230 subjects aged 1-65 years. One hundred samples out of 230 collected from patients with parasitic infections (35 patients with toxoplasmosis, 32 patients with leishmaniasis, 24 patients with amoebiasis and 9 patients with giardiasis) while the rest 130 were apparently healthy subjects and considered as control group. The absorbance of each serum sample against blank was measured by flame atomic absorption spectrophotometer.

Results: Serum zinc levels were decreased significantly in patient group when compared with healthy subjects ($p<0.001$), while both serum copper and serum iron were increased significantly in patient group when compared with control group ($p<0.001$). There was no significant difference in regard to the effect of age and sex on serum trace elements levels in patients and control groups.

Conclusion: The significant decrease in serum zinc level and an increase of serum copper and iron in patients might be related to the parasitic infection.

Key words: Oxidative stress, Parasites, Trace elements.

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Introduction

Many trace elements are important for optimal human metabolic function. These micronutrients serve in a variety of functions including catalytic, structural and regulatory activities in which they interact with macromolecules such as enzymes, pro-hormones and biological membrane[1], others play an important role in immune system[2].

Zinc is an essential element that is required to maintain the normal physiological function of all form of life[3]. It is essential for growth, reproductive function and glucose metabolism. Zinc deficiency found to be associated with chronic illness[4]. Copper is an essential trace element, plays an important role in mitochondrial cytochrome oxidase, cytoplasmic superoxide dismutase (SOD) and ceruloplasmin, some of which are known to have antioxidant function[5]. Iron is a physiologically essential trace element, as useful component of cytochromes and oxygen binding molecules. However, iron is also biochemically dangerous, it can damage tissues by catalyzing the conversion of H2O2 to free-radical ions that attack cellular membranes lipids, proteins and DNA[6].

There are some defense mechanisms to counteract the effect of oxidant radicals. These defense systems prevent the production of free radicals, decrease their activities or destroy them. The antioxidant Glutathione peroxides has selenium, Cu/Zn super-oxide disputes system has copper and zinc in their structure which diminish the harmful effects of free oxygen radicals, catalase has iron as cofactor and ceruloplasmin, the carrier of Cu. Decreasing of these trace elements causes the action of antioxidant systems to be lower and this leads to hyperactivity and inflammation in infection and disease[7].

The present investigation includes the evaluation of trace elements such as Zn, Cu, and Fe in regard to some different parasitic diseases.

Materials And Methods

Subjects

This study was conducted during the first 9 months of 2007. A total of 230 subjects aged (1-65) years were included in the study. There were 35 patients with toxoplasmosis, 32 patients with leishmaniasis (13 of them were with cutaneous leismaniasis and the rest with visceral leishmaniasis), 24 patients with amoebiasis, 9 patients with giardiasis, while the rest 130 subjects were apparently healthy individuals and considered as control group. Patients were diagnosed and followed up by specialist physicians at Al- Suder Teaching Hospital and Basrah Hospital for Maternity and Children. Those parasitic infections were chosen because they are endemic in the region. The work has been approved by the ethical committee of College of Medicine, Basrah, Iraq.

Sampling

Serum samples were obtained by centrifugation of coagulated blood samples of patient and control groups at 3000 r.p.m for 15 min. A dilution used was 1:10 by deionized water. The absorbance of each sample against blank was measured by flame atomic absorption spectrophotometer (Pye Unicam 2900) according to a standard calibration curve done for zinc, copper and iron standard solutions (Wako Pure Chemical Industries Ltd. Japan)[8].

Serum trace element determination

An atomic absorption spectrophotometer instrument was set to zero while aspirated deionized water, samples were run in batchs using standard solutions containing 10, 25, 50, 100 and 200 µg/100 ml of each metals to make calibration curve and checked with these standards while running batch of samples. The current to cathode tube for zinc, copper and iron was 10mA, 6mA and 15mA respectively. The wave length for zinc, copper and iron was 213 nm, 324.2 nm and 248,3 nm respectively.

Statistical analysis

Results were expressed as mean ± SD. The data were analyzed statistically by one – way analysis (ANOVA). P–value of less than 0.05 was considered as statistically significant.

Results

The results of serum trace elements were significantly increased for both serum iron and serum copper while serum zinc was decreased significantly in patients group as compared with control group ($p<0.001$) (Table 1).

Table 1. Basic biochemical characteristic in all studied groups.

Parameters	Patients n=100	Control n=130	P value
S. Fe µg/dl	127.35 ± 14.02	97.23 ± 6.91	0.001
S. Zn µg/dl	84.95 ± 13.31	94.48 ± 6.60	0.001
S. Cu µg/dl	122.53 ± 12.36	93.88 ± 8.18	0.001

Values were expressed as mean ±SD.

Serum trace element results shows increase level of both iron and copper, while serum zinc was decreased for all groups. These results were statistically significant as compared with control group (Table 2).

Serum copper was highest in giardiasis and amebiasis groups and lowest in group of visceral leishmaniasis. There was no statistical significance as Decrease serum zinc level of patients group in both sexes was statistically significant when compared with that of the control groups ($p<0.001$). For both serum copper and iron level there was a significant increase level in both sexes of patients group as compared with that of control group ($p<0.001$) (Table 3).

Table (4) shows that serum iron and copper level for all age groups in patient group were higher than values in control group, which was statistically significant ($p<0.001$). Serum zinc levels were significantly lower in all age groups as compared with control group ($p<0.001$).

Discussion

Zinc is required as cofactor for the function of intracellular enzymes that may be involved in protein, lipid and glucose metabolism[9]. Zinc may participate as integral component of several antioxidant enzymes[10]. The present study shows a significant decrease in serum zinc level in patient group in comparison with control group and this result is in agreement with others[11-18]. This may be due to dietary factors (intake of food low in antioxidant) so body will use endogenous SOD to scavenge the over production of reactive oxygen species as a result of parasitic infection which leads to decrease serum zinc level[19]. Also it could be due to the antioxidant effect of zinc which plays a structural role in the maintenance of Cu-Zn-SOD structural integrity[19].

Serum zinc level decreases with increasing age which goes with aging theory, as SOD decreases with increasing age and serum zinc level correlate positively with erythrocyte SOD and also it correlates negatively with serum malonaldenude which will increase with increasing age. There was no significant difference of serum level of zinc between male and female in the studied groups.

The present study shows a significant elevation of serum copper level in patient group as compared with control group and this result was in agreement with others[7, 20-23]. This may be explained by antagonistic effect of zinc and zinc deficiency in patient with parasitic infection and increase copper absorption by the gastrointestinal tract. Zinc antagonize copper absorption by inducing the synthesis of thionine, which have higher affinity to copper than zinc[24]. The significant increase in serum level of copper demonstrates that inflammation initiate free radical generation. There was no significant difference in regard to the effect of age and sex on serum copper status in patients and control groups (Table 3, 4).

The macrophages mainly in the spleen after phagocytosis of senescent erythrocytes degrade hemoglobin, and heme is catabolized by hemoxygenase. Whenever the capacity of macrophages to handle erythrocytes or heme is exceeded, hemoglobin or heme is released into the circulation, where they bind to haptoglobin, and to hemopexine and albumin respectively. In the macrophages, the free iron is taken up into the ferritin molecule, or released in to circulation, where it binds to plasma transferring. Ferritin can also be released into circulation, and in the liver the released ferritin from kupfer cells is taken by hepatocytes[1].

The present study shows a significant increase in the serum level of iron in patient group as compared with control subjects and these results are in agreement with others[11-18]. This difference may be due to erythrocytes degradation after phagocytosis, also release of ferritin into circulation[1], which might explain the toxic effect of iron in generating hydroxyl radicals via Fenton and Haber – Weiss reactions.

To our knowledge, this is the first work which has been done in Iraq and probably in Middle East.

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Table 2. Basic biochemical character according to the type of parasites in patients and control groups.

mean ± SD

Parameters µg/dl	Toxop. N=35	C.leishm. N=13	V.leishm. N=19	Giard. N=9	Ameb. N=24	Control N=130
S.CU	121.91*a±12.6	122.65*b±8.62	120.33*c±9.59	124.66*d±16.46	124.34*e±14.32	97.23±6.91
S.Fe	127.41*a±12.46	131.00*b±14.69	126.34*c±15.07	122.22*d±22.89	128.00*e±11.15	94.48±6.60
S.Zn	81.11*a±11.92	80.11*b±13.94	84.12*c±12.21	85.86*d±12.25	83.13*e±10.45	93.88±8.18

** significance difference as compared with healthy subject (p<0.001).*
a. significance difference as compared between patients with toxoplasmosis and healthy subjects .
b. significance difference as compared between patients with cutaneouse leishmaniasis and healthy subjects .
c. significance difference as compared between patients with visceral leishmaniasis and healthy subjects .
d .significance difference as compared between patients with giardiasis and healthy subjects.
e. significance difference as compared between patients with amoebiasis and healthy subjects.

Table 3. Serum trace element levels (Zn, Cu, Fe) in relation to sex in patients and control groups.

Sex	Groups		S. Fe µg\dl	S. Cu µg\dl	S. Zn µg\dl
	Control				
Male		n=53	98.18 ± 8.02	92.19 ± 8.06	92.97 ± 6.71
	Patients				
		n=36	124.61* ± 15.28	123.24* ± 11.32	82.99* ± 13.55
	Control				
Female		n=77	96.57 ± 6.01	95.07 ± 8.10	95.52 ± 6.35
	Patients				
		n=64	128.88* ± 13.13	122.14* ± 12.97	86.06* ± 13.14

Values were expressed as mean ± SD
** significant differences as compared with healthy subject (p<0.001).*

Table 4. Serum trace elements levels (Fe, Cu, Zn) according to the age groups in patient and control groups.

Age (year)	Groups	S. Fe µg\dl	S. Cu µg\dl	S. Zn µg\dl
1 – 15	Control n=66	94.64 ± 2.51	92.03 ± 7.24	93.42 ± 6.49
	Patient n=48	126.78* ± 15.99	122.19* ± 11.33	85.31* ± 13.41
16 -40	Control n=46	98.70 ± 8.16	95.68 ± 8.59	95.33 ± 6.40
	Patient n=40	127.77* ± 12.68	122.88* ± 14.46	84.85* ± 13.33
41 -65	Control n=18	102.95 ± 9.80	96.07 ± 9.20	96.24 ± 7.17
	Patient n=12	128.17* ± 10.19	122.75* ± 9.10	83.89* ± 13.89

Values were expressed as mean ±SD
**Significant differences as compared with healthy subjects (p<0.001).*