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Study of zinc and copper in patients with Beta Thalassemia major and splenctomized in Kirkuk city

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ABSTRACT

Beta thalassemia major is one of the common diseases in the world; it is one of health problems among children in Iraq. The disease leads to hemolytic anemia due to reduction of beta globin chains. Zinc and copper are important trace elements for synthesis of metalloproteins of hemoglobin enzymes. As zinc and copper are essential trace for synthesis of DNA; it is important to show their effect on severity of the disease among thalassemic patients.

This study was performed during the period from November 2014 to June 2015. A total of 100 β-thalassemia major patients were enrolled in the current study; and patients were from the Thalassemia center in Azadi Teaching Hospital and 30 healthy children were taken as a control group. The blood samples were collected from 46 males and 54 females of different ages, ranging from (1-18) years. The level of serum zinc and copper were measured using spectrophotometer method. Comparison between thalassemic patients with control group; the results shown that there was high significant increased ($p<0.01$) in serum level of copper (148.69±28.90) while in serum level of zinc was decreased in thalassemic patients (60.52±10.63). Statistically there was no significant difference between different age groups and gender. The copper and zinc values decreased in splenctomized patients in comparison with non-splenctomized patients. The present study concluded that the level of serum copper increased while the level of serum zinc decreased in β-thalassemia major patients, this is also confirmed by other studies.

Keywords: Thalassemia major, trace elements, zinc and copper.

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دراسة الزنك والنحاس لدى مرضى الثلاسيميا الكبرى ومستئصلي الطحال في مدينة كركوك

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الملخص

بيتا ثلاسيميا الكبرى هو من احد الامراض الشائعة في العالم، ويعتبر من احد المشاكل الصحية لدى الاطفال. يسبب هذا المرض الانحلال في الدم وذلك نتيجة اختزال في سلاسل بيتا غلوبين. يعتبرالزنك والنحاس من العناصر الأثرية الاساسية لبناء بروتينات وانزيمات الهيموغلوبين. تهدف الرسالة الى دراسة تاثير الزنك والنحاس على شدة مرض الثلاسيميا الكبرى وكما انها من العناصر الاساسية لعمليات بناء DNA .

أجريت هذه الدراسة خلال الفترة من شهر تشرين الثاني 2014 إلى شهر حزيران 2015. في هذه الدراسة، تم اخذ مجموع (100) مريض مصاب بمرض الثلاسيميا الكبرى وكان المرضى يراجعون مركز الثلاسيميا في مستشفى آزادي التعليمي وتم اخذ (30) طفلا كمجموعة اصحاء. تم جمع عينات الدم من 46 من الذكور و 54 من الإناث بمختلف الأعمار، بدءا من (1–18) سنة وقد تم قياس مستوى الزنك في مصل الدم والنحاس باستخدام طريقة الطيف الضوئي. في مقارنة مع الاصحاء، أظهرت النتائج ارتفاع معنوي ($P< 0.05$) في مستوى مصل النحاس (148.69 ± 28.90) وانخفاض غير معنوي في مستوى مصل الزنك لدى مرضى الثلاسيميا (60.52±10.63)، احصائيا لم يكن هناك فرق معنوي بين مختلف الفئات العمرية والجنس. انخفضت مستويات النحاس والزنك لدى مرضى مستئصلي الطحال بالمقارنة مع مرضى غير مستئصلي الطحال. توصلت هذه الدراسة الى وجود زيادة في مستوى النحاس في الدم في حين انخفض مستوى الزنك في دم المرضى المصابين بالثلاسيميا الكبرى، وانها متوافقة مع دراسات أخرى.

الكلمات الدالة: ثلاسيميا الكبرى، العناصر الاثرية، الزنك والنحاس

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1. Introduction

Thalassemia is one of the most common cause of anemia in human beings; it was first reported by Cooley and Lee [1, 2]. About 150 million people carry the Thalassemia gene throughout the world; it is widely separated in Mediterranean countries than the other parts of the world [3, 4]. It is derived from Greek [5]. In Iraq; it is common among population with]uction of β-globin chains towards higher production of α-chain, which converts hemoglobin function into toxic inclusion bodies causing peripheral erythrocyte hemolysis [10]. Trace elements as copper and zinc are essential for human body; in addition to iron have an important role in pathogenesis. The alteration of these elements combined with excess amounts of hemoglobin subunits enhance the generation of oxygen radicals that leading to early death of the red blood cells and hemolysis [11].

The copper that present in human body; it mostly forms metalloproteins which act as enzymes; and it is a major component of hemoglobin responsible for oxygen transport in blood cells [12]. It plays an integral role in many physiological processes including maintaining a healthy heart, liver, bone strength and brain development, the concentration of copper is highest in the brain and the liver, the central nerves system and the heart have high concentrations of copper [13]. Small amount of copper can actually lead to disease in the body [14]. Zinc takes part in various important body functions; it is found almost in every cell and supports the work of numerous proteins in the body among them are the metalloenzymes [15]. It is absorbed from small intestine and found in the blood bound to albumin. Impaired growths and loss of weight are few of the associated complications due to deficiency of zinc which is one of the factors responsible for growth and puberty disorders in thalassemic patients; which has been well recognized for its role in human health [16, 17, 18, 19]. It is important to assess the status of zinc among the general population, preferably in children [20]. The aim of the present study was planned to evaluate the serum zinc and copper levels in thalassemic patients.

2. Materials and Methods

The study was carried out attending Azadi Teaching Hospital from November 2014 to September 2015. One hundred patients were attended β-thalassemia center (46 males and 54 females), their age were ranging from (1-18) years old. Four ml of blood were collected from

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each patient attending Thalassemia Centre in the hospital, to perform this 4 ml of venous blood in EDTA tube was taken from the patient. The tubes were centrifuged and sera were separated, the serum kept at -20 Centigrade until required. Copper and zinc levels were estimated using spectrophotometer.

3. Statistical Analysis

The collected data were analyzed using SPSS software (version 17, SPSS Inc.USA). The results were expressed as mean±SD for quantitative variables, Analysis ovarian (ANOVA) and students t-test were applied to show significant differences between groups. Data were considered statistically significant at $p<0.05$.

4. Results

A total of 100 patients with β thalassemia major were enrolled. Among these patients (46 males and 54 females) and thirty healthy individuals control were enrolled in the present study. Table (1). shows values of serum zinc and copper in β-thalassemia major patients compared with control group (n=30). Although the serum zinc level in thalassemic patients (60.52±10.63) was lower than controls (63.90±21.47), but statistically there was no significant difference between them ($p>0.05$), the same table illustrates that; high significant in the level of serum copper was in thalassemic patients (148.69±28.90) as compared to the control group (89.30±28.02) ($p<0.01$).

Table (1): Comparison of serum levels of zinc and copper between thalassemia patients and control group.

Mean±SD			
Parameter	β-thalassemia major patients (n=100)	Controls (n=30)	p-value
Serum zinc(mg/dl)	60.52±10.63	63.90±21.47	P>0.05
Serum copper(mg/dl)	148.69±28.90	89.30±28.02	P<0.01

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Table (2). shows the distribution of thalassemic patients according to gender (46 males and 54 females). The serum level of zinc did not vary significantly between males and females (59.82±11.16) and (61.11±10.21) respectively (p>0.05). Also the serum level of copper was not significantly different in both sexes (149.10±26.27) in males, (148.33±31.20) and in females (p>0.05).

Table (2): Comparison of serum levels of zinc and copper according to gender.

Mean±SD			
Parameter	Male (n=46)	Female (n=54)	p-value
Serum zinc(mg/dl)	59.82±11.16	61.11±10.21	P>0.05
Serum copper(mg/dl)	149.10±26.27	148.33±31.20	P>0.05

Table (3) shows the age distribution among thalassemic patients were classified into four age groups; less than 6 years which a count for 18 patients (18%); (6-10) years which a count for 34 patients (34%) and (11-15) years which a count for 32 patients (32%), more than 15 years, which a count for 16 patients (16%), although statistically there was in significant difference in the level of serum (zinc & copper) among age groups, while the highest rate of thalassemia was in age group (6-10) years followed by age group (11-15) years, and the lowest rate was in the age group (>15)years.

Table (3): Comparison of serum levels of zinc and copper according to age group in patients with β-thalassemia major.

Mean±SE				
Age group	No.	Serum zinc (mg/dl)	Serum copper (mg/dl)	ANOVA test F
A:<6yrs	18	59.28±12.27	149±27.84	N.S
B:6-10yrs	34	59.3±11.25	144.8±32.01	N.S
C:11-15yrs	32	61.4±8.40	150.4±28.87	N.S
D: 15>yrs	16	62.8±11.77	153.3±24.38	N.S
D.F=3	F=0.522		F=0.368	N.S=no significant

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Table (4) shows the levels of serum zinc and copper among splenctomized (n=12) and non-splenctomized (n=88) thalassemic patients, the serum levels of zinc and copper in splenctomized patients were (57.85±7.30) and (141.19±27.89) respectively were lower than non-splenctomized patients (60.45± 10.91) and (149±12.61) respectively, there was an increased in serum levels of zinc and copper in non-splenctomized patients compared with splenctomized patients; these increasing statistically was insignificant.

Table (4): Comparison of serum levels of zinc and copper in splenctomized and non-splenctomized patients

	Mean±SD		
Parameter	Splenctomized (n=12)	Non-splenctomized (n=88)	p-value
Serum zinc(mg/dl)	57.85±7.30	60.45± 10.91	P>0.05
Serum copper(mg/dl)	141.19±27.89	149±12.61	P>0.05

5. Discussion

The results from present study showed; the level of serum zinc was lower in thalassemia major patients than controls, but this reducing in zinc level did not differ statistically with controls; this finding is in agreement with the previous study that reported in Tehran [21]. On the other hand the study by Yazdideha explained that insufficient zinc dietary with the poor of zinc as a main reason of zinc deficiency [22]. This is also reported by other researchers [23, 24, 25]. Alsamarrai et al claimed that hypozincemia in thalassemic patients is caused by hyperzincuria due to hemolysis of erythrocytes [6]. In contrast study to the other published studies; they reported high significant level of zinc was in thalassemic patients [26]. Regarding to the level of serum copper; statistically there was higher significant difference in thalassemic patients as compared with controls; this finding is in agreement with that reported in Jordan [21,24]. Al-sammarrai showed that the cause of hypercopperemia is hemochromatosis as a complication of the disease [6]. This finding is in verses with that reported by Tabatabaei and Eshghi who showed decreasing in the level of serum copper [21, 27]. Regarding sex distribution the levels of serum copper and zinc did not significantly

difference between sexes. This finding is also reported among β-thalassemia major patients [28]. The splenectomy is one of the treatment lines in thalassemia major in addition to red blood cells transfusion [29]. There was insignificant difference between these groups in the level of serum copper; there was lower level in splenectomic patients than non-splenectomic patients. This result is also in agreement with the finding of [28, 30]. Although the level of serum zinc and copper in splenectomized and non-splenectomized recorded in significant difference between them, there was lower level in splenectomic patients than non-splenectomic patients [31]. Table (4) demonstrated that there was no significant difference in all parameters investigated among four age groups. This finding is in agreement with that reported by [32]. Who stated that copper is necessary in human nutrition for red blood cells formation [33]. The lowest zinc level was among age group below 6 years old; which might be related to malnutrition [1,3]. While other they did not find zinc level affected in children with thalassemic patients [34].

The high level of serum copper among thalassemic patients than control, this study is not in agreement with that reported by [28]. The highest level of copper was among the group less than 18 years is also against that found by Abdulkhader [28].

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