



## International Journal of Current Research and Academic Review

ISSN: 2347-3215 Volume 2 Number 8 (August-2014) pp. 266-273

[www.ijcrar.com](http://www.ijcrar.com)



### Serum copper and zinc levels of children with asthma

Nemat Bilan<sup>1</sup>, Mohammad Barzegar<sup>1</sup>, Habib Pirzadeh<sup>1</sup>, Lida Saboktakin<sup>1\*</sup>, and Amir Gorbani Haghjo<sup>2</sup>

<sup>1</sup>Pediatric Health Research Center, Department of Pediatric, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>2</sup>Ph.D of Biochemistry, Biotechnology Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

**Corresponding author**

#### KEYWORDS

Asthma,  
Copper,  
Zinc

#### A B S T R A C T

Zinc is as an essential micronutrient for normal growth and health that have important effects on biologic actions including enzyme activity, and release of insulin, homeostasis, cardiovascular, immune function and DNA construction. Childhood asthma is a respiratory disease with increased airway inflammation and airway obstruction was associated with infiltration and accumulation of neutrophils in the airways eosinophil caused to the production of oxidants and inflammation. The aim of this study was determine serum level of copper and zinc in pediatric with asthma. In a case-control study that performed in pediatric department of Tabriz University of Medical Science on pediatric with asthma, serum level of copper and zinc in pediatric with asthma evaluated. 68 of children were boy and 32 of them were girl. Mean age children with asthma was  $5.68 \pm 2.52$  year and mean age control group children was  $5.12 \pm 3.65$  year ( $P=0.375$ ). Mean copper level in children with asthma was  $98.52 \pm 30.78$  and mean copper level in control group children was  $75.48 \pm 15.77$ . Mean Zinc level in children with asthma was  $20.12 \pm 10.14$  and mean copper level in control group children was  $25.20 \pm 8.95$ . Mean copper level in children with asthma was significantly higher than mean copper level in control group children ( $P < 0.001$ ). Mean zinc level in children with asthma was significantly less than mean zinc level in control group children ( $P=0.009$ ).

### Introduction

One of the most essential micronutrients for the growth and natural evolution of the body and health is Zinc having important effects in biological activities in the body including the enzyme activity, insulin release, cardiovascular homeostasis

and immune system function, DNA and proteins synthesis and wound healing (1). Zinc exists in nerve cells, monocytes and macrophages and strengthens the cellular immune response having antioxidant and inflammatory properties.

The administration of zinc has been reported effective in the treatment of many ailments like chronic hepatitis C, acute diarrhea, Shigellosis and Leishmaniasis. On the other hand, have proven in numerous studies that zinc plays an important role in diseases with pathologies such as chronic inflammation and chronic irritation of cellular immune system such as in serum level asthmatics patients(1).

Asthma in childhood is a respiratory disease accompanied by increasing the response, inflammation and obstruction of air ways and eosinophil infiltration and neutrophil accommodation in the air ways lead to generation of the oxidants followed by inflammation.

Studies in recent years indicate the relationship between the serum levels of micronutrients and antioxidant mechanism in asthma (2-3).

Copper and zinc act as a cofactor for a number of enzymes and if they are in natural level they prevent effects of anti-oxidant materials and inflammation (2-3).

There exists an imbalance between oxidants and antioxidants in allergic asthma causing inflammatory processes in the air ways (2, 3). In the study conducted by Oeffelen et al, there existed a reverse relationship between serum zinc and the severity of asthma attacks in childhood (4-6)

In the research of Fernanda et al, the levels of zinc and selenium were lower in pediatric patients with asthma (7). In a study performed by Chin-Hung Guo, with increasing the serum level of copper along with reduced serum levels of zinc, asthma attacks and inflammation of

the air ways aggravated (8-9). Considering that asthma attacks and repeating it import a heavy burden to families and the role of serum copper and zinc in the incidence of childhood asthma and how to respond to drug therapy has been known well, we aimed to measure serum levels of copper and zinc in patients with asthma in lung section Children's Health Education Center of Tabriz which is a country's regional service providers.

Because in our area the serum copper and zinc in children with asthma is not measured. The aim of this study was to determine serum levels of copper and zinc in children with asthma, respectively.

### **Materials and methods**

In a case-control study in the Department of Pediatrics – University of medical sciences, Tabriz, Iran, on children with asthma, serum levels of copper and zinc in children with asthma were evaluated.

Simple sampling method was used and all children and young people with asthma who had referred to the pediatric lung section of children's Hospital and university clinics during 2012 were selected and entered the study. 50 children without asthma at the same age and sex were chosen as control group and were evaluated.

### **Inclusion criteria**

- 1-having a complete medical record
- 2-2-18 years old
- 3-having the weight of the top 25 percent
- 4-lack of other underlying illness
- 5-not receiving Zn in the last 6 months

Sample size was determined according to the sample size table for Cohen case

studies with 5% error and 99% in at least 44 cases and 6 cases were added for considering missed cases.

50 patient samples in patient group and 50 samples in the control group were studied. Patients who themselves or their family consented to participate in the plan are excluded.

The patients in the two groups went under the accurate measurement of height and weight using Seca weight gauge after obtaining written consent and information form was completed.

Blood samples of two groups were collected after 12 hours fasting of patients and serum was separated by centrifugation in low speed in the laboratory and transferred to the -70 freezer in the biochemistry laboratory of Medicinal Applied Research Centre in Eppendorf vials in order to measure the serum levels of zinc and copper via Atomic absorption spectrophotometry method.

NCHS standard curve was used to convert the height and weight to the SDS.

### **Statistical analysis**

The collected data were analyzed by SPSS-17 statistical software. The collected data were expressed as percentage and mean  $\pm$  SD. Continuous (quantitative) variables were compared by Independent samples and Paired t test. Categorical (qualitative) variables were compared by contingency tables and Chi-square test or Fisher's exact test. P-value  $\leq 0.05$  was considered statistically significant.

### **Ethical considerations**

According to the written informed consent of the parents or legal representative of the

child (which is attached) we didn't have any ethical problems in the study. Necessary measures took place to obtain consent from the illiterate individuals.

### **Result and Discussion**

In this study, the serum level of copper and zinc in children with asthma compared with control group and the following results were obtained:

Group was composed of about 50 people (36 boys) and 50 people were in control group (32 boys) (P = 0.391).

The mean ages of children with asthma were  $5.68 \pm 2.52$  and it was  $5.12 \pm 3.56$  in control group (P = 0.375).

Demographic findings of studied children are shown in table I.

The mean serum level of Copper was  $98.52 \pm 30.78$  in children with asthma and  $75.48 \pm 15.77$  in children in the control group.

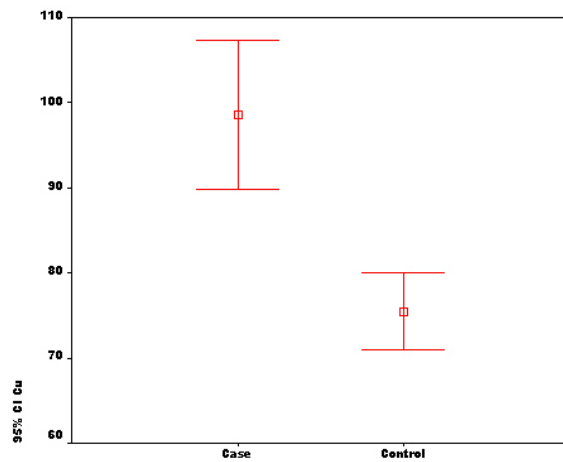
The mean serum Copper levels in patients with asthma is significantly higher than that of the control group (p <001).

The mean serum level of Zinc was  $20.12 \pm 10.14$  in children with asthma and  $25.20 \pm 8.95$  in children in the control group.

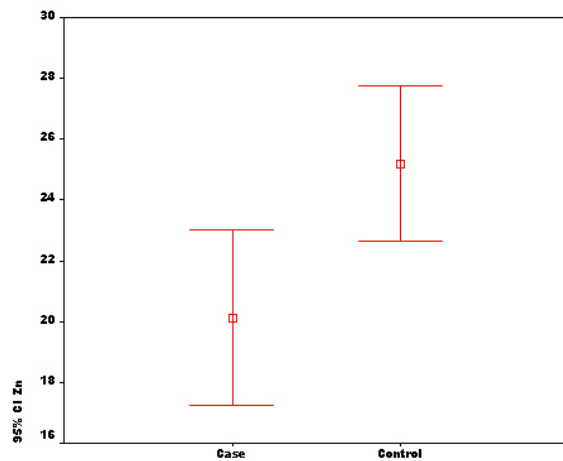
Mean levels of Zinc in patients with asthma were significantly less than children of control group (P = 0.009).

Distribution of Copper and Zinc serum level in patients of two groups (Case and Control) were shown in figure I and II.

Evaluation of parameters based on asthma type and response to treatment were shown in table II.



**Figure.I** Distribution of Copper serum level in patients of two groups (Case and Control)



**Figure.II** Distribution of Zinc serum level in patients of two groups (Case and Control)

**Table.I** Demographic finding of patients in two groups

	Group		P
	Case	Control	
Age	5.69 ± 2.52	5.13 ± 3.65	0.375
Weight	21.71 ± 9.08	21.42 ± 11.48	0.888
Height	112.00 ± 15.78	109.48 ± 21.87	0.511
Birth Weight	3223.20 ± 544.77	3187.00 ± 432.76	0.714
Mother's Age	25.72 ± 5.87	24.92 ± 4.87	0.460

**Table.II** Evaluation of parameters based on asthma type and response to treatment.

	Asthma type			Response to treatment		
	Intermittent asthma	Mild persistent asthma	P	Controlled	Partially controlled	P
Copper serum level	92.80±17.09	99.95±33.36	0.517	94.34±28.87	105.94±33.48	0.204
Zinc serum level	21.03±10.62	16.50±7.29	0.210	21.06±9.48	19.59±10.61	0.630
Age(year)	5.35±2.50	7.00±2.24	0.065	5.51±2.50	5.99±2.60	0.528
Weight(Kg)	20.74±9.05	25.60±8.54	0.131	21.03±8.25	22.92±10.53	0.486
Height(Cm)	109.33±14.98	12.70±14.98	0.015	110.69±15.56	114.33±16.35	0.439
Birth Weight(gr)	3151.50±541.12	3510.00±482.36	0.062	3250.31±543.88	3175.00±558.69	0.644
Mother's Age(year)	25.85±6.09	25.20±5.14	0.758	25.78±6.07	25.61±5.66	0.923

Records of allergy or asthma were observed in the immediate family of 17 patients. Of the 17 patients, 12 patients demonstrated allergy and 5 demonstrate symptoms of asthma. In 12 of the cases, children had blood parents. Records of indoor smoking were seen in 13 cases. Moreover, 40 patients had intermittent asthma (according to GINA 2008) and 10 children (patients) were diagnosed with mild persistent asthma. Concerning pharmaceutical treatment, 31 patients experienced monotherapy while 19 received polytherapy. The treatments led to the control of asthma in 32 patients and relative control of asthma in 18 patients.

Asthma is considered a chronic inflammatory disease leading to temporary blockage of air ways. The genetic and environmental factors involved in the pathogenesis of this disease

(10). Free oxygen radicals including hydrogen peroxide, superoxide and hydroxyl radicals are involved in the pathogenesis of asthma (11-13).

There exist some defense mechanisms under the title of antioxidants agents various harmful agents causing inhibition of free radicals production, reducing their activity and degradation of them. The most important antioxidants include Glutathione peroxidase and superoxide dismutase (14-15).

Zn is regarded one of the main components of antioxidant enzymes leading to decreased harmful effects of oxygen free radicals. Reduction of zinc may cause diminishing the antioxidants system effects and as a result leads to inflammation and hyper activity in air ways (16-18).

Zinc deficiency disturbs oxidant and antioxidant balance which is named oxidative stress. This stress makes pulmonary damage directly and increase of oxidative stress in patients with asthma is mentioned in many studies (11).

Most of the studies pay attention to the protective effects of antioxidants and rare elements like zinc.

In this investigation serum level of copper in children with asthma and healthy children with the same age and sex was compared and studied.

According to the study of Dey Toro et al, zinc deficiency leads to change in immune response from TH1 to TH2 that is effective in the pathophysiology of asthma (19).

In a study performed by David et al at the Department of Pediatrics in the University of Manchester on patients with atopic eczema, they expressed that the copper level in patients with atopic eczema was significantly higher control group (20).

In the other study by David et al at the Department of Pediatrics in the University of Manchester, levels of Zn (Zinc) in patients with atopic eczema were measured which was significantly less than control group (21).

Gua et al conducted a study at the Biomedical Nutrition Department in the University of Hong Kong in Taiwan in 2011, they expressed that children with asthma have higher levels of copper and lower levels of Zinc in comparison to control group (8).

Results of our study were consistent with the results of the above studies, the level of copper in children with asthma was higher and levels of zinc were less than healthy children.

In a survey done by Kocyigit et al (2004) at the Department of Biochemistry in the University of Harran in Sanliurfa, Turkey, on the level of micronutrients in patients with asthma it was shown that the level of zinc was lower in children suffering from asthma than healthy control group and in the contrary the level of copper these children also was higher than control group (22).

Carneiro et al (2011) performed a research in the Sao Paulo University of Brazil representing that children with asthma had increased copper surface relative to the control group; in contrast, these children had decreased zinc levels compared to the control group (7).

In the study of DiToro et al it was suggested that there exist no significant difference between zinc level in patients with allergy and healthy people and the level of copper in children with asthma was higher in patients than healthy subjects (23).

Following a study by El-Kholy et al at the Department of Pediatric diseases in AinShams University, Cairo, Egypt, it was concluded that both copper and zinc play vital roles in protein synthesis and enzymes activity and serum levels of copper was higher and serum levels of zinc was lower in children with asthma than normal people, respectively (4).

In this study, the mean serum level of Copper was  $98.52 \pm 30.78$  in children with asthma and  $75.48 \pm 15.77$  in children in the control group.

The mean serum Copper levels in patients with asthma is significantly higher than that of the control group ( $p < 0.001$ ).

The mean serum level of Zinc was  $20.12 \pm 10.14$  in children with asthma and  $25.20 \pm 8.95$  in children in the control group.

Mean levels of Zinc in patients with asthma were significantly less than children of control group ( $P = 0.009$ ).

### Conclusion

In our study, the average level of Copper was higher in children with asthma than those in control group and mean levels of Zn (Zinc) was lower in children with asthma than control children.

### Suggestions

According to the results, of clinical trial is recommended in the case of the use of zinc supplementation in children with asthma.

### References

- 1- Prasad AS(2009). Impact of the discovery of human zinc deficiency on health. *J Am Coll Nutr*, 28(3),257-65.
- 2- Rahman I, MacNee W(1996). Role of oxidants/antioxidants in smoking-induced lung diseases. *Free Radic Biol Med*, 21(5),669-81.
- 3- Kocyigit A, Armutcu F, Gurel A, Ermis B(2004). Alterations in plasma essential trace elements selenium, manganese, zinc, copper, and iron concentrations and the possible role of these elements on oxidative status in patients with childhood asthma. *Biol Trace Elem Res*, 97(1),31-41.
- 4-el-Kholy MS, Gas Allah MA, el-Shimi S, el-Baz F, el-Tayeb H, Abdel-Hamid MS(1990). Zinc and copper status in children with bronchial asthma and atopic dermatitis. *J Egypt Public Health Assoc*, 65(5-6),657-68.
- 5- Goldey DH, Mansmann HC Jr, Rasmussen AI(1984). Zinc status of asthmatic, prednisone-treated asthmatic, and non-asthmatic children. *J Am Diet Assoc*, 84(2),157-63.
- 6- van Oeffelen AA, Bekkers MB, Smit HA, Kerkhof M, Koppelman GH, Haveman-Nies A, et al(2011). Serum micronutrient concentrations and childhood asthma: the PIAMA birth cohort study. *Pediatr Allergy Immunol*, 22(8),784-93. doi: 10.1111/j.1399-3038.2011.01190.x. Epub 2011 Sep 19.
- 7-Carneiro MF, Rhoden CR, Amantéa SL, Barbosa F Jr(2011). Low concentrations of selenium and zinc in nails are associated with childhood asthma. *Biol Trace Elem Res*, 144(1-3),244-52. doi: 10.1007/s12011-011-9080-3. Epub 2011 May 24.
- 8-Guo CH, Liu PJ, Hsia S, Chuang CJ, Chen PC(2011). Role of certain trace minerals in oxidative stress, inflammation, CD4/CD8 lymphocyte ratios and lung function in asthmatic patients. *Ann Clin Biochem*, 48(Pt 4),344-51. doi: 10.1258/acb.2011.010266. Epub 2011 May 5.
- 9- Guo CH, Liu PJ, Lin KP, Chen PC(2012). Nutritional supplement therapy improves oxidative stress, immune response, pulmonary function, and quality of life in allergic asthma patients: an open-label pilot study. *Altern Med Rev*, 17(1),42-56.

- 10- Ober C(2005). Perspectives on the past decade of asthma genetics. *J Allergy Clin Immunol*, 116,274-278.
- 11- Kelly FJ, Mudway I, Blomberg A, Frew A, Sandstrom T(1999). Altered lung antioxidant status in patients with asthma. *Lancet*, 354,482.
- 12- Jarjoun NN, Calhoun WJ(1994). Enhanced production of oxygen radicals in asthma. *J Lab Clin Med*, 123,131-136.
- 13- Dworsk R(2000). Oxidant stress in asthma. *Thorax*, 55,551-553.
- 14- Halliwell B(1994). Free radicals, antioxidant and human disease:Curiosity,cause or consequence? *Lancet*, 344,721-724.
- 15- Shanmugasundaram KR, Kumar SS, Rajajee S(2001). Excessive free radical generation in the blood of children suffering from asthma. *Clin Chim Acta*, 305,07-114.
- 16- Pucheu S, Coudray C, Tresallet N, Favier A, de-leiris J(1995). Effect of dietary antioxidant trace elements supply on cardiac tolerance to ischemia-reperfusion in the rat. *J Mol Cell Cardiol*, 27,2303-2314.
- 17- Raeve HR, Thunnisen B, Kaneko FT, Cuo FH, Lewis M(1997). Decreased cu,zn-SOD activity in asmatic air way epithelium: Correction by Inhaled corticosteroid *invivo*. *Am J physiol*, 272,148-154.
- 18- Comhair SA, Ricc KS, Arroliga M, Lara AR, Dweik RA, Song W(2005). Correlation of systemic superoxide dismutase deficiency to Air flow obstruction in Asthma. *Am J Respir Crit Med*, 172,300-313.
- 19- Di Toro R, Galdo Captorti, Gialanella G(1987). Zinc and copper status of allergic children. *Acta Paediatr Scand*, 76,612-617.
- 20-David TJ, Wells FE, Sharpe TC, Gibbs AC, Devlin J(1990). Serum levels of trace metals in children with atopic eczema. *Br J Dermatol*, 122(4),485-9.
- 21-David TJ, Wells FE, Sharpe TC, Gibbs AC(1984). Low serum zinc in children with atopic eczema. *Br J Dermatol*, 111(5),597-601.
- 22-Kocyigit A, Armutcu F, Gurel A, Ermis B(2004). Alterations in plasma essential trace elements selenium, manganese, zinc, copper, and iron concentrations and the possible role of these elements on oxidative status in patients with childhood asthma. *Biol Trace Elem Res*, 97(1),31-41.
- 23- Di Toro R, Galdo Capotorti G, Gialanella G, Miraglia del Giudice M, Moro R, Perrone L(1987). Zinc and copper status of allergic children. *Acta Paediatr Scand*, 76(4),612-7.