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Serum Zinc, Copper, Magnesium and Selenium Levels in Children with *Helicobacter Pylori* Infection

Helicobacter Pylori *Enfeksiyonu Olan Çocularda Serum Bakır, Magnezyum, Çinko ve Selenyum Düzeyleri*

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Abstract

Objective: *Helicobacter pylori* infection can cause disease from mild to severe that may be accompanied by micronutrient deficiencies. We aimed to investigate serum zinc, copper, magnesium and selenium levels in *Helicobacter pylori* positive children.

Materials and Methods: Thirty-four children, with chronic abdominal pain and diag-nosed to be *Helicobacter pylori*-positive and 20 healthy children with the same demo-graphic characteristics were included in the study. Serum zinc, copper and magnesium levels were measured in the flame unit of atomic absorption spectrophotometer, selenium levels were measured in the graphite unit of the same atomic absorption spectrophotometer.

Results: Serum zinc levels were significantly higher and serum magnesium levels were significantly lower ($p<0.05$) in *Helicobacter pylori* positive children than those of the control group. Although copper levels were lower in patient group than in control group, this difference was not statistically significant ($p>0.05$). There was no significant difference between serum selenium levels of two groups.

Conclusion: We concluded that in *Helicobacter pylori*-positive children, many trace elements and mineral metabolism may change.

Keywords: *Helicobacter Pylori*, zinc, copper, magnesium, selenium

Özet

Amaç: *Helicobacter pylori* enfeksiyonu mikro besin eksikliklerinin eşlik ettiği hafif şiddetten ağır tablolara kadar değişebilen hastalıklara sebep olabilir. Biz bu çalışmada *Helicobacter pylori* pozitif çocuklarda serum çinko, bakır, magnezyum ve selenyum düzeylerini araştırılmayı amaçladık.

Gereç ve Yöntem: Kronik karın ağrısı olan ve *Helicobacter pylori* pozitifliği saptanan otuz dört hasta çocuk ve hasta grubu ile aynı demografik özelliklere sahip sağlıklı 20 çocuk çalışmaya dahil edildi. Serum çinko, bakır ve magnezyum düzeyleri atomik absorpsiyon spektrofotometresi alev ünitesinde, serum selenyum seviyeleri ise aynı spektrofotometrenin grafit fırın ünitesinde ölçüldü.

Bulgular: Çalışmamız sonucunda *Helicobacter pylori* pozitifliği saptanan çocuklarda kontrol grubuna göre serum çinko düzeylerini istatistiksel olarak anlamlı de-recede yüksek, Magnezyum düzeylerini ise düşük bulduk ($p<0,05$). Bakır düzeyleri kontrol grubunda daha yüksek olmasına rağmen istatistiksel olarak anlamlı değildi ($p>0,05$). Serum selenyum düzeyleri açısından her iki grup arasında istatistiksel anlamlı bir farklılık yoktu.

Sonuç: *Helicobacter pylori* pozitif çocuklarda, birçok eser element ve mineral metabolizmasında değişiklikler olabileceğini söyleyebiliriz.

Anahtar Kelimeler: *Helicobacter pylori*, çinko, bakır, magnezyum, selenium

Introduction

Helicobacter pylori (H. pylori) are estimated to infect at least half of world population. The incidence of *H. pylori* infection in children is about 10% in developed countries and varies from 80 to 100% in developing countries [1]. *H. pylori* infection in gastric mucosa may be asymptomatic transporter or may be related to different situations from moderate gastritis to severe diseases such as gastric cancer [2]. Although severe clinical symptoms of this infection are represented in adults, epidemiological studies show that the infection is acquired in childhood [3, 4].

Since this childhood infection has the potential of worsening the adult disease and effecting micronutrient metabolism [5], the importance of preventing, treating, and following-up the infection in childhood has arisen [3].

H. pylori infection affects the digestion and absorption of dietary nutrients by disrupting gastric secretion and acidifica-

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tion functions. Accordingly, deficiencies in micro-nutrients such as trace elements and minerals, caused by this infection, may trigger impairments in biological and immunological functions [6].

Zinc is an essential trace element found in all body fluids and tissues. It has functions in growth and development as well as in many metabolic events like immunological mechanisms and protein synthesis. Thus zinc is a necessary nutrient in animals. Physiological stresses, such as trauma, infections, and low protein intake, cause a decrease in the plasma zinc level. Copper is a component of many enzymes in the body, and these enzymes take part in various metabolisms like collagen, elastin, melanin and catecholamine syntheses. Copper deficiency due to diet is rare except in malnutrition and in children with chronic diarrhoea. Magnesium is a macro-mineral that has functions in maintaining normal nerve-muscle transmission and replication, transcription and translation. Selenium, as in the form of selenocysteine, is involved in glutathione peroxidase, iodothyronine de-iodinase, and thioredoxin reductase enzymes [7].

Several studies have shown that *H. pylori* infection has relations to the deficiencies in copper, vitamin B12, folic acid, and vitamin A, C, and E [5, 8-11]. These deficiencies may be derived from anorexia caused by dyspeptic symptoms or from malabsorbtion secondary to intestinal bacterial infections, which is the result of hypo-achlorhydria in the stomach in the presence of *H. pylori*.

Various cases ranging from mild to severe clinical conditions may be accompanied by micronutrient deficiencies caused by *H. pylori* infection. Accordingly, we aimed in this study to investigate the serum zinc, copper, magnesium and selenium levels in *H. pylori* positive children.

Materials and Methods

After ethical procedures (ethical comity approval, informed consent), 34 children, admitted to paediatric gastroenterology clinic of Ataturk University Medicine Faculty with chronic abdominal pain and diagnosed to be *H. pylori-positive* with rapid urease test, were included in the study. Furthermore, patients receiving multivitamin and mineral treatment, anaemic patients receiving treatment for iron deficiency, patients with malnutrition and obesity, patients with any diet restrictions and vegetarian diet and patients with any other metabolic disorders were excluded from the study. Control group composed of 20 healthy children with similar demographic characteristics.

Blood samples taken from patients and healthy children were put into gel-containing vacutainers and centrifuged at 3,500 rpm for 10 minutes, and serum samples were stored at -800C until the day of analysis. Serum zinc, copper and magnesium levels were measured in the flame unit of atomic absorption spectrophotometer (Perkin Elmer AAnalyst 800 model, AAS, USA), selenium levels were measured in the graphite unit of the same spectrophotometer. Serum levels were determined by using standard graphics created for each element.

Statistical analyses were performed by statistical software program SPSS for Windows version 19.0 (SPSS; Chicago, IL, United States). Results were given as mean±standard deviation (SD). Since variables showed normal distribution by Kolmogorov-Smirnov test, a parametric test-independent t-test- was performed. $p<0.05$ was considered statistically significant.

Results

Mean ages, gender and mean serum zinc, copper, magnesium and selenium levels of *H. pylori*-positive children and control groups are shown in Table 1.

Serum zinc levels were significantly higher and serum magnesium levels were significantly lower ($p<0.05$) in *H. pylori* positive children than those of the control group. Although copper levels were lower in patient group than in control group, this difference was not statistically significant ($p>0.05$). There was no significant difference between the serum selenium levels of two groups.

Table 1. Mean ages, gender and mean serum zinc, copper, magnesium and selenium levels of patient and control groups

Parameters	Patient group (n=34)	Control group (n=20)	p value
Age (years)	10.43±2.49	9.75±2.09	0.314
Gender (n, male/female)	17/17	12/8	
Zinc (µg/dL)	990.5±354.2	321.0±130.9	0.000*
Copper (µg/dL)	146.3±28.95	163.0±40.79	0.087
Magnesium (mg/dL)	1.79±0.35	2.33±0.18	0.000*
Selenium (µg/dL)	38.79±14.54	40.25±14.78	0.724

* Values significantly different between *H. pylori* positive children and control group ($p<0.05$)

Discussion

Considering that the prevalence of *H. pylori* infection and of concomitant micro-nutrient malnutrition is high all over the world, we can mention that our results may be significant to evaluate the changes and clinical results of micronutrient metabolism.

In our study we found that serum zinc levels were significantly higher in *H. pylori*-positive children but there was no significant difference between the serum copper and selenium levels between *H. pylori*-positive and healthy children.

Similar to our results, Dovhanj et al. [12] found that serum zinc levels were significantly higher in *H. pylori*-positive patients with chronic gastritis compared to *H. pylori*-negative patients with chronic gastritis and as well as in healthy people. Researchers reported that there was no significant difference in serum copper concentrations of the two groups.

Since metal ion concentration can change rapidly depending on diet, gastric mucosa is a highly variable habitat for *H. pylori*. Accordingly, studies have shown that *H. pylori* developed toxic metal export systems as gastric acid adaptation mechanism [13, 14]. One of these systems, *H. pylori* CznABC transport system, removes cadmium and zinc from bacterial cytoplasm and prevents urease inhibition of these substances [13, 14]. We can conclude that high levels of serum zinc in *H. pylori*-positive children may be based on the increased release in gastric mucosa and later increased intestinal absorp-tion with this system.

In another study conducted by Ustundag et al. [15], similar results were reported between healthy controls and chronic gastritis patients associated with *H. pylori* infection with respect to the plasma selenium concentrations. In our study, we determined lower serum magnesium levels that are statistically significant in *H. pylori* positive children compared to healthy controls. On the other hand, magnesium is impacted to be an im-portant factor for virulence and survival of *H. pylori* in gastric mucosa in many studies [14, 16-17].

Pfeiffer et al. [17] showed that Mg2+ acquisition by a trans membrane protein named CorA is essential for *H. pylori* in vitro, as CorA mutants did not grow in media without Mg2+ supplementation. They also showed that *H. pylori* CorA plays a key role in the adaptation to the low - Mg2+ conditions predominant in the gastric environment.

Low magnesium concentrations in gastric cells may be accompanied by the low serum magnesium concentrations in *H. pylori*-positive children and magnesium balance in gastric cells can be balanced with magnesium replacement in addition to *H. pylori* eradication treatment.

H. pylori infection can cause iron deficiency anaemia or various vitamin deficiencies even in the conditions without ulceration, erosion or gastrointestinal symptoms [4, 18]. Studies have shown that *H. pylori* eradication may be useful in treating the iron deficiency and iron deficiency anaemia without iron replacement [19]. Similarly, it has been reported that *H. pylori* eradication may be useful in treating vitamin B12, vitamin A and vitamin E deficiencies without replacing these vitamins [11]. Further detailed studies may be needed in relation to the trace elements and minerals.

In conclusion although the major limitation of our study was the number of the participants, we can conclude that in *H. pylori*-positive children, many trace elements and mineral metabolism may change, and these micronutrients may have specific roles in pathogenesis, progression and follow-up of the diseases related to these elements.

Ethics Committee Approval: Ethics committee approval was received for this study.

Informed Consent: Informed consent forms were taken from the volunteers who participated in this study.

Peer-review: Externally peer-reviewed.

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