



Levels Estimation of Iron, Zinc and Copper in the Serum of Children Infected with Giardiasis

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Abstract:

Giardiasis is an infection in the small intestine, it's caused by a microscopic parasite called Giardia lamblia. In this study, we examined stool samples for 75 children, 1–12 years old during the period from August to November 2023 from children who attended a pediatric hospital in Kirkuk city, and we estimated the levels of iron, zinc, and copper in these children. A stool examination was done for all samples to detect cysts or trophozoites of Giardia lamblia. Also, we measured the levels of iron, zinc, and copper by atomic absorption spectrophotometer. The highest rate of parasite infection (66.7%) was recorded in the age group (4–6)years old. Serum iron and copper levels considerably decreased ($P<0.05$) in comparison to the control group. It was noted that most of the infected children suffer from abdominal pain with intermittent diarrhea.

Keywords: Giardiasis, Iron, Zinc, Copper, Children.

تقدير مستويات الحديد والزنك والنحاس في مصل الأطفال المصابين بالجيارديا

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الخلاصة:

الجيارديا هي عدوى في الأمعاء الدقيقة، وتسببها طفيلي مجهري يسمى الجيارديا اللامبليية. فحصنا في هذه الدراسة عينات براز لعدد 75 طفلاً تتراوح أعمارهم بين 1 و 12 عاماً خلال الفترة من أغسطس إلى نوفمبر 2023 من الأطفال الذين حضروا إلى مستشفى الأطفال في مدينة كركوك، وقمنا بتقدير مستويات الحديد والزنك والنحاس لدى هؤلاء الأطفال. تم إجراء فحص البراز لجميع العينات للكشف عن الكيس أو التروفوزويت من الجيارديا اللامبليية، أيضاً قمنا بقياس مستويات الحديد والزنك والنحاس بواسطة مقياس الطيف الضوئي للامتصاص الذري. أعلى معدل للإصابة بالطفيليات (66.7%) مسجل في الفئة العمرية (4-6) سنوات. انخفضت مستويات الحديد والنحاس في الدم بشكل كبير ($P < 0.05$) مقارنة بالمجموعة الضابطة، ولوحظ أن معظم الأطفال المصابين يعانون من آلام في البطن مع إسهال متقطع.

الكلمات المفتاحية: داء الجيارديا، الحديد، الزنك، النحاس، الأطفال.

1. Introduction:

Giardiasis is a popular infection by protozoa and can cause clinical symptoms from acute or chronic diarrhea, malabsorption of minerals and fat, intestinal irritation, anorexia, and nausea, it may also cause growth and developmental retardation to asymptomatic [1]. Giardiasis is caused by a parasite called *Giardia lamblia*, it has two stages in its life cycle, the trophozoite with pear-shaped, two nuclei, four pairs of flagella, and a suction disc used to attach to the intestinal wall and the cyst with oval shape strong walls, four nuclei and numerous internal fibers, transmission the infection happens by ingestion water and food contaminated with the cyst [2]. Most infected people with giardiasis do not show many symptoms [3]. Children experience symptomatic infections more frequently than adults due to their weakened immune systems and propensity for recurrent infections. The patient's symptoms vary depending on whether they have an acute or chronic Giardia infection [4]. Patients with giardiasis frequently have malabsorption syndrome and abnormalities in the levels of serum iron, zinc, and copper [5]. Iron, copper, and zinc are essential micronutrients for growth, development, and reproduction, and deficiency of these micronutrients can cause major impairments to enzymatic, physiological, and cellular functions [6].

The current study aims to assess the spread of *Giardia lamblia* in children attending to general pediatric hospital for the period between August to November 2023 and to find out the extent of the impact of the infection with Giardiasis on serum levels of iron, zinc, and copper.

2. Material and Methods

This study was carried out in the laboratory of a pediatric hospital in Kirkuk City from August to November 2023. Stool samples were collected from 75 children aged from 1 to 12

years old, where the samples were collected in sterilized stool cups, branded with the name and time of collection. The fecal examination was done for all samples to detect *Giardia* cyst and trophozoite using direct wet smear and formol ether sedimentation concentration technique, it was carried out according to Garcia [7]. 50 positive cases for giardiasis were recorded and 25 cases were free of *Giardia lamblia* or another parasitic infection which was considered as the control group. Blood samples were collected from all groups and centrifugation was done to obtain serum to estimate iron, zinc, and copper levels by atomic absorption spectrophotometer. During the previous four months, both groups did not take any vitamins or mineral supplements.

ANOVA was used to analyze the results statistically and display the significant difference between the two groups, infected and control.

3. Results and Discussion

Out of 75 stool samples examined by different techniques, 50 were positive for *Giardia lamblia*, and the total infectivity rate was 66.7%. The percentage of *Giardia* infection among males (38.7%) was higher than in females (28%); results revealed that there are no significant variances between males and females in infected groups Table 1. These results agree with [8] and [9], and disagree with [10].

Table (1): Prevalence of *Giardia lamblia* according to sex.

Sex	No. of stool samples examined	Percentage of stool samples examined	No. of a positive sample	Percentage of positive sample
Males	42	56	29	38.7
Females	33	44	21	28
Total	75	100	50	66.7

In the infected group with *Giardia lamblia*, 44% of cases were between 4-6 years old which presents the highest rate, while the lowest percentage 16% recorded in the age group between 10-12, Table 2. The results of this study agree with [8] and [11]. A high average of *Giardia lamblia* infection has been recorded in some communities up to 50% in children under 5 years old [12], because of the undeveloped immune system which led to exposure to different pathogens such as parasites, bacteria, viruses [13], also health hygiene and education, lower socioeconomic status especially among migrants enhanced infectious diseases [14].

Table (2): Prevalence of *Giardia lamblia* according to age group

Age groups	No. of the infected group	percentage of the infected group	percentage of control group	No. of the control group
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1-3	9	18	3	12
4-6	22	44	12	48
7-9	11	22	4	16
10-12	8	16	6	24
Total	50	100	25	100

The serum Fe, Zn and Cu concentrations were found to be (Fe: 41.24 ± 6.21 $\mu\text{g/dL}$), (Zn: 79.32 ± 5.78 $\mu\text{g/dL}$) and (Cu: 58.84 ± 5.97 $\mu\text{g/dL}$) in children with giardiasis, which were higher than control (Fe: 78.91 ± 6.73 $\mu\text{g/dL}$), (Zn: 80.77 ± 6.22 $\mu\text{g/dL}$) and (Cu: 89.34 ± 6.71 $\mu\text{g/dL}$),

Table 3.

Table (3): Levels of iron, zinc, and copper in the serum of the infected group and control

Minerals	Infected group Mean $\pm$ SD	Control group Mean $\pm$ SD
Iron	41.24 ± 6.21	78.91 ± 6.73
Zinc	79.32 ± 5.78	80.77 ± 6.22
Copper	58.84 ± 5.97	89.34 ± 6.71

In this study, serum iron and copper concentration significantly declined in the infected group when related to the control group; these results agree with [15]. Malabsorption-associated iron lack is expected in patients with *Giardia lamblia*, which might be protecting in the formation of the hydroxyl radical [16]. In the small intestine, copper is absorbed in a smaller amount through the large intestine [17]. There was no significant variance in the level of serum Zinc between the group infected with giardiasis and the control groups, accordingly, this study agrees with [18] and disagrees with [6], that giardiasis caused poor absorption of zinc [19]. A high percentage of zinc levels could be seen in acute infections while Chronic infections could cause a lasting decline in serum zinc levels [20].

4. Conclusion

This study recorded the highest rate of parasite infection in the age group of 4-6 years old, Symptoms in the infected groups were recurrent diarrhea, abdominal pain, and weight loss. Serum levels of iron and copper significantly declined in the children infected with giardiasis, whereas no significant difference was detected in the serum zinc levels between the infected and control groups.

5. References

- [1] Coles CL, Levy A, Dagan R, Deckelbaum RJ, Fraser D. Risk factors for the initial symptomatic giardia infection in a cohort of young Arab-Bedouin children. Ann Trop Paediatr. 2009;29:291–300.
- [2] Brooks GF, Carroll KC, Butel JS, Morse SA, Mietzner TA. Jawetz, Melnick, and Adelberg's Medical Microbiology. 26th ed. McGraw-Hill Companies; 2013. p. 719-720.
- [3] Farthing MJ. New perspectives in giardiasis. J Med Microbiol. 1992;37:1–2.

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- [4] Parija SC. Intestinal, oral and genital flagellates. In: Textbook of Medical Parasitology (Protozoology and Helminthology). 2nd ed. All India Publisher and Distributor, Chennai; 2004. p. 62–70.
- [5] Karakas Z, Demirel N, Tarakcioglu M, Mete N. Serum zinc and copper levels in southeastern Turkish children with giardiasis or amebiasis. *Biol Trace Elem Res*. 2001;84:11–18.
- [6] Ertan P, Yereli K, Kurt O, Balcioglu IC, Onag A. Serological levels of zinc, copper and iron elements among *Giardia lamblia* infected children in Turkey. *Pediatr Int*. 2002;44:286–288.
- [7] Garcia LS. Laboratory methods for diagnosis of parasitic infections. In: Baron EJ, Finegold SM, editors. *Bailey and Scott's Diagnostic Microbiology*. 8th ed. St. Louis: C. V. Mosby; 1990. p. 776–861.
- [8] Khana LTY, Fouad PS, Haddad DN. Study on prevalence of *Giardia lamblia* among patients attending Pediatric Hospital in Kirkuk City and its effect on some hematological parameters. *Hospital*. 2017;7(4):71-73.
- [9] Alsadoon Z, Whaeeb ST, Abduwahed TK. The effect study of the gender and age on prevalence Giardiasis in Baghdad Governorate-Iraq. *Mater Today Proc*. 2021;24:10-2.
- [10] Al Saeed AT, Issa SH. Frequency of *Giardia lamblia* among children in Dohuk, northern Iraq. *EMHJ-Eastern Mediterranean Health Journal*. 2006;12(5):555-561.
- [11] Mohammed BA, Rasheed ZK, Jihad LJ, Abass KS. Frequency of *Giardia lamblia* among Iraqi children in Kirkuk governorate. *Systematic Reviews in Pharmacy*. 2020;11(12):1909-1911.
- [12] Hawrelak J. Giardiasis: pathophysiology and management. *Altern Med Rev*. 2003;8:129–142.
- [13] Saldiva SR, Silveira AS, Philippi ST, Torres DM, Mangini AC, Dias RM, et al. *Ascaris-Trichuris* association and malnutrition in Brazilian children. *Paediatr Perinat Epidemiol*. 1999;13:89–98.
- [14] Ulukanligil M, Seyrek A. Demographic and socio-economic factors affecting the physical development, haemoglobin and parasitic infection status of school children in Sanliurfa province, Turkey. *Pub Health*. 2004;118:151-158.
- [15] Squitti R, Lupoi D, Pasqualetti P, Dal Forno G, Vernieri F, Chioventa P, et al. Elevation of serum copper levels in Alzheimer's disease. *Neurology*. 2002;59:1153–1161.
- [16] Culha G, Sangun MK. Serum levels of zinc, copper, iron, cobalt, magnesium, and selenium elements in children diagnosed with *Giardia intestinalis* and *Enterobiosis vermicularis* in Hatay, Turkey. *Biol Trace Elem Res*. 2007;118:21–26.
- [17] Delibas N, Aydemir M, Ayata A, Demirci M, Tarhan V. Serum Fe, Zn, Cu and SOD activity levels in children with giardiasis. *Acta Parasitol Turcica*. 1996;20:25–9.
- [18] Demirci M, Delibas N, Altuntas I, Oktem F, Yonden Z. Serum iron, zinc and copper levels and lipid peroxidation in children with chronic giardiasis. *J Health Popul Nutr*. 2003;21:72–75.

- [19] Roxstrom-Lindquist K, Palm D, Reiner D, Ringqvist E, Svard SG. Giardia immunity—an update. Trends Parasitol. 2006;22:26–31.
- [20] Gunduz Z, Yavuz I, Koparal M, Kumandas S, Saraymen R. Serum and cerebrospinal fluid zinc levels in children with febrile convulsions. Acta Paediatr Jpn. 1996;38:237–41.