
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: Giardiaiasis, Iron, Zinc, Copper, Children.
الخلاصة:
الجيارديا هي عدوى في الأمعاء الدقيقة، وتسببها طفيلي مجهري يسمى الجيارديا اللامبلية. فحصنا في هذه الدراسة عينات البراز لـ75 طفلًا يتراوح أعمارهم بين 1 و 12 عامًا 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 الزكري الكشف عن الكيس أو التروفووزيتي من الجيارديا اللامبلية، أيضًا قمنا بتقييم 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 

الكلمات المفتاحية: داء الجيارديا، الحديد، الزنك، 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>
<thead>
<tr>
<th>Sex</th>
<th>No. of stool samples examined</th>
<th>Percentage of stool samples examined</th>
<th>No. of a positive sample</th>
<th>Percentage of positive sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>42</td>
<td>56</td>
<td>29</td>
<td>38.7</td>
</tr>
<tr>
<td>Females</td>
<td>33</td>
<td>44</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
<td>50</td>
<td>66.7</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Age groups</th>
<th>No. of the infected group</th>
<th>percentage of the infected group</th>
<th>percentage of control group</th>
<th>No. of the control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>9</td>
<td>18</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4-6</td>
<td>22</td>
<td>44</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>7-9</td>
<td>11</td>
<td>22</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>10-12</td>
<td>8</td>
<td>16</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Infected group Mean± SD</th>
<th>Control group Mean± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>41.24±6.21</td>
<td>78.91±6.73</td>
</tr>
<tr>
<td>Zinc</td>
<td>79.32±5.78</td>
<td>80.77±6.22</td>
</tr>
<tr>
<td>Copper</td>
<td>58.84±5.97</td>
<td>89.34±6.71</td>
</tr>
</tbody>
</table>

Table 3.

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


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