



## Original Article

# Prevalence of *Entamoeba Histolytica* and *Giardia Lamblia* in Children Visiting to Heevi Pediatric Hospital in Dohuk City, Kurdistan Region, Iraq

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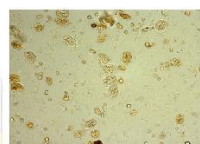
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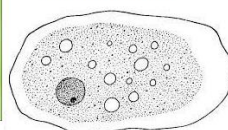
## ABSTRACT

*Entamoeba histolytica* and *Giardia lamblia* are considered as two of the most widely distributed gastrointestinal protozoan parasites in the world, especially in underdeveloped nations, where they cause serious health issues in the form of amebiasis and giardiasis, respectively. The fecal-oral pathway describes the way in which both protozoa are transmitted, specifically through the consumption of tainted food or water. This study was conducted from January 2020 to December 2021 at Heevi Paediatric Hospital in Dohuk City, Kurdistan Region, Iraq, to determine *E. histolytica* and *G.lamblia* prevalence among children presenting with symptoms of diarrhoea. The direct swab of stool approach was used to analyze 2132 samples. Patients' ages ranged from less than 1 year old to over 12. According to the findings, the *E. histolytica* infection prevalence rates were 147(14.4%) and 188 (16.9%), respectively, in 2020 and 2021. Furthermore, the prevalence rates of *G.lamblia* were found to be 11.1% and 1.2%, respectively, with a statistically significant rate ( $P<0.01$ ). Intestinal parasite infections were shown to be substantially linked to both age and gender, with *E.histolytica* and *G.lamblia* infections being more common in males than females. In addition, the prevalence rates of *E.histolytica* and *G.lamblia* infection were found to be the highest and the lowest in age groups less than 1 year old and over 12, respectively, with statistical significant rate ( $P<0.05$ ). Protozoal infections are especially common in infants and young children since they have not yet acquired a fully functional immune system. To reduce the incidence of intestinal protozoan parasites, which can cause a wide variety of diseases, it is crucial to improve health conditions.

## GRAPHICAL ABSTRACT



Giardia Lamblia



Entamoeba Histolytica

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## Introduction

One of the most prevalent serious health issues affecting more than three billion people globally is the prevalence of gastrointestinal protozoan parasites [1-7]. The children and infants are the majority of infection among people, and according to the World Health Organization (WHO) [8]; these parasites are present in more than 450 million newborns and children worldwide [9]. The most prevalent intestinal parasites are *Giardia lamblia* and *Entamoeba histolytica*. In poor nations, these infections are frequently and widely present. They are in charge of deadly serious illnesses, which eventually cause issues with public health [10].

Amoebiasis, or amoebic dysentery, is an infection caused by *Entamoeba histolytica* which mainly causes diarrhea or dysentery in infants in developing countries. Every year, more than 100,000 of children die from amoebiasis [11, 12]. *Entamoeba histolytica* is typically transmitted through the fecal-oral route, which involves drinking or consuming food or water that has been infected with a protozoan cyst. Furthermore, it can spread by direct contact with people, fresh produce, dirt, swimming in contaminated water, and living in areas where the disease is endemic [13, 14]. The high prevalence of *Entamoeba histolytica* infections are frequently linked to certain risk factors, including as insufficient diet, poverty, and lack of health care.

The most typical signs of infections with *Entamoeba histolytica* include bloody diarrhea, severe dysentery, weight loss, physical exhaustion, weariness, and abdominal discomfort [15]. Infection with *Entamoeba histolytica* that are asymptomatic is more dangerous than symptomatic infection because negligence will lead to serious amoebic dysentery and associated negative implications. Trophozoites are a non-invasive infection found in the gut lumen that frequently only affects asymptomatic individuals. In some cases, trophozoites with clinical signs infiltrate the intestinal mucosa (intestinal disease) or spread to extra-intestinal locations like the brain, liver, and lungs through the bloodstream (extra-intestinal disease). *Aamoeba*

can infect the liver and liver abscess can be resulted if left untreated become life-threatening. In some cases, the cytoplasm of an amoeba cell contains swallowed red blood cells. In the large intestine (colon), *Entamoeba histolytica* can be present without causing disease [16]. In the presence of hygienic conditions and other crucial health components, the infection may clear on its own without threatening the patient's life. The protozoan *Giardia lamblia* is a flagellate that infects various hosts. In developed nations, *Giardia lamblia* prevalence ranges from 2% to 5%, whereas in developing nations, the incidence is significantly higher-it is typically greater than 30%. By absorbing the mature cysts of the parasite while eating food through the fecal-oral pathway, this parasite can get infected [17]. In developing countries, *Giardia lamblia* is very common as a result of unsanitary conditions and low water quality control. The most common age group for this parasite infection, according to epidemiological studies, is children under 12 years old [18]. *Giardia lamblia* can cause various symptoms, such as diarrhea, steatorrhea, bloating, abdominal pains, pale, oily feces, gas, and weight loss.

Nausea and vomiting are occasionally possible symptoms. Lactose intolerance may result from an active or severe case of giardiasis and may persist for several months even after the parasite (*giardia lamblia*) has been treated [19]. *Giardia lamblia* can cause anemia and malnutrition by preventing the absorption of iron, vitamins, minerals, proteins, lipids, and carbs during its reproductive cycle in the digestive tract of its host [20]. The most commonly infected individuals are children and newborns who are malnourished as a result of this protozoan, with weight loss and stunted growth being the most typical indications of their infection. Anemia can result from a generalized parasite infection that also has intestinal symptoms and from other physical and mental issues like weight loss and slowed growth in children.

Related to the previously mentioned issues, the purpose of the current investigation to establish the prevalence of *Giardia lamblia* and *Entamoeba histolytica* regardless of age and sex in 2132

children's referred to Heevi paediatric Hospital in Dohuk, Iraq, during 2020 and 2021.

## Materials and Methods

### Sampling and study design

From January 2020 to December 2021, stool samples from 2132 children, who had primary enteritis and clinical indications of diarrhea, were taken from the Heevi Pediatrics Hospital. Sterile plastic bottles that have been labeled with particular personal data such as name, age, gender, and collecting date, were used to collect these samples.

### Stool sample processing

The features of feces were documented, including their hues (yellow, brown, semi-brown, and greenish) and textures (mucous, serous, viscous, and bloody). A direct saline technique made with sodium chloride solution containing 0.9 percent was used to analysis the samples under a light microscope. A tiny bit of recently passed feces was placed on a glass slide along with a drop of physiological saline or lugol's iodine solution. This slide was carefully inspected under the microscope using the direct smear method to check for the presence of cysts or trophozoites. The textures (mucous, serous, greasy, and

bloody) and various colors (brown, yellow, semi-brown, and greenish) of the stools were noted (17).

### Statistical analysis

The significant relationship was determined using the Chi-square test in SPSS version 25 (IBM Franklin D. Roosevelt, New York, NY), with a p-value less than 0.05 indicating significance.

## Results and Discussion

Between January 2020 and December 2021, stool examinations were performed on a total of 2132 patients who attended Heevi Paediatric Hospital in Duhok City. The numbers of parasitic infections with *E. histolytica* and *G. lamblia* throughout this period are listed in Table 1. In 2020, 1020 samples were investigated, and it was found that 147 (14.4%) of those samples had *E. histolytica* infections, which was more than the 12 (1.17%) samples that had *G. lamblia* infections and differences were statistically significant ( $P < 0.01$ ) at the probability level. In 2021, 1112 samples were investigated, and 188 (16.9%) of those samples tested positive for *E. histolytica* infection. This number was greater than the infection rate for *G. lamblia* 14 (1.25%), and the differences were statistically significant ( $P < 0.01$ ).

**Table 1:** Number of *E. histolytica* and *G. lamblia* infections from 2020 and 2021

Parasite species	<i>E. histolytica</i> Found/total	<i>G. lamblia</i> Found/total	P-value
2020	147/1020	12/1020	$P < 0.01$
2021	188/1112	14/1112	
Total	335/2132	26/2132	

**Table 2:** *E. histolytica* and *G. lamblia* infection with respect to age group between 2020 and 2021

Age group (years)	2020		2021	
	No. of <i>E. histolytica</i> % Found/total	No. of <i>G. lamblia</i> % Found/total	No. of <i>E. histolytica</i> Found/total	No. of <i>G. lamblia</i> % Found/total
Less than 1 years old	48/147 (32.6)	4/12 (33.3)	71/188 (37.7)	3/14 (21.4)
1-2	45/147 (30.6)	3/12 (25)	63/188 (33.5)	4/14 (28.5)
2-4	21/147 (14.2)	2/12 (16.6)	28/188 (14.8)	2/14 (14.2)
4-6	19/147 (12.9)	2/12 (16.6)	15/188 (7.9)	2/14 (14.2)
6-12	11/147 (7.4)	1/12 (8.3)	9/188 (4.7)	3/14 (21.4)
Up to 12	3/147 (2.04)	0/12 (0%)	2/188 (1.06)	0/14 (0%)

**Table 3:** *E. histolytica* and *G. lamblia* infection with respect to gender between 2020 and 2021

Years	No. % of <i>E. histolytica</i> Found/total	No. % of Males Found/total	No. % of Females Found/total	No. % of <i>G. lamblia</i> Found/total	No. % of Males Found/total	No. % of Females Found/total	P-value
2020	147/1020 (14.4)	80/147 (54.4)	67/147 (45.5)	12/1020 (1.1)	9/12 (75)	3/12 (25)	P<0.05
2021	188/1112 (16.9)	118/188 (62.7)	70/188 (37.2)	14/1112 (1.2)	11/14 (78.5)	3/14 (21.4)	
Total	335/2132 (15.7)	198/335 (59.1)	137/335 (40.8)	26/2132 (1.2)	20/26 (76.9)	6/26 (23.07)	

The examination of the correlation between the age and *E. histolytica* and *G. lamblia* infections in 2020 and 2021 is indicated in Table 2. In 2020, the age groups of 0-1 year old 48 (32.6%) and above 12 years 3 (2.04%) reported the highest and lowest prevalence rates of *E. histolytica* infection. Between the infection with *E. histolytica* and various age groups, the infection rate was statistically significant ( $P<0.01$ ).

In addition, there was no infection in the 12-and-older age group, while *G. lamblia* showed the highest rate of infection in the under-1-year-old population (33.3%). However, the differences were not statistically significant. Furthermore, with minor modifications, infection prevalence rates in 2021 were similar to those in 2020. The prevalence of *E. histolytica* infection was highest and lowest in those under 1 year old (71.7%) and those over 12 (1.06%), respectively. Moreover, there was a statistically significant association between the rate of infection and various age groups for *E. histolytica* ( $P<0.01$ ). Similarly, there was a 4 (28.5%) frequency of *G. lamblia* in children aged 1-2 years old, but no infections in children aged 12 and over; this difference was statistically not significant.

Table 3 provides the link between *E. histolytica* and *G. lamblia* infections with respect to gender in 2020 and 2021. The data showed that the infection was found more common in male than in female. Males were more likely to be infected with *E. histolytica* in 2020, at 80 (54.4%), than females, at 67 (45.5%). In addition, with a statistically significant rate ( $P<0.05$ ), the prevalence of *G. lamblia* infection was higher in males 9 (75%) than in females 3(25%). The analysis of 2021 data showed that the prevalence

of *E. histolytica* was higher in men 118 (62.7%), compared to women 70 (37.2%). *G. lamblia* infection prevalence was greater in males 11 (78.5%) than in females 3 (21.4) at a statistically significant rate ( $P<0.05$ ).

It is well established that Intestinal parasitic infections (IPIs) are a global burden, due to increased morbidity and mortality [21, 22]. According to the World Health Organization (WHO), there are currently more than 2 billion people harboring IPI worldwide [23]. Poor deprived communities that suffer with low socioeconomic and educational status, where sewage management and improper waste, limited access to clean water supplies, poor hygiene habits, and ignorance of appropriate personal practices are more likely to propagate IPI dissemination [24, 25].

Table 2 presents the findings of the assessment of link between infection and age with *E. histolytica* and *G. lamblia* between 2020 and 2021. In 2020, the age groups less than 1 year old and over 12 exhibited the highest and the lowest rates of prevalence of *E. histolytica* infection. Moreover, the age group under 1 year old had the largest *G. lamblia* infection, and the age group over 12 had no infections. In addition, with some variance, the rate of infection prevalence in 2021 was similar to that in 2019. Age groups less than one year old and over 12 had the highest and lowest rates of *E. histolytica* infection, respectively. Furthermore, *G. lamblia* prevalence was in the age group of 1-2 years old and no infection was found in the age group of over 12.

These results were similar to those studies which reported that the prevalence rates of *E. histolytica* was 15.6% in preschool children in Bangladesh

[26], and 11% in children of Delhi, India, and Pakistan [27, 28] and 21.0% in seven villages of Malaysia [29]. Similar results were also found in Al-Karamah Teaching Hospital and in Ibn Al-Atheer Hospital in Iraq by [30, 31]. The reason of infection prevalence is high in the children among this age group may be due to their poor health and decreased resistance when compared to the older people. Furthermore, the fact that the crucial defense systems of these children are not fully developed makes it more difficult for them to fight off disease. Consequently, compared to the older people, they become more susceptible to parasites. Moreover, inadequate water supply, poor hygiene, toilet training, climatic conditions, huge populations, and the lack of social support are some factors that play the important roles in the prevalence of *E. histolytic* and *G.lambli*a infection [13, 16, 31].

These findings were similar with those of other investigations which obtained that diarrhea occurrence in males was higher than in females [32]. In addition, our data in accordance with other studies such as Obadiah (2012) obtained that the prevalence rates of *E. histolytica* were 48.8% and 34.44%, respectively, in males and females [33]. Moreover, other studies shows that the prevalence of this disease is higher in males than in females (27.7% and 24.3%, respectively) [34]. The fact that males are more likely than females to have parasite illnesses may be the cause of a higher incidence of *E. histolytica* in males. This is a result of inadequate immunity in male, who typically display an infection that is more severe than in female [35].

These variations in immune reactions to infection are brought about by variations in environmental factors and physiological factors with hormonal roots [36]. Variations in the interplay between the endocrine and immune systems can be further used to explain these differences in infection between the sexes. Likewise, sex steroids, especially male androgens and female estrogens, modulate many aspects of host immunity, and androgens reduce immunological competence [37]. Males are more susceptible to diseases because of steroid hormones' impact on disease-resistant genes and behaviors [35]. In

females, the lower prevalence may also be due to the increased concern for healthcare [16].

## Conclusion

In this work, it was shown that intestinal parasite infections were significantly related to age and sex, with *E.histolytica* and *G.lambli*a infections being more common in men than women. Likewise, the prevalence of *E.histolytica* and *G.lambli*a infection was the lowest in the age groups of less than 1 year old and more than 12 years old, respectively ( $P<0.05$ ). Protozoan infections are especially common in infants and young children, as they have not yet developed a fully functional immune system. To reduce the incidence of protozoan intestinal parasites that can cause various diseases, improving health conditions is very important.

Improved community health education is required, with sanitation, cleanliness, and purification of drinking water being the key components of community health, to avoid infection with *E. histolytica* and *G. lamblia*.

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## Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

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