



them using a variety of diagnostic techniques, including as microscopy, genetic approaches, and antigen detection, to ascertain the presence of *G. lamblia* and *E. histolytica*.<sup>[5]</sup> These epidemiological studies' findings have demonstrated that various populations have unique infection rates. It has been found that variables such as age, gender, location, and socioeconomic status affect how common certain parasites are. As an example, children are more prone to contract *G. lamblia* and *E. histolytica* in areas with poor sanitation and restricted access to clean water.<sup>[6,7]</sup> *G. lamblia* and *E. histolytica* infections are prevented and controlled through a variety of regulations such as enhancing sanitation and hygiene practices, guaranteeing access to clean water, encouraging health awareness and education, along with putting in place suitable treatment plans for afflicted parties.<sup>[8]</sup> A serious public health problem is the increasing rate of *E. histolytica* and *G. lamblia* outbreaks worldwide. In order to reduce the impact of these diseases on affected communities, it is essential to comprehend the variables that lead to the prevalence of these parasites and to create efficient prevention and treatment techniques.<sup>[9]</sup> The study's goal was to provide light on the distribution of *giardia lamblia* and *entamoeba histolytica* infections in Iraq's southern governorates.

## MATERIALS AND METHODS

The current retrospective cohort study investigation's goal is to look at the geographic and temporal distribution of reported cases of *G. lamblia* and *E. histolytica* infections in the Southern Governorates of Iraq. Between January 2022 and December 2022, data for this study were collected from Iraqi teaching hospitals. By employing microscopic analysis, we were capable of to verify the Giardia and Entamoeba species diagnoses by microscopic direct smear by taking about 2 mg for each stool sample and mixed with a drop of normal saline (0.9%) and iodine on a glass slide which covered by a cover glass carefully and examined by light microscope. A total of 2000 patients responded to this survey.

### The study area

The provinces with the highest incidence of site infection were Thi-Qar, Miasan, Basra, and Wasit, which accounted for 100% of all cases. The data were further broken down by patient gender and seasonality (January-December). Group 1 included instances younger than a year old; Group 2 included cases between 1 and 4 years old; Group 3 included cases between 5 and 14 years old; Group 4 included cases between 15 and 44 years old; and Group 5 included patients above 45 years old.

### Ethical approval

All enrolled patients' parents or careers signed a written illustrative consent form. The Declaration of Helsinki's ethical guidelines for the medical research involving human subjects were strictly adhered to in the conduct of the present investigation (2013). The Department of Medical Laboratory Techniques at Shatra Technical College, Southern Technical University, granted approval for ethics through its research committee.

## Statistical analysis

To evaluate the variations in prevalence by gender, age group, and geographic location, the Chi-square test was employed utilizing the version 26 of SPSS (SPSS Software, Inc., Chicago, IL, USA).

## RESULTS

### The prevalence of *E. histolytica* and *G. lamblia* among socio-demographic characteristics

The data reveals the distribution of confirmed cases based on age, with 5.3% in the age group of 1, 34.9% in the age group of 1-4, 25.7% in the age group of 5-14, and 33.0% in the age group of 45 or older. The outcome also indicates the proportion (%) of confirmed cases based on gender, with 100% for males and 100% for females.

### The geographical distribution of *Entamoeba histolytica* and *Giardia lamblia* infections among southern surveyed provinces

The study assessed the geographic distribution of parasites and found that in every governorate, *E. histolytica* was more widespread compared to *G. lamblia*. According to the research findings, the prevalence of *E. histolytica* in Wasit Governorate is higher than in the other governorates studied in study number 532 (26.6%), as shown in Table 1. While the prevalence of *G. lamblia* is generally lower than that of *E. histolytica*, the results of this study showed that the prevalence of *G. lamblia* was higher in Maysan Governorate than in the other governorates, namely in number 168 (8.4%), as shown in Table 2. *E. histolytica* and *G. lamblia* prevalence rates were determined to be 5.9% and 2.8%, respectively, within Thi-Qar Governorate [Figure 1].

### The incidence of *Entamoeba histolytica* and *Giardia lamblia* infections in the investigated population, with emphasis on variations in the seasons

The results of this study revealed that *E. histolytica* is more common than *G. lamblia* in the winter, spring, summer and autumn seasons. *G. lamblia* infection rates were 2.4% in the winter, 27.1% in the spring, 2.7% in the summer, and 13.9% in autumn, respectively, whereas *E. histolytica* incidence percentages were 24.6% in the winter and 3.5% in the summer. The findings revealed that the number of cases of *E. histolytica* is greater in the spring compared in other seasons, with an overall incidence of 27.1%. Springtime brings with it a 3.5% incidence rate of *G. lamblia*, which exceeds in previous seasons [Table 3 and Figure 2].

**Table 1: The prevalence of *E. histolytica* and *G. lamblia* among socio-demographic characteristics (age, sex)**

Age (years)	Percentage (%) of confirmed cases	Sex	Percentage (%) of confirmed cases
1>	5.3% (106)	Male	100% (1000)
1-4	34.9% (698)	Female	100% (1000)
5-14	25.7% (514)		
45 ≥	33.0% (660)		

**The incidences of *Giardia lamblia* and *Entamoeba histolytica* infections among southern provinces that had been examined divided into age groups**

It is obvious that the parasite *E. histolytica* exceeds *G. lamblia* in all age groups according to the age groups covered in this study, which ranged across individuals older than 1 year to those who are 45 or younger. At prevalence rates of 3.8% and 1.5%, respectively, *E. histolytica* is more common in adults over the age of 1 year compared to *G. lamblia*. Among children 1–4 years old, *E. histolytica* is more prevalent than *G. lamblia*, exhibiting the incidence rates of 31.3% and 3.6%, respectively. This indicates that across all age categories, *E. histolytica* is the most widespread. Regarding children aged 5–14 years, *E. histolytica* is more common in comparison with *G. lamblia*, with incidence rates of 22.3% and 3.4%, respectively. The overall incidence of *E. histolytica* is significantly higher among individuals over 45 years of age and older than that of *G. lamblia*, reaching rates of 28.9% and 4.1%, respectively. The data presented in Table 4 demonstrate that compared to other age groups, children between the ages of 1 and 4 years had an elevated incidence of *G. lamblia*.

**The proportion of infections with *Entamoeba histolytica* and *Giardia lamblia* in southern regions, with an emphasis on the spread of these diseases by gender**

The results of the research indicated that, with proportions of 58.96% and 69.2%, respectively, males are more probable compared to females to be infected with *E. histolytica*. The data suggests that *G. lamblia* is more common in men than in women, with a documented incidence of 41.04% in men versus 30.8% in women. In comparison to *G. lamblia*, Table 5

highlights that *E. histolytica* appears to be more prevalent in both genders.

**DISCUSSION**

The incidence of *E. histolytica* and *G. lamblia* in the southern districts of Iraq was measured in a survey carried out in 2022.

**Table 2: The prevalence of *Entamoeba histolytica* and *Giardia duodenalis* among sociodemographic characteristics (age and sex)**

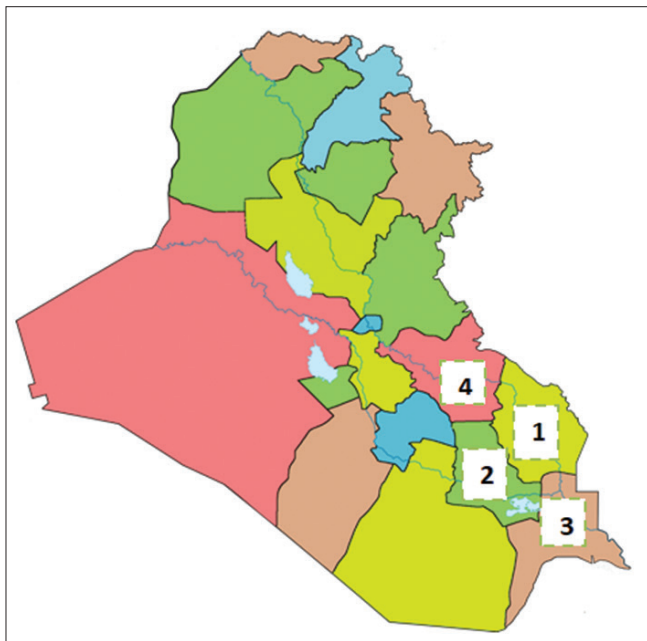
Age (years)	Percentage of confirmed cases	Sex	Percentage of confirmed cases
<1	106 (5.3)	Male	1000 (100)
1–4	698 (34.9)	Female	1000 (100)
5–14	514 (25.7)		
≤45	660 (33.0)		

**Table 3: The changing seasons in the examined population's infections with *Giardia duodenalis* and *Entamoeba histolytica***

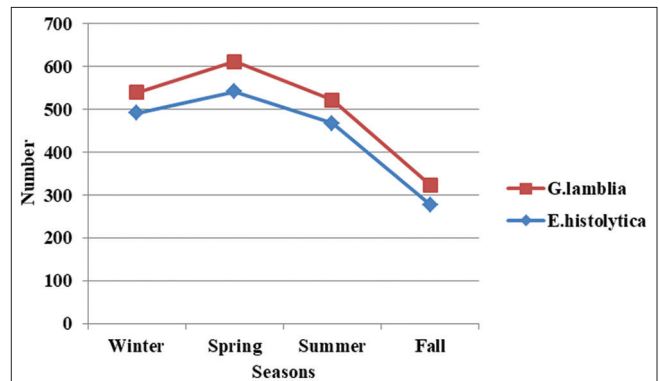
Season	Number of positive cases (%) among seasonal distribution	
	<i>Entamoeba histolytica</i>	<i>Giardia duodenalis</i>
Winter	492 (24.6)	48 (2.4)
Spring	542 (27.1)	70 (3.5)
Summer	468 (23.4)	54 (2.7)
Fall	278 (13.9)	46 (2.3)

**Table 4: The percentage of infections with *Giardia duodenalis* and *Entamoeba histolytica* by age group in the southern provinces under the study**

Age (years)	Age related percentage of confirmed cases	
	<i>Entamoeba histolytica</i>	<i>Giardia duodenalis</i>
<1	76 (3.8)	30 (1.5)
1–4	626 (31.3)	72 (3.6)
5–14	446 (22.3)	68 (3.4)
≤45	578 (28.9)	82 (4.1)



**Figure 1:** The geographic distribution on the map (1 – Miasan, 2 – Thi-Qar, 3 – Basra, 4 – Wasit)



**Figure 2:** Number of positive cases (%) among seasonal distribution

**Table 5: The prevalence of *Giardia duodenalis* and *Entamoeba histolytica* infections by sex in the southern regions that were assessed**

Gender	Number of positive cases (%) among sex	
	<i>Entamoeba histolytica</i>	<i>Giardia duodenalis</i>
Male	1179.0 (58.96)	821.0 (41.04)
Female	1384.0 (69.2)	616.0 (30.8)

The results of the investigation showed that the infection rates associated with *E. histolytica* were considerably greater than those of *G. lamblia*. The reason for this variation is probably because cysts are more active in their surroundings. The results of our study agreed with those reported by Al-Khaysee and Sultan (2008) and Al Warid (2012).<sup>[10-12]</sup> Environmental, nutritional, socioeconomic, geographical, and demographic and health-related factors can all influence the prevalence of *G. lamblia* and *E. histolytica* identified in various study investigations. However, it is important to remember that *G. lamblia* is more prevalent than *E. histolytica* according to various researches. The observed variations in frequency highlight the complex characteristics of intestinal protozoal parasites and emphasize the need for more study to improve the understanding of the factors determining their prevalence.<sup>[13-15]</sup> There were notable differences in the global prevalence of *G. lamblia* and *E. histolytica*. For example, proportions were higher in the central and northern sectors than in the Southern and Middle Euphrates regions. Numerous ecological factors that affect the mode of transmission can be linked to the reported geographic distribution of various intestinal parasite species. Furthermore, it is critical to keep in mind that differences in the nations' rates of economic expansion and living standards could contribute to the observed patterns of development. The results we obtained match with a study conducted by Bisht *et al.* that demonstrated the influence of geographical region on the incidence of infections caused by parasites.<sup>[16,17]</sup> It was found that seasonal variations had a major effect on *G. lamblia* and *E. histolytica*. Rates of infections were higher in the winter and spring seasons. The results of this study fit in with past research indicating that these parasites seem more common during the periods of elevated rainfall. The infectivity of *Giardia* and *Entamoeba* cysts has also been shown to persist longer in cooler seasons than in hotter ones.<sup>[18,19]</sup> Both gender and age significantly influenced the incidence of *G. lamblia* and *E. histolytica* in this research population. The age group of 15–44 years old accounts for the largest percentage of samples that test positive for these parasites. The increased likelihood that people in this age range will take part in a variety of occupational activities that increase their vulnerability to infection through contact with polluted soil, water, and food sources could be the explanation for this phenomenon. An increased prevalence of various gastrointestinal parasite infections has also been shown in earlier research on people between the ages of 15 and 44 years. However, there was no statistically significant

correlation found between infection rates and age.<sup>[20]</sup> Gender significantly impacted the prevalence of these protozoan parasites in our sample. The percentage of positive cases was greater in the male population. Males may be more susceptible to unhygienic circumstances outside during varied activities than females, who tend to spend a larger percentage of their time home. This could explain the phenomenon that has been observed. The outcome is in line with what other investigations have found.<sup>[21]</sup> Furthermore, molecular tools will assist and improve the detection of *G. lamblia* and *E. histolytica*, with higher sensitivity and specificity.<sup>[22]</sup>

## CONCLUSION

According to our findings, *E. histolytica* is more frequent in the studied population than *G. lamblia*. Long-term initiatives to improve sanitary and living conditions must be launched immediately in high-prevalence areas. These approaches have the potential to decrease parasite damage. Parasite prevalence can also be reduced through health and education programmed. By fostering healthy habits, these programmed may help reduce the prevalence of *E. histolytica* and *G. lamblia*. Our data suggest that *E. histolytica* is more frequent than *G. lamblia* and that thorough control strategies must be implemented immediately. In addition to health and education programmed, better sanitation and living conditions can help to lessen the parasites' detrimental effects on the community under the study.

## Acknowledgements

We would like to thank the environmental health units' workers in Teaching Hospital of Southern Governorates, and we most grateful to the laboratory staff of the Department to protect and improve the environmental in the southern governorates. We express our gratitude to the College of Veterinary Medicine at the University of Fallujah for providing the motivation to do this research.

## Financial support and sponsorship

Self-funded by authors.

## Ethics Code

Not applicable.

## Conflicts of interest

The authors declare there is no conflict of interest.

## Authors' Contributions

All authors were contributed in designing, lab experiments, analysis, writing the article, and approved the final version of it.

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