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Distribution Patterns and Risk Factors of Intestinal Parasites Among Different Populations in Duhok Province, Iraq

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Abstract

Enteric infections are a major public health concern worldwide, and they are more common in places with insufficient water sources, poor sanitation, low socioeconomic situations, and poor hygiene habits. Most causes of enteric infection may be due to *Giardia lamblia, Entamoeba histolytica,* and some helminths have a serious role in intestinal disease. The present study aimed to investigate the frequency of intestinal parasites (eggs and cysts) in various age groups and sexes with respect to the level of sanitation and personal hygiene in different levels of education, according to the source of eating and drinking of people in different areas in Duhok province. Outpatients with diarrhea and other gastrointestinal disorders provided stool samples. at the Kurdistan Region of Iraq's Duhok area, at nine teaching and private hospitals: Azadi and Heevi Pediatric, Amedi, Semel, Shekhan, Sidra, Vin, Awni, and Ghazi. The faeces specimens that were obtained were analyzed macroscopically for composition and consistency before being studied under a microscope using the direct wet mount technique. Infection with an intestinal parasite was recorded in about 849 (28.3%) positive from the 3000 examination specimens. The highest rate of intestinal parasite was due to *Entamoeba histolytica* 94.4 %(802/849), mostly in the age group 0–10 years (42.4%), high prevalence of amebiasis in male in center of Duhok and Shekhan about 428(50.4%), 14 (1.6%) from total 849 infection samples respectively and high rate of amebiasis in female in Amedia and Semel 33 (3.8%),45(5.3%) from total 849 infection samples respectively and high level of giardiasis recorded in female in center of Duhok and Semel 18(2.1%), 11(1.2%) respectively from total infection samples and these different was statistically significant p<0.05, primary levels of education about (62.1%), drinking filter water (85.9%), eating outside home (53.3%), There was a statistically significant change (p < 0.05). that is, risk factors that show elevated infection levels. According to the present research, improved health depends critically on better living conditions, clean water, and promotion of health education. This disease must be reduced among the population by implementing these measures.

Keywords: *Intestinal parasite, Prevalence, Risk factor, Entamoeba histolytica, Amebiasis*
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I. INTRODUCTION

Intestinal parasite infections are one of the biggest health risks in impoverished nations (Abed, 2024). Among school-aged children, parasitic infections are particularly prevalent (Luong, 2003). Poverty, illiteracy, poor hygiene, poor health care, poor education, a lack of clean water supply, as well as hot, humid environments play a role in intestinal parasitic infections in developing countries. The prevalence of diseases caused by protozoa and helminthic parasites affects the health of an individual (Harhay *et al*., 2010; Quihui *et al*., 2006).
There are ten most common infections in the world associated with soil-transmitted helminthes (WHO, 1987). STH, which is most common among schoolchildren, is characterized by stunted growth, iron deficiency anemia, malnourishment, and decreased physical activity (Sackey *et al.,* 2003; Stephenson *et al.,* 1998).

In poor nations, almost 600 million schoolchildren and 270 million preschoolers reside in regions where parasites are highly contagious and require prevention and treatment (WHO, 2010).

There is proof that intestinal parasites like *Entamoeba histolytica* invade host tissues both within and outside the body (Jameel *et al*., 2017). Although the great majority of infected individuals have no symptoms at all, this parasite mostly inhabits the colon and can harm the host's intestinal wall tissues. Furthermore, some helminths, such as *Ascarise lumbrical*, can cause serious morbidity and mortality, particularly in developing nations. Giardiasis, a common small intestinal infection caused by the protozoan *Giardia duodenalis* (also known as *Giardia intestinalis* and *Giardia lamblia*), is characterized by symptoms like flatulence and watery diarrhea (Hassan and Mero, 2020). One of the main causes of parasite diseases spreading to people through the

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fecal-oral pathway is poor personal cleanliness. When the soil is polluted, the eggs can spread to dust, vegetables, doorknobs, and other surfaces. From there, they can go to the hands and eventually to the mouth (Mustafa *et al*., 2001; Kagei, 1983). Cysts and eggs of intestinal parasites stick to money, instruments, vegetables, fruits, door knobs, and fingers (Ayeh-Kumi *et al.,* 2009). Additionally, flies can spread them (Abed, 2024). This survey was required to find out more about the frequency of intestinal parasite infections in Duhok province and the risk factors that are linked to them.

II. Materials And Methods

A. Samples and data collection

Outpatients visiting nine teaching and private hospitals in the Duhok area of the Kurdistan Region of Iraq provided 3000 stool samples, including (Azadi, Hevi Pediatric, Amedi, Semel, Sidra, Shekhan, Vin, Awni, and Ghazi) between January and November of 2024. The fresh stool specimens were collected in sterile containers that were fully labelled with the patient's information and clearly labelled screw-topped sample tubs.

The Duhok General Directorate of Health's ethics committee accepted the use of data and samples for this project.

Participants' demographics, including gender, age, education level, drinking water type, and food source, were taken into consideration when designing the data collection process. The samples were taken and examined macroscopically by students undergraduate Medical Laboratory Department, Faculty of Health Science, Cihan University.

B. Sample examination

The samples were analyzed macroscopically for consistency (diarrheic form, soft form, or formed form) and composition presence of blood, mucus, and helminth adults/ segments.) Examination of faeces revealed various colours, including yellow, brown, semi-brown, and greenish.

A little fleck was taken out of the sample in order to identify parasite stages like cysts and trophozoites, eggs, pus cells, red blood cells (RBCs), and epithelial cells.

On a sanitized slide, place the specimen in a drop of regular saline (0.9%). This technique can detect trophozoites in fresh fecal samples. Using a wooden stick, the two drops were thoroughly mixed before being placed under a coverslip and viewed under a light microscope at the appropriate magnifications of 10x, 40x, and 100x. To document each stage of the intestinal parasite that was seen, three slides were made from different parts of each specimen.

C. Data management and analysis

As a result, the prevalence rate was calculated as follows: Number of people infected / total number of people examined *100 = prevalence (%). An Excel spreadsheet was created, and the data imported into SPSS version 25 analyzing the data, we calculated the frequencies of each variable. Using a Chi-square ($\chi 2$) test, the prevalence of parasite infection was examined to determine whether there were any parameters that indicated a statistically significant relationship between intestinal parasite infection and risk factors at the $p < 0.05$ level.

III. Results

About 849 (28.3%) of the 3000 stool specimens that were analyzed macroscopically and microscopically for the presence of intestinal parasites such as *Entamoeba spp., Giardia lambilia*, and ova of *H. nana* were found to be positive. The positive *Entamoeba* (cysts/trophozoites) were found in 802 (94.4%), *Giardia lambilia* 41(4.8%), and ova 6 (0.7%) in different areas in Duhok province.

The prevalence of intestinal parasites as amoebiasis and giardiasis, among age groups was different. Overall, 28.3% of the specimens were positive for intestinal parasite, age between (0-10) were 42.4% and (11-20) 13.1%, (21-30) 14.2%, (30>) 30.1% correspondingly, the age-group disparities in infection rates were statistically significant ($p < 0.05$) (Figure 1).

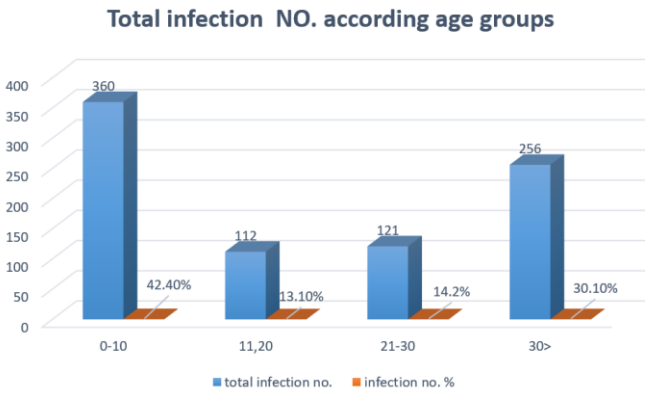

Figure 1. Prevalence of intestinal parasites according to different age groups. Chi-square statistic: 198.45. ($p<0.05$).

The data showed (Table 1) that the prevalence of intestinal disease by *E. histolytica* and *G. lambelia*, ova of *H. nana* in different area as (Center of Duhok, Amedia, Semel, Shekhan) with different gender female and male which is determine high prevalence of amebiasis in male in center of Duhok and Shekhan about 428(50.4%),14 (1.6%) from total 849 infection samples respectively and high rate of amebiasis in female in Amedi and Semel 33 (3.8%),45(5.3%) from total 849 infection samples respectively and high level of giardiasis recorded in female in center of Duhok and Semel 18(2.1%), 11(1.2%) respectively from total infection samples and these different was statistically significant $p<0.05$.

The data revealed that the distribution of intestinal parasites among people in different areas was varied, and the highest number was in Duhok (730), followed by Semel (59), Amedi (33) and Shekhan (27), as shown in Figure 2.

The data showed that the prevalence of amebiasis and giardiasis according different level of education which is showed primary school have high level of infection 197(62.10%) from total 317 according level of education and high school 51(16.0%) from total infection no., collage 69(21.7%) and these different was statistically significant $p<0.05$. (Figure 3).

Table 1. Distribution of intestinal parasites among the population in different areas by gender.

Area	Type of parasites	Gender	Total infection No.	Total infection No.%	Total infection No. according area	Infection No.% according to area
Duhok	*Entamoeba histolytica*	Male	428	50.4%	730	58.6%
		Female	280	32.9%		38.3%
	Giardia lamblia	Male	1	0.1%		0.1%
		Female	18	2.1%		2.4%
	Ova of H. nana	Male	1	0.1%		0.1%
		Female	2	0.2%		0.2%
Amedi	*Entamoeba histolytica*	Male	0	0	33	0
		Female	33	3.8%		100%
	Giardia lamblia	Male	0	0		0
		Female	0	0		0
	Ova of H. nana	Male	0	0		0
		Female	0	0		0
Semel	*Entamoeba histolytica*	Male	0	0	59	0
		Female	45	5.3%		76.2%
	Giardia lamblia	Male	0	0		0
		Female	11	1.2%		18.2%
	Ova of H. nana	Male	2	0.2%		3.3%
		Female	1	0.1%		1.6%
Shekhan	*Entamoeba histolytica*	Male	14	1.6%	27	51.8%
		Female	2	0.2%		7.4
	Giardia lamblia	Male	11	1.2%		40.7
		Female	0	0		o
	Ova of H.nana	Male	0	0		o
		Female	0	0		o
Total					849	

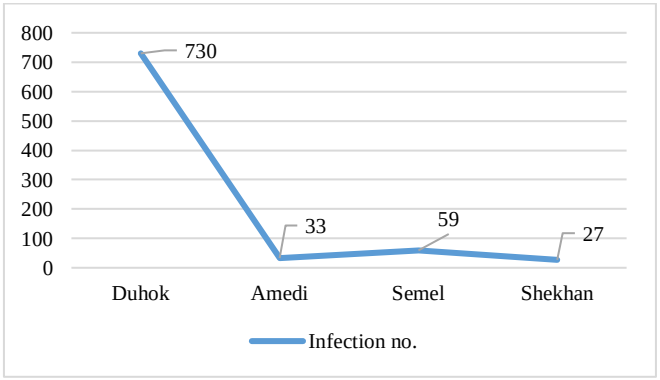

Figure 2. Infection numbers of parasites in different areas.

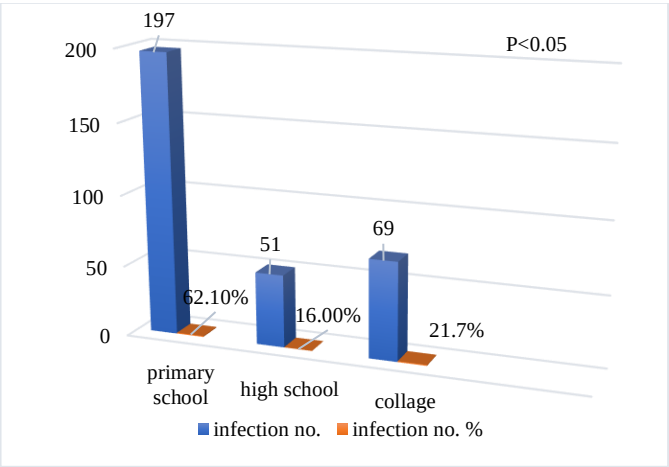

Figure 3. Infection rate of parasites according level of education.

The relationship between intestinal parasites (amebiasis, giardiasis) and some variables, people who eat mostly outside the home showed a higher rate of infection compared to eating inside the home, 453 (53.3%), 394 (46.4%), respectively. However, these results were statistically not significant p>0.05. In this study, people who used filtered water had a higher prevalence of 730 (85.9%) compared with those who drank tap water, 119 (14.0%), p<0.05. (Table 2).

Table 2. Population-level prevalence of amebiasis and giardiasis with ova in connection with certain factors.

Variables	Infection no.	Infection no.%	P value
Eating (Food)	849		
Inside	394	46.4%	p>0.05
Outside	453	53.3%	
Source of Water	849		
Tap water	119	14.0%	P<0.05
Filter water	730	85.9%	

IV. Discussion

Approximately 849 (28.3%) of the 3000 stool specimens examined under a microscope revealed intestinal parasites like *Giardia lambilia*, *Entamoeba spp*., and ova. Numerous studies on intestinal parasite prevalence have been carried out globally, and they have found that infection rates vary based on the geographic locations, hygiene habits, and living situations of the population (Alharazi *et al.,* 2020). It is essential to examine illnesses that endanger human health across the world. As a result, epidemiological research on the incidence of intestinal parasite infections in various locations has traditionally aimed to identify risk categories and illnesses that may represent a significant hazard to human populations (Saida, 2016).

Many factors, such as sources of food and drinking water, educational level, influence infectiousness, disease transmission, and mortality rates (Coulibaly *et al.,* 2012). In endemic areas, if a patient has a fever, weight loss, appetite loss, diarrhea, or steatorrhea, an intestinal parasite should always be considered (Jameel and Eassa, 2021).

Many studies have been done in Duhok province to determine the distribution of intestinal parasitic infection and factors that affect on population. In this study identify amebiasis and giardiasis with some ova in stool samples and look at how they relate to certain risk factors in outpatients who visit the nine teaching and private hospitals in Duhok province.

In this research, 3000 samples were examination for general stool examination and 849 samples were positive for intestinal parasites, case amebiasis recorded 94.4% (802/849), giardiasis 4.8% (41/849), ova 0.7% (6/849) these high rate of intestinal parasite due to amebiasis show similarity with results of Haji and Bamarni, (2023) 47.66% while giardiasis 15.5% in additional, Hasan *et al*., (2023) also reported amebiasis higher infected than giardiasis (14.4% vs 1.1%). Moreover, the prevalence of intestinal parasites in this study, according to different areas (Duhok, Amedi, Semel, Shekhan), showed high significance (85.9%, 3.8%, 6.9%, 3.1%) respectively.

The type of participants in this study and the quantity of samples examined could be the cause of the discrepancy. The infection rate in males was higher than in females (53.8% vs 46.1%). This result agreed with previous studies conducted in Duhok by Hasan *et al.,* (2023a) and Hasan *et al*., (2023b), (67.43% vs 32.56%), (54.4%, 45.5%) respectively, and Ismail, (2018) showed a high rate of infection was found in male. In additional our result disagreed with study done in Duhok by Haji and Bamarni, (2023), (54% vs 46%) and other study reported in Erbil City, North of Iraq by Mahmood and Mustafa (2020), who approved that the infection rate of intestinal parasite was higher in females than the males. Since men are more social, and because of genetic differences controlled by microRNAs on the female X chromosome, women may also have a stronger immune system than men. Additionally, women pay closer attention to hygiene and cleaning procedures (Klein and Flanagan 2016). The age range with the highest infection rate was 0–10. 42.40% in infants and children, as these age groups are more vulnerable to illnesses due to weakened immune systems and a lack of knowledge about self-protection against contamination. These findings are consistent with a study conducted in Duhok and Zakho City by Hasan *et al.* (2023a) and Al-berfkani (2021), 54 %, 41% respectively, which also mentions that most infections of intestinal parasites occur in the age group between 0-10. Furthermore, Mahmood and Mustafa in Erbil found that the age group of 1-4 years had the highest percentage of amebiasis infection (13.8%) (Mahmood *et al.*, 2020). Our data, however, differed from Mohamed's estimate of the highest infection rate (51.7%) among Kassala, Sudan's 10–19 age group (Mohamed *et al*., 2009).

A significant association was also found between the participants' level of education and intestinal infection. Individuals with lower educational primary school (62.10%) are more likely to contract infectious illnesses than those with higher education levels (21.7%). In actuality, members of these groups consume more street food, which is frequently not hygienic or prepared properly. In addition, our results show similarity with Hassan *et al.* (2024), who found that people had the highest risk of infection in primary school (80.7%). Moreover, these results agree with a study done by Hasan *et al.* (2023a) also showed a high rate of infection in primary school, 52.66%, this increase level indicates low hygiene among students in school and more playing outside.

Participants in this study engage in unhygienic behaviors, such as those who drink tap water or filter water14% ,85%, respectively, high infection was found in this study in people who drink filter water may cause of these people mostly in young age group or have another reason for getting infection as low hygination, these results disagree with Haji and Bamarni (2023), Hasan *et al.*(2023b) which is recorded most infection rate in people consume tap water (83.0% 68.86%.) respectively. 53.3% of those who often ate food from restaurants outside of their houses or on the street had far higher infection rates; these findings are consistent with a study conducted in Duhok by Hasan *et al.* (2023a). The reasons for illness might be linked to life style situations, dirty toilets, and a lack of washing your hands before eating. These characteristics are linked to low socioeconomic level, lack of exposure to health education programs, poverty, and poor sanitation and hygiene standards. The same risk factors for the illnesses have been identified by people in the Italian, Yemeni, and Indian populations (Nath *et al*., 2015; Rinne *et al.,* 2005).

V. Conclusion

This study recorded the prevalence of intestinal parasites at 28.3% in different areas in Duhok province (Duhok, Amedi, Shekhan, Semel). This distribution is highly affected by variables including age, sex, education, water source, consumption of raw, unwashed fruits and vegetables, and eating outside the home. Therefore, improved family living situations, environmental cleanliness, and health education can significantly help lower the infection rate.

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