

## INTESTINAL PARASITES AND ASSOCIATED RISK FACTORS AMONG PRIMARY SCHOOL CHILDREN IN DUHOK CITY-KURDISTAN REGION/IRAQ

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(Received: April 26, 2022; Accepted for Publication: July 24, 2022)

### ABSTRACT

**Background:** The present study was carried out during the period from October 2021 until March 2022, to detect the presence of parasites in stool samples of primary school children.

**MATERIAL AND METHODS:** A total of 1172 diarrheic stool specimens were randomly collected from primary school children of both sexes and different ages (6-12 years) visited Azadi Teaching Hospital, Heevi Pediatric Hospital, and Kurdistan private (Maternity and Pediatric) Hospital in Duhok city.

**RESULTS:** In the current study, 40.96% (480/1172) of the examined specimens were positive for parasitic stages, they included 56.67% (272) males and 43.33% (208) females. High prevalence (40%) of intestinal parasites was reported among the age group 6-7 years. The recorded intestinal parasitic species included: *Entamoeba histolytica* which was the most dominant intestinal protozoa with infection rate of 21.67% (254/1172), followed by *Enterobius vermicularis* 13.48% (158/1172), then *Giardia lamblia* of about 5.46% (64/1172), while *Blastocystis hominis* was reported only in four children at a rate of 0.34% (1172). As regards to some sociodemographic factors, significant correlations ( $P < 0.05$ ) were observed between the rates of infection with intestinal parasites and residency, dirty fingers and family size. While regarding other factors such as, literacy, hand washing and having pets the correlations were non-significant ( $P > 0.05$ ).

**KEYWORDS:** Intestinal parasites, Protozoa, Helminths, children, Sociodemographic factors, Duhok

### INTRODUCTION

Globally, it is estimated that about 3.5 billion people are affected with intestinal parasitic infections (IPIs), most of them are children (1). The high prevalence of IPIs in children are associated with low socioeconomic status, poor hygienic habits, unsanitary waste disposal, poor medical care, unsafe drinking water supplies, poor nutritional status, and very poor literacy rate (2). Frequent infection of children with intestinal parasites may result in malnutrition, growth retardation, physical weakness, poor performance of children especially those at primary school age (3). The majority of IPIs morbidity and mortality are caused by amoebiasis (amoebic dysentery) which occurs in both developed and under-developed countries. *Entamoeba histolytica* infects about 500 million individuals/year, causing disease in 50 million and ultimately resulting in 100,000 deaths/year (4,5). Similarly, *Giardia lamblia*, a common causative agent of diarrhea, affects about 200 million individuals worldwide (3). While infection with helminths lead to nutritional deficiency and impaired

physical development, which lead to negative consequences on cognitive function and learning ability (6,7). In addition to these, maternal, child health and worker productivity can also be affected by infection with soil-transmitted helminths (STHs). Studies indicated that even moderate infection may have adverse effects on growth, iron deficiency anemia, and cognitive functions of school-age children (8).

The epidemiology of infections with intestinal parasites shows that these parasites can infect human at all ages. However, the incidences are higher in certain specific areas, while some age groups are affected to a greater extent (7). Studies carried out in different areas worldwide showed that the circumstances of each individual involve the overall prevalence of intestinal parasitic infections, and children are the victims (8). In addition to protozoa, among helminths, it is reported that hookworms constitute about one-third of the neglected tropical diseases in Sub-Saharan Africa. More than 90% of the 207 million cases of *Schistosoma* infections occurred in Sub-Saharan Africa, and the highest prevalence occurred among children at primary school age and

teenaged (1,2). In Kurdistan region (Duhok) many studies have been performed such as a study by (9,10,11,12), and a study in Khanaqin City/Diyala (13), but all of these studies examined stools of children from different ages who attended Hospitals, while the present study provides more information about the prevalence of intestinal parasitic infections among primary school children and their related sociodemographic factors. Therefore, the current study is adopted to detect the presence of the parasites (protozoa and helminthic) stages such as cysts, eggs and larvae in stool samples among primary school children in Duhok city and to correlate them with some sociodemographic factors.

### MATERIALS AND METHODS

A cross-sectional study was performed in Azadi teaching Hospital, Heevi Pediatric and Kurdistan private (Maternity and Pediatric) Hospitals in Duhok city. In this study 1172 primary school children of both sexes and different ages (6-12 years) who visited these hospitals.

A semi-structured questionnaire was prepared to collect data on socio-demographic variables, behavioral habits, and environmental factors. Before taking any stool sample, agreement and verbal consent was taken from the child's mother/father. With the assist of the child's mother/father; each child was requested to bring about 5 g of fresh stool sample in a labeled plastic container and submitted immediately to the laboratory/Parasitology section. For detecting *Enterobius vermicularis* the current

study depends on recovering the adult stage from stool samples rather than using any special techniques used for detecting this parasite.

**Samples examination:** Macroscopic and Microscopic examination were done.

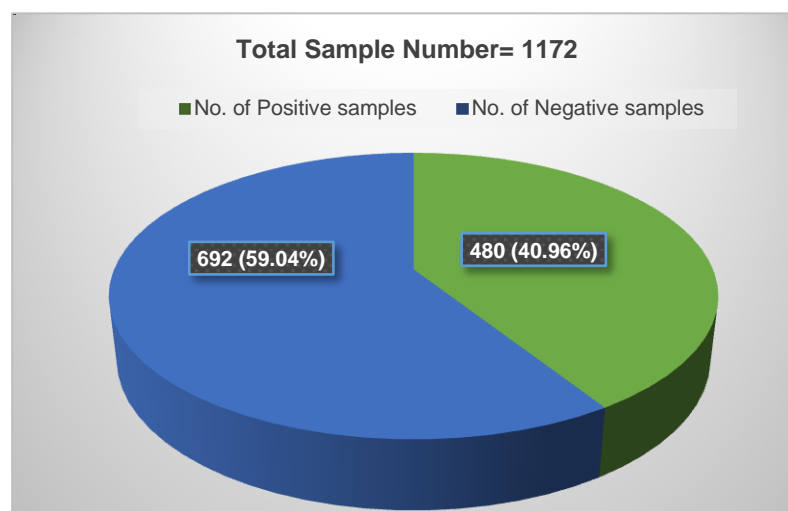
As a first step, the sample was examined macroscopically. The second step was examined microscopically by direct wet mount and formol-ether concentration methods. Two grams of stool sample was examined by the direct wet mount technique, and the remaining 3g was examined by the formol-ether concentration technique (14). Both x10 and x40 objectives were used for the identification of intestinal parasites. Identification based on morphological features of parasitic stages.

**Data Quality Control:** To ensure quality control, the questionnaires were pretested by taking samples before the data collection. All samples were labeled with the student's code to avoid confusion of their results. Each questionnaire was checked whether the necessary information was properly filled.

**Statistical analysis:** the obtained data were arranged, coded, and saved in Microsoft Excel. Then analyzed in relation to risk factors by using Statistical Program Social System (SPSS software) version.21, which was considered significant according to the  $P$  value  $< 0.05$ .

### RESULTS

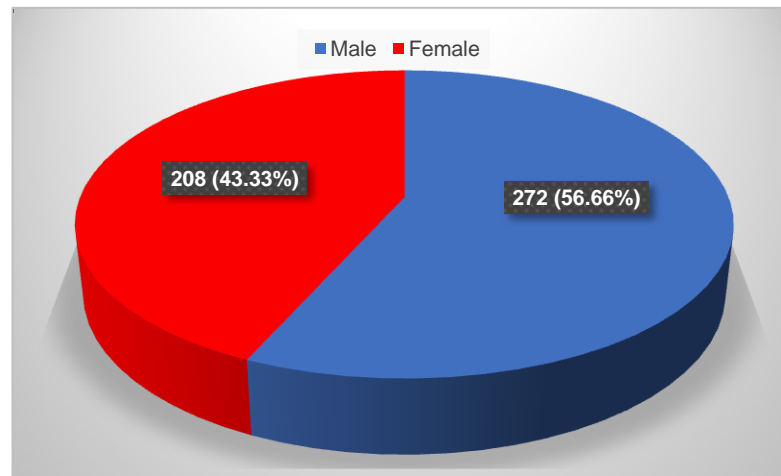
A total of 1172 randomly collected stool samples from children at primary school age (ranging between 6-12 years old) of both sexes were examined for the presence of parasites.



**Fig. (1):** -The prevalence of intestinal parasitic infections among primary school children in Duhok city.

Out of the total examined stool samples, 40.96% (480/1172) were infected with different species of intestinal parasites (Figure 1) with a

higher rate in males as compared to females (56.66% vs 43.33%) from total number infected (Figure 2).



**Fig. (2):-** Prevalence of IPIs among primary school children according to gender (N=480)

The highest prevalence of intestinal parasites was reported among the age group (6-7) years,

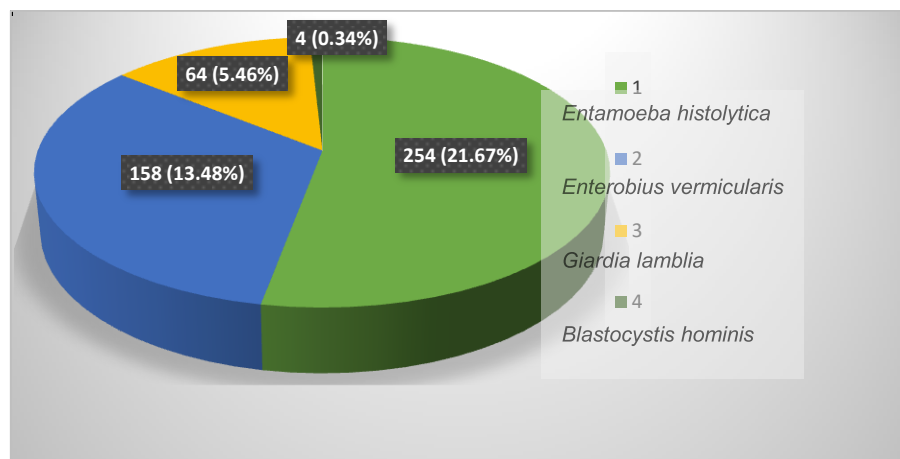
which was 40%, these results were statistically significant ( $P < 0.05$ ) as shown in Table (1).

**Table (1):** -The relationship between age and prevalence of IPIs among primary school children (N=480)

Age Group	Number of Infected	Percentage	Significance
6-7	192	40	< 0.05*
8-9	148	30.	
10-12	140	29.	

Regarding to the distribution of the intestinal parasitic species, most recorded parasites belong to protozoa, among helminths only adult *E. vermicularis* was detected. The highest rate of the detected parasites was with *E. histolytica* constituting 21.67% (254/1172), followed by *E.*

*vermicularis* 13.48% (158/1172), then *G. lamblia* which was reported at a rate of 5.46% (64/1172). While *B. hominis* was reported only in four children with the lowest rate of 0.34%, as indicated in Figure (3).



**Fig. (3):-** The species and percentage of intestinal parasites among primary school children in Duhok City (N=480)

As regard to some sociodemographic factors, the majority of the infected children resided in Duhok city constituting 59.58% (286/480), while the rest resided in rural area 40.42% (194/480). For children mothers' educational status, more than 52.08% (250/480) were illiterate. In regards

to personal hygiene and other sociodemographic factors they are illustrated in Table (2). Statistical analysis showed significant ( $P < 0.05$ ) correlation between rate of infection with IPIs and some sociodemographic factors such as residency, dirty fingers and family size.

**Table (2):-** The species and percentage of intestinal parasites among primary school children in Duhok City according to sociodemographic factors (N=480)

Sociodemographic characteristics	Number (n)	Percentage %	P-value
Residency*			
Urban	194	40.42	0.05*
Rural	286	59.58	
Mother's Educational Status			
Literate	230	47.92	0.05
Illiterate	250	52.08	
Hand washing before meals			
Yes	204	42.50	0.05*
No	276	57.50	
Hand washing after using toilets			
Yes	222	46.25	0.05
No	258	53.75	
Dirty finger nails			
Yes	324	67.5	0.05*
No	156	32.5	
Presence of pets			
Yes	286	59.58	0.05*
No	194	40.42	
Family size			
≤5	124	25.83	0.05*
>5	356	74.17	

\* Significant

## DISCUSSION

Intestinal parasitic infections have a worldwide distribution and are considered as an important public health problem among children at school age in many countries including Iraq and Kurdistan Region. According to WHO, 1998, IPIs classified among the ten most common infections in the world including amoebiasis, ascariasis, hookworm infection, and trichuriasis (15). In the present study, the rate of infection with different types of intestinal parasites is high constituting about 40.96% (480/1172) with a higher rate in males as compared to females (56.66% vs 43.33%) from total number infected.

These results were in agreement with studies performed by (11, 13). While disagreed with a study in Baghdad (16) when they found (38% in males and 42.2% in females). These differences in results among both sexes may be belong to the high outdoor activities of males than females (11). In regard to age factor, the age group between (6-7) years showed the highest prevalence of about 40%, which decreased with the increase in age, this is may be attributed to poor hygiene habits away from their mother and low socioeconomic condition (17). These results agreed partially with a study performed by (16) in which 93.8% within age group 6 years were

infected with intestinal parasites, while disagreed with a study (11) in Duhok.

In this study 4 parasitic species were recorded included: *E. histolytica* with the highest infection rate (21.67%), followed by adult stage of *E. vermicularis* (13.48%), then *G. lamblia* which (5.46%), while *B. hominis* was found at the lowest rate (0.34%). The current results are in line with most reported studies in regards to *E. histolytica* with the highest prevalence rate as compared to other parasites (10,13,18, and 19)

*E. vermicularis* was considered to be worldwide in distribution and commonly affected school-aged children; in general, the transmission of *E. vermicularis* infection including hand to mouth and/or person to person directly (20). In the present study, unexpected high infection rate with this parasite was reported by isolation of adult stages from examined stools.

Relatively, the result of *E. vermicularis* is reported in high rates, this might be attributed to improper application of hygienic behavior such as dirty or contaminated hands or foods, especially after defecation or before having a meal (21).

Regarding to some sociodemographic factors, residency, dirty finger nails, presence of pets, and large family size have significant impacts on the prevalence of parasitic infections among enrolled children. On the other hand, factors such as literacy and hand washing after using toilets, even though, higher rates were reported among children of illiterate mothers, in addition to those who did not washing hands after using toilets, but these rates were statistically non-significant ( $P > 0.05$ ). Rural residents showed the highest infection rates (59.58%) in comparison to urban one (40.42%). These results showed higher rates than that reported by (12) in Duhok city which displayed high statistically differences among studied groups including children living in camps, villages, and in city center with rates of 35.21%, 23.94%, and 18.30%, respectively. This may be due to the differences among selected groups, which including children living in camps (12). Moreover, in Erbil (21) a high rate of infection was recorded among rural school children (33.42%) in comparison with urban school children (29.67%). On the other hand, the present results disagreed with (22) in Yemen which reflected significantly high proportion in urban area than rural (64.5% vs 49.2%, respectively).

Furthermore, children with dirty finger nails were more probable to develop intestinal parasitic infections (67.5%) as compared with those who have clean finger nails (32.5%). The obtained result is in line with a study by (23) in Ethiopia which showed high infection rate in students who had unclean fingernails as compared with those who had clean fingernails (62.6% vs 37.4%).

Statistically, non-significant differences were recorded in the relationship between the educational level of children's mother and the prevalence of IPIs, which was 52.08% with illiteracy mothers while the intestinal parasites rate was 47.92% in literate mothers. The present rates are in accordance with the findings of a study in Baghdad city, which reported a rate of 45.2% for illiterate mothers (16).

In regards to other associated risk factors including practicing good hygienic habits, washing hands before having meals, they will less likely get IPIs than children having bad hygienic habits (42.5% vs 57.5%), respectively. This result is in line with the findings reported in Ethiopia, in which a rate of 20.3% was reported in children who always wash their hands before eating (24).

Moreover, children who fondle pets showed more infection rate for intestinal parasites than others who did not get into contact with pets (59.58%) such results were reported in Ethiopia among 58.7% of children fondling pets. (23)

Large family size is considered an important factor associated in increasing IPIs risk, due to overcrowded behaviors (25,26). In the current study, the rate of intestinal parasites was high in families with more than five members 74.17% (356/480) with significant differences ( $P$  value  $< 0.05$ ), a study in Ethiopia also reported high rate of infection among families with more than 6 members of 30.8% (24). Furthermore, a study in Baghdad showed the highest rate (64.8%) in children with families  $\geq 22$  members and lowest rate (31.1%) in children's families with 1-3 members (16).

## CONCLUSION

The current study showed high rates of infection with intestinal parasites among children at primary school age in Duhok city/Kurdistan Region-Iraq. Indicating that Intestinal parasitic infections are a major public health problem in the community. Therefore, considerable efforts should be given to reduce

and prevent these high rates of IPIs through introducing health education program and the application of hygienic habits among the schools and the community.

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