



## Intestinal parasitic infection and its contributing factors in children of the primary schools in Karbala Governorate

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### Abstract

**Introduction:** Intestinal parasitic infection in children is considered a major problem in public health in Iraq and other developing countries associated with poor environmental and personal hygiene.

**Objective:** To assess the intestinal parasitic infection, and to determine its associated factors among school children.

**Methods:** Total 450 students of primary schools selected randomly by using stratified sampling technique, were conducted in this cross sectional study. Arrangement of the students of 1<sup>st</sup> to 6<sup>th</sup> grades in the school alphabetically in a lists was done. This study, started from the beginning of September 2021 through the end of March 2022. By using a structured questionnaire data was collected about socio-demographic characteristic( name, age, residence, gender, level of education and occupation of the parents. behavioral and environmental factors (hand washing practice, hygiene facilities : availability of safe water supply and clean latrines) . specimens of tool from all children in the study were analyzed for intestinal parasites.

**Results:** From total 450 primary school children 60% (268) had intestinal parasites female: male ratio is 1:1. Most infected children were lived in the rural areas (63.1%), students with housewives mothers were (72.4%), and about half of the parents had low educational levels( primary or intermediate school), the most common intestinal helminth infection was *Enterobiusvermicularis* (27.6%), and *Entamoebahistolytica* was the most common protozoa infection (16.4%). When binary analysis logistic regression was applied, rural residence of the students, not enough family income, were the main factors which increase chance of get IPI among children of the primary school.

**Conclusion:** low educational level of the mothers, Poor hand washing practice before eating, after playing outside and donot use soap hand washing, poor hygienic facilities like poor and old sewage carriage system at school, sharing the same bed, mixed sources of drinking water from mixed sources of were the major factors associated with increased risks of intestinal parasitic infection among children in the school.

**Keywords:** Intestinal parasitic infections; Intestinal protozoa; Intestinal helminthes; *Entamoeba histolytica*, hand washing practice

### 1 Introduction

Intestinal parasitic infections which affected more than 3.5 billion people all over the world are considered one of the most common and serious problems in public health [1], children are more prone to parasitic infection than adult especially in developing countries due to overcrowding in the school , close contact with to each other and with soil , do not comply with hygiene principles, as the supply of good quality drinking water and latrine coverage are poor.[2,3] The major causes of intestinal parasitic infections are the species of protozoan and helminthes.[4] Poor people experience excess morbidity when a cycle of repeated parasitic infections and subsequent under nutrition that can

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continue from one generation to other if there is no interventions from the public health authorities. The morbidity of the infection may include several nutritional disorders, such as iron deficiency anemia and weight loss, or causing growth delay or retardation like stunting, GIT disorders like abdominal pain, and dyspepsia, and lastly impairment of the school performance due to deficient in the cognitive function of the children [5]. The infection of parasites are transmitted by Faecal-oral route through contaminated objects with faeces such as food, water, nails, and fingers, [6]. The most common parasitic infection in children of school age followed by preschool children is known as enterobiasis. The prevalence of enterobiasis in children which has been reported by the World Health Organization is between 4% and 28% and among approximately 200 million people are infected worldwide about one third of cases are children aged 5 to 10 years [7]. *E. histolytica* and *G. lamblia* which can be transmitted by contaminated drinking water and/or food water with a protozoan cyst, may cause weight loss and malabsorption syndrome in children and adults, who are infected [8]. Another study conducted in Dohuk City/ Iraq in 2021 found that the *E. histolytica* and *G. lamblia* infection prevalence rates were (16.9%) and 1.2% respectively [9]. The aim of this study was assessing the rate of infection, type of parasites, sociodemographic behavioral characteristics together with poor school hygiene facilities linked to parasitic infections among primary school children in Karbala.

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## 2 Patients and Methods

A cross-sectional study conducted among children of primary school of both sexes, from rural and urban areas, in the period from from the beginning of September 2021 through the end of March 2022 in Karbala City about one hundred km to the south of Baghdad).

### 2.1 Sampling method

The schools were randomly selected by using stratified sampling technique from the list of schools obtained from the Karbala directorate of education. Arrangement of the students of 1<sup>st</sup> to 6<sup>th</sup> grades in the school alphabetically in a lists was done.

### 2.2 Sample size

An appropriate sample size was calculated according to the sample size equation. The following sample equation was applied

$$N = Z^2 \times pq / d^2$$

Where N = Sample size. Z = confidence label. P = estimated proportion of an attribute that is present in the population. q = 1 - p. d = margin of error to determine the sample size. Using the proportion of 50% to achieve the maximum sample size, and d=0.05, and z=1.96, the estimated sample size will be 384 students p= 0.50, q= 1-p =0.50, z =1.96, d=0.05 . N = 384

We will add 15% for non-response, so the sample size is = 442

### 2.3 Stool Sample Collection

Parents were engaged for children who were trained previously on how to collect about 3 to 5 g fresh stools and bring hygienically in labeled cups along with applicator sticks

### 2.4 Stool Sample Examination

Stool samples were analyzed for parasitic infestations following the standardized protocol (annex D). The examination was conducted in the primary health care centers in the vicinity of the selected schools. according to WHO guidelines each specimen was examined macroscopically for composition, consistency, color, odor, presence of mucus and blood [10], by using direct wet-mount and formol-ether concentration techniques the stool samples was examined microscopically. All stages of development cyst, egg, larvae, and adult of the parasites were recorded. Presence of *E. histolytica* in stool specimens was confirmed by detection it's antigen. For the diagnosis of the Enterobiasis, the parents of children were advised to apply cellulose tape around the anus of a suspect patient,<sup>10</sup>.

### 2.5 Data collection

Data collected by Structured validated questionnaire; Face to face interview with respondents and another part of the questionnaire was sent to the parents or care takers to fill. The questionnaire consisted of 2 parts; Part 1: Socio-demographic characteristics including student's name, age, residence and gender, in addition to the level of education, occupation and marital status (Divorce, widow or widower person) of the parents. Part 2: Consist of 1- Behavioral

factors: the following behaviors will be assessed: Hand washing before eating. Eating unwashed/raw vegetables. Presence of dirty material under the nails. (By inspection of the researcher). Hand washing after toilet or playing outside. Shoe wearing habits. 2- Hygiene facilities : Availability of safe water supply , clean latrines and Presence of any fault in carriage system at both home and school of the students .

## 2.6 Statistical analysis

For data entry and statistical analysis. Statistical Package for Social Sciences (SPSS version 19) was used, suitable tables was used to express the frequency data. chi-square test of independence was used for statistical association. To determine independent risk factors for infestation, logistic regression analysis was applied. If p-value less than 0.05, it was considered statistically significant.

## 2.7 Ethical approval

Ethical approval was obtained from the Ethical Committee from both Karbala directorate of health and Karbala directorate of education and a written consent should be obtained from the caretakers of the children prior to the start of data collection. All data were held in a password protected computer and kept for research purpose only.

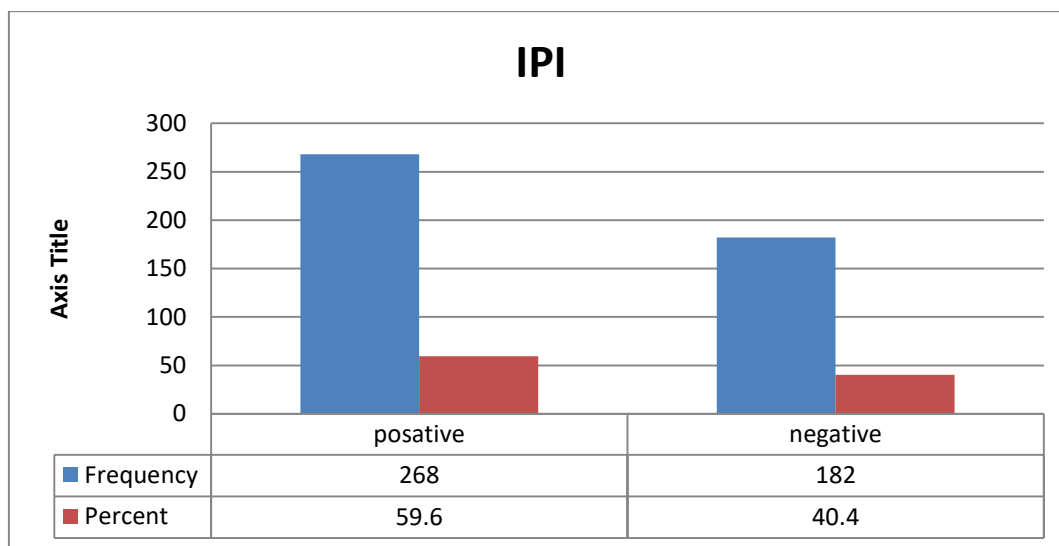
## 3 Results

Among total of 450 children aged 7–14 years participated in this study on voluntary basis. 233 (51.8%) were boys and the remaining 217 (48.2%) girls, providing 100% response rate, about half (50.4%) of the students were living in urban areas. The mean age of the children was 9.2 years, with standard deviation of  $\pm 1.79$  and 328. (73%) of the students were in the age category of (7-10 years) represented the students occupied 1st-5th classes, about 3% of the children's fathers and 17.6% of the children's mothers were illiterate, more than two thirds of the mothers were housewives, only 11 (2.4%) from the fathers of the students were jobless, majority of parents (94.2%) were not separated, and only 4% of the parent had not enough monthly income.

**Table 1** Sociodemographic characteristics of study participants.

Sociodemographic characteristics		Frequency 450	Percent (100%)
Gender	Male	233	51.8
	Female	217	48.2
Age groups	7- 10	328	72.9
	11-14	122	27.1
Residence	Urban	227	50.4
	Rural	223	49.6
Living together parents	Yes	424	94.2
	No	26	5.8
Family income	Not enough	18	4
	Enough	432	96
Education of the father	Illiteracy	13	2.9
	Primary or intermediate	227	50.4
	Secondary and more	210	46.7
Occupation of the father	Jobless	11	2.4
	Employed	190	42.2
	Self employed	249	55.4
Occupation of the mother	House wife	326	72.4
	Employed	124	27.6
Education of the mother	Illiteracy	79	17.6
	Primary or intermediate	227	50.4
	Secondary +	144	32.0

The proportion of children with intestinal parasites was 59.6% (268). Four different types of intestinal parasites were identified. *Entamoeba histolytica* 74 (16.4%) was the most common protozoan infection followed by *Giardia lamblia* 26 (5.8%) whereas *Enterobius vermicularis* was the most common intestinal helminthic infection 124 (27.6%). Only 27 (6%) of the participated children had mixed IPI. (Figure1) and (Table 2).



**Figure 1** Prevalence of Intestinal Parasites

**Table 2** Types of Parasitic infection.

Parasitic infection	Frequency	Percent
Total negative	182	40.4%
<i>Enterobius vermicularis</i>	124	27.6%
<i>Entamoeba histolytica</i>	74	16.4%
<i>Giardia lamblia</i>	26	5.8%
<i>Entamoeba coli</i>	17	3.8%
Mixed	27	6.0%
Total	450	100.0%

logistic regression analysis was applied to determine independent risk factors for infestation , living in the rural area (OR = 2.89, P = 0.000) , not enough family income (OR = 1.92 , P = 0.012), low educational level of the mothers (OR = 2.21, P = 0.000), Poor hand washing practice before eating (OR = 31.25, P = 0.001 ) or after playing outside (OR = 4.33 , P = 0.003 ) washing the hand with water only after defecation (OR = 4.20 , P = 0.000 ) , poor sewage system in the school (OR = 2.18, P = 0.003 ) , sharing the same bed (OR = 3.080, P = 0.000 ) , mixed sources of drinking water (OR = 5.130, P = 0.004 ) , were the main factors lead to increase risk of infection of intestinal parasites in the children. Table 3.

**Table 3** Logistic regression analysis of significant predictors associated with the intestinal parasitic infection among primary school children.

Variables	P	OR	95% CI	
			Lower	Upper
Behavioral factors				
Not washing hand after playing out side	.003	4.33	2.48	9.80
Not washing the hand before eating	.001	31.25	15.60	62.50
Not Using soap and similar material	.000	4.20	1.99	8.84
Sociodemographic factors				
Rural residence	.010	2.89	1.88	4.47
Not enough family income	.012	1.92	1.16	3.18
Low educational level of the mother	.000	2.21	1.44	3.38
Hygiene facilities				
Mixed type of drinking water	.004	5.13	3.13	8.38
Sharing the same bed	.000	3.08	1.85	5.11
Faulty carriage system at school	.003	2.18	1.30	3.64

## 4 Discussion

Intestinal parasitic infections especially in children lead to various health problems, including growth and mental health-related disorders, and may lead to impairment of the cognitive and academic performance of the children [3].

### 4.1 Prevalence

In the current study, the overall prevalence of infection was 60% of the students in Karbala city nearly same result was found in It was comparable with the studies done in Basra (59.98%) [12]. Ethiopia (57.9%) [13] in Yemen (62.4%) [14] Sudan (56.9%) [15], higher than IPIs in school children in Saudi Arabia (5.3%) [13], Najaf (24.89%), Duhok (20.10%) [12], Iran (18%) [16], in Baghdad City (24.39%) [17]. In Sudan (24.8%) [18], in Egypt (30.7%) [19]. The prevalence was less than that reported from Burkina Faso (84.7%) [20] and in primary school children in Al-Mahweet, northwest of Sana'a [21] (90.0%). Differences in the rate of infection could be attributed to differences in the environmental sanitation, personal hygiene, level of education and the availability of safe drinking water sources [22].

### 4.2 Type of the parasites

Concerning the type of parasites isolated in this study, Entamoeba histolytica was the most common protozoa infection followed by Giardia lamblia whereas Enterobius vermicularis was the most common intestinal helminthic infection. 6% of the participated children had mixed infection. In agreement with other studies [23-25]. Other study in Iran Giardia lamblia, Blastocystis hominis (B. hominis) and Entamoeba histolytica/dispar respectively [26] and in Yemen other study found that, E. histolytica/dispar and G. lamblia were the most common types of parasites in children [27]. Since most children in the study used protective shoes specially when they were playing outside and in their home they had enough healthy latrines, they did not defecate in open field. So, this might be the possible reason why the Soil-transmitted helminths infection was not detected.

### 4.3 Risk factors

#### 4.3.1 Sociodemographic factors

In the current study there was no significant association between parasitic infection and gender of the children. Other study was reported that the prevalence of IPI was slightly higher among boys [28]. In contrary, study in south India showed that females had higher prevalence of IPI than male [29], the variation of the results in our study may be due to that female and male school at this age usually play outdoors together and live in the same environment. There was no

significant association between parasitic infection and age although there was slight increase among children aged 7-9 years (Table 9). This finding was in agreement with, Calik et al 2014 in Turkey [30], in contrast to study in Ethiopia explained that the presence of intestinal parasite was associated significantly with age [31]. The high prevalence in all age groups due to either general ignorance and poor awareness about the basic rules of hygiene. The current study showed that children in rural areas had more IPIs compared to children in the urban area. This finding is supported by studies in Yemen [32], and Nigeria [33] and in contrast to other study where the infection was higher in urban area [34]. The high prevalence in rural areas can be related to scarcity their safe drinking water, sharing the members the same beds, which lead to auto infection and high prevalence of *E.vermicularis*. Parents' education is a significant predictor of intestinal parasitic infection among their children, although high rate of house wife mothers, similar to finding was reported in other study [35], but other study found that a combination of education and occupation of the parents were not related to IPIs in the school children [36]. It was expected that better children's health when the mothers have more time in the household, the health behaviors of the children are influenced negatively by lower educational levels of the parents. high rate of IPI among children from the poor families in consistent with other study . [37], other study found family income were not significantly associated with IPI [38]. Poor families could not afford healthy measures, toilet's sanitation and household water treatment.

#### 4.3.2 Behavioral factors and Hygiene facilities

Poor hand washing practice (particularly after using toilet, before eating and after playing outside and inadequate use of soap,) was significant predictor of IPI. This result was in agreement with other studies [39,40]. This is may be due to lack of awareness and knowledge of the parents about importance of hand washing practice in prevention of IPI. In the current study infection was more among children who were eating raw ,unwashed vegetables. This finding is in agreement with other studies [41,42]. Regarding relationship between intestinal parasitic infection among primary school children and lack of sanitation facilities in these schools, poor sewage carriage system at school, sharing the same bed specially in the rural and poor families , drinking water from mixed sources were the main predictive factors significantly associated with increased chance of getting infection of intestinal parasite in the school children, in agreement with other studies [43-45]. The high rate of infections could be due to unhygienic habits practiced by these children at home and in school [46].

#### 4.3.3 Limitations

- This is a cross sectional study and temporal relationship between the potential risk factors and the outcome cannot be inferred.
- The response for some variables was subjective.
- 3-The results of this study may not be extrapolated to all of the Iraqi population.

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## 5 Conclusion

- About two third of primary school children in Karbala city had infection of intestinal parasite
- The most co-varieties of intestinal parasitic infection among children were rural residence, low family income and low parent's education.
- Poor sanitary facilities at schools and poor hand washing practice were significant predictors of infection of intestinal parasite among children.

#### Recommendations

- regular screening of IPI
- Mass deworming treatment coupled with school health education.
- Health education of the parents, particularly mothers.
- Raising standard of school sanitary facilities and ensure periodic supervision.

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## Compliance with ethical standards

#### Statement of ethical approval

Before conducting the investigation, the investigator obtained ethical clearance from the Ethical Committee from both Karbala Directorates of Health and Karbala directorate of education.

#### Statement of informed consent

A written informed consent from the parents or care takers of the participant was obtained prior to the start of data collection.

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