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RESEARCH ARTICLE

FREQUENCY OF INTESTINAL PARASITIC INFECTIONS AMONG SCHOOLCHILDREN IN IBB CITY-YEMEN

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Abstract

Objectives: Intestinal parasitic infections are widely distributed and remain one of the most health problems in Yemen. This is a cross-sectional study aimed to determine the prevalence of intestinal parasitic infection and associated factors among schoolchildren in Ibb City, Yemen.
Methods: A total of 300 stool samples were collected from schoolchildren between January to April 2018 and examined by direct smear and formalin ether concentration techniques.
Results: The result showed that 62.7% were positive for intestinal parasites, with a higher frequency of single than multiple infections (85.1 *vs*. 14.36%, respectively). Also, 85.64% were infected by protozoa whereas 14.36% infected by helminths. The prevalence of infection was 61.70% for *Entameba histolytica*, 23.94% for *Giardia lamblia*, 7.45% for *Ascaris lumbricoides*, 4.3% for *Hymenolepis nana*, and 2.61% for *Enterobius vermicularis*. Moreover, the highest prevalence of *E. histolytica*, *G. lamblia*, and *A. lumbricoides* was within group aged 9-12 years. *H. nana* was between age groups of 9-12 and 13-16 years while *E. vermicularis* was found among 5-8 and 9-12 years. In addition, females were 69% infected significantly higher than males 54.55%. Besides, the various signs and symptoms associated with intestinal infections have been documented.
Conclusion: High prevalence of intestinal infection was documented among schoolchildren drinking from cistern water, poor hygiene practices, poor food sanitation, non-swimming, and non-previously treated for *Schistosoma* parasite. High frequency of intestinal parasitic infection between schoolchildren in the study area requires more effort to implement the appropriate programmers that warrant to control and prevention the prevalence of intestinal parasitosis.
Keywords: Ibb City, intestinal parasitic, prevalence, schoolchildren, Yemen.

INTRODUCTION

Intestinal parasitic infection, caused by protozoa and helminths, is one of the world's largest health problems and is responsible for affecting nearly 3.5 billion people and about 450 million illnesses caused by intestinal parasites[1]. The highest prevalence of parasitosisis concentrated in developing countries with up to 50%[2]. Many factors play an important role in developing countries for transmission of the intestinal parasites the representing the unavailability of potable water, reduced hygienic environments, fast population growth, and, low economic status[3,4]. Intestinal parasitic infections are the most threats that challenge the healthy living in developing countries mainly affecting school children[5]. The young children are found to be too much affected within intestinal parasites compared to adults because of their increased requirements of nutrition and weak immune systems. The presence of intestinal parasites in this age group have been accompanied with significantly risk problems such as slowly in growth, lack of protein-energy malnutrition, iron deficiency, decrease in physical activity, and impaired mental function and learning ability[6]. It was estimated that around 12% of the world wide illness burdens resulting from intestinal parasites are reported amongst children aged 5-14 years old in developing countries[7]. Also, nearly 270 million pre-school and 600 million schoolchildren are living in a zone where the parasites are extensively transmitted[8]. In developing countries, the intestinal parasites such as *Entameba histolytica*, *Giardia lamblia*, *Enterobius vermicularis*,

and *Hymenolepis nana* are more easily spread and more frequently between children[9]. Yemen belongs to the developing countries that lack the strategies and programs for eradicating or preventing transmission the parasitic infection among the population. There are several reports have been performed to evaluate the infections of intestinal parasitic between children in Yemeni communities. A study by, in Hadramowat, Al-Haddad and Baswaid[10] found that the most infective parasites prevailed in children were *G. lamblia*, *E. histolytica*, *Ascaris lumbricoides*, *Trichuris trichiura*, *H. nana*, *Taenia saginata*, and *Schistosoma mansoni*. However, in Sana'a, Alyousefi *et al*.,[11] reported that the intestinal parasites among children were *G. duodenalis*, *E. histolytica/dispar*, *Cryptosporidium*, *A. lumbricoides*, *S. mansoni*, *H. nana* and *E. vermicilari* recorded in urban and rural areas. Also, it was reported that 75.4% of examined children under 12 years in Taiz districts were infected with *E. histolytica/dispar*, *G. duodenalis*, *A. lumbricoides*, *H. nana*, *S. mansoni*[12]. Moreover, Alwabr and Al-Moayed[13] recorded that the *E. histolytica*, *S. mansoni*, *T. trichiura*, and *E. vermicularis* were reported between schoolchildren in Al-Mahweet governorate. One study only was conducted in Ibbcity, in 2010, and showed *E. histolytica*, *G. lamblia*, *A. lumbricoides*, *T. trichiura*, *H. nana*, *S. mansoni*, *Ancylostoma duodenale*, *E. vermicularis*, and *Strongyloides stercoralis* the most prevalent intestinal parasitic among children[14]. This study is small and not enough to show the occurrence of intestinal parasitic among schoolchildren and related factors. Therefore, the aim of the current work was to determine the prevalence of intestinal parasitic infections and risk factors for parasite infection among schoolchildren in Ibb, Yemen.

SUBJECTS AND METHODS

Study Design and Area

A cross-sectional study was carried out at medical laboratory department, Ibb University which located in Ibb city, Yemen, during the period from January to April 2018. There were seven districts subjected for present work that are Al-Dehar, Al-Maeen, Al-Mashanh, Al-Sabal, Harathah, Mafrg-Jeblah, and Shaban that located in Ibb city. From each district, one school was selected randomly.

Ethical statement

The study protocol was permitted by the University of Ibb, Yemen, and authorization to start collection of data was granted by the Education Office of the City of Ibb. Before the start of data collection and samples, the goals and methods of study were explained to the school principals and children to agree to their inclusion in this study.

Data Collection

A designed questionnaire was subjected to each participant such as age, gender, the clinical information like diarrhea, blood in the stool, and abdominal pain as well as environmental factors like; source of drinking water, personal hygiene, food sanitation, parents occupation, swimming, and previous *Schistosoma* treatment.

Sample Collection and Examination

A total of 300 stool samples were chosen of schoolchildren, aged between 6-16 years old, attending governmental schools. A dry, clean, leak proof container (labeled faecal) was given to each child and was instructed on how to introduce specimens (stool) into the bottles and transmitted to a laboratory, as soon as possible, for parasitological examination[15]. The specimens were prepared and tested by using three methods of routine examination of stool: wet preparation, saline sedimentation centrifuged, and formalin/ether concentration[15].

RESULTS

Three hundred specimens were chosen of school children presenting to seven governmental schools in Ibb city. Of these samples, 168(56%) were females and 132 (44%) were males. The distribution of collected samples according to age was listed in Table 1. The distribution of collected samples according to districts was figured in Figure 1. It was collected *48* (*16*%) samples from Al-Dehar, 43 (14.3%) samples from Al-Maeen, *39* (13%) samples from Al-Mashanh, 37(12.3%) samples from Al-Sabal, *44*(14.67%) samples from Harathah, *47* (15.67%), and samples from Mafrg-Jeblah, and *42* (14%) samples from Shaban.

Table 1: The distribution of collected specimens according to gender and age.

Gender	Age groups (years) N(%)			Total
	5-8	9-12	13-16	
Female	52 (17.3)	68 (22.7)	48 (16)	168 (56)
Male	47 (15.7)	45 (15)	40 (13.3)	132 (44)
Total	99 (33)	113 (37.7)	88 (29.3)	300 (100)

Out of 300 schoolchildren samples, *188* (62.7%) were recorded positive for parasites infection while *112* (37.3%) samples were reported negative for parasitic infection as shown in Figure 2. Furthermore, multiple infections were obviously identified and documented that 160(85.1%) of the positive samples were infected with one type of parasite species, while 28 (14.9%) were infected by double types of parasites (Table 2).

Table 2: Multiplicity of parasitic infections among schoolchildren.

Infections multiplicity	Number of samples	Rate %
One parasite	160	85.1
Two parasite	28	14.9
Total	188	100

Figure 3 shows that the 161 (85.64%) of the positive samples were infected by intestinal protozoa (cyst) while 27(14.36%) of the positive samples were infected by intestinal helminthes (eggs). The present results showed that the most predominate of intestinal parasites was *E. histolytica* with 116(61.70%) followed by *G. lamblia* 45(23.94%), *A. lumbricoides* 14

(7.45%), *H. nana* 8(4.3%), and *E. vermicularis* 5(2.61%) as listed in Table 3. The occurrence of intestinal parasitic infection according to age highest prevalence of *E. histolytica* was reported among the age group of 9-12 years (41.4%) followed by the age of13-16 years (37.9%).

Table 3: Prevalence of intestinal parasites among schoolchildren.

Parasite types	Frequency	Percent %
E. histolytica	116	61.70
G. lamblia	45	23.94
A. lumbricoides	14	7.45
H. nana	8	4.3
E. vermicularis	5	2.61
Total	188	100

The high rate infections were 51.1% and 57.1% recorded between 9-12 years by *G. lamblia* and *A. lumbricoides*, respectively. Also, the similar results of *H. nana* infection were (50%) reported between groups aged 9-12 and 13-16 years while infection *E. vermicularis* infection was found among 5-8 years and 9-12 years as listed in Table 4.Moreover, the overall rates of intestinal parasitic infection were recorded 69.1% and 54.55%, respectively, in females and males Table 4. Table 5 summarizes the common signs and symptoms among infected schoolchildren. It was revealed that the high rate was 49.3% recorded with an abdominal pain followed by 46.7% for diarrhea. While the low rate was with 8% with bloody in the stool. The results based on factors were found that the frequency of intestinal parasitic infection among schoolchildren drinking from the cistern with 76.6%, poor hygiene with 76.1%, poor food sanitation with 57.4%, no swimming practice 68.1%, not previously treated for *Schistosoma* 68.1%as listed in Table 6.

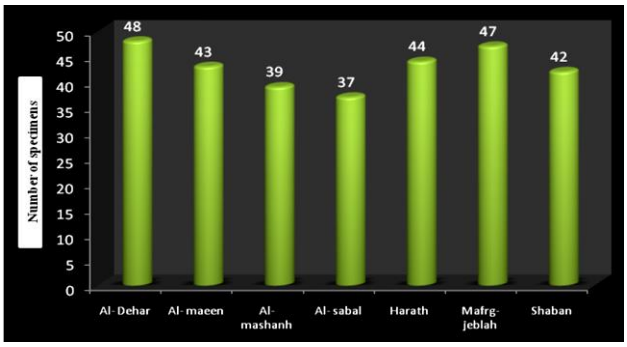

Figure 1: The collected samples according to districts.

DISCUSSION

Recently, the high rate of intestinal parasites prevalence among children in Yemen is well-known. The major factors associated with the incidence of intestinal parasitic diseases refer to the low hygienic practices, environment contamination with fecal, lack of safe water, and health education resulting from the high level of poverty[13]. The present study was revealed that 300 samples (168 females and 132 males) were collected from schoolchildren from Ibb city.

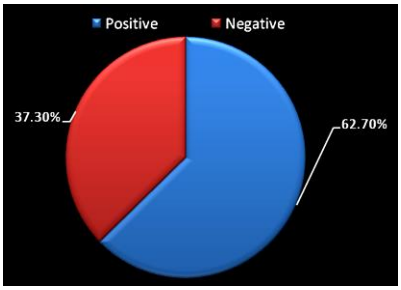

Figure 2: Positive and negative for parasitic infection.

It was observed that 62.7% of samples were reported positive for intestinal parasitic infection while 37.3% were reported negative. Similar studies reported from different regions of Yemen including Hadramowat governorate (58.7%)[10], Ibb (57.4%)[14], and Sana'a (54.8%)[16]. However, the low prevalence was reported in Yemen; in Taiz 38.2%[12], in Sana'a city 40.3%[11], while the higher prevalence was in Al-Mahweet governorate with 90%[13]. The current work showed that the multiple infections at 14.9% with two types of parasites. Similarity, the previous studies were reported the multiple infections in Yemen; in Sahar district 3%[17], in Sana'a city 11.7%[11], and in Sana'a governorate 8.5%[16], in Al-Mahweet 75.5%[13].

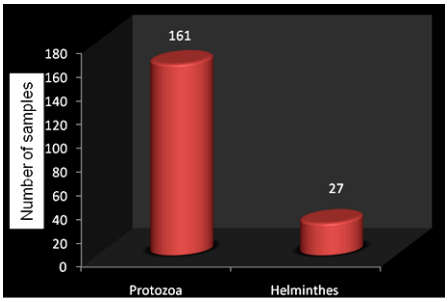

Figure 3: Type of intestinal infection among schoolchildren.

In the current investigation, the intestinal protozoa were 85.64% the most predominant infections observed among schoolchildren, while the intestinal helminthes infections were (14.36%). A similar result was reported by Al-Mekhlafi *et al.*,[16] found thatprotozoa and helminthic infections were 37.6% and 17.2%, respectively, recorded among rural schoolchildren in Sana'a. In this result showed that the *E. histolytica* was the most prevailed of intestinal parasitic infection with

116 (61.70%) followed by *G. lamblia* 45(23.94%), *A. lumbricoides* 14(7.45%), *H. nana* 8 (4.3%), and *E. vermicularis* 5(2.61%). This result is consistent with previous studies conducted in Yemen. A study by Alsubaie *et al.*,[14] documented that the high prevalence of intestinal parasitic was *E. histolytica* (33.7%), *G. lamblia* (23.6%), *A. lumbricoides* (14.3%), *T. trichiura* (9.3%), *H. nana* (6.2%), *S. mansoni* (3.1%), *A. duodenale* (1.2%), *E. vermicularis* (0.8%), and *S. stercoralis* (0.8%). However, a study by Alwabr and Al-Moayed[13] recorded that the most common intestinal parasites prevalence were *E. histolytica* (64%) followed by *S. mansoni* (36.5%), *Trichuristrichiura* (18%), and *E. vermicularis* (13%). Another study by AL-Harazi[12] reported that the 75.4% of examined children were infected with *E. histolytica/dispar* (20.6%), *G. duodenalis* (12.4%), *A. lumbricoides* (3%), *H. nana* (0.9%), and *S. mansoni* (0.9%) in an urban and rural area.

Table 4: Distribution of intestinal parasitic infections in relation to age and gender.

Variables		Identified parasites N (%)					Total (%)
		E. histolytica	*G. lamblia*	*A. lumbricoides*	*H. nana*	*E. vermicularis*	
Age (years)	5-8	24 (20.7)	12(26.7)	2(14.3)	0	2(40)	40 (40.40)
	9-12	48 (41.4)	23(51.1)	8(57.1)	4(50)	2(40)	85(75.22)
	13-16	44 (37.9)	10(22.2)	4(28.6)	4(50)	1(20)	63(71.6)
Gender	Male	42 (36.2)	16 (35.6)	6(42.9)	4(50)	4(80)	72(54.55)
	Female	74 (63.8)	29(64.4)	8(57.1)	4(50)	1(20)	116(69.1)

In contrast, Alyousefi *et al.*,[11] observed that the frequency rates of intestinal parasites were *G. duodenalis* (17.7%) followed by *E. histolytica/dispar* (17.1%), *A. lumbricoides* (2.4%), *H. nana* (1.4%), *E. vermicularis* (0.4%), and *S. mansoni* (0.3%). Also, Al-Haddad and Baswaid[10] found that the most parasites prevailed in children were *G. lamblia* (19.17%), *E. histolytica* (16.83%), *A. lumbricoides* (15.83%), *T. trichiura* (2.33%), *H. nana* (2.33%), *T. saginata* (1.50%), and *S. mansoni* (0.67%). *E. histolytica* and *G. lamblia* consider the most of prevalent protozoan parasite among children and cause of intestinal morbidity. *E. histolytica* infects annually about 500 million cases and causes around 50 million of amoebic dysentery and invasive amoebiasis diseases and kills about 100 thousand persons[18,19]. *G. lamblia* responsible for about 200 million cases every year[20]. Also, *A. lumbricoides* and *T. trichiura* are responsible for about 1.2 billion and 795 million, respectively, infections globally[21].

Table 5: Clinical signs and symptoms among infected schoolchildren.

Signs and symptoms	Responding to question	
	Yes (%)	No (%)
Bloody in stool	24 (8)	164 (54.7)
Fever	72 (24)	116 (38.7)
Cough	80 (26.7)	108 (36)
Muscles pain	44 (14.7)	144 (48)
Diarrhea	140 (46.7)	48 (16)
Itch skin	68 (22.7)	120 (40)
Abdominal pain	148 (49.3)	40 (13.3)
Weight loss	88 (29.3)	100 (33.3)

The prolonged of parasitosis diseases lead to bleeding of intestinal, mal-absorption and deficiency of nutrients, damage of cells and tissues. In eventually these results generally effect in retardation of growth, slow height-weight development, impaired in mental development, school absence, low academic performance, predisposed to malnutrition and infection[22,23]. In current work, the highest prevalence of *E. histolytica, G. lamblia,* and *A. lumbricoides* infection was recorded on group aged 9-12 years. While the age groups of 9-12 and 13-16 years were 50% infected by *H. nana.* The *E. vermicularis* infection was found between 5-8 years and 9-12 years old. These results are in agreement with Alwabr and Al-Moayed[13] who observed that the high prevalence of intestinal parasitic infection was (43%) recorded in the age group 10-12 years. This could be clarified by the extreme movement of children at this age and they may become more susceptibility to infected water while swimming/playing or fetching water for domestic purposes or helping in agriculture activities[24]. In the present study, the prevalent intestinal parasites in females with 69% was significantly higher than males (54.55%).Conversely, the previous study by Alwabr and Al-Moayed[13] reported that the infection rates between males (46.5%) were higher than females (43.5%).

Table 6: Factors associated with intestinal parasitic infection among schoolchildren.

Variables		Frequency (%)
Source of water	Piped	44 (23.4)
	Cistern	144 (76.6)
Personal hygiene	Good	45 (23.9)
	Poor	143 (76.1)
Food sanitation	Good	80 (42.6)
	Poor	108 (57.4)
Parents occupation	Agriculture	44 (23.4)
	Others	144 (76.6)
Swimming	Yes	60 (31.9)
	No	128 (68.1)
Previous Schistosoma treatment	Yes	60 (31.9)
	No	128 (68.1)

The present result showed that the majority of clinical signs and symptoms sufferings are associated with the main parasites in Yemen such as *E. histolytica* and *Giardia*. Also, blood in the stool, cough, muscle aches, skin itch and weight loss were shared with all parasitic infections and another illness. This result was

supported by Al-Haddad and Baswaid[10] who found that different symptoms as diarrhea, abdominal pain, abdominal distention, constipation, between participated. The effect of intestinal parasites on children weight was investigated in Yemen. Alwabr and Al-Moayed[13] showed that more than 67% of the infected schoolchildren were found to be underweight and 22% stunting. The environmental and behavioral factors could be played a major role in prevailing of intestinal parasitic infections with high rate in the study area.

CONCLUSIONS

It can be concluded that the high frequency of protozoa and helminthes infections reported in the present investigation indicated poor hygiene and environmental pollution as a problem of public health among schoolchildren in the area. Therefore, there are more efforts to implement the appropriate programmers that warrant to control and prevention the prevalence of intestinal parasitosis among schoolchildren.

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AUTHOR'S CONTRIBUTION

Qasem EA: writing original draft, methodology. **Edrees WH:** supervision, formal analysis, conceptualization. **Al-Shehari WA:** editing, methodology. **Alshahethi MA:** investigation, conceptualization. The final manuscript was read and approved by all authors.

DATA AVAILABILITY

Data will be made available on request.

CONFLICT OF INTEREST

No conflict of interest associated with this work.

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