



## RESEARCH ARTICLE

## CROSS SECTIONAL STUDY ON THE PREVALENCE OF INTESTINAL PARASITIC INFECTIONS AMONG DISPLACED PERSONS IN YEMEN

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## Abstract

**Background:** Intestinal parasitic infections (IPIs) are considered major health concerns in developing countries especially among economically disadvantaged communities. Currently, there is a lack of information on the prevalence of IPIs among internally displaced persons in Yemen.

**Objectives:** To determine the prevalence of IPIs among internally displaced person in Saber camp, Lahaj governorate, Yemen during May- November 2019.

**Methods:** A cross-sectional study was conducted among internally displaced person from the Saber camp. samples of fresh stool were collected from the participants and examined by wet mount and formal-ether fecal concentration technique. Data were processed using the Statistical Package of Social Science (SPSS), version 25.0. The significant level set was p-value <0.05.

**Results:** The study involved a sample of 350 participants. Overall, the study found that 156 (44.6%) of the participants were infected with at least one intestinal parasite. The most predominant parasite determined in this study was *Entamoeba histolytica/dispar* (24.6%) followed by *Giardia lamblia* (19.7%), *Hymenolepis nana* 7.1%, *Enterobius vermicularis* 0.90%, and *Strongyloides.stercoralis* 0.30%. The prevalence rate of parasitic infection in males was 55 (45.8%), whereas females were 101 (43.9 %). The association between intestinal parasitic infections (IPIs) and gender was found statistically insignificant ( $\chi^2 = 0.118$ ,  $P = 0.732$ ,  $df = 1$ ). The finding of the study showed that the prevalence rate was significantly different based on the age of respondents ( $\chi^2 = 12.10$   $P = 0.033$ ,  $df = 5$ ) with the highest prevalence in the age group 1-9 years was 45.5%, where the lowest was 5.8 % in groups of respondents age between 40 to49 years.

**Conclusion:** This study reveals an alarmingly high prevalence of IPIs (44.6 %) on IPIs infection among internally displaced person in Saber camp in Lahaj governorate, Yemen. Hence, there is a great need for improvement of sanitation and proper health education is required to reduce intestinal parasitic infection.

**Keywords:** Intestinal parasite, Internally displaced person, Saber camp.

## 1. Introduction

Intestinal parasites "infections (IPIs) is a collective term that includes infections caused by both helminths and protozoan that inhabiting the gastrointestinal tract (GIT), and have a global distribution and give rise "to the burden of infectious diseases worldwide and are still considered as public health problems in developing countries especially among children in rural areas [1,2]. It has been "estimated that 3.5 billion individuals have been infected with intestinal parasites and approximately 450 million

individuals developed the diseases [3]. The major etiologic agents of intestinal parasites that infect human are; "Entamoeba histolytica, Giardia lamblia, Taenia species, Hymenolepis species, Ascaris lumbricoides, Trichuris trichiura, Enterobius vermicularis, Hookworms, Strongyloides stercoralis, and Schistosoma mansoni [4]. It has been reported that factors like poverty, inadequate or non-existent sanitation, lack or reduced access to safe water, unsafe human waste disposal systems, open field defecations and unavailability of sufficient health care, bad climatic and

environmental conditions, geographic and socio-economic factors, relatively humid areas, and high population density [5,6] lead to the prevalence of intestinal parasitic infections.

Which makes it alarming in Yemen, most studies in different localities and populations showed that intestinal protozoan infections were highly prevalent and most of these studies were concentrated on the prevalence of these parasites in infants and children [7–11]. In March 2015, Yemen underwent major political upheaval civil war. As a result of insecurity and war in Northern part of Yemen a large number of people from this part were displaced southwards to live in displaced camps, the number of people fleeing violence started to rise in 2015 after international intervention in the country's civil war. Thus, the number of internal displaced persons (IDPs) in Yemen increased dramatically in the last years due to armed confrontations of the government with the rebellions.

An estimated 3.6 million people are internally displaced, in Yemen. Overcrowding and social system straining in main cities were caused by the flow of these displaced persons who end up living in a very bad economic, health and educational status [12].

Several studies that addressed parasitic infections in displaced populations in different parts of the world showed high prevalence of intestinal parasitic infections such as in Sierra Leone [13], and Southern Sudan [14]. Displacement Camp provides ideal environment for the transmission of parasites and increases the risk of acute diarrheal diseases, and intestinal parasitic infections [13].

In Yemen, there are many Camps for those people distributed in various governorate, one main Camp of internally displaced people in Lahaj governorate. Hence, to best of our knowledge, this is the first study in Yemen on the prevalence of intestinal parasites among those people towards intestinal infections. Our study will be among the internally displaced person who have been forced to leave their native places due to wars. Those people are living now in worse situation because living in Camp not as living at their homes which there is no cleaning bath and shortage of water source. Hence, displacement Camp provide ideal environmental for the transmission of the parasite and increase the risk of acute diarrheal disease, and may lead to increase death rate among these people especially the children. Thus, current study has been designed to provide a baseline information on the prevalence of IPIs. The findings of this study will help policy makers of public health sector to make a decision that contribute to control and prevent intestinal parasitic infections in the country.

## 2. Materials and Methods

This cross-sectional study was conducted over a period of five months, from November 2019 to March 2020 among internally displaced people who reside in Saber Camp in Lahaj governorate, Yemen (Fig. 1). Displaced persons are persons who have been forced to leave their native places, and who have not crossed an

internationally recognized state border. The study includes the internally displaced people who reside in study area and willing to sign informed consent as volunteers to participate in the study.

### 2.1 Study Population and Sample Size

Two-tailed  $\alpha$  was used with a p value = 0.05 at a 95% confidence interval (CI); therefore,  $Z_{\alpha} = 1.96$  for all variables.) was used.

$$n = \frac{z^2 pq}{d^2}$$

Where, n is the sample size and z is the z statistic for a level of confidence (e.g., for a level of confidence of 95%, the z-value= 1.96). p is the prevalence of IPIs, which was calculated based on the prevalence reported in a previous study conducted in Yemen [9] which were 90 % with a degree of precision = 5 %. Hence, the minimum sample size was calculated was 138.

### 2.2 Sample Collection

A specimen container with dry, clean and cup for each eligible resident were appropriately labeled and given to the household representative, along with oral instructions on how to collect and bring adequate amount of fresh stool. Then the samples were transferred to laboratory of parasitology for microscopic examination in University of Science & Technology, Aden. The stool sample was examined for physical appearance such as color, consistency, soft\formed, presence of blood or mucus or presence of adult worms.

### 2.3 Microscopic Examination

#### 2.3.1 Direct wet mount method by use of saline and iodine

A drop of normal saline was placed on the center glass slide and drop of iodine solution in center of other slide. Then, applicable stick was used to pick small amount of stool and emulsified with saline or iodine on each slide. After that, each slide was covered with cover slide above the sample gently to reduce formation of air bubbles. Later, the wet preparation was mounted on the stage of microscope and examined using objective 10x and 40x.

#### 2.3.2 Formalin ether sedimentation technique

About 0.5g of stool (1/2 tea spoon) was transferred to 10 ml of formalin in a test tube. It was mixed and allowed to stand for 30 minutes for adequate fixation. It was sieved through two layers of gauze in a funnel into clean centrifuge tube. About 3 to 4 ml of diethyl ether was added, the tube closed with a glass stopper and shake well for 15 minutes. After that, the stopper was removed carefully.

Later, the tube was centrifuged using the centrifuge machine for 5minutes at 5000 revolution per minutes, four layers were found. Decant the supernatant, a small amount of the sediment at the bottom of the tube containing parasites, a layer of formalin, a plug of fecal debris, and a layer of ether at the top. The plug of debris

was loose from the side of the tube, using an applicator stick. Rapidly the tube inverted and poured off the ether, the debris and the formalin. Finally, all sediment was transferred on to a clean grease free slide and covered with a coverslip and examined for cysts, Oocysts, eggs and larva or parasites using x10 and x40 objectives, respectively.

### 2.4 Statistical Analysis

The data were first obtained in an excel file and then imported into Statistical Package for Social Sciences (SPSS) software, version 25. The data were processed and checked by another person expert in the field of data analysis to ensure clarity of the data entries before starting the analysis process. The demographic information of the subjects were presented in percentages and frequencies. Proportion (percentage) was used to present the prevalence of intestinal parasites infection, while means and standard deviations were used to present the quantitative data differences between prevalence's of intestinal parasitic infection in relation to gender and age groups by using the Chi square test ( $\chi^2$ ). A confidence level of 95% was used to determine the significance of the association between the variables of the study.

## 3. Results

### 3.1 Demographic Characteristics of the Respondents

A total of 350 were participated voluntarily in this study. Out of the 350 respondents, 120 (34%) were males and 230 (66 %) were females (Fig.2). The age of respondents ranges from 1 to 71 years old, and they were grouped into six age categories (i.e. 1– 9, 10–19, 20-29,30-39,40-49 and  $\geq 50$ ). The mean age of respondents ( $\pm$ Standard Deviation (SD)) was  $21.47 \pm 17.87$  years, and the dominant age group was 1-9 years old 132 (37.7 %), followed by the 10-19 year-old age group, which accounted for 81 (23.1 %) (Fig. 3).

### 3.2 Overall Prevalence of IPIs among Respondents

A total of 350 respondents were included in the analyses. Out of the 350 subjects targeted in the study, 156 were infected giving an overall prevalence of 44.6%, while the remaining 194 respondents (55.4%) were not infected with an intestinal parasite as revealed through fecal examination. However, the types of parasites observed in the stool specimens were *E. histolytica/dispar*, *G. lamblia*, *H. nana*, *E. vermicularis* and *S. stercoralis*.

### 3.3 Prevalence of IPIs by Species

The prevalence of *E.histolytica/dispar* was 24.6 %, which made it the most prevalent IPIs in the study area followed by *G.lambliia* 19.7 %, approximately 7.1 % for *H.nana*, 0.90 % for *E. vermicularis* and for *S.stercoralis*, the prevalence was 0.30 %. Out of the 350 persons, 129 (36.9 %) were infected by single parasite, whereas 26

(7.4 %) were infected by two parasites. Another 1 case (0.3 %) had three types of IPIs (Table 1).

### 3.4 Parasitic Infection by Gender

In general, a total of 156 male and female were infected with one or more parasite species. Of the 120 male sampled, 55 males (45.8%) were infected, whereas out of 250 females participated there 101 females (43.9%) were infected with one or more parasite species. There was no statistically significant association between intestinal parasitic infections and gender ( $\chi^2 = 0.118$ ,  $P = 0.732$ ,  $df = 1$ ). The results are shown in Table 2.

Of the 156 persons that were infected, 86/156 (55.1%) were infected with *E. histolytica*, including 27/86 (31.4%) males and 59/86 (68.6%) females. A total of 69 respondents (44.2%) were infected with *G. lamblia*, including 27 (39.1 %) males and 42 (60.9 %) females. 25 respondents (16.0 %) were infected with *H. nana*, including 10 (40%) males and 15 (60 %) females. A total of 3 respondents (1.9 %) were infected with *E. vermicularis*, including 3 (100%) females. However, only one respondent (0.64 %) were infected with *S. stercoralis*, including 1 male only (100 %).

### 3.5 Prevalence of Parasitic Infections by Age Groups

Table 3 summarizes the prevalence of parasitic infection by age group. There were a total of 71 people infected within the age group 1-9 years, 38 cases in age group 11-19 years, and 18, 10, 9 and 10 cases in age group 20-29 years, 30-39 years, 40-49 and age group of 50 years and more, respectively. There were significant differences within the age group among parasite infection, with ( $\chi^2 = 12.10$   $P = 0.033$ ,  $df = 5$ ). There was no significant difference in all species infection among the different age groups (Table 4).

## 4. Discussion

Intestinal parasitic diseases are still protuberant in some tropical and sub-tropical regions around the world and are commonly prevalent in undeveloped or developing countries, however, the prevalence of intestinal diseases in different areas and countries can indirectly reflect the local sanitation conditions and living conditions [15].

This study showed that 44.6 % of all the subjects that participate in this study harbor at least one species of intestinal parasites. This infection rate was lower compared to previous studies carried out in Yemen. For example, in Hadhramout governorate, the prevalence of intestinal parasite among children was 58.7% [7], also it was lower than the overall prevalence rate (90%) among primary schools pupils in Al-Mahweet Governorate [9], similarly it was lower than the overall prevalence of 72.9% among apparently healthy workers at restaurants of Sana'a City [16]. On other hand, the finding of the current study is higher than the overall prevalence Parasitic Infections (21.8%) among workers in restaurants in Mukalla, Hadhramout, Yemen [10].

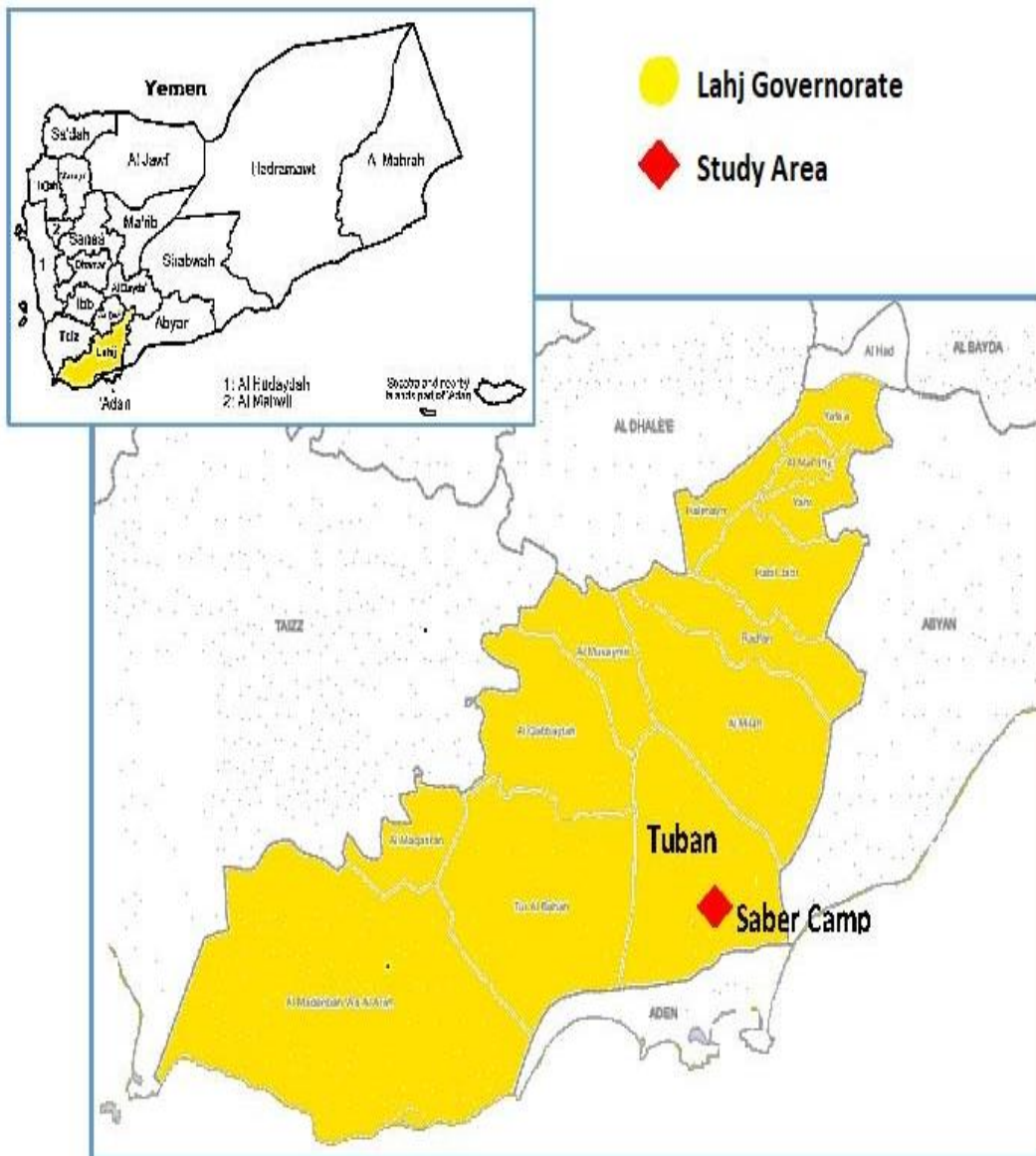


Fig. 1. Map of the study area

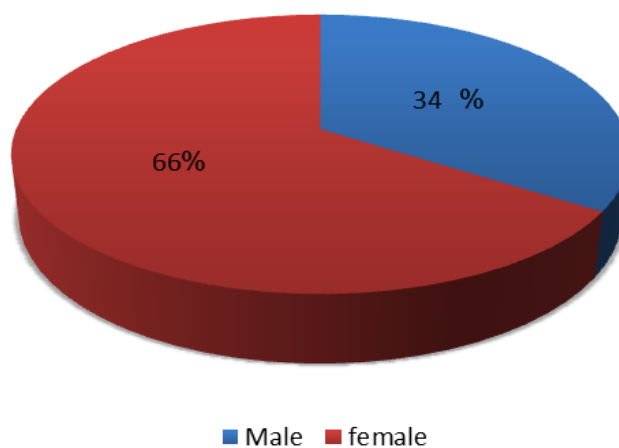


Fig. 2. Distribution of respondents based on gender



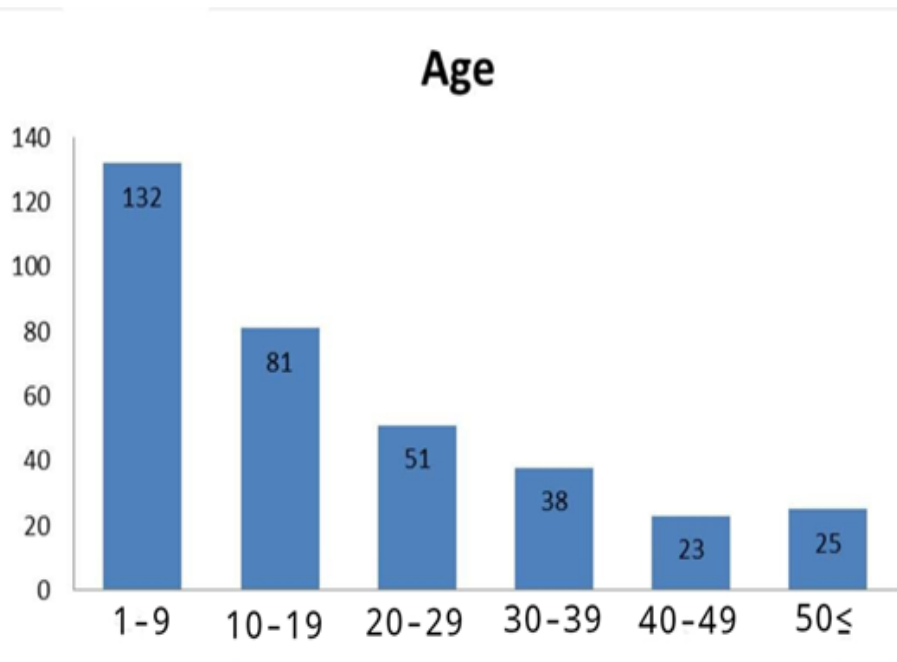


Fig. 3. Distribution of respondents based on age

A large discrepancy in the prevalence of intestinal parasitic infections was observed by comparing the results revealed by this study to those reported in previous studies in conducted in different regions in Yemen. Indeed, large variation in the prevalence of intestinal parasitic infections could most likely be explained by the variation of the sample participants examined. In addition, the high prevalence of recording in the current study could be attributed to respondents' predisposition to factors of intestinal parasitic infections; such as lack of sewage disposal system, lack of safe and clean water, poor health care facilities, socio- economic status, poor housing and lack of awareness at the family level [5,9]. In comparison with displaced people in other country, the finding of the current study is higher than the overall prevalence (21.8%) reported in Maiduguri, Borno state in a study conducted in Nigeria [17], and higher than other studies such as in Iraq the overall prevalence was 5.83%, and study conducted in Kassala town, Sudan (17.8%) [18].

However, the finding of current study is a lower than the prevalence (63.0%), reported from study conducted in Sudan[14], and Nigeria (79.5%) in displaced camps area [19]. However, the vast differences in overall prevalence was expected and is most likely due to the geographic region of sampling, socioeconomic profile of respondents, sample size, method of the detection as well as the type of sampling and sanitary condition.

Compared to results of studies conducted in other Middle East countries, the prevalence of intestinal parasites in the current study is markedly higher than that reported in Palestine, among pre-school children, (16.6%) [20], and that reported, by a study in the United Arab Emirate, among native and non-native people attending hospitals of Ministry of Public Health in Sharjah, i.e., 7.74% [21]. The prevalence of IPIs among Qatari and non-Qatari

people was 10.2% according to a study by Abu-Madi et al [22]. Another study in Iran showed a prevalence rate of 8.8% among food handlers [23], also form the prevalence in Oman was (18%) among all patients for whom a stool sample examination request was made [24]. On the other hand, current study showed a lower prevalence rate of parasitic infection compared to the prevalence reported by Mehraj et al. (2008) in Pakistan [25], 52%, and lower than the reports in India where the overall prevalence of intestinal parasites was 92.32% [26]. Also, the prevalence of current study seems low in comparison to study reported among the youngsters and children in Egypt and Turkey, it was 57.3% and 53%, respectively [27,28]. In Saudi Arabia, the results correspond to the present prevalence, i.e., 42.2% in urban areas and 47.1% in regions where sewage system is in open channels [29]. Similarly, in Hail region, Saudi Arabia reported a prevalence rate of (45.38%) which is most similar to that found in current study [30]. However, these differences could be ascribed to the differences in the study subjects, geography of the place and the socioeconomic condition. Besides that, the sample size and the different diagnostic methods used from one study to another should also be considered as a possible reason behind the disparity in the infection rates ,the habit of the study participants in relation to hygienic circumstances, low socio-economic status standard additionally influences their wholesome status and might be related to illiteracy, unhygienic practices, unawareness, open defecation and consumption of water in camp areas [9,27].

In the present study, the most predominant parasites were *E. histolytica/dispar* and *G. lamblia* which were rated at 24.6 % and 19.7% %, respectively, however, the prevalence of *E.histolytica/dispar* is varied in different regions of Yemen. The findings are higher than those

reported in previous studies carried out in Yemen such as in a study conducted among school children in rural areas of Ibb governorate [11], and in Mukalla among restaurant workers [10], and among patients in Sana'a city [31]. However, a study conducted in Al-Mahweet governorate reported higher rate of *E. histolytica/dispar* in comparison to current finding [9].

Our results showed higher rate of *G. lamblia* and *E. histolytica* than the prevalence of *G. lamblia* (6.1%) and *E. histolytica* (23.5%) reported in Nigeria [19], also higher than the prevalence of *G. lamblia* (15.1 %) reported among displaced children of preschool age from poor neighborhoods in Colombia [32].

These differences could be attributed to contaminated water, ineffective filtration, rapid, improper defecation and water supply system in camps as well as open defecation, unhygienic behavior and lack of awareness in the communities are the possible risk factors of transmission of parasites [33].

The present study showed that the rate of intestinal parasites was slightly higher in males (45.8%) than females (43.9%), but the difference was not statistically significant. Our finding is comparable to the previous reports; study conducted in Nigeria among internally displaced person showed the prevalence of gastrointestinal parasitic infection was higher in males (81.8%) than females (77.5%) with no statistically significance [19]. It is also similar to reports from Sudan where the frequency of infection of IPIs among displaced people was slightly higher in males 64.7%, compared to female group 64% [34]. However, the lack of statistical association stated in this study might be related to the fact that both genders were exposed to the same sources of infection at the same rate, they both take part in related camp chores that could expose them to infection with the parasitic agents [19].

This is in agreement with the previous report from Al-Mahweet, Yemen, mentioned that the infection rate of intestinal parasites was different between males (46.5%) and females (43.5%) [9]. A study conducted in Nepal revealed that the prevalence of intestinal parasites among males (28.2%) was higher than females (20.2%) and the difference was not statistically significant [35].

However, other studies have indicated the opposite finding. A study conducted in Jeddah, KSA showed that the infection in females (48.7%) is more than male (47.8%) [36]. This could be indicated that the gender may or may not play a vital role in Parasitosis that is depending on the region and other environmental or behavioral factors [9].

The prevalence rates according to participants' age-groups showed that respondents belonging to 1-10, 11-20 years old had higher prevalence, indicating that the association with intestinal parasitic infections is statistically significant. This is in agreement with the previous studies that showed that the infection was high among IDPs aged <10 years (93.1%) [19], and in Sudan the frequency of IPIs was higher (73.5%) in less than 12 years group, whereas it was 55.3% in older group [34]. These could be attributed to the overcrowded classrooms and health care centers participants are attending, which makes them in frequent contact with each other, the type of soil and water they play with, the materials they used to share with each other, and poor personal hygiene system that could facilitate parasites' prevalence [34,37].

The main limitation of the study is that the results were limited to only internally displaced people in Saber camp, Lahaj. Thus, the findings of this study may not be representative of the prevalence of IPIs in whole community, but rather represent the prevalence of IPIs in the sample targeted by the study. Therefore, the limitations of this study should be considered when interpreting its findings.

**Table 1.** Prevalence of intestinal parasitic infections according to species (N=350) among displaced person

Parasite species	No. of infected persons (n)	Prevalence rate
<b>Protozoa</b>		
Entamoeba histolytica/dispar	86	24.6%
Giardia lamblia	69	19.7%
<b>Helminthes</b>		
Enterobius vermicularis	3	0.90%
Hymenolepis nana	25	7.1%
S.stercoralis	1	0.30%
<b>Type of infection</b>		
Single	129	36.9
Double	26	7.4
G. lamblia + H. nana	2	-
G.lambli+a+E.histolytica/dispar	19	-
E. histolytica/dispar + H. nana	4	-
H. nana + E. vermicularis	1	-
Infected with three species	1	0.3
H. nana + E. vermicularis + E. histolytica/dispar	1	-

**Table 2.** prevalence of parasitic infections by gender groups

Parasite species	Female (n= 101)	Male (n= 55)	X2	p-value
All parasites	101	55	0.118	0.732
E.histolytica	59	27	0.423	0.516
Giardia lambelia	42	27	0.584	0.445
H.nana	15	10	0.390	0.532
S.stercoralis	0	1	1.92	0.166
E.vermicularis	3	0	1.58	0.554

**Table 3.** Prevalence of IPIs by age of the participants (n= 156)

Age	Positive	Negative	Overall prevalence	p-value
1-9	71	61	45.5	0.033
10-19	38	43	24.4	
20-29	18	33	11.5	
30-39	10	28	6.4	
40-49	9	14	5.8	
≥50	10	15	6.4	

**Table 4.** Prevalence of IPIs by age of the pupils among each species (n= 156)

Age	E.histolytica		Giardia		H.nana		S.stercoralis		E.vermicularis	
	Neg	Pos.	Neg	Pos.	Neg	Pos.	Neg	Pos.	Neg	Pos.
1-9	92	40	102	30	116	16	132	0	129	3
10-19	60	21	65	16	76	5	81	0	81	0
19-20	41	10	43	8	50	1	50	1	51	0
21-29	33	5	31	7	38	0	38	0	38	0
30-39	21	2	17	6	21	2	23	0	23	0
40-49	17	8	23	2	24	1	25	0	25	0
Total	264	86	281	69	325	25	349	1	347	3
Overall prevalence	24.6 %		19.4 %		7.1%		0.29 %		0.90 %	
X <sup>2</sup> value	9.641		4.078		10.491		5.88		4.997	
Df.	5		5		5		5		5	
p-value	.086		.583		.062		.318		.416	

## 5. Conclusion

The findings of this study warrant further studies among other areas of displaced person. Also, it is recommended that more effort is needed to effectively reduce these infections with emphasis on preventive measures such as good hygienic, provision of safe domestic water and heightened provision of community health education on sanitation and IPIs transmission. The data of the current study is could be beneficial to the public health service in designing control strategies for areas of high transmission.

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## Competing interests

Authors have declared that no competing interests exist.

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## دراسة مقطعية على انتشار العدوى الطفيلية المعوية بأوساط النازحين داخلياً بمخيم صبر بمحافظة لحج

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## المُلخَص

**الخلفية:** العدوى الطفيلية المعوية تعد واحدة من الاهتمامات الصحية الرئيسية في البلدان النامية وخاصة بين اوساط المجتمعات المحدودة الدخل. في الوقت الحالي، لا توجد معلومات كافية حول انتشار الطفيليات المعوية بين النازحين داخلياً في اليمن.

**الأهداف:** تحديد مدى انتشار الطفيليات المعوية بين النازحين داخلياً في مخيم صبر بمحافظة لحج، اليمن خلال شهر مايو - نوفمبر 2019.  
**الطريقة:** أجريت دراسة مقطعية على النازحين داخلياً في مخيم صبر. تم جمع عينات من البراز من كل مشارك وفحصها باستخدام تقنية التركيز الرطب وتقنية تركيز البراز الإيثر الرسمي. تم تحليل البيانات باستخدام البرنامج الإحصائي SPSS الإصدار 25.0 واستخدمت قيمة  $p < 0.05$  كدلالة إحصائية.

**النتائج:** تضمنت الدراسة 350 عينة. بشكل عام، وجد أن 156 (44.6%) من المشاركين مصابون بواحد أو أكثر من الطفيليات المعوية. كان الطفيلي الأكثر انتشاراً الذي تم اكتشافه في هذه الدراسة هو *Entamoeba histolytica / dispar* (24.6%) تليها *Giardia lamblia* (19.7%)، *Hymenolepis nana* 7.1%، *Enterobius vermicularis* 0.90%، *Strongyloides stercoralis* 0.30%. بلغ معدل انتشار العدوى الطفيلية عند الذكور 55 (45.8%)، بينما كانت الإناث 101 (43.9%)، ولا توجد علاقة ذات دلالة إحصائية بين العدوى الطفيلية المعوية والجنس ( $\chi^2 = 0.118$ ،  $P = 0.732$ ،  $df = 1$ ). أظهرت نتائج الدراسة أن هناك فرقا ذا دلالة إحصائية في معدل الانتشار بناءً على عمر المستجيبين ( $P = 0.033$ ،  $\chi^2 = 12.10$ ،  $df = 5$ ) مع أعلى معدل انتشار في الفئة العمرية 1-9 سنوات 45.5%، حيث كان أقلها 5.8% في الفئة العمرية 40-49 سنة.

**الاستنتاج:** تكشف هذه الدراسة عن انتشار عالٍ بشكل مثير للقلق للطفيليات المعوية بنسبة (44.6%) وتكشف أيضاً عن عدم كفاية المعرفة والمواقف والممارسات بشأن العدوى بين النازحين داخلياً في مخيم صبر بمحافظة لحج، اليمن. وبالتالي، هناك حاجة كبيرة لتحسين الصرف الصحي والتتقيف الصحي للحد من العدوى الطفيلية المعوية.

الكلمات الرئيسية: العدوى الطفيلية المعوية، النازحين داخلياً، مخيم صبر.

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