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Prevalence of intestinal parasitic infections in Abugota province, Gezira state, Sudan

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Abstract

Intestinal parasitic infections are among the most common communicable diseases worldwide and have always been an important public health problem in the tropics particularly in developing countries. This study aimed to determine the prevalence of intestinal parasitic infections as well as to assess the predisposing factors for the infection in Abugota province, Gezira state, Sudan. This study was conducted at the Department of Medical parasitology, university of medical sciences and technology. A cross sectional study involving 168 participants (100 female and 68 male) was conducted from January to May 2018. Structured questionnaire were used to identify socio demographic and behavioural factors. Stool specimens were collected from all study participants and examined for intestinal parasites using direct microscopic examination and formol-ether concentration technique. For coccidian parasites modified Ziehl–Neelsen staining was performed. Out of 168, 108 (64.3%) were positive for intestinal parasites. The highest prevalence was seen with Giardia lamblia 55 (50.1%) followed by Entamoeba histolytica/dispar 43 (39.8%), Cryptosporidium species 22 (20.4%), Hymenolepis nana 16 (14.8%), Entrobius vermicularis 2 (1.2%), Schistosoma mansoni 1 (0.6%) and Strongyloides stercolaris respectively. The highest prevalence (36.30%) of parasites was seen in age under 12 years old, $p<0.05$. There was statistically association for the prevalence of intestinal parasites with educational level, Nails status ($p<0.05$).

In conclusion, the prevalence of intestinal parasites in Abugota was high. Therefore, the need to take serious personal, environmental hygiene and regular awareness programs would contribute to the reduction of this high prevalence of intestinal parasites.

Key words: Intestinal parasites, Sudan, Prevalence, Risk factors.

INTRODUCTION

Epidemiological studies show that Intestinal parasitic infections are one of the biggest socioeconomic and medical problems of the society worldwide.[1] Particularly in tropical and

subtropical countries.[2] 3.5 billion people affected globally and resulting in approximately 450 million people infected; mostly young children.[3] Contagious and parasitic diseases responsible of more than 80 % of all deaths In developing countries.[4] Prevalence of intestinal parasitic infections rate is highest in sub-Sahara Africa, followed by Asia and then Latin America and the Caribbean. [5] There is strong correlation between the high prevalence of these infections and poverty, poor environmental sanitation and inadequate health services.[6] and also is related to poor personal hygiene, unsafe water supply, and lack of health education.[7]

In Sudan, Intestinal parasites are widely distributed. Different studies were performed to determine the prevalence and related risk factors of intestinal parasitic infection and the resultant, prevalence of these infections significantly changes in terms of infection rate or risk factors.[8] The transmission of this intestinal parasites infection has attitudinal, ecological and biological bases.[9] Transmission by ingestion of faecal contaminated food or water or faecal contaminated hands come in contact with the mouth or by skin penetration of the larval stage when direct contact with faecal contaminated soil.[10] Diagnosis is routinely by using microscope. Preparation of stool samples for microscopy performed by the direct wet mount or the concentration techniques. In spite of low sensitivity of the direct wet mount method [11, 12] it is still used in low and middle income countries.[12] There are many methods for concentrating intestinal parasites stages; cysts, eggs and larvae can be concentrated in specimen; such as formal-ether sedimentation technique.[13] This technique is better than direct wet mount because it detects few numbers of parasites.[14] The aim of this study was to determine the prevalence of intestinal parasitic infections as well as to assess the predisposing factors for the infection in Abugota province, Gezira state, Sudan.

MATERIALS AND METHODS

Study design, area, population and data collection

The study was a descriptive cross-sectional conducted from January to May 2018, in Abugota province, Al Gezira state, Sudan. The state lies between the Blue Nile and the White Nile in the east-central region of the country (14°30′N 33°30′E). It has an area of 27,549 km^2.

This study was carried out on 168 participants consisting of 100 female and 68 male with age range between 1 to 83 year, attending Abugota Health Canters. The sample size was originally calculated to be 168, based on the prevalence of 12.5%, according the equation $N= Z^2Pq/d^2$.

Verbal informed consent was obtained from each participant before starting data collection, and from parents regarding to children after explaining the purpose and procedures. The questions selected for analysis referred to age, gender, educational level Hand washing ,habit of eating unwashed vegetables, habit of eating raw/undercooked meat, defecation in open field, shortening finger nail, nails status (Clean/dirty) and presence of toilet in the house.

Samples collection and preservation

Fresh faecal specimens were collected in clean, wide mouth, transparent stool containers which provided to each person who was agreed to participate in the study. Numbers of the patients were properly labelled, and samples transferred to the medical parasitology lab. The diagnosis was based on direct wet mount and sedimentation concentration method (Formalin –Ether sedimentation concentration method).

Once sample was transported to the laboratory at university of medical sciences and technology in Khartoum, saline wet mount was performed. The remaining sample was mixed with 10 % formalin as preservative and formalin-ether

concentration technique was used. Preservation of faecal specimens is important to maintain protozoan parasites morphology and also to stop development of helminths stages; eggs and larvae.

Microscopic examination and staining Methods

Saline Wet Mount

By using a wooden stick, approximately 2 mg of stool sample was emulsified in a drop of normal saline on a glass slide. The preparation was covered with a cover slip and examined under the microscope. The identification of intestinal parasites was observed by using 10x and confirmed by 40x.[15]

Formal-Ether Concentration

1 g of stool sample was emulsified in 7 mL of 10 % formal water. Then strained through a strainer and the filtrate was collected in a centrifuge tube. 3 mL of ether was added to it, and the mixture was shaken well for 1 min. It was then centrifuged at 3000 rpm for 1 min.

The faecal debris was loosened with an applicator stick simultaneously with formal water, carefully decanted, leaving 1 or 2 drops. The deposit, after shaking, was transferred to a glass slide, and a cover slip placed over it and examined microscopically by using 10x and confirmed by 40x.[16]

Modified Ziehl-Neelsen Stain (Acid Fast Staining)

The smear was fixed with absolute methanol for 3 min and carbol fuchsin was added for 5-10 minutes, washing with clean tap water. Then, it was decolourized with 3% hydrochloric acid in 95% ethanol until no more colour floods from the smear. Then, the smear was counter-stained with methylene blue for about 30 seconds. Finally, the smear was washed, drained, air-dried, and examined by oil immersion (100x). [17]

Data management and analysis

Data were analyzed by using SPSS 21 (Statistical Package of Social Science program, version 21) and STATA 11 program. Normality of data was tested using Kolmogorov Smrinov and Shapiro Wilk test. Descriptive and inferential statistics were used to present data involving Fisher's exact test and binary logistic regression. A P value less than 0.05 was considered as statistically significant.

RESULTS

A total of 168 participants were included in this study. The age ranges between 1 to 83 years old, with mean age 22.98 ±19.527 years

About 40.5 % of participants were males and 59.5 % were females. Age groups divided according to median because data are not normally distributed. 55.4 % of participants had primary school education (Table 1).

Table 1: Description of Sociodemographic characteristics among the 168 study participants

Socio-demographic variables		
Age	Number	Percent
Less than 12 years	83	49.4
12 years and more	85	50.6
Gender		
Male	68	40.5
Female	100	59.5
Education		
Illiterate	32	19
Primary school	93	55.4
Secondary	30	17.9
University	11	6.5
Postgraduate	2	1.2

Prevalence of intestinal parasites

One stool sample was examined for each participant and out of 168 participants, 108 samples were positive for the intestinal parasites including protozoa and helminths, giving an overall prevalence of 64.3%. Out the 108 positive samples, 79 were infected with single parasite, 24 samples with 2 parasites and 5 samples with more than two parasites. The identified protozoa species were *Giardia intestinalis*, *Entamoeba histolytica/dispar* and *Cryptosporidium* species, the helminths were *Hymenolepis nana*, *Entrobius vermicularis*, *Schistosoma mansoni* and *Strongyloides stercolaris* (Table 2 and Figure 1).

Table 2: Number and frequency of the detected different parasites in 108 positive samples.

Parasite species	Number	Frequency %
G. intestinalis	55	50.1
E. histolytica /dispar	43	39.8
Creptosporidium species	22	20.4
H. nana	16	14.8
E. vermicularis	2	1.2
S. mansoni	1	0.6
S. stercoralis	1	0.6
Total	140	100

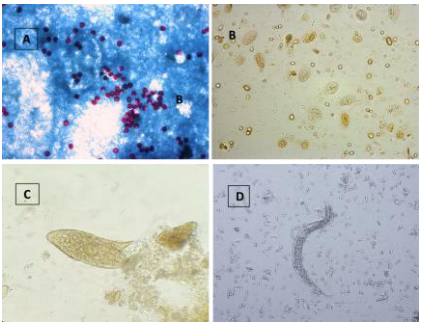

Figure1: The figure demonstrates representatives for identified protozoa and helminths in the study. A: Cryptosporidium species oocysts; B: *Giardia intestinalis* trophozoites and cysts; C: *Schistosoma mansoni* ovum; C: *Strongyloides stercolaris* larva. Micrograph magnification was 1000x.

Intestinal parasites and possible risk factors

Distribution of intestinal parasitic infections according gender, age and educational level in the study was showed that frequency of infection was 64.7% (44/ 68) in male group, which was 64% (64/ 100) in female group. The frequency was 73.5% (61/83) in less than 12 years group, which was 55.3% (47/85) in older group. Fisher's Exact test did not find a significant difference in distribution of the parasitic infection between male and female groups (p= 0.999). However, significant differences were found between younger and older groups (p= 0.016) and between educational levels also (p=0.018), as shown in figure 3.

Table 3: Prevalence of intestinal parasites according to age, gender and educational level.

Gender, age and educational level	Positive	Negative	Total	Frequency %	Fisher's Exact Test *P* value
Male	44	24	68	64.7	
Female	64	36	100	64	0.999
Less than 12 years	61	22	83	73.5	
12 years and more	47	38	85	55.3	0.016**
Illiterate	17	15	32	53.1	
Primary school	69	24	93	74.1	
Secondary	14	16	30	46.7	
University	6	5	11	54.5	
Postgraduate	2	0	2	100	0.018**

Moreover, relationship was revealed between prevalence of intestinal parasitic infections and possible risk factor; finger nails status (Clean or dirty). Participants who have dirty fingers are more contributed to have Intestinal parasitic infections 8.563 (3.402-21.55) times statistically significant, p<0.05 (Table3, 4 and 5).

Table 4: Binary logistic regression for prediction intestinal parasitic infection among study participants

Binary logistic regression for prediction Intestinal parasitic infection								
							95% C.I. for EXP(B)	
Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Gender	0.075	0.521	0.021	1	0.886	1.078	0.388	2.996
Age (Years)	-0.008	0.015	0.298	1	0.585	0.992	0.963	1.021
Educational level	-0.681	0.504	1.825	1	0.177	0.506	0.189	1.359
Practice of eating unwashed vegetables	-0.408	0.517	0.622	1	0.43	0.665	0.242	1.831
Practice of eating raw/undercooked meat	0.146	0.455	0.103	1	0.748	1.157	0.474	2.823
Hand washing	-0.161	0.569	0.08	1	0.777	0.851	0.279	2.598
Open field Defecation	-0.735	0.559	1.728	1	0.189	0.48	0.16	1.435
Shortening finger nail	0.771	0.517	2.22	1	0.136	2.161	0.784	5.956
Dirty nails	2.147	0.471	20.796	1	0.00001	8.563	3.402	21.55
Toilet in the house	0.356	0.474	0.565	1	0.452	1.428	0.564	3.616
Constant	-2.441	1.669	2.141	1	0.143	0.087		

Moreover, no statistically significant differences were detected between the prevalence of intestinal parasites and factors such as gender, habit of eating unwashed vegetables, habit of eating raw/undercooked meat, hand washing, defecation in open field, shortening finger nails, presence of toilet in the house (p>0.05) as shown in Table 5.

Table 5: Prevalence of intestinal parasites according to environmental and personal factors

Environmental and personal factors		**Intestinal parasitic infection**		**Fisher's Exact Test P value**
		Negative	Positive	
Habit of eating unwashed vegetables	Yes	28	56	0.629
		16.70%	33.30%	
	No	32	52	
		19.00%	31.00%	
Habit of eating raw/undercooked meat	Yes	28	51	0.999
		16.70%	30.40%	
	No	32	57	
		19.00%	33.90%	
Hand washing	No washing	30	70	0.056
		17.90%	41.70%	
	Washing only with water	29	38	
		17.30%	22.60%	
	Washing with soap	1	0	
		0.60%	0.00%	
Open field Defecation	Yes	42	84	0.271
		25.00%	50.00%	
	No	18	24	
		10.70%	14.30%	
Shortening finger nail	Yes	51	82	0.234
		30.40%	48.80%	
	No	9	26	
		5.40%	15.50%	
Finger nails status	Dirty	16	77	0.0000001
		9.50%	45.80%	
	Clean	44	31	
		26.20%	18.50%	
Presence of toilet in the house	Yes	44	76	0.725
		26.20%	45.20%	
	No	16	32	
		9.50%	19.00%	

DISCUSSION

Intestinal parasitic infections are distributed worldwide and still a main public health concern in many countries.[18]

Epidemiological surveys on the prevalence of intestinal parasites infections in different area were conducted to recognize high-risk communities and improve suitable strategy to eradicating these parasites. In line with this view, this study performed to assess the prevalence and associated risk factors of different intestinal parasitic infections in Abugota province, Gezira state, Sudan.

In the current study, the overall prevalence of intestinal parasites was 64.3 %, and this high percentage might be due to habits practiced by participants as well as poor quality of life and behaviour. This finding is similar to what reported previously in which the prevalence was 64.4 %.[19] and slightly lower when compared with studies revealed that the prevalence was 70 % [20] in Khartoum, 77.1 % [6] in Turkey and 77.9 % [21] in Ethiopia. Much lower than what was reported by Abdel-aziz *et al* [22] in central Sudan (90.4 %) who collect the samples in October, so the difference between prevalence rates of intestinal parasitic infections may be due to the deference between geographical areas, population and even seasons. Also disagrees with different studies performed in Al-kalakla [8] , Kasala [13] , Khartoum [23] , India [18] and the prevalence was 30 %, 17.8 %, 24.9 % and 13.3 % respectively.

The protozoan parasites detected in this study were more than helminthic parasites, *G. intestinalis* (50.1 %), *E. histolytica/dispar* (39.8 %), and *Cryptosporidium* species (20.4%). The forth parasite is *H.* nana (14.8 %) which is helminth. All these parasites are transmitted by feacal- oral route, and this is a pointer to the fact that, this area with high level of contamination by human faeces.

G. intestinalis parasite was the most predominant (50.1 %); this was in agreement to most findings reported from Sudan in which *G. intestinalis* topped the list of intestinal parasites detected [13, 19, 20] , study from Nepal [24] and from Turkey [25] .

We found out that, those participants less than 12 years had higher prevalence which is revealed a statistically significant association with intestinal parasitic infections (p=0.016), and similar findings have also been reported in [8, 13, 24]. This may be due to high contact of children in this age to the environment, they usually play in ground and less aware of important personal hygiene activities such as hand washing habit before meals and after defecations or after playing.

There was no significant difference (p>0.05) between the intestinal parasitic infections and gender. This suggested that parasitic infections were independent of gender in Abugota, and this agrees with [6, 8, 24, 26] Contrary to finding in Turkey [25]

The prevalence of intestinal parasites was higher in primary school education and there was a statistically significant difference between educational level and this prevalence (p=0.018). In primary school age children, tend to eating and playing outdoor with their friends especially in this environment which lack hygiene. This result disagree with study performed in Nigeria [27] which reported no significant difference in the prevalence of the intestinal parasitic infections and educational level of participants.

Increased number of participants with no washing hands, 70 (41.7%), and who with open field defecation practice , 84 (50%), may lead to dirty finger nails which is one of the factors strongly associated with intestinal parasitic infection in this study, p=0.001. This is probably due to low knowledge of participants about the feco-oral transmission of intestinal parasite through their dirty finger nails. Similar findings found in other study [21] which showed that participants who had unclean finger nails are more likely to acquire infections as

compared to those who had clean finger nails. This result disagree with study conducted in North Gondar, Ethiopia.[28]

CONCLUSION AND RECOMMENDATIONS

In conclusion, it has been shown that prevalence of intestinal parasites in Abugota is high. The results of this study indicated that protozoan infections are more predominant than helminthic infections .The most prevalent parasite was *G. intestinalis*.

Health education and keeping finger nails clean are play a potential role in preventing people from infection of intestinal parasites. Primary school children should be provided with regular school basic health information, especially personal hygiene. These would be good attempts towards to eradicate intestinal parasites.

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