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Prevalence of Intestinal Parasitic Infections and Associated Risk Factors among School Children in White Nile State, Sudan

Mohammed A Suliman[1*], Abdalmoneim M Magboul[1], Hafiz Y Mohammed[1], Abdelhakam G Tamomh[2], Husameldin A Bakhit[3], Sara A Altoum[1] and Shawath M Ahmed[1]

[1]*Department of Parasitology and Medical Entomology, Faculty of Medical Laboratory Sciences, University of El Imam El Mahdi, Kosti, Sudan*

[2]*Department of Microbiology and Immunology, Dalian Medical University, Dalian, China*

[3]*Department of Parasitology and Medical Entomology, Faculty of Medical Laboratory Science, White Nile University, Ksoti, Sudan*

[*]**Corresponding author:** Mohammed A Suliman, Department of Parasitology, University of El Imam El Mahdi, Sudan, Tel: +249912877552; E-mail: mohammedahmed7919@gmail.com

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Abstract

This prospective cross sectional study was conducted in White Nile State during the period of September 2017 to estimate the prevalence of intestinal parasite infection among schools children. Among the 253 stool samples tested, the overall prevalence was 56.9% (144/253), with higher prevalence in Hagar Asalya School 80% (64/80), followed by Al Kadogly School 52.4% (44/84) and Al azhari showed 40.4% (36/89). The commonest intestinal parasites among the schools children were *E. histolytica* 31.2% (79/253), *G. lamblia* 22.9% (58,253) and *H. nana* 2.8% (7,253). The most infected age group was (10-13) with prevalence of 43% (108/253). Females were more infected than males, p-value=0.0001. There was significant correlation between intestinal parasitic infection and sources of drinking water, hand wash after toilet. Whereas, no significant association was observed with father education, mother education and toilet availability.

Keywords: Prevalence; Intestinal parasite; Associated risk factors; Sudan

Introduction

Intestinal parasites infection is one of the most common health problems affecting human's world [1]. Over three billion people throughout are infected by the intestinal parasites and 450 million people report symptoms of sickness [2]. In spite of remarkable development in medical science in recent years, the parasitic infection remains a serious health issue in developing countries [3]. Intestinal parasitic infections occur in both rural and urban population, especially in school age children due to their habit of playing or handling infected soils, eating with soiled hands, unhygienic toilet practices, and ingestion of contaminated food, water or soils [4,5]. Apart from causing morbidity and mortality, these infections can cause iron deficiency, retardation of growth, energy malnutrition, and low education performance of schoolchildren [6,7].

There are several environmental and socio-economic factors contributed to the association of the intestinal parasitic infection with children. Among them are lack of education, poverty, poor sanitary conditions, the absence of potable water, inadequate disposal of excreta, and poor housing facilities [8]. The environmental, geographical, and socioeconomic factors are responsible for spatial distribution and prevalence of various species of intestinal parasites in the world [9].

Although several studies were carried out on the distribution and prevalence, still there are several localities lacking epidemiological information on Kosti City, located in southern part of Sudan is one of such localities without any report in this regard. Thus, this study aimed to assess the prevalence of intestinal parasite infections and associated risk factors among schoolchildren in White Nile State.

Materials and Methods

Study area

This cross sectional study was conducted during the period of September 2017 in White Nile State (WNS), Southern Sudan about 270 km from Khartoum State. WNS consists of seven governorates. Two localities Kosti and Rabak were selected for this study. Kosti located in the West of Nile basin, whereas the Rabak in east part. Three schools, Al Azhari and Al Kadogly from Kosti locality, and Hagar Asalya from Rabak locality were selected.

Study population

School children aged from 10-17 years, both male and females in basic and higher secondary school from Kosti and Rabak localities in White Nile State were recruited for this study. To select the study subjects, the students were first classified according to their educational level (grade 5 to 8 for basic schools and grade 1 to 3 for secondary school) and they were taken from each class category by systematic random sampling.

Inclusion criteria

School children of different age living in the study areas were included.

Exclusion criteria

Children who received treatment parasitic infections during the last two weeks before the study were excluded.

Ethical considerations

Prior to stool samples collection, preliminarily meeting was held up with the directors of the schools and head of healthcare centers and the outline of the project was explained. Then both schoolchildren and their parents were asked for verbal consent.

Sample size

A total of 253 stool samples were collected from the participants by systematic random sampling.

Data collection and laboratory procedures

A questionnaire was administered to school children to identify the age, sex, toilet availability, water sources, father and mother education sanitary and hand wash after toilet. To ensure the reliability of the information, the children were interviewed in their local language by research assistants. All the questionnaires were checked for accuracy and completeness

After proper instruction, the children were given labelled stool containers and applicator sticks to collect fresh stool samples. Each of the specimens was checked for its label, quantity and procedure of collection. Stool samples were processed with a direct microscopic technique to detect cysts, trophozoites, eggs and larva of intestinal parasites immediately. The remaining parts of the samples were preserved in 10% formalin solution for formal ether concentration technique. A structured questionnaire also developed, along with a stool specimen container. The questionnaire questions were structured based on possible risk factors.

For direct stool examination, small amount from fresh stool sample suspended with one drop of physiological saline in a clean and dry, covered by cover glass and the preparation was examined microscopically by using 10X objective to detect parasite with iris condenser closely sufficiently and using 40X objectives to identify the parasite [10].

Formal ether concentration technique performed as described by Cheesbrough [10], about 4 ml of 10% formal saline transferred to the centrifuge tube, added about 1 ml from preserved stool sample, then added 3 ml of ether and covered by stopper, shake by hand for 1 minutes then centrifugation for 1 minute at 3000 rpm. By using stick loosen the layer of faecal debris from the side of the tube and rapidly invert the tube to discard the ether, faecal debris and formalin. The sediment was examined microscopically by using 10X objective to detect parasite with iris condenser closely sufficiently and using 40X objectives to identify the species.

Data analysis

All statistical analysis was carried out using Graph Pad prism 5 software. The One-way ANOVA and student t-test were employed for analysis of differences between groups. $p<0.05$ considered significant

Results

The prevalence of intestinal parasites in White Nile State (WNS)

Out of the 253 stool samples examined, 56.9% (144/253) were positive with at least one of the intestinal parasites. Among intestinal parasite, three species were detected, two species of protozoa and one species helminths. The 22.9% (58/253) has *G. lamblia*, 31.2% (79/253) has *E. histolytica* and 2.8% (7/253) infected with *H. nana*, as shown in Table 1.

The prevalence of intestinal parasite in a different schools

Three schools, two from Kosti (Al Kadogly and Al Azhari) and one from Rabak (Hagar Asalaya) were selected. Among these schools, Hagar Asalya has higher prevalence 80% (64/80), followed by Al Kadogly 52.4% (44/84) and Al azhari showed 40.4% (36/89) in Table 2.

Species	Positive (%)	No. of cases
G. lamblia	22.90 %	58
E. histolytica	31.20 %	79
H. nana	2.80 %	7
Total	56.90 %	144

Table 1: The prevalence of intestinal parasites in WNS.

School	*G. lamblia*	*E. histolytica*	*H. nana*	Total
Hagar Asalaya	28.8% (23)	46.2% (37)	5% (4)	80% (64)
Al Kadogly	22.6% (19)	28.6% (24)	1.2% (1)	52.4% (44)
Al Azhari	18% (16)	20.2% (18)	2.2% (2)	40.4% (36)

Table 2: The prevalence of intestinal parasite in different schools.

		G. lamblia	*E. histolytica*	*H. nana*	Total	p-value
Gender	Male	8.3% (21)	12.3% (31)	0.7% (2)	21.3% (54)	0.0001
	Female	14.6% (37)	19% (48)	2% (5)	35.6% (90)	
Age group	10-13	16.6% (42)	24.1% (61)	2% (5)	42.7% (108)	0.0001
	14-17	6.3% (16)	7.1% (18)	0.8% (2)	14.2% (36)	

Table 3: Prevalence of intestinal parasites according to the gender and age groups.

The prevalence of intestinal parasites according to the gender and age groups

Among the gender, females were found infected more than males with 35.6% (90/253) female and 21.3% (54/253) males, p-value<0.0001. All participants were ranged from 10-17 years old and they divided into two groups (10-13 and 14-17) years old. The age group (10-13) had higher prevalence 42.7% (108) than the age group (14-17) 14.2% (36), p-value<0.0001, as shown in Table 3.

The prevalence of intestinal parasite and associated risk factors

The results of personal questionnaire were used to determine the possible risk factors for intestinal parasitic infection. Significant relationship was noticed between intestinal parasite infection and resources of drinking water and hand wash after toilet, p-value 0.0002, 0.0035 respectively. Meanwhile, no significant association was observed with father education, mother education and toilet use, as shown in Table 4.

	Positive (%)		Negative (%)	p-value	OR
Toilet availability	Yes	51.4% (130)	38.7% (98)	1	1.042
	No	5.5% (14)	4.3% (11)		
Source of water	Canal	15.8% (40)	11.9% (30)	0.0002	0.4041
	River	41.4% (104)	31.2% (79)		
Father education	Educated	46.2% (117)	32.8% (83)	0.3515	1.357
	Non educated	10.7% (27)	10.3% (26)		
Mother education	Educated	20.2% (51)	19.8% (50)	0.1196	0.6471
	Non educated	36.8% (93)	23.3% (59)		
Hand wash after toilet	Yes	35.6% (90)	34.4% (87)	0.0035	0.4215
	No	21.3% (54)	8.7% (22)		

Table 4: Prevalence of intestinal parasite and associated risk factors.

Discussion

This study was conducted in White Nile State, Sudan to determine the prevalence of intestinal parasitic infection and associated risk factors among school children.

The overall prevalence rate was 56.9%, with higher prevalence in Hagar Asalya 80%, followed by Al Kadogly 52.4% and Al Azhari showed 40.4%. This prevalence rate was higher than the rate reported from Khartoum, Sudan [11], where the prevalence rate was 44%. Similar lower results also obtained from other countries such as in Ethiopia [12], Panama [13] and Turkey [14] with prevalence rates 45.3%, 47.4%, 44.6%, respectively. On the other hand, higher prevalence also observed from Chencha town, Southern Ethiopia [15] and Plateau Central and Centre-Ouest regions of Burkina Faso [16], the prevalence were 81.0% and 84.7% respectively. These variations in prevalence might be due to differences in climatic conditions, environmental sanitation, economic and educational status of parents and study subjects, and previous control efforts.

In this study the commonest parasites were 22.9%, *H. nana* 2.8 %, *E. histolytica* 31.2% and non-pathogenic *E. coli* 14%. Similar parasites with high prevalence were reported from Khartoum, Sudan [17]. However, same species of the intestinal parasite with variant prevalence detected in Kassala, Sudan [18].

According to the age groups, the age group (10-13) showed higher prevalence 42.7% compared the 14.2% in the age group (14-17). Association of the intestinal parasitic infection to the age group has been reported also from several studies [12,19].

Prevalence rate according to the gender showed 20.7% for male and 35% for female. This study was in a line with study done in Addis Ababa, Ethiopia [12], they reported 77.9 0% in female and 22.1% males. Contrasting to our result, study from P. R. China showed more males were infected by intestinal parasite than females [20].

In this study, the source of drinking water and practice of good hand washing before eating were significantly associated with intestinal parasitic infection. Similar associations of intestinal parasitic infection with source of drinking water and hand washing habit also reported from Bahir Dar, Ethiopia [21] and Saudi Arabia [22]. However, Toilet availability, father education and mother education did not show statistically significant associations with intestinal parasitic infections (p>0.05).

The limitations of the present were subjected to the following. As the collection period was short, potential seasonal fluctuations might have affected the actual prevalence. Modified acid-fast staining technique was not used to detect *Cryptosporidium* species. Due to lack of antigen tests, *Entamoeba histolytica* and *Entamoeba dispar* were not separated.

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