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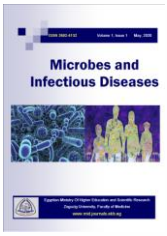

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Original article

Prevalence and risk factors of schistosomiasis and intestinal helminths infection among school children in White Nile State, Sudan

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ABSTRACT

Background: This cross-sectional study was carried out in White Nile State, Sudan from May to September 2017 to determine the prevalence of schistosomiasis and intestinal helminths infections. **Methods:** Urine and stool samples were collected from all participants. Urine samples were examined for ova of *Schistosoma haematobium* (*S. haematobium*) using a sedimentation technique, whereas the stool samples were tested by using the Kato-katz technique for *Schistosoma mansoni (S. mansoni)* and other intestinal helminths. **Results:** Out of 347 urine samples and 336 stool samples examined, the prevalence of *S. haematobium* was 10% (35) and no positive cases were detected for *S.mansoni*. For the other intestinal helminths, the overall prevalence was 12.2% (41), the species detected were *Hymenolepis nana* 11.3% (38) and *Taenia* species 0.9% (3) . Among the different schools, the prevalence of urinary schistosomiasis and intestinal helminths in Alliya was 14.8% (17) and 16.8 %, respectively. In Gooz al salaam, the prevalence was 7.9% for *S. haematobium* and 18.5% for intestinal helminths. Moreover, the *S. haematobium* prevalence was 7.6% (8) in Hagar Assalya, but no positive cases were detected for intestinal helminths. Regarding the gender, *S. haematobium* infection was higher in males (6.3%) than in females 3.7%, but the females has higher intestinal helminths 8.9%. The age group (10-13) has higher prevalence for urinary schistosomiasis and intestinal helminths, 7.2% (25) and 9.5 % (32), respectively. **Conclusion:** The mothers' education and source of drinking water showed significance regarding urinary schistosomiasis and intestinal helminthic infections, meanwhile, the fathers' education was not significantly correlated.

Introduction

Schistosomiasis is a water born parasitic disease caused by *Schistosoma species.* This digenic trematode found in the blood vessels of man. More than 237 million people are infected with this blood fluke [1]. Most human infections are caused by *S.haematobium, S.mansoni*, and *S.japonicum*, less prevalent species include *S.mekeongi* and S.*intercalatum* [2]. The main burden of schistosomiasis is concentrated in sub-Saharan Africa, where schistosomiasis control had been neglected for many decades, and hence country-specific infection rates above 25% are the norm rather than the exception [3-5]. In Sudan, the schistosomiasis is endemic in White Nile River and Geizera state [6]. The development of irrigation schemes across the Nile for agricultural purposes has led to significant environmental modification, favoring the spread of vector-borne diseases, including schistosomiasis [7].

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More than three billion people are infected with intestinal parasites according to the WHO [8,9]. The intestinal helminths are most common in rural regions including Sub-Saharan Africa [10]. Prevalence of intestinal helminths and other intestinal parasites have been studied in different areas of the tropics and subtropics [11]. The purpose of this study was to assess the prevalence and risk factors of schistosomiasis and intestinal helminths among school children in the study area. The findings of this study might help in strengthening the information available so far and encourage policy makers to design effective strategies to combat intestinal parasitic infections

Material and Methods

Study area

This cross-sectional descriptive study was conducted during the period between May to September 2017 in White Nile State (WNS). Southern Sudan to 270 kilometers from Khartoum state. WNS consists of seven governorates. Two localities Kosti and Rabak were chosen for this study. Kosti located in the west of the Nile basin, whereas the Rabak in eastern part. Three schools, Alliya and Goz Alsaalam from Kosti locality, and Hajar assalya from Rabak locality were chosen. The main occupation of the population is either employees in the governmental sugar factory or farmers along with the village.

Study population

School children aged from 10-17 years, both males and females in basic and higher secondary school from Kosti and Rabak localities in the 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

Sample size

A total of 347 urine samples and 336 stool samples were collected from the participants by systematic random sampling technique.

Ethical consideration

Ethical approval was obtained from the Faculty Research Committee of University of El Imam El Mahdi. Prior to stool samples collection, meeting was held up with the schoolteachers and the outline of the project was explained.

Sample collection

Before samples were collected, children were given instruction on how to collect the sample and the amount of urine and stool needed. Children were also instructed not to contaminate urine and stool with water and wash their hands after wards. The samples collected from grade 5 to 8 for basic schools and grade 1 to 3 for secondary school.

The study subjects were provided with dry and clean well labeled screw cap containers and instructed to include the terminal urine and the amount of stool needed. About 10 ml of urine and enough amount of stool samples were collected. The samples were transferred to the parasitology laboratory in University of El Imam El Mahdi for parasitological examination.

Sample examination

The stool samples were examined by using kato Katz and formal ether centrifugation sedimentation technique, urine samples were examined by centrifugation sedimentation technique. For Kato technique, stool samples were tested for the presence of *S. mansoni* eggs using the standard Kato Katz technique [12].

Urine examination

The appearance of the urine hematuria and proteinuria were examined macroscopically and reported. About 10 ml of each urine sample were transferred to a centrifuge tube after mixing, and then centrifuged at medium speed (2000rpm) for 3 minutes avoiding high speed, because it causes hatching of miracidium. Using Pasteur pipette the supernatant was discarded from each tube and the sediment were transferred to a clean slide and covered with cover glass. The preparation was examined microscopically using 10X and 40X objectives for *S. haematobium* eggs [13].

Data analysis

All statistical analysis was carried out using GraphPad 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 Schistosomiasis and intestinal helminths in WNS

A total of 347 students were selected for this study. Stool and urine samples were collected from each participant and investigated for parasites.

Out of 347 urine samples and 336 stool samples examined, the prevalence of *S. haematobium* was 10% (35/347) and no positive cases detected for *S.mansoni*. For the other intestinal helminths, the overall prevalence was 12.2% (41/336), the species

detected were *Hymenolepis nana* 11.3% (38/336) and *taenia* species 0.9% (3/336) as shown in **table (1)**.

The prevalence of schistosomiasis and intestinal helminths infection according to the schools

Out of 115 urine samples examined in Alliya, the prevalence of *S. haematobium* was 14.8% (17/115). For the other intestinal helminths, the prevalence of *hymenolepis nana* was15.9% (17/107) and *taenia species* 0.9% (1/107). In Goz alsaalaam, the prevalence of *S. haematobium* was 7.9% (10/127), *hymenolepis nana*16.9% (21/124) and *taenia species* 1.6% (2/124). Moreover, the *S. haematobium* prevalence was 7.6% (8/105) in HajarAssalya, but and no positive cases were detected for *H. nana and taenia spp* in HajarAssalya (**Table 2)**.

The prevalence of *S.haematobium* and intestinal helminths among to the gender and age groups

According to the gender, *S. haematobium* infection was higher in males (6.3%) than in females (3.7%), but the females had higher intestinal helminths (8.9%) than the males (3.2%) **(Table 3)**.

The age groups ranged from (10-17) years old. The subjects were divided into two groups, (10-13) and (14-17). The *S.haematobium* infection was higher in age group (10-13) 7.2% (25), the same group also had higher intestinal helminthic infection 9.5 % (32) **(Table 3)**.

The socio-demographic parameters of *S.haematobium* infection

Among 10% (35/347) infected with *S. haemtobium* subjects, source of drinking water and mother education had significant association with the disease infection, *P.value 0.0001, 0.0017*, respectively. On the other hand, father education didn't show significance, *P.value 0.2929* **(Table 4)**.

Table 1. The prevalence of schistosomiasis and intestinal helminths in WNS.

		No. positive (%)	Total %
Schistosoma Spp.	*S.haematobium*	10% (35/347)	10 % (35/347)
	S.mansoni	0% (0/336)	
Intestinal helminths	*H.nana*	11.3% (38/336)	12.2 % (41/336)
	Taenia species	0.9% (3/336)	

Table 2. Prevalence of schistosomiasis and intestinal helminths infection among schools.

School	*S. haematobium* (%)	*H.nana* (%)	*T.species* (%)
Alliya	14.8% (17/115)	15.9% (17/107)	0.9% (1/107)
Goz alsaalaam	7.9% (10/127)	16.5% (21/124)	1.6% (2/124)
Hajar Assalya	7% (8/105)	0% (0/105)	0% (0/105)

Table 3. *S.haematobium* and intestinal helminths prevalence among the gender and age groups.

		S.haematobium	*P .value*	Intestinal parasites	*P .value*
Sex	Male	6.3% (22)	***0.0001***	3.2% (11)	***0.0015***
	Female	3.7% (13)		8.9% (30)	
Age groups	10-13	7.2% (25)	***0.0022***	9.5% (32)	***0.0010***
	14-17	2.8% (10)		2.8% (9)	

Table 4. Socio-demographic characteristics and prevalence of *S.haematobium*.

	S.hematobium		***P. value***
Source of drinking water	Canal	4.7% (17)	*0.0001*
	River	5.2% (18)	
	pipe	0% (0)	
Fathers' education	Education	4.9% (17)	*0.2929*
	Non education	5.2% (18)	
Mothers' education	Education	2.6% (9)	*0.0017*
	Non education	7.5% (26)	

Discussion

In Sudan, schistosomiasis is the most prevalent parasitic disease, and both urogenital and intestinal forms of schistosomiasis are common throughout the country with geographically varying degrees of prevalence [14]. The slow current of the White Nile River and the presence of the dense grasses and vegetation in the river create a good environment for intermediate host breeding and growth. This study was carried out to evaluate the Schistosomes and intestinal helminths prevalence in White Nile State.

The overall prevalence of *S.haematobium* and *S.mansoni* was (10%) and (0%), respectively. These rates are lower than the rates reported in White Nile River basin, which were 45.0% and 5.9% for *S.haemtobium* and *S.mansoni* respectively [15], is also lower than the results obtained in the Darfur state 20% [16]. This variation may be due to the intense schistosomiasis control programmes through the Koicka and national programmes White Nile State, beside increased awareness about the disease.

For the other intestinal helminths, the overall prevalence was 12.2 % (41/336). Two species were detected, *H.nana and T. species* with prevalence of 11.3% and 0.9% respectively. These results were higher than results reported in khartoum, 2.7 % [17]. However, it was lower than reports from Ethiopia, 34.2 % [18].

It was obvious that the rate of *S.haematobium* infection was higher in males 6.3% (44) than females 3.7 % (10). Similar observations also have been reported from Egypt and Malawi [19,20]. This could be due to more exposure of the males to infection because of water activities like revenue, bathing, agriculture and swimming.

The prevalence rate of *S.haematobium* and intestinal helminths infection were associated with age. This result was in line with reports from Gambella, Ethiopia [21]. However, it is in contrast with another results obtained from Enfranz Towns, Ethiopia [22], they reported no association of schistosomiasis with age.

According to social demographic parameters, we found an association between the mother education and *S. haematobium* infection, as well as between the source of drinking water and *S. haematobium* infection. This finding is similar to that reported by others [23,24]

Conclusion

This study showed that the urinary schistosomiasis and intestinal helminths were prevalent among the school children in White Nile State, Southern Sudan. Hymenolepis nana and taenia species were the common intestinal helminths detected. Sources of drinking water and mother's education were statistically associated with parasitic infections. The findings showed that much work remains to be done to improve the health of the students. Measures including education on personal hygiene and environmental sanitation, water supply and treatment should be taken into account to reduce the prevalence.

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