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Prevalence of intestinal schistosomiasis and associated risk factors in New Halfa city, Kassala state, Sudan

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ABSTRACT:

— ***Objective:*** *Schistosomiasis* is the second most prevalent parasitic disease in tropical countries after malaria in both rural and agricultural areas. This study aims to determine the prevalence and the associated risk factors of intestinal schistosomiasis in New Halfa, Kassala state, Sudan.

— ***Materials and Methods:*** A cross-sectional study was conducted in New Halfa city, Kassala state, Sudan. The study involved 190 participants. A structured questionnaire was used to collect the data related to gender, age, residence, level of education, and source of drinking water. Stool samples were collected from the study participants. It was then examined using three parasitological techniques, and the data were analyzed using SPSS (Statistical Package for Social Science) version 21 (IBM, Armonk, NY, USA).

— ***Results:*** The results showed that out of 190 study populations only 9 (4.7%) were infected with *Schistosoma mansoni.* The infection rate in females (5.9%) was slightly higher than the infection rate in males (3.8%). The highest prevalence rate (11.1%) was reported among the age group of 80 to 99 years. The study showed that the prevalence rate of infected individuals in the village was higher relative to the city. People drinking from the channels had higher infection rates compared to those using farm tanks as a source of drinking water. The study also reported a high prevalence rate of infection among primary and secondary school participants.

— ***Conclusions:*** The prevalence rate of Schistosoma mansoni infection in the study area is low and there is no significant association between the risk factors in the study and *Schistosoma mansoni* infection.

— ***Keywords:*** Intestinal schistosomiasis, Risk factors, New Halfa, *Schistosoma mansoni.*

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INTRODUCTION

Schistosomes are known as blood flukes and schistosomiasis is the second most prevalent parasitic disease in tropical countries after malaria in rural and agricultural areas[1]. It is a major source of morbidity and mortality in Africa, South America, the Caribbean, the Middle East, and Asia[2].

In Sudan, it is persistently endemic in most parts of the country, particularly in the center where most of the irrigating agricultural schemes are constructed. It affects most of the population of these areas especially schoolchildren, farmers, and animal breeders[3]. The transmission of infection requires contamination of surface water by eggs contained in human *excreta*, presence of specific freshwater snails (intermediate host), and human contact with infested water[4]. The infection presents with abdominal pain, diarrhea, bloody stool or urine, and in chronic cases, liver damage, renal failure and infertility may occur[5]. Many risk factors predispose to the development of disease in humans such as age, nutritional state, and level of natural immunity at the time of the infection, lifestyle, and other factors[6]. The standard diagnostic technique for the diagnosis of intestinal Schistosomiasis is a microscopic demonstration of eggs in the stool samples[7]. The drug of choice for treating infection with Schistosomiasis is praziquantel[4].

This study aims to determine the prevalence of *Schistosoma mansoni* infection and its associated risk factors in New Halfa city, Sudan.

MATERIALS AND METHODS

Study Design

A descriptive cross-sectional hospital-based study was conducted in new Halfa city (Sudan) from August 2020 to June 2021. A sample of 190 patients, who came to Yashfeen hospital in New Halfa city (Sudan), was obtained using the sample size formula (Z^2 p q/d^2) with error margin of 5%, confidence level of 95%, and prevalence of 14.5% obtained from a previous study[8].

Sample Collection

Each participant in this study was provided with a labeled container that is transparent, clean, dry and wide, and was well instructed on fecal sample collection.

Parasitological Technique

Direct smear examination and formal ether concentration technique were used for the detection of *Schistosoma mansoni* infection.

Direct Smear Examination

Wet preparation was made by mixing a small amount of stool with a drop of normal saline on a slide using an applicator wooden stick. The slide was covered by a coverslip and examined under the microscope using 10x and 40x magnifications for detecting eggs of *Schistosoma mansoni.*

Triple Wet Preparation

The direct smear examination has been done three times.

Formal Ether Concentration Technique

The preparation was made by putting 10 ml of 10% normal saline in a beaker, 1 g of stool was added and sieved using a metal sieve. The sieved stool was then put in a conical tube, equal volume of ether was added. After that, it was mixed and centrifuged at 500 rpm. The three upper layers were decanted, and the sediment was transferred to a slide. It was then covered using a cover glass and examined under microscope with 10x and 40 x magnifications.

Data Collection and Analysis

A questionnaire was designed to collect data about gender, age, residence, level of education and source of drinking water. Then, the data were analyzed using Statistical Package for Social Science (SPSS) computer program version 21 (IBM, Armonk, NY, USA).

RESULTS

The prevalence of Schistosoma mansoni was 4.7% (Table 1). 55.3% of those infected were males. No statistically significant difference was found relative to females (p-value =0.504) (Table 2).

The rate of infection was highest among those aged 80 to 99 years. However, there was no significant difference when compared to the other age groups (p-value= 0.571) (Table 3). The infection rate was more among villagers (6.7%), but no significant difference was demonstrated compared to city dwellers (p-value= 0.155) (Table 4). Those drinking channel water were found to have more infection rates (6.9 %), but no significant difference was found when compared to farm tank users (p-value= 0.129) (Table 5). Those who studied up to primary schools had more prevalence of infection (6.5%). However, no statistically significant difference was demonstrated relative to the other levels of education (p-value= 0.907) (Table 6).

Formal ether concentration technique was found to be significantly better (p-value= 0.000) than either wet preparation or Triple wet preparation in diagnosis of *Schistosoma mansoni* infection (Tables 7 and 8).

Table 1. Prevalence of *Schistosoma mansoni* infection among study population.

Total No	No positive	No negative	Prevalence (percentage)
190	9	181	9 (4.7%)

Table 2. Prevalence of *Schistosoma mansoni* infection among study population according to gender.

Gender	Number examined	Number positive	Prevalence
3.8%	4	105 (55.3%)	Males
5.9%	5	85 (44.7%)	Females
4.7%	9	190 (100%)	Total

p-value = 0.504

Table 3. Prevalence of *Schistosoma mansoni* infection among study population according to gender.

Age group	No examined	No positive	Prevalence (percentage)
1-19	67	3	4.5%
20-39	49	3	6.1%
40-59	34	0	0%
60-79	31	2	6.4%
80-99	9	1	11.1%
Total	190	9	4.7%

p-value = 0.571

Table 4. Prevalence of *Schistosoma mansoni* infection among study population according to residence.

Residence	No examined	No positive	Prevalence (percentage)
City	86	2	2.3%
Village	104	7	6.7%
Total	190	9	4.7%

p-value = 0.155

Table 5. Prevalence of *Schistosoma mansoni* infection among study population according to residence.

Source of water	No examined	No positive	Prevalence (percentage)
Channel	101	7	6.9%
Farm Tanks	89	2	2.2%
Total	190	9	4.7%

p-value = 0.129

Table 6. Prevalence of *Schistosoma mansoni* infection among study population according to of level of education.

Source of water	No examined	No positive	Prevalence (percentage)
Illiterate	65	2	3.0%
Primary school	46	3	6.5%
Secondary school	34	2	5.9%
University	41	2	4.9%
Other	4	0	0.0%
Total	190	9	4.7%

p-value = 0.907

Table 7. Comparisons between Wet preparation and FECT in diagnosis of *Schistosoma mansoni* infection among study population.

Technique	No examined	No positive	Prevalence (percentage)
Wet preparation	190	3	1.8%
Formal ether conc. technique	190	9	4.7%

p-value = 0.000

Table 8. Comparisons between Wet preparation and FECT in diagnosis of *Schistosoma mansoni* infection among study population.

Technique	No examined	No positive	Prevalence (percentage)
Triple wet preparation	190	5	2.6%
Formal ether conc. Technique	190	9	4.7%

p-value = 0.000

DISCUSSION

In this study, the prevalence rate of Schistosoma mansoni was found to be lower than the rates reported by studies done in 2011[8], and in 2010 in New Halfa[9]. The infection rate was also lower than those reported in Gezira state in 2018[10].

The prevalence was higher than a study done in Khartoum state in 2020[2].

The relatively higher infection rates in males were similar to the study done in New Halfa[8].

This study showed that the infection rate was highest among the age group of 80 to 99 years, which disagrees with the finding obtained by Mohamed and Goreish[8], who reported that the highest prevalence rate was between 4-12 years.

Our study showed that there is no significant difference in rates of infection between rural (village) and urban (city) area, unlike a study done by Alwabr[11], which showed that schistosomiasis is more prevalent in rural areas.

The prevalence rate of infection in our study was insignificantly higher among the population using the channel as a source of water and this was similar to a study in Yemen[11].

The highest prevalence rates according to educational level were reported among primary school and secondary school and this finding was similar to that obtained from the study conducted in the state of Khartoum in 2020[2], with statistically insignificant differences in rates. Most of the study populations in these two levels of education were between the ages of 20 and 50 because they did not complete their education.

Although there are differences in rates of infection according to risk factors (gender, age, residence, source of water, and educational level), these differences were not significantly associated with the infection.

Among the three parasitological techniques used in our study, formal ether concentration technique was found to be the best in making the diagnosis and these differences in rates were found to be highly significant (p=0.000).

CONCLUSIONS

The prevalence rate of *Schistosoma mansoni* infection in the study area is low and there is no significant association between the risk factors in the study and *Schistosoma mansoni* infection. However, applying control programs to eradicate the disease is still warranted.

Conflict of Interest:
The authors declare that they have no conflict of interests.

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