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### Short Communication

## Epidemiology of Schistosomiasis among Villagers of the New Halfa Agricultural Scheme, Sudan

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#### **Abstract**

**Background:** Schistosomiasis is one of the major communicable diseases of public health and socioeconomic importance in developing countries. This study assessed the situation of schistosomiasis among villagers of the New Halfa Agricultural Scheme, Sudan.

**Methods:** An epidemiological survey was carried out in three randomly selected residential sites: Village 19, Village 26 and Talat shagrat Camp, from October to December 2013. Feces and urine samples were collected from 2433 individual (1195 male and 1238 female) and examined for schistosomiasis infection. The prevalence and intensity of infection were calculated according to study sites and participants' sex and age-group.

**Results:** There was no infection with *Schistosoma haematobium* among the examined individuals, while the overall prevalence of *S. mansoni* infection was 27.4% and the mean intensity among those infected was 261.1 eggs per gram (epg). A high prevalence and intensity of infection was found among the residents of Talat shagrat Camp, followed by the other two villages. The prevalence of infection among males was 41.4%, and among females was 13.9%. On the other hand, the intensity of infection among females was 293.4 epg and among males 187.6 epg. A high prevalence of infection was found in the age-groups 11-20 years and > 50 years. High intensity of infection was present in the age-groups 31-40 years and > 50 years.

**Conclusion:** The finding of the study shows the need for an integrated control program against schistosomiasis. Mass treatment, provision of adequate clean-water supply and combating the intermediate snail host are suggested.

## Introduction

Schistosomiasis is the most prevalent parasitic disease after malaria in terms of socioeconomic and public health importance in the developing world with a huge impact on public health and socioeconomic development (1-3). Schistosomiasis remains truly neglected in some countries because of the close link with poverty, lack of political voice of infected people and the deficiency in a developed global financing system (4).

In Sudan, the first case of the disease was reported by Balfour (5), who found 17% of the children in Khartoum Primary School suffering from urinary schistosomiasis. Since 1919, the disease has been discovered in the northern part of the country (6), and later was reported from different parts including, Eastern Sudan (7-9), Western Sudan (10-12), Lake Nasser area (13), Gezira Agricultural Scheme (14-16), Rahad Agricultural Scheme (17) and Gunaid Sugar Cane Scheme (18, 19). Because of the expansion of water resource projects in Sudan, some serious water-borne diseases, especially schistosomiasis as mentioned above and malaria, have increased and become a big health problem in these areas.

The objective of the present study was to investigate the situation of schistosomiasis infection among three residential sites at New Halfa Agricultural Scheme, Sudan. The study finding will provide a baseline of information which can be used in the control strategies.

## Materials and Methods

### *Study area and sampling*

A parasitological survey of urinary and intestinal schistosomiasis was carried out in three randomly selected residential sites: Talat shagrat Camp, Village 19 and Village 26 in the New Halfa Agricultural Scheme (15°20'N, 35°61'E), Kassala State, Sudan, from October to December 2013. At the selected sites, a total

of 2508 individual (1245 male and 1263 female) from randomly selected houses was requested to provide samples of urine and feces as well as age information. Each individual was given two labeled clean screw-top plastic containers (60-ml), one for urine and the other for feces sample collection, and accordingly informed to collect about 5 gram of feces and to half fill the container with urine sample. Samples were transported to the laboratory within two hours of collection and urine samples were microscopically examined by utilization of the simple centrifugation/sedimentation technique (18), while the fecal samples were examined by the locally developed modified Kato technique (20). The prevalence and intensity of infection were calculated in accordance with Bush et al. (21).

### *Ethical considerations*

The randomly selected houses were visited and the purposes of the study were explained for the household and other family members to encourage their participation in the survey. All subjects who were microscopically found to be infected with schistosomiasis were treated under medical supervision.

### *Data analysis*

Data analysis was performed using Chi-square test, the statistical software; STATISTIX (version 4, USA) was used for analysis. Values were considered significant when  $P < 0.05$ .

## Results

### *The study participants*

Out of the 2508 individual requested for providing fecal and urine samples, 2433 (1195 males and 1238 females) were responded by providing samples. Microscopically, not a single sample verified *S. haematobium* ova. Therefore, all findings presented in this study referred only to *S. mansoni* infection.

**Prevalence and intensity of *S. mansoni* infection, according to residential site**

The overall prevalence of *S. mansoni* infection among the three residential sites was 27.4%, while the mean intensity among those infected was 261.1 eggs per gram. A high prevalence and intensity of infection was observed among the residents of Talat shagrat Camp followed by the other two villages (Table 1). A significant difference was observed in the prevalence of infection ( $P < 0.05$ ), as well as in the intensity of infection ( $P < 0.05$ ) among the three sites.

**Prevalence and intensity of *S. mansoni* infection, according to the study participants' sex**

The percentages of the surveyed communities, stratified by sex, were almost around unity, 49.1% males and 50.9% females. The prevalence of infection among males was significantly higher than that among females ( $P < 0.05$ ), while the intensity of infection among females was higher than that among males ( $P < 0.001$ ) (Table 1).

**Table 1:** Infection parameters of *S. mansoni*, according to the residential site and participant sex, the New Halfa Agricultural Scheme, Sudan

Categories	Number examined (frequency %)	Prevalence %	Intensity ± SD (eggs/gram)
Residential site			
Village 26	1753 (72.1)	25.6	246.7 ± 2.1
Village 19	348 (14.3)	10.6	215.7 ± 1.5
Talat shagrat Camp	332 (13.6)	54.8	311.8 ± 2.2
Overall	2433 (100)	27.4	261.1 ± 2.1
Participant sex			
Male	1195 (49.1)	41.4	187.6 ± 2.4
Female	1238 (50.9)	13.9	293.4 ± 2.0
Overall	2433 (100)	27.4	261 ± 2.1

**Prevalence and intensity of *S. mansoni* infection, according to the study participant age-group**

According to the study participant age-groups, the prevalence of infection was increased to reach a minor peak at the age-group 11-20 years, and then declined to increase gradually to attain a second apex in the age-group above 50 years (Table 2). There was a significant differ-

ence among age-groups in the prevalence of infection ( $P < 0.05$ ). On the other hand, the intensity of infection was increased to a minor peak at the age-group 31-40 year and to another apex at the age-group above 50 years. However, there was no significant difference among age-groups in the intensity of infection ( $P > 0.05$ ).

**Table 2:** Infection parameters of *S. mansoni*, according to the study participant age-groups, the New Halfa Agricultural Scheme, Sudan

Age-groups in years	Number examined (frequency %)	Prevalence %	Intensity ± SD (eggs/gram)
1 – 10	315 (12.9)	22.5	219.8 ± 2.4
11 – 20	448 (18.4)	32.4	214.7 ± 2.0
21 – 30	478 (19.6)	23.4	265.0 ± 2.0
31 – 40	518 (21.3)	27.2	275.7 ± 2.0
41 – 50	336 (13.8)	25.9	246.5 ± 2.9
> 50	338 (13.9)	32.8	310.7 ± 1.8
Overall	2433 (100)	27.4	261.1 ± 2.1

## Discussion

In the present study, there was no urinary schistosomiasis (*S. haematobium*) detected among the examined subjects. However, intestinal schistosomiasis (*S. mansoni*) was detected in the three study sites with a higher prevalence and intensity of infection among the residents of Talat shagrat Camp, followed by the other two villages. This finding is likely related to the location of the camp near a minor water canal, thus a higher chance for residents to contact this water body, which is likely to be contaminated. In addition, because of the poor socio-economic status of the campers, reflected in the inaccessibility of latrines and a source of clean-water supply. Therefore, they have no alternative to get water for their domestic usage, other than the surrounding contaminated canalization system. Village 26 was located adjacent to the suffering camp; this might present considerable transmission pressure, as reflected in the relatively high infection rate and the high worm burden. Proximity of this village to the canalization system encourages the inhabitants to collect water from the canals whenever the water system is not working. Although the socioeconomic status of the villagers is much better than that of the campers, the surrounding canals provide an attractive site for swimming, bathing and water collection. On the other hand, the monitored infection parameters for village 19 were lower than in the former two sites. This might be explained on the basis of the distant location of the village from water bodies as well as the very low occupational water-contact, since the bulk of the inhabitants are government employees. Consistent with other surveys, the findings indicated that the investigated study areas were composed of a collection of micro-foci; each of the three having its own specific characteristics. Such patchy mapping has been attributed to different factors, including the limited size of transmission sites (22, 23), the habitat proximity to human settlements (24), the habitat geology and climatic

conditions (25) and the role of human activity (26).

In the present study, the prevalence of *S. mansoni* infection among males was significantly higher than that of females. This finding agrees with many previous studies in endemic areas (13, 18, 23, 27). On the other hand, females overrode males in the intensity of infection. In fact, many factors might contribute in such an odd situation, including water collecting by females as well as campers' females, in particular, observed washing extremities and clothes/utensils in the surrounding small canals, presenting for considerable body exposure and duration.

In the present study, the prevalence and intensity of *S. mansoni* infection among the different age-groups examined was similar to the findings of other national studies. The prevalence peaked at age-group 11-20 years and then declined to increase again in the age-group above 50 years. The first part of the low-pattern could be due to the gradual build-up of the defensive mechanism and the considerable water-contact activities among young inhabitants. The later rise might be explained on the basis of the reduced immunity among elders coupled with the reduction in water-contact activities. The apex of intensity among the middle-age group was likely to be related to the fact that such age-group represents the bulk of the farmers and the agricultural laborers. The aforementioned overall ups-and-downs of the two infection parameters, related to age-groups, were ideally observed in each of the three surveyed study areas. In most endemic areas, the prevalence and intensity of infection with *S. mansoni* and *S. haematobium* increase with age up to 10-20 years, followed by a decline in older age-groups (28, 29).

## Conclusion

The present study shows the need for an integrated control program against schistosomiasis. Such a program should include mass

treatment for all villagers, the provision of adequate clean water-supply and latrine, implementation of health education program and combating the intermediate snail host.

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