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Original Research Article

Prevalence of *Schistosoma haematobium* infection among students at Al-Agali Islamic complex in Al-Kalakela area, Khartoum State-Sudan

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ABSTRACT

Background: In Sudan, urinary schistosomiasis caused by *S. haematobium* is endemic in many areas of the country, mainly among school-age children. The study was done with the aim to determine the prevalence and possible risk factors of *S. haematobium* among students at Al-Agali Islamic complex in Al-Kalakla- Sudan.
Methods: A total of 102 students were participated. 10 ml of urine sample was taken from each participant, the samples were allowing it to sediment, a drop from sediment was taken and examined microscopically using x40 objective to identify *S. haematobium.* A structured questionnaire was used to collect data on socio-demographic characteristics and some risk factors. The data were analyzed used SPSS version20. Chi-square test was used to determine the significance differences between variables. The Odds ratio (OR) was applied with 95% CI.
Results: The prevalence of *S. haematobium* among students was 12.7% (13/102). The results showed there was no statistical association between socio-demographic variables (Age group, parents' education, monthly family income and family size) and S. *haematobium* positivity (p>0.05). Bivariate analysis showed; swimming in rivers (OR= 8.09, 95% CI=1.69-38.73, p=0.008), working in agriculture (OR= 4.42, 95% CI=1.25-15.55, p=0.020), past infection of *S. haematobium* (OR=4.87, 95% CI= 1.44- 16.45, P=0.010), pre-schistosoma treatment (OR=10.29, 95% CI=2.14-49.39, p=0.003) and don not knew mode of transmission (OR=10.72, 95% CI=1.33-86.01, p=0.025), statistically significant with *S. hameatobium* positivity.
Conclusion: The *S. haematobium* is still prevalent among students in study area. Health education on the mode of transmission, possible risk factors and prevention is recommended.

Keywords: *S. haematobium*, Khartoum State, Sudan, Prevalence

INTRODUCTION

Schistosomiasis (Bilharziasis as "the infection was first described by the German physician Theodor Bilharz") is a water borne parasitic disease caused by Schistosoma, the digenic trematode found in the blood vessels of man and livestock.[1] Schistosomiasis is a parasitic disease caused by blood vessel-dwelling flukes of the genus Schistosoma. There are several species in the genus but primarily *S. haematobium* (causes urinary Schistosomiasis), *S. mansoni*, and *S. japonicum* (both cause intestinal schistosomiasis) infect humans.[2,3]

Schistosomiasis considered as a neglected tropical disease by the World Health Organization (WHO), schistosomiasis affects more than 250 million people worldwide with an estimated global burden of 1.4 million disability-adjusted life years (DALYs) in 2017.[4] Schistosomiasis is one of the occupational associated infection that can be transmitted to a susceptible host or

through recreation that involves contact with water infested with the free living *cercariae* that penetrate the skin and develops to maturity in the human[5]. Schistosomiasis is a worldwide public health problem within tropical and sub-tropical areas. An estimated 779 million people are at risk of contracting the infection. It is most prevalent among school-going children[6]. The main group at risk is school children, while other specific occupational groups (fishermen, irrigation workers, farmers), women and other groups using infested water for domestic purposes are also considered to be at risk.[3]

S. haematobium is an etiologic agent of urinary schistosomiasis and it is most prevalent in Africa[7]. In sub-Saharan Africa, S. haematobium infection is estimated to cause 70, 32, 18 and 10 million cases of haematuria, dysuria, bladder-wall pathology and major hydronephrosis, respectively.[7] Urinary schistosomiasis leads to a variety of clinical manifestations as haematuria, The presence of blood cells in urine. Other associated features are dysuria and suprapubic pain.[8]

The prevalence of Schistosomiasis in Africa: many countries are affected by disease, so the prevalence different from countries. In Nigeria the urinary schistosomiasis varies from 13.8% among secondary school students at Ondo State, 58.7% among children school in Kwara State to78% among primary school pupils -Lagos State.[8-10]

The prevalence of schistosomiasis in the children in the River Volta basin in South Eastern Ghana ranges from 2-21%.[11] In Malawi: the prevalence of *S. haematobium* among preschool children 13% [12]. In Tanzania: the prevalence of S. haematobium among children aged 5 to 17 years 5.7%.[13] In Cote d'Ivoire: the prevalence of *S. haematobium* among schoolchildren 14%[4]. In Ethiopia: The prevalence of S. haematobium infection among children in Hassoba, Buri and Hanledebe villages in the Middle Awash Valley was 37%, 25%, and 23.5%, respectively.[14] In Burkina Faso the prevalence among school-age children 8.76%.[15] In Senegal the prevalence of S. haematobium among school children 57.6%.[16] Several endemic countries in Africa launched national programmes for the control of schistosomiasis.[15] These programmes are largely based on preventive chemo-therapy with praziquantel and are targeted at school-age children and adults at risk.[15]

In Sudan, the risk for schistosomiasis is widespread, especially in the major irrigation systems in the Gezira area between the Blue and White Nile Rivers. High prevalence of *S. mansoni* infection in some areas in the West Equatorial region and both *S. mansoni* and *S. haematoabium* are endemic in the Upper Nile region, in Sudan about 5 million people are infected by schistosomiasis.[17] *Schistosomiasis* is widespread and constitutes a critical public health problem in Sudan mainly among children school age as compared to other age groups. Number of factors have been deemed responsible because of higher rates between the specified age groups. Thus, for instance, include the increased water activities such as fishing or swimming. Besides, improper hygiene arrangements provide better opportunities for the spread of infection.[18] The prevalence of Schistosomiasis in Sudan different from area to other, the different studies showed the prevalence was 40% among schoolchildren in White Nile State.[17] 46.5% among student in White Nile River Basin[2]. 45.6% among children at Al-Rahad City – North Kordofan State[18]. 24.1% among school children in Al-Lamab Bahar Abiad Area, Khartoum State.[3] This study, therefore, aimed to study the prevalence and associated risk factors of *S. haematobium* infection among students at Al-Agali Islamic Complex in Al-Kalakela area, Khartoum State - Sudan.

METHODS

Study design

A cross sectional descriptive study which was conducted among students at Al-Agali Islamic Complex in Al-Kalakla area in Khartoum State, Sudan.

Study population and sampling

The study population were students at Al-Agali Islamic Complex. The total number of students was 110. We use the total coverage of students attending during the study period, 102 students were participated. While 8 students were absent during period of data collection.

Data collection

Data were collected from participants (Students) used the following tools:

Questionnaire

Pre tested structured questionnaire was used to collect socio-demographic characteristics such as (Sex, age group, marital status, monthly income, educational level, and family history of obesity), possible risk factor such as

Collection of urine samples

Urine samples were collected from participants between 10:00 a.m. and 1:00 p.m. corresponding to the period of maximum egg output in urine. A clean dry 30 ml plastic screw capped container was used. The container was labelled with corresponding number so the results would not be exchanged. The urine collected was immediately taken to the laboratory to analysis.

Parasitological examination

Collected urine samples were immediately transported to the laboratory of epidemiology at Faculty of Public and Environmental Health - University of Khartoum (about

20 km from the study area). Using sedimentation method. The procedures for the urine examination are as follows: 10 ml of each urine sample was taken, centrifuged at 3000 rpm for 5 minutes. The supernatant was discharged and sediment transferred onto clean grease free glass, covered with a cover glass. Then entire sediment was examined microscopically using 40X objective to identify *Schistosoma haematobium* ova which is characterized by the presence of terminal spine and recorded as eggs/10ml of urine.

Data analysis

Data were analysed used SPSS (Statistical Package for Social Science) version 20. Chi-square test was used to determine the significance differences between variables. The Odds ratio (OR) was applied with 95% confidence intervals. Differences to be significant at level of p.value less than 0.05. Study was conducted after approval from the department of epidemiology at Faculty of Public and Environmental Health, University of Khartoum. Verbal consent was taken from the head of the Complex and then informed consent was obtained from the parents of students.

RESULTS

Prevalence of S. haematobium among participants

Out of 102 samples of urine examined 13 were found infected (positive) with *S. haematobium* (urinary schistosomiasis) which gives a prevalence of 12.7%, while 87.3% (89/102) were negative (Figure 1).

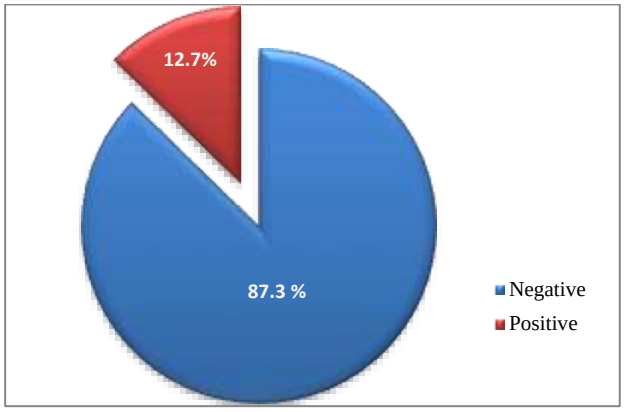

Figure 1: Prevalence of *S. haematobium* among participants.

Socio-demographic characteristics of study participants

According to the age group 54.9% of participants in age group11-15 years, 30.4% in age group 16-20 years, while 14.7% (15 out of 102) in age group 5-10 years. Regarding to their parents' education status, 55.9% of participants, their mothers were illiterate, 35.3% primary/basic education, while 8.8% (9/102) secondary education. Regarding to their fathers' education 46.1% were illiterate, 39.2% primary/basic education while 14.7% have secondary education. Regarding to their family monthly income most of their participants' families were low income (66.7%), 26.4% of families' middle income while 6.9% (7/102) with high income. Regarding to the participants' family size, 41.2% of families have less than six members, 19.6% their members 6 person, while 39.2% of participants have big families (>6 persons) (Table 1).

Table 1: Socio-demographic characteristics of participants.

Variable	Frequency	Percentage (%)
Age group/years		
5-10	15	14.7
11-15	56	54.9
16-20	31	30.4
Mothers education status		
Illiterate	57	55.9
Primary	36	35.3
Secondary	09	08.8
Graduate	00	00
Fathers education status		
Illiterate	47	46.1
Primary	40	39.2
Secondary	15	14.7
Graduate	00	00
Monthly income		
Low	68	66.7
Middle	27	26.4
High	07	06.9
Family size		
<6	42	41.2
6	20	19.6
>6	40	39.2

Socio-demographic characteristics associated with S. haematobium positivity

According to association between socio-demographic variables (Age group, parents' education, monthly family income and family size) and *S. haematobium* positivity, the results showed there is no statistically significant (p>0.05) (Table 2).

Table 2: Relationship between socio-demographic characteristics of participants and *S. haematobium* positivity.

Variable	*S. haematobium* n (%)		Total n (%)	Chi-Square	P value
	Positive	Negative			
Age group in years					
6-10	02 (13.3)	13 (86.7)	15 (17.7)		
11-15	06 (10.7)	50 (89.3)	56 (54.9)	0.531	0.766
15-20	05 (16.1)	26 (83.9)	31 (30.4)		
Mothers education status					
Illiterate	07 (12.3)	50 (87.3)	57 (55.9)		
Primary	05 (13.9)	31 (86.1)	36 (35.3)	0.075	0.963
Secondary	01 (11.1)	08 (88.9)	09 (08.8)		
Fathers education status					
Illiterate	06 (12.8)	41 (87.2)	47 (46.1)		
Basic	06 (15.0)	34 (85.0)	40 (39.2)	0.681	0.711
Secondary	01 (06.7)	14 (93.3)	15 (14.7)		
Monthly income					
Low	09 (13.2)	59 (86.8)	68 (66.7)		
Middle	03 (11.1)	24 (88.9)	27 (26.4)	0.094	0.953
High	01 (14.3)	06 (85.7)	07 (06.9)		
Family size					
<6	05 (11.9)	37 (88.1)	42 (41.2)		
6	03 (15.0)	17 (85.0)	20 (19.6)	0.120	0.941
>6	05 (12.5)	35 (87.5)	40 (39.2)		

*P<0.05 considered significant at CI 95%.

Table 3: Univariate analysis of some risk factors associated with *S. haematobium* positivity among participants.

Variable	*S. haematobium* n (%)		Total n (%)	Odds (confidence interval) (CI 95%)	P value
	Positive	Negative			
Hearing by *Schistosoma*					
Yes	11 (14.9)	63 (85.1)	74 (72.5)	2.26 (0.47-10.95)	0.307
No	02 (07.1)	26 (92.9)	28 (27.5)	1	
Mode of *Schistosoma* transmission					
Knew	12 (20.3)	47 (79.7)	59 (57.8)	10.72 (1.33-86.01)	0.025*
Don't Knew	01 (02.3)	42 (97.7)	43 (42.2)	1	
Source of water supply					
Taps	08 (07.8)	35 (34.3)	43 (42.2)	2.46 (0.74-8.15)	1.385
Stream/rivers/well	05 (08.5)	54 (91.5)	59 (57.8)	1	
Swimming in rivers					
Yes	11 (23.4)	36 (76.6)	47 (46.1)	8.09 (1.69-38.73)	0.008*
No	02 (03.6)	53 (96.4)	55 (53.9)	1	
Working in agriculture					
Yes	09 (23.1)	30 (76.9)	39 (38.2)	4.42 (1.25 -15.55)	0.020*
No	04 (06.3)	59 (93.7)	63 (61.8)	1	
Pass infection of Schistosoma					
Yes	08 (26.7)	22 (73.3)	30 (29.4)	4.87 (1.44-16.45)	0.010*
No	05 (06.9)	67 (93.1)	72 (70.6)	1	
Pre Schistosoma treatment					
Yes	02 (03.3)	58 (96.7)	60 (58.8)	10.29 (2.14-49.39)	0.0003*
No	11 (26.2)	31 (73.8)	42 (41.2)	1	

*P-value < 0.05 considered significant at CI 95%.

Association between some risk factors and S. haematobium positivity among participants

Table 3 Demonstrate the relationship between some risk factors such as; Hearing by Schistosoma, mode of transmission, source of water supply, swimming in rivers, working in agriculture, past history of schistosoma and pre-schistosoma treatment *S. haematobium* positivity. The results showed that, the prevalence more among those don't knew the mode of transmission, there was statistical association between don't knew of mode of transmission history and *S. haematobium* positivity OR 0.09 (95% CI 0.011- 0.75, p=0.025). The findings show the participants whose swimming in rivers are eight times more likely to have *S. haematobium* compared to those not swimming in rivers OR 8.09 (95% CI 1.69-38.73, p=0.008). The results show respondents whose working in agriculture are four-and forty-three times more likely to have *S. haematobium* compared to those have not working in agriculture OR 4.43 (95% CI 1.26- 15.56, p=0.020). The results show there was statistically significant between past medical history of schistosoma and *S. haematobium* positivity OR 4.87(95% CI 1.44- 16.45, p=0.010). Also, the result show there was strong statistical association between the pre-schistosoma treatment and *S. haematobium* positivity OR10.29 (2.14-49.39, p=0.0003). The results show there is no statistical association between hearing about schistosoma, source of water supply and *S. haematobium* positivity (p=0.307 and 1.385 respectively).

DISCUSSION

This study was designed to determine the prevalence of *S. haematobium* and to identify the possible risk factors associated with infection among student in Al-Agali Islamic Complex, Southern part of Khartoum – Sudan. Schistosomiasis is the most prevalent parasitic disease in Sudan, both urogenital and intestinal forms of schistosomiasis are common throughout the country with geographically varying degrees of prevalence.[2] The findings showed, the prevalence of *S. haematobium* among students was 12.7%. This result similar with that found among children school in Um-Asher Area, Khartoum, Sudan 12.9%.[24] Our finding was lower than that found in different areas in Sudan; 24.1% among school children in Al-Lamab Bahar Abiad Area, Khartoum State, 40% among schoolchildren in White Nile State, 45.6% among children at Al-Rahad City-North Kordofan State[18] and 46.5% among student in White Nile River Basin.[2,3,17,18] Our finding was higher than that found in Tanzania 5.7%.[13] Also, our result similar with that found in Malawi 13%.[12] Our finding was lower than finding in some different countries in Africa; In Nigeria 58.7%, in Cote d'Ivoire 14%, in Senegal 57.6%, in Ethiopia 23.5%-37%.[4,9,14,16]

The results showed the prevalence of *S. hameatobium* higher among age greater ten years; 54.9% in age group 11-15 years, 30.4% in age group 16-20 years while 14.7% in age group 5-10 years. This agreement with that found in Sudan, the highest frequency of positive cases was found among the age group of 12 to 15 years (64.4%).[17] Also similar with that reported in Yemen, the children aged >10 years were more prone to be infected with *S. haematobium* than younger children.[19] This study revealed that there was no statistical association between socio-demographic characteristics (age group, parents' education, monthly family income and family size) and *S. haematobium* positivity (p>0.05). in particular, our finding disagrees with that reported in Sudan an association between the levels of parental education and S. haematobium infection.[20] In Cote d'Ivoire a significant relationship between illiteracy of the parents/guardians and *Schistosoma* infection was reported[4]. In Yemen a significant association between the high prevalence of schistosomiasis and the age of children, fathers' educational level, household monthly income[19]. Our results similar with that reported in Malawi; socioeconomic status of the household was not an independent factor associated with infection in Children.[22]

The findings of the present study showed there was statistical association between don't knew of mode of transmission history and *S. haematobium* positivity OR 0.09(95% CI 0.011- 0.75, p=0.025).

The association between schistosomiasis and water contact is well documented. The findings showed the participants whose swimming in rivers are eight times more likely to have *S. haematobium* compared to those not swimming in rivers OR 8.09 (95% CI 1.69-38.73, p=0.008). our study similar with findings have been reported in previous studies in different countries; in Nigeria reported the closeness of the schools to the host stream and the frequent exposure to the stream contributed to high prevalence of urinary schistosomiasis among the students.[8] In Cote d'Ivoire study revealed that swimming and fishing in freshwater by schoolchildren was strongly associated with infection with *S. haematobium.*[4]

The study showed respondents whose working in agriculture were at four-and forty-three folds' higher risk of getting *S. haematobium* OR 4.43 (95% CI 1.26- 15.56, p=0.020). this agreement with that found in Nigeria noted that pupils whose parents were farmers had the highest infection rate and relatively followed by those whose parents were civil servants and traders[21]. Also, this result agreed with study from Ethiopia; reported occupation of father was significantly associated with urinary schistosomiasis where children with farmer as father's occupation were two times more likely to be infected than children with non-farmer as father's occupation[23]. The study showed there was statistically significant between previous infection of schistosomiasis and *S. haematobium* positivity OR 4.87 (95% CI 1.44- 16.45, p=0.010). Which is similar to that found in Sudan a history of urinary schistosomiasis treatment was strongly associated with

S. haematobium infection in South Kordofan State.[20] Our finding agreement with study from Nigeria, showed that participants who had a history of schistosomiasis were 2.87 times more likely to be infected compared with individuals that did not have history of schistosomiasis.[25]

CONCLUSION

The present study shows that *S. haematobium* is still prevalent among students in Khartoum State, Sudan; 12.7% of the participants were found to be positive for *S. haematobium*. Screening of family members and treating the infected individuals should be adopted by the public health authorities to control this infection. School and community-based health education regarding mode of transmission and possible risk factors are recommended to reduce the transmission and morbidity of schistosomiasis.

Limitations of the study

This study had numbers of limitations. The cross-sectional design may not allow for the temporal relationship for the potential risk factors and outcomes, other factors were not assessed such as (Ethnicity, time spend in swimming and information and source of information about) and small of sample size that my influence on study.

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