Original Research Article

Chronic Urogenital Schistosomiasis among In-School Adolescents in Sokoto, North-Western Nigeria

ABSTRACT

Aims: To assess the prevalence, intensity, associated factors and predictors of chronic urogenital schistosomiasis among in-school adolescents in Sokoto

Study design: Descriptive cross- sectional survey.

Place and Duration of Study: Secondary Schools in Sokoto metropolis, Sokoto State, Nigeria, between January and April 2018.

Methodology: A total of 590 apparently healthy secondary school students aged between 10 and 19 years in Sokoto metropolis were selected using multi-stage random sampling technique. Designed pretested semi-structured questionnaire was used to obtain relevant socio-demographic and clinical information. Urine specimen was obtained and subjected to urine analysis and microscopy for ova of *Schistosome haematobium*. Data was analyzed using IBM-SPSS version 25.0.

Results: Mean age of subjects was 15.1 ±2.6 years. There were 334(56.6%) males and 256(43.4%) females. Majority 371(62.9%) attended public secondary schools, most 264 (44.7%) were of middle socio-economic family status, and 300(50.8%) were from rural community setting. The commonest source of water for domestic use was pipe-borne 203(34.4%), and swimming was the predominant 55(9.3%) recreational water- related activity. The overall prevalence of chronic urogenital schistosomiasis was 22.9%, significantly ($p<0.001$) higher among males, with age group category 15-17 years mostly 59(29.6%) affected. All 135(100%) of the infected subjects had microscopic haematuria, 119(88.2%) had proteinuria, and 108(80.0%) had leucocyturia. Age group category 15-17 years ($p=0.027$), male gender ($p<0.001$), low and middle social classes ($p<0.001$) respectively, and residence in rural community setting were independent predictors of chronic urogenital schistosomiasis infection. Male gender was the only predictor ($p=0.003$) of intensity of infection.

Conclusions: Chronic urogenital schistosomiasis is prevalent among the subjects. Middle adolescence, male gender, swimming, rural community setting and low-middle socio-economic classes were independent predictors of infection.

Keywords: Chronic urogenital schistosomiasis, adolescents, Sokoto, Nigeria

INTRODUCTION

Schistosomiasis is a common neglected tropical disease affecting resource constraint countries in tropical Africa, the Middle East, Asia, and Latin America. It's a snail borne, fresh water transmitted disease caused by the cercariae of digenetic trematodes of the genus Schistosoma (1). Schistosomiasis is of public health importance with serious socio-economic impact especially in the setting of constrained resources (2-4). Sub-Saharan Africa accounts for up to 90% of cases with an estimated 280,000 deaths due to schistosomiasis annually (4, 5). Nigeria has been described as the most endemic country for schistosomiasis in Sub-Saharan Africa, with 29 million people reportedly infected and an estimated 101.3 million people at risk of infection (6). The prevalence of urogenital schistosomiasis in Nigeria has been reported to range from 8.3% to 58.5%, predominantly among school-aged children (7-15). Age, sex, altitude and mean annual rainfall have been identified as important risk factors for the transmission of the disease (16, 17). School aged children are considered to be at the highest risk of infection, being more likely to participate in water contact activities such as bathing, fishing, farming and swimming in infested water bodies, compared with other age groups (1, 4, 12, 13, 15, 18, 19). One of the two major species infecting humans in sub-Saharan Africa is Schistosoma haematobium, which causes urogenital schistosomiasis, and the other is Schistosoma mansoni, the cause of intestinal schistosomiasis(20). Infection occurs through skin penetration by cercariae larva of schistosome. Acute schistosomiasis is rarely reported in individuals living in areas endemic for S. haematobium, or S. mansoni probably as a result of in-utero sensitisation in chronically exposed individuals resulting in lowered immune responsiveness to schistosome antigens in infants born to infected mothers, unrecognition, or under-reporting (21, 22). Chronic schistosomiasis, occurs when eggs are deposited in various body tissues, commonly affecting the liver, bladder and urogenital system, and less commonly in the central nervous system. In the case of Schistosoma haematobium, the chronic phase occurs following egg deposition and granuloma formation, mainly in the urinary bladder wall, resulting in abnormalities in the mucosa. The disease manifests with lower urinary tract symptoms, such as hematuria, frequency, and dysuria. Further complications include bladder and ureter fibrosis, kidney disease, and squamous cell carcinoma of the urinary bladder (20, 23-26). The control and elimination of schistosomiasis requires interruption of a complex pathway of transmission governed by the interplay of humans, intermediate host snails and human–water contact patterns (18). Schistosomiasis control programs in Africa focus predominantly on community-based preventive chemotherapy through mass drug administration with praziquantel, a broad spectrum anthelminthic, to reduce morbidity. However, Rapid re-infection following treatment with praziquantel is said to be common, especially among children from schistosomiasis-endemic areas (18). It has been reported that the drug is unable to kill developing schistosomes and does not prevent re-infection in cases of continued exposure, while its continuous use may lead to drug-resistant S. haematobium(27).

Previous studies on urogenital schistosomiasis conducted in Sokoto, North-western Nigeria had focused on primary school aged children in selected rural communities, with varying prevalence (28-31). Urogenital schistosomiasis as a cause of cancer of the bladder among children and adults had been previously reported in the study location (32, 33). The apparent persistence of the infection beyond childhood through adolescence to adulthood made it necessary to examine the status of adolescent secondary school students in Sokoto, an age group that had been consistently assumed to be less affected by urogenital schistosomiasis compared to primary school aged children. It is not unusual for adolescents to conceal health conditions perceived to be associated with sensitive symptoms such as could occur in urogenital schistosomiasis manifesting with haematuria or dysuria (34). More so, schistosomes could run an indolent course without apparent symptoms until in its advanced stages (18). This study sought to assess the prevalence, intensity, associated factors and predictors of chronic urogenital schistosomiasis among in-school adolescents in Sokoto. It was hoped that the outcome of this study would make apparent, the status of adolescents in the state, and to put in place an all–inclusive preventive measures for the continuous interruption of the disease process, in order to forestall possible life threatening complications of urogenital schistosomiasis such as kidney diseases and cancers of the bladder.

MATERIAL AND METHODS

Study area:

The study was conducted in Sokoto metropolis, the Capital of Sokoto State. The metropolitan city of Sokoto lies between latitudes 10^{O} and 14^{O}N, and longitude $3^{O}3^{1}$ and $7^{O}7^{1}$ east of the equator, and covers an area of 60.33 square kilometers. The topography of the State is dominated by a rolling sand plain, with some parts within the Fadama low land, traversed by an extensive flood plain of the Sokoto Rima River System. The state has an average annual rainfall of about 640mm.The town has within it, three Local Government Areas (LGAs) which include Sokoto-North, Sokoto-South and Wamakko LGAs (35). There were 47 (28 public and 19 private) secondary schools in the metropolis and 27 of them were coeducational. Sokoto-North LGA had 15(7 public and 8 private) secondary schools, Sokoto- South LGA had 19(14 public and 5 private) secondary schools and Wamakko LGA had 13(7 public and 6 private) secondary schools. Islam is the predominant religion of the people. The major indigenous tribes in the State are Hausa and Fulani, with few non- indigenous tribes also represented. Agriculture is the major source of sustenance of the people. Other occupations include petty trading and working in civil service. Hausa language is generally spoken, with English as the official language of the State (35). The total population of adolescents aged 10-19 years in the metropolis was 136,900 with a projected population of 195,186.67 in 2018 (36).

Study design and subjects:

The study was a cross sectional survey that was conducted between January and April 2018 in secondary schools in Sokoto metropolis, Sokoto State, Nigeria. Multi-stage random sampling technique was employed in selecting the participating schools. The schools were stratified based on LGA's into co-educational (27) schools and non-coeducational (20) schools. Further stratification per LGA was done by line listing the schools into public and private schools. Simple random sampling method (balloting technique) was used to select 6 secondary schools from the coeducational schools (one public and one private school from each of the three LGA's) following 20% proportional allocation. The desired sample size was allocated proportionally to the randomly selected schools based on the student population. Six class levels were identified per selected school, and an arm from each class level was randomly selected by balloting. Students from each arm were selected by systematic random sampling technique, with investigators ensuring proportional allocation of gender. The study comprised of assenting randomly selected apparently healthy secondary school adolescents aged between 10 years and 19 years whose parents or guardians consented to the study, and who satisfactorily completed the questionnaire. Females who were menstruating were excluded.

Sample size determination:

The minimum sample size for the study was calculated using the formula for qualitative cross-sectional study (37). A proportion of 60.8% was used from a previous study (31). The degree of accuracy was set at 0.05. A minimum sample size of 366 was arrived at, which was increased to 407 in anticipation of 90% response rate. The researchers enhanced the calculated sample size by 50%, of the minimum sample size to 590.

Data collection:

The selected schools were visited before the commencement of the study to discuss the significance, nature and requirements for the study with the school principals and other relevant staff, as well as to identify a vacant room for the conduct of the study. On the day of the commencement of the study in each school, the investigators were introduced by the principal or a representative, to the students and teachers during the assembly period. Free periods for data collection were identified per school, which were mostly morning break time, and detailed information about the study was given to the students from the selected classes.

Designed pretested semi-structured questionnaires were distributed to the parents and guardians of the randomly selected students that satisfied the inclusion criteria, through the school teachers. Information sought included; age, gender, address, ethnicity, parent's occupation and level of education, histories of haematuria, dysuria, change in frequency of micturition, and ingestion of medication for deworming. Other information sought included source of water for domestic use, such as well, stream, river, tap, bore hole as well as water contact activities such as bathing, swimming, fishing and farming.
Clean labeled 20mls wide mouth screw-capped universal bottles, with numbers corresponding to the identification numbers of the questionnaire of each subject were used to collect quantities of terminal urine samples between the hours of 10:00h - 14:00h, to coincide with the periodicity of egg excretion in S. haematobium-infected subjects (38), on each collection day. The urine samples were transported to the

Medical Microbiology and Parasitology laboratory of Usmanu Danfodiyo University Teaching Hospital Sokoto, for analysis. A laboratory request form was used to record the result of urine analysis.

Urine analysis technique:

Each urine specimen was divided into 2 aliquots and a dipstick urinalysis was performed on one aliquot of the urine, using 10SG Multistix (dipsticks) strips by Bayer Plc and in accordance with the manufacturer's instructions. The reagent strips were dipped in the urine specimens, making sure that all the colour pads for testing the parameters were completely immersed for the duration specified by the manufacturer (2-3 seconds). Each test strip was then drawn across the edge of the container to remove excess urine. The pads reacted progressively, producing colour changes in given intervals. After 30 seconds, visual comparison of the test pads' colours with colour chart provided on the bottle containing the strips was used to report and grade parameters tested. Colour changes occurring one minute after dipping the reagent strip in the urine were regarded as of no significance, in order to avoid false reading which can occur from too rapid or too late observations of the test strips. Proteinuria, haematuria, and Leucocyturia of one plus and above were recorded and considered abnormal.

Urine microscopy for ova of schistosome haematobium:

The second aliquot of urine was microscopically examined for ova of S. haematobium. For urine sample with visible blood or cloudiness, two drops of saponin agent were added to de-haemoglobinize the red blood cells to enhance easier detection of egg (38). About 10mls of urine was centrifuged at 3000 revolutions per minute for 5 minutes in a graduated plastic conical centrifuge tube to sediment the schistosome eggs. The supernatant was discarded by inversion of the tube and the sediment thoroughly re-suspended in the remaining supernatant. The sediment was transferred to the center of a clean grease-free slide using a Pasteur pipette and covered with a glass slip to avoid bubble formation. This was mounted on a light microscope and examined at x10 and then x40 objectives to identify *Schistosoma haematobium* ova which appears as golden yellowish and elliptical in shape with a terminal spine (14). For positive urine samples, the eggs were counted and each average count was recorded as number of eggs per 10 ml of urine (39). Intensity of infection was categorized as light (< 50 eggs/ 10 ml of urine) or heavy (≥50 eggs/10 ml of urine) (40).

Data analysis:

The data obtained from each subject during the study period was recorded in a standard proforma and properly verified. Data was analyzed using Statistical Package for Social Science (SPSS) statistical software (version 25.0). The prevalence of urogenital schistosomiasis, proteinuria, haematuria, and leucocyturia were presented as percentages while the age distribution of the studied subjects' was analyzed and expressed as mean and standard deviation. Frequency distribution tables were used to illustrate results. Chi square test was used to determine associations between categorical variables and Fischer's exact test was used when an expected cell value was less than 5. Logistic regression was used to determine the variables that were independently associated with urogenital schistosomiasis. Strength of associations was measured using adjusted odds ratio (aOR) at 95 % confidence intervals (CIs).The level of statistical significance was set at p- value <0.05.

Ethical considerations:

Ethical approval for the study was obtained from the Health Research and Ethics Committee of Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto. Approval to conduct the study was also obtained from the Sokoto State ministries of Education/ Science and Technical Education, and the school authorities concerned. An Informed written consent and assent was sought and obtained from the parents/ guardians, and the study participants respectively. The interviews were scheduled to take place during morning break sessions to avoid undue disruption of students' academic activities. The data obtained were treated with utmost confidentiality. The results were communicated to the parents/guardians through the school head. Treatment of students with positive results was done by the researchers in collaboration with the state's ministries of Education and Health.

RESULTS

Sociodemographic characteristics of the subjects:

The respondents' age ranged from 10-19 years, with a mean (±SD) age of 15.1 ±2.6 years. Majority 249(42.2%) were between the ages of 10-14 years. Most 334(56.6%) of the respondents were males, majority 478(81.0%) were of Hausa ethnicity, and mainly 371(62.9%) attending public secondary schools. A large proportion of the subjects 264 (44.7%) were of middle socio-economic family status. (Table 1).

Table1: Sociodemographic profile of the respondents

Variables	Frequency (*n* = 590)	Percent
Respondents Age (years)		
10-14	249	42.2
15–17	199	33.7
18–19	142	24.1
Mean = 15.1 ± 2.6 years		
Gender		
Males	334	56.6
Females	256	43.4
Ethnicity		
Hausa	478	81.0
Yoruba	30	5.1
Igbo	19	3.2
Others (Fulani,Igbira, Barebari, kanuri,)	63	10.7
School type		
Public	371	62.9
Private	219	37.1
Class		
Junior secondary	277	46.9
Senior secondary	313	53.1
Socioeconomic status		
Upper class	158	26.8
Middle class	264	44.7
Lower class	168	28.5
Community setting		
Urban	290	49.2
Rural	300	50.8

Source of water for domestic use:

The subjects' major sources of water for domestic use were pipe-borne 203(34.4%), well 189(32.0%), and borehole 115(19.55). The commonest water- related activity was swimming among 55(9.3%) with the activity being frequent among 80(60.6%) of the respondents that were engaged in water-related activities. (Table 2).

Table 2: Major source of water and water- related activity

Variables	Frequency (*n* = 590)	Percent
Source of water		
Pipe-borne	203	34.4
Well	189	32.0
Borehole	115	19.5
River	24	4.1
Stream	27	4.6
Dam	21	3.6
Pond	11	1.9
Water-related activity		
Farming	10	1.7
Washing	13	2.2
Bathing	14	2.4
Playing	19	3.2
Fetching	21	3.6
Swimming	55	9.3
None	458	77.6
Frequency of activity (*n* = 132)		
Occasionally	52	39.4
Frequently	80	60.6

Prevalence of urogenital schistosomiasis among the subjects:

The overall prevalence of urogenital schistosomiasis was 22.9%. The most affected age group category was 15-17 years with an age specific prevalence of 59(29.6%), and this was statistically significant (p=0.002). The gender specific prevalence was significantly (p<0.001) higher among males 111(33.25%). (Table 3).

Table 3: Age and Gender Specific Prevalence of urogenital schistosomiasis

Variables	Number infected (*n* =135)	Number examined (*n* = 590)	Percent
Age category (years)			
10-14	40	249	16.1
15–17	59	199	29.6
18–19	36	142	25.4
Chi square (p-value)	12.213 **(0.002)**		

Gender			
Males	111	334	33.2
Females	24	256	9.4
Fisher's exact test	**<0.001**		
Overall prevalence	135	590	22.9

Associated symptoms and urine morbidity markers of infected respondents:

A large proportion of respondents infected with *Schistosoma haematobium* experienced dysuria 80(59.3%), frequency 58(43.0%), and gross haematuria 51(37.8%). All 135(100%) of the infected subjects had microscopic haematuria, 119(88.2%) had proteinuria, and 108(80.0%) had leucocyturia.

Intensity of *Schistosoma haematobium* infection:

Majority 81(60.0%) of the infected respondents had light infection, which meant that the egg count was < 50 eggs/ 10 ml of urine. (Figure 1).

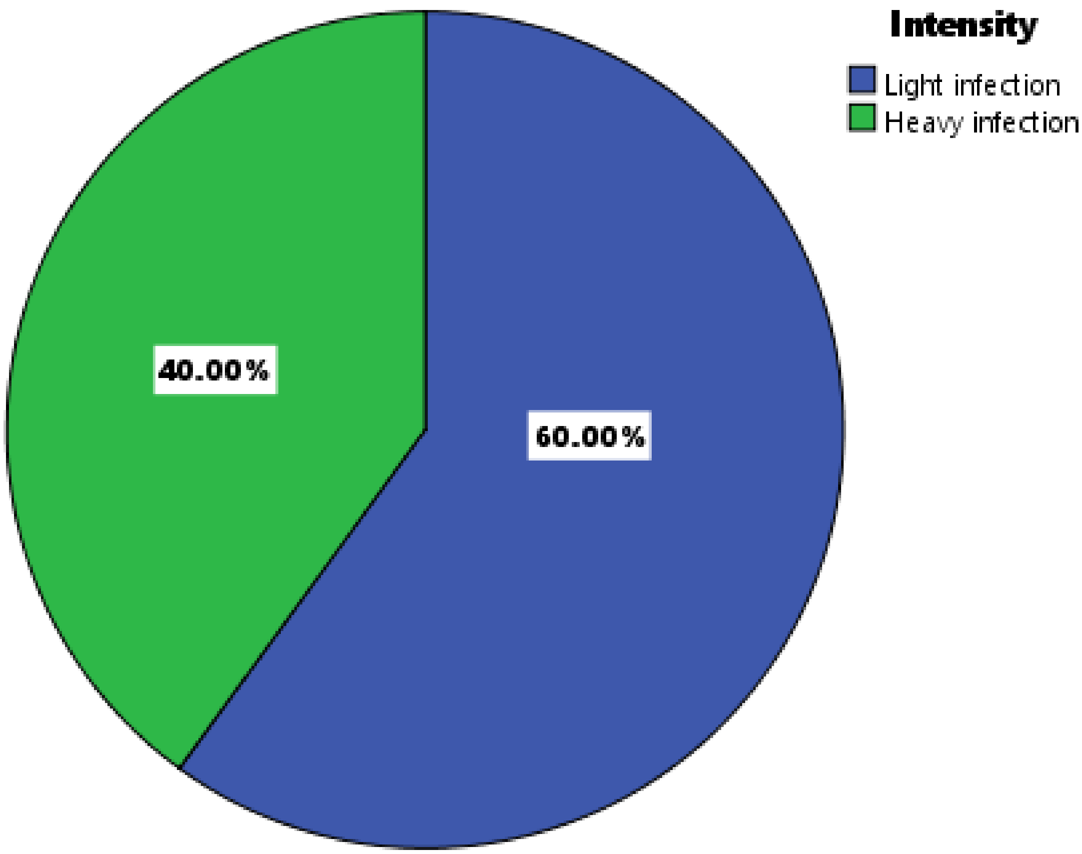

Figure 1: Intensity of *Schistosoma haematobium* among infected subjects

Factors associated with *Schistosoma haematobium* infection:

The socio-demographic factors that were significantly associated with *Schistosoma haematobium* infection were age group category (p =0.002)**,** (gender (p<0.001), tribe (p=0.004), school type (p<0.001), socio-economic class (p<0.001), community setting (p<0.001), and type of water related activity (p<0.001). (Table 4).

Table 4: Socio-demographic factors associated with *Schistosoma haematobium* infection

Variable	**Respondents (n = 590)**		**Test statistic p value**
	Infection n (%)	**No infection n (%)**	
Age group category (years)			
10-14	40(29.6)	209(45.9)	χ^2 =12.213
15-17	59(43.7)	140(30.8)	**p = 0.002**
18-19	36(26.7)	106(23.3)	
Gender			
Male	111(82.2)	223(49.0)	Fishers exact
Female	24(17.8)	232(51.0)	**p<0.001**
Tribe			
Hausa	123(91.1)	355(78.0)	χ^2 =13.091
Yoruba	4(3.0)	26(5.7)	**p=0.004**
Igbo	0(0.0)	19(4.2)	
Others	8(5.9)	55(12.1)	
School type			
Public	116(85.9)	255(56.0)	Fishers exact
Private	19(14.1)	200(44.0)	**p<0.001**
Socioeconomic class			
Upper class	64(47.4)	104(22.9)	χ^2 = 35.033
Middle class	53(39.3)	211(46.4)	**p <0.001**
Lower class	18(13.3)	140(30.8)	
Community setting			
Urban	47(34.8)	243(53.4)	χ^2 = 14.399
Rural	88(65.2)	212(46.6)	**p <0.000**
Type of water-related activity			
Farming	10(7.4)	0(0.0)	
Bathing	13(9.6)	1(0.2)	
Swimming	51(37.8)	4(0.9)	χ^2 = 441.784
Washing	13(9.6)	0(0.0)	**p <0.001**
Fetching	15(11.1)	6(1.3)	

Playing	17(12.6)	2(0.4)
None identified	16(11.9)	442(97.1)

Predictors of *Schistosoma haematobium* infection:

On bivariate analysis using logistic regression test, age group category 15-17(p=0.027), male gender (p<0.001), Hausa tribe (p=0.027), public school attendance (p<0.001), low social class (p<0.001), middle class (p=0.023), and residence in rural community setting were independent predictors of chronic urogenital schistosomiasis infection. (Table 5).

Table 5: Predictors of *Schistosoma haematobium* infection

Variables	aOR	95% CI		p-value
		lower	Upper	
Age group category (years) (15-17 vs 10-14*)	1.775	1.068	2.947	**0.027**
Age group category (years) (18-19 vs 10-14*)	0.806	0.496	1.309	0.383
Gender (Female vs Male*)	0.208	0.129	0.335	**<0.001**
Tribe (Other tribes vs Hausa*)	0.420	0.194	0.906	**0.027**
School type (Public vs Private*)	0.209	0.124	0.351	**<0.001**
Type of water-related activity (Swimming vs Other activities*)	0.003	0.000	0.023	**<0.001**
Socioeconomic class (Lower class vs Upper class*)	0.209	0.117	0.374	**<0.001**
Socioeconomic class (Middle class vs Upper class*)	0.512	0.288	0.910	**0.023**
Community setting (Rural vs Urban*)	2.146	1.440	3.199	**<0.001**

aOR = Adjusted Odds Ratio **CI** = Confidence Interval *** = Reference** group

Factors associated with the intensity of *Schistosoma haematobium* infection:

The socio-demographic factors that were found to be significantly associated with the intensity of *Schistosoma haematobium* infection on bivariate analysis were gender (p<0.001), and type of water related activity (p=0.043). (Table 6). However, on logistic regression analysis, male gender was the only predictor (p=0.003) of intensity of infection with about nine times more likelihood of heavy infection occurring among males than females (aOR (95% CI): 9.695(2.175-43.223)).

Table 6: Factors associated with intensity of *Schistosoma haematobium* infection

	Variable	Intensity category (n = 135)	Test statistic

	Light n (%)	Heavy n (%)	p value
Age group category (years)			
10-14	21(25.9)	19(35.2)	χ^2 =2.728
15-17	40(49.4)	19(35.2)	p = 0.256
18-19	20(24.7)	16(29.6)	
Gender			
Male	59(72.8)	52(96.3)	χ^2 =12.196
Female	22(27.2)	2(3.7)	**p<0.001**
Tribe			
Hausa	74(91.4)	49(90.7)	χ^2 =0.710
Yoruba	3(3.7)	1(1.9)	p=0.701
Others	4(4.9)	4(7.4)	
School type			
Public	67(82.7)	49(90.7)	χ^2 =1.725
Private	14(17.3)	5(9.3)	p=0.144
Socioeconomic class			
Upper class	11(13.6)	7(13.0)	χ^2 = 1.988
Middle class	28(34.6)	25(46.3)	p = 0.370
Lower class	42(51.9)	22(40.7)	
Community setting			
Urban	28(34.6)	19(35.2)	χ^2 = 0.050
Rural	53(65.4)	35(64.8)	p = 1.000
Type of water-related activity			
Farming	7(8.6)	3(5.6)	
Bathing	7(8.6)	6(11.1)	
Swimming	28(34.6)	23(42.6)	χ^2 = 12.304
Washing	12(14.8)	1(1.9)	**p = 0.043**
Fetching	11(13.6)	4(7.4)	
Playing	6(7.4)	11(20.4)	
None identified	10(12.3)	6(11.1)	
Frequency of activity (n=119)			
Occasionally	29(40.8)	12(25.0)	χ^2 = 3.240
Frequently	42(59.2)	36(75.0)	p = 0.198

DISCUSSION

This study has demonstrated the occurrence of chronic urogenital schistosomiasis among in-school adolescents in Sokoto, the intensity of infection, and the associated factors. The overall prevalence of urogenital schistosomiasis among the studied subjects was 22.9%, which was similar to the prevalence of 22.7% that was reported in a study conducted in Katsina, North-western Nigeria (7). This finding is however, in contrast with previous studies conducted in the study location and other parts of Nigeria, where higher prevalence rates were reported (8, 10, 11, 13, 19, 28, 30, 31). Similarly, higher prevalences were reported from Senegal, Sudan, Mali, and Mozambique (41-44). Differences in ecological, climatic, and cultural factors have been attributed to the higher prevalence of urogenital schistosomiasis observed in southern and eastern parts of Nigeria in comparison to the North (7, 45). Additionally, the observed variation in the prevalence of chronic urogenital schistosomiasis could be explained by the differences in the age category of the studied subjects as compared to previous studies, including those conducted in locations similar to the study area (7, 10, 11, 13, 19, 29, 30). Some of the aforementioned studies sampled age groups cutting across school age children through adults to the elderly. The increasing prevalence of chronic urogenital schistosomiasis with increasing age as observed in this study is in consonance with reports from other studies (7, 13, 28-30). As in the previous studies, greater involvement and exposure to field and recreational activities among older children in the study area could be attributed to this finding.

The preponderance of infected males in this study is in agreement with reports from other studies (7, 14, 15, 30, 44). Practices increasing the exposure of males to water related activities such as swimming, bathing, as well as playing around infested water bodies in the study area could be responsible for this finding. The activities of females in the study area are restricted by cultural and religious beliefs (35), with few of the infected females in this study engaging occasionally in washing and fetching of water from outdoor sources. Contrary to the gender prevalence in favour of males in this study, female subjects had higher prevalence of urogenital schistosomiasis in studies conducted in Southern Nigeria and other parts of Africa, due to gender assigned responsibilities in favour of increased risk of infection (45, 46). Other reports revealed no gender variation in infection among the subjects and attributed this to risk of exposure being similar among subjects by virtue of their age (47, 48). Regardless of the varied reports, the occurrence of urogenital schistosomiasis in both sexes is a well-established fact, and affected persons are at risk of developing complications from the disease especially if left untreated.

Proteinuria and haematuria as morbidity markers of urogenital schistosomiasis were higher in prevalence in this study compared to reports from Southern and North Central Nigeria (14, 47, 49). Although the physiological, biochemical, immunological and prognostic roles of these markers in relation to urogenital schistosomiasis are yet to be ascertained (50), they have been reported to correlate with the presence and intensity of infection and could be employed as indirect diagnostic tools, as well as screening tools to monitor the progress of interventions directed at curtailing the disease (28, 47, 49, 51). Similar to previous reports, the intensity of infection among majority of the subjects with urogenital schistosomiasis in this study was light (15, 47, 49, 52). The implication of this finding is that, subjects in this study could be considered to be at a lower risk of infection-related morbidity. However, it is important to note that even light forms of infection are recommended to be taken seriously because they could be associated with significant morbid conditions (53).

The finding of water contact activity in the form of swimming as an independent predictor of urogenital schistosomiasis in this study is in consonance with report from other studies (7, 28). The predominance of middle adolescents in this study could explain this finding because they are a group of children with established adventurous tendencies, hence the increasing chances of getting infected (14). It is evident that despite the major sources of water for domestic use being pipe-borne, well and borehole by majority of the subjects, engaging in recreational activity such as swimming played a significant role in determining the occurrence of urogenital schistosomiasis infection. Residence in rural community setting being a predictor of urogenital schistosomiasis in this study corroborates with the report from other studies (14). Socio-cultural practices such as washing, fishing and recreational activities in fresh water harbouring infected snails are said to be very common in the rural areas of northern Nigeria and many other villages in the western and eastern parts of the country, thus facilitating the transmission of the disease (45). Agriculture as the major source of sustenance of residents in the study area is in favour of higher involvement in water contact activities among children in this setting (35).

Low-middle socio-economic status was associated with higher risk of infection among subjects in this study. Lack of education, public health facilities, very poor sanitary conditions and poverty has been linked to the occurrence of urogenital schistosomiasis (45). Parents engaged in brown collar jobs have been reported to have higher risk of children being infected with urogenital schistosomiasis because these jobs are closely related to poverty and cannot exclusively rely on wholesome water sources (54). Male gender as an independent predictor of intensity of urogenital schistosomiasis infection in this study is in consonance with the report from Katsina, North-Western Nigeria (7). This finding might be related to males being more likely engaged in socio-cultural and economic conditions allowing for frequent exposure to water contact activities in the study location. Perhaps, the extent of body surface area exposed in males as well as the duration and frequency of exposure to infested water bodies could be attributed to the intensity of infection being heavier among the male subjects. Hotter seasons are said to increase exposure to water recreational activities in infested water bodies (50). In the study area, males are more likely to engage in such activities than their female counterparts because of socio-cultural practices (35).

CONCLUSION

Chronic urogenital schistosomiasis is prevalent among secondary school students in the study location and majority had light infection. Middle adolescence, male gender, swimming, rural community setting and low-middle socio-economic class were independent predictors of infection. Male gender remained a predictor of heavy intensity infection among subjects. Multipronged approach of focused health education and awareness programs to reduce risk behaviours especially targeted at adolescents in the study area, improved socio-economic and cultural practices as well as sustainable routine screening and treatment interventions by the state government and other stake holders in the study area are recommended control measures to reduce the prevalence of chronic urogenital schistosomiasis.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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