

Risk factors, symptoms and effects of urinary schistosomiasis on anthropometric indices of school children in Zaria, Kaduna state, Nigeria

Abstract

Nigerian children suffer a great burden of parasitic infections. Urinary schistosomiasis is associated with children's daily indulgence in uncontrolled water activities in unsafe water bodies. The study was aimed at assessing the level of urinary schistosomiasis among school children in Zaria-Nigeria, as well as the risk factors, signs/symptoms and effects associated with it. A total of 200 children from different primary schools in Zaria consented to this study through their parents and school managements. Urine sample (10mls) and anthropometric indices (weight in kilogram, height in meters, mid-arm circumference in centimeters) were obtained from each pupil, followed by administration of a structured questionnaire. The samples were analysed at the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University Zaria. The overall prevalence of urinary schistosomiasis among the pupils was 21(10.5%). The male pupils 16(14.8%) were significantly more infected than the female pupils 5(5.4%). Also children within the age of 13-14years and 9-10years had the most infections. Swimming and irrigation farming were found to be significant risk factors ($P \leq 0.05$). The infection was significantly associated with abdominal pain, painful urination, and frequent urination and visible haematuria. Pupils with mid-arm circumference of 21.0-22.9cm had the highest infections but there was not significant association with the disease. Pupils with normal BMI had more infections than the underweight pupils but the relationship was statistically insignificant. This study did not find harmful associations between urinary schistosomiasis and anthropometric indices considered. There is an urgent need of efforts to control schistosomiasis in Nigeria.

Keywords: urinary schistosomiasis, zaria, school children, effects, anthropometric index, risks, symptoms

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Abbreviations: BMI, body mass index; CM, centimeter; χ^2 , chi square; KG, kilogram; M, meter; MAC, mid-arm circumference; MLS, milliliters; NTDS, neglected tropical diseases; OR, odd ratio; RPM, revolutions per minute; SPSS, statistical package for social sciences; UNICEF, united nations international children's emergency fund; US CIA, united states central intelligence agency; WHA, world health organization

Introduction

In Nigeria, children of ages 0-14 years make 43.01% of its population structure (US CIA World Fact book, 2016; The Carter Center.¹ The nation suffers from many neglected tropical diseases (NTDs) with a great deal of schistosomiasis cases. School children are vulnerable to schistosomiasis, which has remained a major public health problem in Nigeria.² The disease is one of the world's oldest diseases,³ yet not many countries have eliminated it. However, countries like Japan and Egypt have eradicated schistosomiasis, though about 230-240 million individuals worldwide are infected, thereby helping in the spread of the disease.⁴⁻⁶ Nigeria is one of the African countries endemic for the disease (GSA) with a prevalence of 9.5%.⁷ A prevalence of 12.3% had been reported by⁸ with an emphasis on unawareness of the disease among children as the cause of its continued spread. So many complications can arise due to underlying *Schistosoma* infection: bladder cancer Infections Landscapes,⁹ anemia,⁹ funiculitis,

painful urination, prostatitis, laziness, fistulization and haemospermia WHO. Less attention has been given towards control of the disease in Nigeria, hence it menace is increasing. Poverty, abundant snail population, unsafe water sources, and uncontrolled juvenile water-contact activities are among the frequently reported risk factors.¹⁰⁻¹³ This research was aimed at finding the prevalence, risk factors, signs/symptoms, and effects of urinary schistosomiasis on children's anthropometric indices in Zaria, Nigeria.

Materials and methods

Study area and consent

The study was conducted in Zaria, Kaduna State, Nigeria. The pupils, their parents and teachers were briefed on the importance of the study and ethical consents were obtained. For the benefit of the study, each pupil was given his/her test result. Those that had *Schistosoma haematobium* infections were referred to the hospital for medical attention.

Collection of samples

Urine samples (10mls each) were collected from consented pupils. Structure questionnaires were administered to gather data on demography, risk factors and signs/symptoms of schistosomiasis from the children. The samples were covered in dark cold containers and

conveyed for analysis at the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University, Zaria.

Anthropometric indices

For each pupil, the weight in kilogram (kg), height in meters (m) and mid-arm circumference in centimeters (cm) were measured with a weighing scale, a calibrated meter rule, and a flexible tape respectively. The body mass index (BMI) was determined by dividing the weight by square of the height. BMI was compared with the standard by Health Promotion Degree.¹⁴ The MAC was compared with the standard of the WHO/UNICEF.¹² However, since the entire subjects had MAC of greater 12.5cm, the data were further categorized into six groups varying by an interval of 2 for analysis.

Laboratory analyses

Each urine sample was examined for visible color and transferred into a labelled centrifuge tube. Centrifugation was done at 3000 rpm for 5 minutes. The supernatant was discarded and the sediments were collected using Pasteur pipettes. Wet mount of the sediments was made with addition of Lugol's iodine to enhance contrast and cover slip was placed. Microscopy was done using the light microscope at 10x and 40x objectives. Color atlases were used to aid identification of *Schistosoma haematobium* ova. Any sample with *Schistosoma haematobium* count of ≥ 50 egg per 10ml urine was considered as heavy infection; otherwise it was light infection.

Statistical analyses

Laboratory results and data collected from questionnaires were subjected to statistical analyses (Chi Square, χ^2 and Odd ratio, OR) at=0.05 using the IBM SPSS version 21.

Results

Out of 200 school children in primary school involved in this study between the ages of 5-14years, 92 were females while 108 were males. Overall prevalence of urinary schistosomiasis was 21(10.5%) (Figure 1). Light infection cases were 20(10.0%) while only one case of heavy infection found in a male (Figure 2). The male pupils 16(14.8%) were significantly more infected than 5(5.4%) female pupils ($\chi^2=4.651$, $df=1$, $P=0.031$, $OR=3.026$). Pupils within the age of 7-8years had more infections followed by those of 13-14 years, but there was no infection in pupils of 5-6 and 9-10years ($\chi^2=11.144$, $df=4$, $P=0.025$) (Table 1). Among the risk factors considered, swimming ($\chi^2=6.102$, $df=1$, $P=0.014$, $OR=3.578$) and irrigation farming ($\chi^2=5.541$, $df=1$, $P=0.019$, $OR=3.368$) had significant associations with occurrence of urinary schistosomiasis. Pupils that involved in fishing activity were 2.105times more at risk of getting the infection than those who did not. Considering the source of domestic water, pupils that used wells were most infected with *Schistosoma haematobium* than those that either use boreholes or taps (Table 2).

Abdominal pain ($\chi^2=24.682$, $df=1$, $P=0.000$, $OR=8.763$), painful urination ($\chi^2=17.747$, $df=1$, $P=0.000$, $OR=6.455$), red-colored urine ($\chi^2=10.732$, $df=1$, $P=0.005$) and frequent urination ($\chi^2=4.480$, $df=1$, $P=0.034$, $OR=2.628$) were found to be significant signs/symptoms of schistosomiasis (Table 3). The anthropometric indices examined showed that pupils with the lowest and highest MAC had no infection compared to other categories but the relationship was insignificant. Also, pupils with normal BMI were rather more infected with *Schistosoma haematobium* than those that were underweight (Table 4).

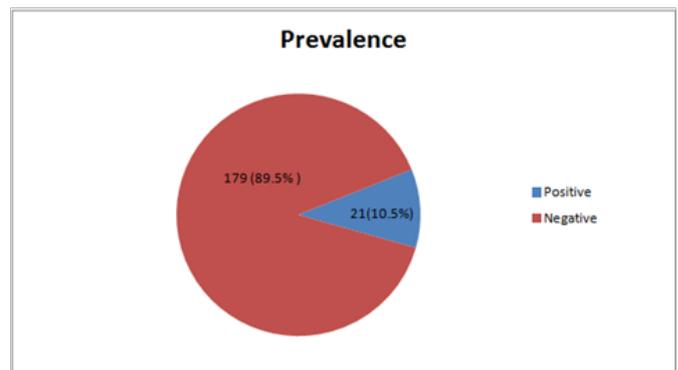


Figure 1 Overall prevalence of urinary schistosomiasis among school children in Zaria, Nigeria.

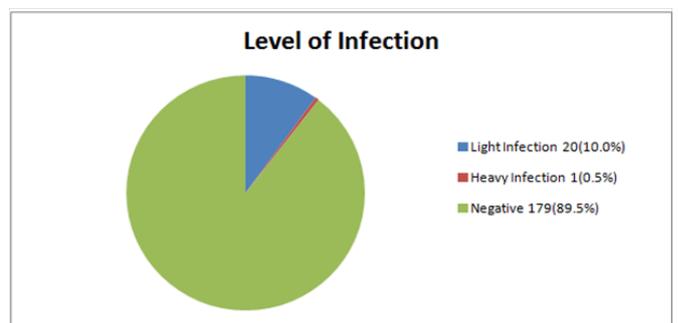


Figure 2 Level of urinary schistosomiasis among school children in Zaria, Nigeria.

Table 1 Occurrence of urinary schistosomiasis by demographic factors of school children in Zaria

Parameter	Number examined	Number positive (%)
Gender*		
Female	92	5(5.4)
Male	108	16(14.8)
Total	200	21(10.5)
Age** (Years)		
6-May	4	0(0.0)
8-Jul	17	4(23.5)
10-Sep	30	0(0.0)
12-Nov	48	2(4.2)
13-14	101	15(14.9)
Total	200	21(10.5)

Table 2 Risk factors associated with urinary schistosomiasis among school children in Zaria, Nigeria

Risk factor	Number examined	Number positive (%)
Swimming^a		
No	176	15(8.5)
Yes	24	6(25.0)

Table Continued....

Risk factor	Number examined	Number positive (%)
Irrigation farming^b		
No	175	15(8.6)
Yes	25	6(24.0)
Fishing^c		
No	178	17(9.6)
Yes	22	4(18.2)
Water Source^d		
Borehole	144	13(9.0)
Tap	31	3(9.7)
Well	25	5(20.0)

^a $\chi^2=6.102$, $df=1$, $P=0.014$, $OR=3.578$; ^b $\chi^2=5.541$, $df=1$, $P=0.019$, $OR=3.368$,

^c $\chi^2=1.552$, $df=1$, $P=0.213$, $OR=2.10$; ^d $\chi^2=2.755$, $df=2$, $P=0.252$

Table 3 Signs/Symptoms of urinary schistosomiasis among pupils in Zaria, Nigeria

Sign/Symptom	Number examined	Number positive (%)
Abdominal pain^x		
No	159	8(5.0)
Yes	41	13(31.7)
Painful urination^y		
No	151	8(5.3)
Yes	49	13(26.5)
Frequent urination^z		
No	144	11(7.6)
Yes	56	10(17.9)
Urine colour^p		
Milky-white	55	2(3.6)
Red	7	3(42.9)
Yellow-orange	138	16(11.6)

^x $\chi^2=24.682$, $df=1$, $P=0.000$, $OR=8.763$; ^y $\chi^2=17.747$, $df=1$, $P=0.000$, $OR=6.455$,

^z $\chi^2=4.480$, $df=1$, $P=0.034$, $OR=2.628$; ^p $\chi^2=10.732$, $df=2$, $P=0.005$

Table 4 Effects of urinary schistosomiasis on some anthropometric indices of pupils in Zaria, Nigeria

Anthropometric index	Number examined	Number positive (%)
MAC category* (Cm)		
15.0 – 16.9	21	0(0.0)
17.0 – 18.9	62	8(12.9)
19.0 – 20.9	59	5(8.5)

Table Continued....

Anthropometric index	Number examined	Number positive (%)
MAC category* (Cm)		
21.0 – 22.9	47	7(14.9)
23.0 – 24.9	9	1(11.1)
≥25	2	0(0.0)
Body mass index**		
Normal	64	7(10.9)
Underweight	136	14(10.3)

^{*} $\chi^2=4.306$, $df=5$, $P=0.506$; ^{**} $\chi^2=0.019$, $df=1$, $P=0.890$, $OR=0.934$

Discussion

Urinary schistosomiasis is still a neglected health burden among children in Nigeria. The prevalence of 10.5% found in this study indicated a rise from the reported prevalence of 9.5% by the Nigerian Federal Ministry of Health in 2015.⁷ However, prevalence report from this study was lower than 12.3% reported by. Some locations in Nigeria are highly endemic for urinary schistosomiasis with prevalence of about 50-80%;¹⁵⁻¹⁹ a few other locations have 0-10% of the population infected.²⁰⁻²² The high number of light infection cases that occurred among the children was an indication of low intensity of the disease in the region. Heavy infections can only result from repeated exposures to schistosome cercariae in infested water.²³ The prevailing disease situation is an indication that the efforts aimed at eliminating some NTDs by health-promotion agencies need serious intensification. Many researches had implicated male children with higher risk of schistosomiasis as found in this study. Only very few researches had reported a higher occurrence in female children.¹⁸ The male children probably had more infections because they have higher tendencies of indulging in open water-activities like swimming, fishing and wadding than the girls.^{24,25} reported similar gender distribution.

Children of 5-6years of age were not infected probably because they are too small to engage in water activities in unsafe water bodies like the other children of higher age-groups. This agreed with the findings. Also,²⁶ observed that schistosomiasis decreases with increase in age. Older children often indiscriminately indulge in open water activities than adults. Swimming and irrigation farming were found to associate with the occurrence of the disease in the study population. More commonly, reported risk factors of schistosomiasis always include unawareness, swimming, irrigation farming, fishing, wadding, use of water from rivers or dams.^{27,28} Schistosomes can penetrate intact skin during contact with cercarial-infested water bodies.²⁵ Also, children that engaged in fishing activities as well as those that use wells as main source of water had more infections because of the high tendencies of coming in contact with cercariae from infested water. Some wells maybe poorly managed and exposed to snail infestation.

In this study, abdominal pain, passing out red-colored urine accompanied by pain and high frequency were the signs/symptoms that associated with the disease. The presence of red-colored urine indicated haematuria. This agreed with many other reports.²⁹⁻³² *Schistosoma haematobium* infection can discomfort a child's daily school activities due to the pain and/or high urge for urination. No significant association was found between urinary schistosomiasis and BMI or MAC in this study. All the children had MAC greater than

12.5cm as compared with the WHO/UNICEF standard for detection of malnutrition. However, schistosomiasis can affect the health condition of children; especially in the form of growth stunting and poor academic performance in school.²¹⁻²³ Some will miss school in the course of diagnosis and treatment.

Conclusion

The prevalence of urinary schistosomiasis among school children in Zaria, Nigeria was found to be 10.5%. There was 10.0% cases of light infections and only 0.05% of heavy infection. The male children are 3.026 times at higher risk of getting the infection than the females. Swimming and irrigation farming were found to be associated risk factors of urinary schistosomiasis. Most of the infected children significantly had abdominal pain and painful urination at high frequency; their urine samples were red in color indicating the presence of haematuria. There was no significant indication of any effects of urinary schistosomiasis on both the body mass index and mid-arm circumference of the children. All the children had MAC above 12.5cm. However, children in Zaria still suffer from urinary schistosomiasis. The solution, therefore, is routine surveys and interventions. The parents and school teachers should help at ensuring that pupils do not indulge in any activities in or at near unprotected water bodies through proper awareness and caution. Government, WHO, UNICEF and other charity organizations should intensify efforts on provision of safe water to communities in Nigeria as well enlightenment programs on the disease.

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Conflict of interest

The authors declare that there is no any financial interest or any conflict of interest in this work.

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