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Research Article

CURRENT STATUS AND PREDICTORS OF URINARY SCHISTOSOMIASIS AMONG SCHOOL CHILDREN LIVING IN COMMUNITIES AROUND MAIRUWA DAM, FUNTUA LOCAL GOVERNMENT, KATSINA STATE, NIGERIA

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ABSTRACT

Schistosomiasis, is one of the world's major Neglected Tropical Diseases of great public health concern. It is mostly prevalent in poor communities with little or no access to portable drinking water and adequate sanitation. This research is aimed to determine the current status and predictors of urinary schistosomiasis among schoolchildren living in communities around Mairuwa dam, Funtua Local Government, Katsina state, Nigeria. The survey was conducted among 394 schoolchildren aged 7-15 years. Socio-demographic information of the children was obtained using pre-tested questionnaires. Urine samples were collected using standard techniques and examined by filtration method for the presence of *Schistosoma haematobium* eggs. The findings showed an overall prevalence of 29.4% and mean intensity of 29.0 eggs/10ml of urine. The findings further indicated that, males were most infected by the disease as all the females that participated in the survey were un-infected. Children from Dikke primary school were more infected compared to the participants from the other primary schools. The main predictors for the infection in the area were gender (P = <0.01) and water contact activities (P = <0.01). Efforts to curtail the spread of the infection in the area should include supply of safe drinking water and vigorous public awareness campaigns at both school and community levels.

Keywords: Mairuwa dam, Schistosomiasis, *Schistosoma haematobium*, Schoolchildren, Urine.

INTRODUCTION

Schistosomiasis belongs to a group of chronic disorders caused by parasitic flatworms (family Schistosomatidae) commonly called blood flukes. It is characterized by inflammation of the intestines, bladder, liver, and other organs. It is often seen as the humanity's most serious parasitic infection, being endemic in about 78 countries and affecting over 220 million people yearly in Africa, Asia, South America, and the Caribbean (WHO, 2019). Schistosomiasis, as one of the major Neglected Tropical Diseases (NTDs) bedeviling humanity, is most prevalent in rural communities, where hygiene is poor due to poverty or due to the lack of infrastructure to support adequate health care services (Deribe *et al*., 2011). The disease is ordinarily contracted by washing, bathing, or swimming in water water bodies populated by snails that carry the cercariae. The parasites were first identified as a cause of the disease in the 1850s by Theodor Bilharz, a German pathologist working in Egypt (Encyclopaedia Britannica, 2010). There are two (2) major forms of schistosomiasis; the Intestinal (which mainly affects the liver and spleen and causes intestinal damage and hypertension of the abdominal blood vessels) and Urogenital (affects the bladder, ureters and kidneys) schistosomiasis caused by the four species of schistosomes (WHO, 2019). Intestinal schistosomiasis is caused by *S. mansoni, S. japonicum, S. mekongi* and *S. guineensis* while Urogenital schistosomiasis is caused by *Schistosoma haematobium.*

The different species of *Schistosoma* have different types of snails serving as their intermediate hosts (Leder &

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Weller, 2009; Yohanna *et al*., 2016). These hosts are as follows: *Biomphalaria spp*. For *Schistosoma mansoni*; *Oncomelania spp*. for *Schistosoma japonicum*; *Tricula spp*. (*Neotriculaaperta*) for *Schistosoma mekongi*; *Bulinus spp*. for *Schistosoma haematobium* and *Schistosoma intercalatum.* The disease ranks second to malaria and its morbidity has caused an increased mortality rate of an estimated 280,000 people each year in the African region alone (CDC, 2008; Diseases, 2015). More than 97% of global cases of Schistosomiasis occur in Africa (Stothard *et al*., 2006; Stothard *et al*., 2009) and high prevalence estimates and infection intensities are found in school-aged children, adolescents and adults (Wall *et al*., 2018). School-aged children in endemic areas are mainly the targeted group, as the frequency of schistosomiasis treatment is determined by the prevalence of infection in such group (WHO, 2014). The total number of people in need of preventive chemotherapy globally by the year 2014 was 258.9 million, of which 123.3 million were school-age children (WHO, 2014). Research has shown that the burden of schistosomiasis in Nigeria has been updated to 29 million infections (Moné *et al*., 2010; Steinmann *et al*., 2006), which amounts to 14% of the global number of Schistosomal infections and this puts Nigeria at the top of the list of endemic countries (CDC, 2008).

Various socio-epidemiological factors are responsible for the transmission of the disease and level of infection. Among such factors are the distance from transmission site, migration and emergence of new foci, urbanization, socio-economic status, sanitation, water supply pattern, and level of fecal contamination of water source (Barreto, 1991). Development of water resources, which is a priority of most developing countries, has contributed immensely to the prevalence of schistosomiasis even in areas hitherto known as relatively free of the disease (Moné *et al*., 2010). Increased prevalence in areas brought under irrigation in several parts of Africa has been sufficiently recorded (Berry-Cabán, 2013). Previous reports from other parts of the state have shown that Schistosomiasis is endemic and a matter of public health concern in the state (Ahmed & Gidado, 2013; Ahmed & Gidado, 2010;Usman *et al*., 2019). However, in the course of this research within the study area, we noticed that there is little concern on health risk associated with irrigation practice, migration and other water contact activities that predispose humans to *Schistosoma* infection while probable cases of infection among schoolchildren in the study area were largely unreported. To the best of our knowledge, this study will serve as the baseline for other researches of its kind in the study area. Therefore, the current study aims to determine the prevalence and predictors of urinary schistosomiasis among schoolchildren living around Mairuwa Dam, Funtua Local Government Area, Katsina state, Nigeria.

MATERIALS AND METHODS

The Study Area

The study area is Funtua Local Government Area of Katsina state. Funtua town is the headquarter of the Local Government, situated about 200 Kilometres south of Katsina town (The state headquarter). According to the data obtained from Wikipedia, Funtua town approximately lies on Latitude 11°32′N and Longitude 7°19′E respectively. Funtua Local Government area is located within the tropical continental climate zone with high temperatures throughout the year, as well as distinct rainy and dry seasons. The average annual rainfall for the area is 850 mm – 950 mm. The vegetation of the area is the Northern Guinea savannah type with scattered trees and tall grasses. The average annual temperature and humidity of the area were 32^{o}C and 44% respectively. The Local Government covers an area of 448 Square Kilometres and has a population of 225,571 inhabitants by the year 2006 (NPC 2006) and 570,110 inhabitants according to 2016 estimate (Wikipedia, 2019). Mairuwa dam is located about 10 Kilometres west of Funtua town along the Funtua - Gusau highway. The dam primarily supplies water to Funtua town for domestic and industrial purposes. The water from the dam is also utilized for irrigation purposes.

Sample size and its calculation

The sample size for this study was calculated in accordance with WHO guidelines (Naing *et al*., 2006). The formula used for the calculation is as follows:

$$N = \frac{z^2 p(1-p)}{d^2}$$

Where:

N = Sample size.
Z = Standard normal deviate =1.92 at 95% confidence interval.
p = Expected prevalence probability of success = 37.8% = 0.378.
d = Degree of precision = 0.05 at 95% CI.
1 - p = q = probability of failure = 1 – 0.378 = 0.622.

Therefore

$$N = \frac{z^2 p(1-p)}{d^2} = \frac{1.96^2(1-0.378)}{0.05^2} = \frac{3.8416 \times 0.378 \times 0.622}{0.0025} = \frac{0.9032}{0.0025} = 361.28$$

The minimum sample size required for this study is 361. This sample size was however increased by 10% to maximize precision and take care of possible dropouts, hence a total of 400 samples were considered for this survey.

Sample collection and questionnaire administration

Before the commencement of the study, the objectives of the research and design procedure were explained to the heads of the selected villages, Local Education Authority officials, Parents of the selected schoolchildren as well as the children, in order to get their maximum cooperation and permission to conduct the survey. Participants who voluntarily agreed to participate were included in this study (universal sampling). A total of 394 respondents agreed to participate and were given a structured questionnaire to fill-

in some required information. This cross-sectional community-based study was conducted form June to August 2019. The participants selected were aged between 8 to 14 years who lived and attend primary schools within communities around Mairuwa dam. The communities include, Mairuwa, Dikke, Unguwar Malam Musa and Barebari.

Laboratory analysis

Laboratory analysis of urine samples to determine the presence of *Schistosoma* eggs was done using sedimentation method as described by Cheesbrough, (2005). Each urine sample was mixed thoroughly with a glass rod and 10ml was transferred into a 10ml centrifuge tube using a syringe and centrifuged at 2000rpm for 5 minutes. The supernatant was discarded and the sediment transferred to a microscope glass slide and covered with a cover slip. Examination of the entire sediment was done microscopically using the x 10 and x 40 objectives. A drop of Lugol's Iodine was added to the sides of the cover slip prior to examination. Eggs with terminal spine characteristic of *Schistosoma haematobium* were counted for each positive sample and the result was recorded as the number of eggs/10ml of urine (Cheesbrough, 2005). The urine samples were also examined for visible haematuria and proteinuria.

Data analysis

Data obtained from the study was analyzed using the Statistical Package for Social Sciences (SPSS) software version 20.0 for Windows software. The data collected was first carefully cleaned and entered into an excel worksheet before being transferred into appropriate file for further analysis. Chi-square (χ^2) test was used to determine the level of association between the prevalence of the disease and other socio-demographic factors.Prevalence was calculated as defined by (Margolis *et al*.,1982). *P*-values that are ≤0.05 were considered significant.

Ethical clearance and Consent

Ethical clearance was obtained from the Medical Research Ethics Committee of the Katsina State Ministry of Health (Ref. No. MOH/ADM/SUB/1152/1/252, dated 05/03/2019) before embarking on the research. The purpose of the research was clearly explained and discussed with the school administrators, village authorities, parents and their children, as well as the respective Local Government Education Authority to seek for their consent. Participants were informed that they can withdraw from the survey at any time of their wish without giving prior notice. The written and signed or thumb-printed informed consents were obtained from all the participants before the survey commences. All the research protocols were duly approved by the Research Ethics Committee.

RESULT AND DISCUSSION

The results from this study revealed an overall prevalence of 29.4% for Urinary Schistosomiasis among the study subjects. Further breakdown of the findings showed that 47.9% of the males that participated in the survey were infected while none of the females was infected. An assessment of the distribution of infection according to age groups revealed that the age group 7 – 9 years had the highest prevalence (33.7%) while the age group 13 – 15 years had the lowest prevalence (25.9%). The detailed result is shown on Table 1.

Data on the prevalence of infection by schools indicated that Dikke Primary School had the highest prevalence rate of 34.64% followed by Unguwar Malam Musa Primary School (28.6%), then Barebari Primary School (28%) and lastly Mairuwa Primary School (26.5%). The mean egg count/10ml of urine among the subjects according to schools revealed 28.96 eggs, 32.53 eggs, 28.93 eggs and 25.76 eggs/10ml for Mairuwa, Unguwar Malam Musa, Barebari and Dikke Primary Schools respectively. Therefore, Unguwar Malam Musa Primary School presented the highest mean egg count/10ml as shown on Table 2.

Table1. Prevalence of *S. haematobium* infection by gender and age group among the respondents (N = 394).

Variable	No. Screened	No. infected	Prevalence (%)
Gender			
Males	242	116	47.9
Females	152	0	0
Age Group (Years)			
7 – 9	98	33	33.7
10 – 12	242	69	28.5
13 – 15	54	14	25.9
Total	394	116	29.4

Table 2. Prevalence and intensity of the infection among the participants by School.

Schools	No. examined	No. infected	Specific prevalence (%)	Mean egg count/10ml
Mairuwa Model Primary Sch.	98	26	26.5	28.9
U/Malam Musa Primary School	98	28	28.6	32.5
Barebari Primary School	100	28	28.0	28.9
Dikke Primary School	98	34	34.6	25.8
Total	394	116	29.4	29.0

Results on some possible predictors of the infections among the study subject indicated that there is no significant association (P = 0.53) between the age groups and *Schistosoma haematobium* infection among the participants. However, a strong statistical association (P = <0.001) exists between gender and infection among the participants. On the other hand, Parents' occupational status of the participants (P = 0.39) has no association with infection of *Schistosoma haematobium* among the Participants. Likewise, parents' educational status has no influence on infection (P = 0.82) among the participants. Moreover, there is a statistical association (P = <0.001) between water contact activities and infection among the schoolchildren living around Mairuwa dam. Therefore, *Schistosoma haematobium* infection among the children in the study area is mainly influenced by gender and water contact activities of the participants (Table 3).

Table 3. Association of some socio-demographic information with the infection in the study area.

Variables	No. examined	No. infected (Positive)	No. un-infected (Negative)	*P-value*
Age Group (Years)				
8 – 10	99	33	65	0.5308
11 – 12	242	69	173	
13 and above	54	14	40	
Gender			G	
Male	242	116	126	<0.0001
Female	153	0	153	
Parents' occupational status				
Civil servants	71	24	47	0.3900
Others	323	92	231	
Parents' educational status				
Formal education	209	63	146	0.8248
No formal education	185	53	132	
Water contact activity				
Drinking	6	2	4	<0.0001
Washing	20	4	16	
Swimming	73	33	40	
Fishing	22	11	11	
Irrigation	15	10	5	
Crossing	79	9	70	
At least two activities	179	47	132	

The result of this investigation showed that Urinary Schistosomiasis prevalent and a matter of public health concern in the study area. The prevalence rate of *Schistosoma haematobium* infection reported in the present survey (29.4%) was lower than those reported from some previous similar studies (Ahmed & Gidado, 2018; Dawaki *et al*., 2015; Usman *et al*., 2019). The prevalence of urinary schistosomiasis observed in the study area could be attributed to the proximity of the communities to the dam and water contact activities of the participants such as fetching, swimming, washing, fishing and irrigation. However, these findings revealed that the infection can only infect males since females recorded zero infection. This might the possible to the fact that male individuals frequently visit the infested water bodies while females are mostly kept indoors under the custody of their parents. Information regarding gender and infection revealed that males were significantly more infected. Our findings showed that none of the female participants was infected. Our findings are in agreement with the results from previous similar studies (Ahmed & Gidado, 2018; Dawaki *et al*., 2015; Usman *et al*., 2019; Zeng *et al*., 2011). Our

findings regarding the prevalence by age groups indicated that, the younger age groups were more infected to the older ones. This finding agrees with the report of (Berry-Cabán, 2013; Mohammed *et al*., 2015). It is however not consistent with those of (Ahmed & Gidado, 2018; Usman *et al*., 2019). The younger participants in this study demonstrated more frequent contact activity with contaminated water source and had lack of general awareness of the implications and the dangers of infection. The older children were cleverer and informed about the infections as such they tend to have lower contact with infected water and find alternative ways of recreation, therefore they had less chance of being infected.

The present study attempted to find the possible predictors of infection among the subjects. Though the prevalence showed variation in infection among the various age groups, statistical analysis showed no significant association ($P>0.05$), which means irrespective of age, individual can come down with urinary schistosomiasis. Furthermore, infection based on the parents' occupational status showed that children of civil servants were more infected compared to those belonging to non-civil servant parents, although the difference is not statistically significant ($P>0.05$). This could be attributed to the fact that the parents were largely out of home during the day as to take proper care of their children, especially as they return from school. As regards to the parents' educational status, the results from this study revealed that children of more educated parents were slightly more infected with schistosomiasis compared to those from the non-educated parents. The probable reason for this in the study area is because even the so-called educated parents only attended the basic schools and it is difficult to differentiate the educated from the non-educated parents in the area based on their normal daily life activities. The findings from this study further revealed that water contact activities of children in the area have an impact on the prevalence of the disease. The findings from the research showed that there is a very significant association ($P<0.05$) between the water contact activities of the participants and prevalence of the disease. These findings agree with the results of the findings from previous researches (Bala *et al*., 2012; Bello *et al*., 2003; Houmsou *et al*., 2012; Mohammed *et al*., 2015) who reported fishing, irrigation, bathing, playing and washing to be the most important activities that enhance the chance of skin penetration by Schistosome cercariae.

CONCLUSION

The present study demonstrated that the infection is endemic in the study area. Moreover, gender type and water contact activities were the main predictors associated with the infection in the study area. Although the prevalence level in the study area is a matter of public health concern, the mean egg counts among the participants showed that they harbour light infections. Therefore, the prevalence and associated risk factors reported in this study provide strong evidence that there is a great need for mass drug administration, school and community-based health education pertaining good personal hygiene and sanitary practices which are paramount among these communities.

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