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Prevalence and Risk factors of Urinary Schistosomiasis among Secondary School Students in Dutsinma Local Government Area of Katsina State

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Abstract

Urinary Schistosomiasis (Bilharziasis) is a neglected, water-borne disease of major public health concern and can lead to chronic ill health condition mostly in rural environments. This study aimed to assess the prevalence and risk factors of urinary schistosomiasis among students of three selected secondary schools in Dutsinma Local Government Area of Katsina State. A school-based questionnaire were administered to collect data on students' population, report of hematuria, student's age, sex, attitude and practices of the students. A total of four hundred and forty-two (442) samples were collected and examined using a Visual Test Procedure (VTP) with Combi – 10 Uri screen® (German Technology) and Microscopic examination was carried out using x10 objective lens for the detection of *Schistosoma haematobium* (*S. haematobium*) eggs. Eggs of *Schistosoma haematobium* were detected in one hundred and forty (140) urine samples representing 31.7%; 134 (30.3%) were from males while only 6 samples (1.4%) were from females ($P<0.05$). The prevalence of hematuria was significantly higher ($P<0.05$) in males than in females. The highest prevalence was observed among age group 15 – 17 years (16.74%) while the least prevalence was observed in age group 9 – 11 years (0.23%). The study identified factors such as closeness of water bodies (OR= 2.9, P-value= 0.002) and swimming (OR= 7.5, P-value= < 0.0001) as risk factors for Schistosomiasis in the study area. The study confirmed high prevalence of *Schistosoma haematobium* in the study area. The study suggests that water control measures, proper sanitation and public enlightenment are highly needed to lower the prevalence of the urinary Schistosomiasis in the study area.

Keywords: Prevalence, risk factors, Schistosomiasis, Hematuria

INTRODUCTION

Urinary Schistosomiasis (Bilharziasis) is a parasitic, water – borne disease, caused by the larval forms of *Schistosoma haematobium* (a parasite of the genus Schistosoma) acquired from infested freshwater snails of Balinus spp. The disease is considered as a major public health concern and can lead to chronic ill health condition mostly in rural dwellers of tropical and subtropical regions of the world (Amuta and Houmsou, 2014). Schistosomiasis is one of the most important neglected tropical diseases in terms of public health affecting more than 200 million people and is second to malaria in term of public health importance, killing an estimated 280,000 people each year in the African region alone (CDC, 2011).

The disease is reportedly endemic in 53 countries in the Middle East and most of the African countries (Chitsulo *et al.*, 2000). Currently, about 436 million people are at risk of infection and 112 million are infected in sub-Saharan Africa (WHO, 2012). About 70 million individuals experience hematuria (blood in urine), 32 million dysuria (painful urination), 18 million bladder-wall pathology and 10 million experience distension and dilation of the renal pelvis and calyces, usually caused by obstruction of the free flow of urine from the kidney in Sub – Saharan Africa alone (Bello *et al.*, 2014). Nigeria is one of the countries in which schistosomiasis is known to be highly endemic with an estimated 101.28million persons at risk and 25.83 million infected (Chitsulo *et al.*, 2000). It could lead to secondary diseases like kidney damage and cancer in some cases. Other health impacts associated with the disease are risk of anemia, bladder cancer, nutritional deficiencies, delayed puberty in children, stunted growth in children and impairment of cognitive development in infected individuals as well as decreasing physical activity, school performance, work capacity and productivity (WHO, 2002).

Various factors (both environmental and socio-economic) are considered to be responsible for the continued persistence of gut parasitic infection in children. Some of these factors

include poor sanitary conditions, unhygienic practices, lack of portable water, poor housing and poverty (Amuta *et al.*, 2004). The conditions lead to continued exposure to the causal parasites and thus high rates of infection (Catherine *et al.*, 2003).

School age children are thought to have frequent water contact, that would make them more vulnerable to Schistosomiasis, and hence they are more associated frequently with *Schistosomiasis* problems (Bala *et al.*, 2012). Hence, this study aimed to assess the prevalence and risk factors of urinary Schistosomiasis among school pupils in Dutsinma Local Government Area of Katsina State.

MATERIALS AND METHODS

Study design

A cross-sectional study was conducted among students of the selected secondary schools in Dutsinma Local Government Area of Katsina State. These schools are Government Senior Secondary School Darawa (GSSS Darawa), Government Junior Secondary School Darawa (GJSS Darawa) and Government Pilot Secondary School Dutsinma (GPSS Dutsinma). A total of four hundred and forty two (442) urine samples were collected for examination. One hundred and forty six (146) samples were collected from students of GPSS Dutsin-ma as well as GJSS Darawa comprising a total number of two hundred and ninety two (292) i.e. 66%. On the other hand, one hundred and fifty (150) samples were collected for examination from GSSS Darawa students, having a total percentage of 34 (34%).

Study area

The study was carried out among students of some selected secondary schools in Dutsin-ma Local Government Area of Katsina State ($12^0 27'29''$E). It covers an area of 527km^2 and has a population of 169,671 as at the 2006 census (*NIPOST Retrieved 2009-10-20*). Three secondary schools were selected in this area. These schools are GJSS Darawa, GSSS Darawa and GPSS Dutsin-ma. The choice of such schools was determined by their proximity to water bodies.

Ethical consideration and Advocacy

The protocol for this study was approved by Zonal Education Quality Assurance – Katsina State Ministry of Education, Dutsin-ma Local Government Area of Katsina State. This was done by means of consent letters addressed to each principal concerned. The principals, students and their teachers were enlightened on public health significance of the disease and the relevance of the study. Those students whose principals consented were recruited for the study.

Sample and Sampling Technique

Sample size

The required sample size was determined using the formula as described by Dawet *et al.*, 2012.

$$n = \frac{Z^2pq}{d^2}$$

Where;
n = Sample size
Z = Statistical corresponding to level of confidence = 1.96 for 95% confidence interval.
p = Expected prevalence based on previous studies = 55% = 0.55 (Amuta and Houmsou, 2014).
q = Probability of failure = 1- p = 1- 0.55 = 0.45
d = Absolute error or degree of precision = 5% = 0.55
Therefore,

$$n = \frac{(1.96)^2 \times (0.55) \times (0.45)}{(0.55)^2} = \frac{3.8416 \times 0.2475}{0.0025} = \frac{0.950796}{0.0025} = 380.32 \approx 380$$

Therefore, the minimum sample size is 380 samples using a tolerable error of 5% but for this work, 16% of the sample size was added to increase precision.

Sample collection

Terminal urine samples were collected from the students recruited across the schools selected for this study. About 20 mL of urine sample was collected into a sterile corked plastic tube from each student between the hours of 10:00am – 02:00pm and labeled appropriately. These samples were then transported to laboratory for examination.

Physical examination of the urine samples

The samples collected were physically examined to determine their color and turbidity. They were categorized and documented as cloudy/dark (may indicate dehydration), brown/red (may indicate presence of blood), clear/pale yellow (may indicate presence of bilirubin) and green (may indicate presence of pseudomonas infection) appearances (Steggal, 2007). These data were recorded appropriately in the urinalysis form.

Urinalysis Using Visual Test Procedure with Combi – 10

The urine samples were analyzed to obtain some chemical parameters like bilirubin, glucose, blood, ketones, leucocytes, nitrate, pH, protein, specific gravity and urobilinogen using a commercial reagent strip Combi – 10 Uri screen® (German Technology). This was done by dipping a strip (which subsequently changed color almost immediately) into each fresh urine sample. The resultant color change was compared with the standard color scale provided by the manufacturer. The results were recorded in the urinalysis form. The color change was in harmony with the presence/absence of some chemical parameters of each urine sample. (Cheesbrough, 2006).

Microbiological examination of the urine samples

All the samples were examined parasitologically, by filtration technique (WHO, 2011). Two drops of eosin stain were added to each urine sample which was shaken and from which a 10 mL aliquot was drawn and filtered through Whatman filter paper. A 20 mL aliquot of 10% Lugol's iodine was flushed through and syringe full of air was later flushed through to flush out excess fluid from the filter paper. The filter paper was gently removed with a pair of forceps, placed on a drop of super saturated ninhydrin stain on a glass slide to make the eggs easily visible during examination, and air dried at room temperature. *Schistosoma haematobium* eggs were identified with their characteristic terminal spines, on microscopic examination; the number of eggs in the entire filter paper was counted and recorded as number of eggs in 10 mL of urine (Eggs/10 mL of urine).

Questionnaire

Semi – structured questionnaire designed to elicit information on water contact and control activities in the community were used to collect data from the school children examined and community health care providers to assess the impacts of National control inventions in these health care providers who worked in the communities. The questionnaires for the children probed into their demographic details like age, sex, students' population, report of hematuria and water contact activities while that of health care providers probed into their knowledge of diseases affecting the community members, treatment interventions given in the community, measures for preventing infections with *Schistosomiasis* and challenges that impede control/elimination efforts.

Data analysis

Data analysis was conducted using chi – square test and Fisher's exact test (where applicable) at 95% confidence interval and 0.05 level of significance. P values <0.05 were considered statistically significant.

RESULTS

The physical and chemical characteristics of the urine samples of the studied population are presented in table 1. Cloudy and offensive smell urine were observed in 184 (41.6%) and 165 (37.3%) of the samples respectively. With respect to pH, 196 (44.3%) of the urine samples had basic pH while 159 (36.0%) of the urine samples were acidic. Absence of hemoglobin was observed in 284 (64.3%) of the urine samples while higher amount of hemoglobin (+3) was observed in 64 (14.5%) of the samples. Normal protein level (≤ 150mg) was present in 262 (59.3%) while 180 (40.7%) had high amount of protein in the urine samples.

Table 1: Physical and chemical characteristics of the urine samples (n=442)

Variables	Number (%)
Appearance	
Straw colored urine	93 (21.0%)
Cloudy	184 (41.6%)
Offensive smell	165 (37.3%)
pH	
Acidic	159 (36.0%)
Neutral	87 (19.7%)
Basic	196 (44.3%)
Hemoglobin	
Absence	284 (64.3%)
+1	36 (8.1%)
+2	58 (13.1%)
+3	64 (14.5%)
Protein	
Normal result (≤ 150mg)	262 (59.3%)
Abnormal result (> 150mg)	180 (40.7%)

Prevalence of urinary *Schistosomiasis*

A total number of four hundred and forty two (442) students from the selected secondary schools in Dutsinma Local Government Area of Katsina State were examined for urinary Schistosomiasis and one hundred and forty (140) students were positive for the infection representing 31.7%. The male students accounted for one hundred and thirty four (134) representing 30.3% while the female students accounted for only 6 representing 1.4%. The prevalence rate was significantly higher in males ($P < 0.0001$) and are at higher risk (OR = 20.63) of contacting the disease than their counter parts (Table 2).

Prevalence of *Schistosomiasis* by age group show that the highest prevalence of 16.74% was observed in age group 15-17 years while the least prevalence of 0.23% was observed in age group 9-11 years (Table 3). The prevalence of *Schistosomiasis* observed in this study varies significantly with age-group among the students ($P = 0.001$). The highest prevalence observed between the age group 15-17 was perhaps due to people at this age are prone to contracting the disease due to their attitude toward contamination with water bodies.

Table 2: Prevalence of Urinary Schistosomiasis by gender

Gender	No. Examined	No. infected	Prevalence (%)	OR	CI	P-value
Males	291	134	30.3	20.63	0.225-0.109	< 0.0001
Females	151	06	1.4			
Total	**442**	**140**	**31.7**			

Table 3: Prevalence of Urinary Schistosomiasis by age groups

Age group	No. Examined	No. infected	Prevalence (%)	P - Value
9 - 11	2	1	0.22	0.0011
12 - 14	98	17	3.85	
15 - 17	228	74	16.74	
18 - 20	98	43	9.73	
21 - 23	15	5	1.13	
24 - 26	1	0	0	
Total	**442**	**140**	**31.7**	

χ^2 =16.13, df =3 P = 0.0011.

Results presented in Table 4 show the prevalence of urinary Schistosomiasis among the selected secondary schools. The prevalence varies significantly among the schools ($P < 0.05$). The highest prevalence was observed in GJSS Darawa (16.06%) followed by GPSS Dutsinma with 8.37% prevalence while the least prevalence (7.24%) was observed in GSSS Darawa.

There is an association between the schools and infection (P < 0.0001). This high prevalence in GJSS Darawa was probably due to the closeness of the school to water body.

Table 4 shows some risk factors associated with urinary schistosomiasis among school aged children in Dutsinma LGA of Katsina State, Nigeria. The study identified factors such as closeness of water bodies (OR= 2.9, P-value= 0.002) and swimming (OR= 7.5, P-value= < 0.0001) as risk factors for Schistosomiasis in the study area.

Table 4: Prevalence of Urinary Schistosomiasis by schools

School	No. examined	No. infected	Prevalence (%)	P – Value
Total	**442**	**140**	**31.7**	
GPSS Dutsinma	146	37	8.37	< 0.0001
GSSS Darawa	150	32	7.24	
GJSS Darawa	146	71	16.06	

χ^2 =29.51, df =2 P = < 0.0001.

Table 5: Risk factors of urinary Schistosomiasis among school aged children in Dutsinma LGA of Katsina State, Nigeria.

Closeness of water bodies				2.9	1.46 – 5.75	9.98	0.02
Yes	395	197	49.9				
No	47	12	25.5				
Irrigation				1.55	0.91 – 2.66	2.59	0.1 ***ns**
Yes	356	119	33.4				
No	86	21	24.4				
Laundry				6.93	4.05 – 11.85	51.09	< 0.0001
Yes	275	121	44.0				
No	167	19	11.4				
Playing				0.79	0.4 – 1.53	0.50	0.48 ***ns**
Yes	401	125	31.2				
No	41	15	36.6				
Swimming				7.5	4.79 – 11.75	86.38	< 0.0001
Yes	224	132	58.9				
No	21	35	16.1				

Risk factors	**NE**	**NI**	**Pr. (%)**	**OR**	**CI**	χ^2	P – value

NE= Number of Examined, NI= Number of Infected, Pr.= Prevalence, OR= Odd Ratio, CI= Confidence Interval, *ns= Not Significant.

DISCUSSION

The results of this study show that urinary schistosomiasis is still a major health concern in Dutsinma Local Government Area, with prevalence rates of >30% among school-aged children. The WHO recommended strategy for such area is annual praziquantel mass treatment for both enrolled and non-enrolled school-aged children with additional interventions of improved sanitation, water supply and health education (UNDP, 2015). Reduction of disease incidence, provision of safe water supplies and proper sanitation are components of sustainable development goals (Nmorsi *et al.*, 2005) and these should be pursued rigorously for equity, in the context of universal health coverage to improve the health, as well as reduce poverty among these deprived rural communities.

The prevalence rate of 31.7% obtained for these areas in this study indicate increasing transmission when compared with a rate of 8.1% that was reported by the National survey conducted in 2012 (FMoH, 2012) and predictive estimate of 0.1 - 10% in Edo State (Adeyemi *et al.*, 2014) who reported prevalence rates of 56% from other communities in Edo State and Nmorsi *et al.*, 2005, who also reported high prevalence rates of 65% in Ikpeshi, Akoko Edo LGA of Edo State. The prevalence rate was significantly higher in males (P < 0.0001) and are at higher risk (OR = 20.63) of contacting the disease than their counter parts. This is perhaps due to males are more involved in such a lifestyle as swimming in contaminated waters, playing near rivers, fishing activities, etc.

This high prevalence and intensity of infection in the study areas are strongly associated with the general unavailability of safe water supply and good sanitary facilities to the communities and consequent sole dependence of the people on the river bodies for their water needs.

Provision of anti-parasitic for free would not be enough, there is need for education on parasitic diseases to be incorporated into the school's curriculum. Given the challenge of low acceptance of praziquantel and turn up for treatment (as reported by health providers), reinforced treatment campaigns and other alternative measures of distributing the drugs (such as house to house distribution) that may be more convenient and effective should be incorporated into interventions. The lack of amenities especially safe sanitation and water supply has led to adoption of practices and habits that propagate the disease levels in some communities; for this reason, mass chemotherapy Programme needs to be complimented by public health measures such as environmental management and provision of amenities, in order to achieve the global goal of elimination of the disease as a public health problem (WHO, 2013).

And lastly, awareness of *Bilharziasis* among the children was very poor; a few of them believed that the blood in their urine was associated with the river but did not regard it as a disease. Although there is some form of enlightenment provided by the health workers to community members, the lack of alternative safe sources is a challenge. The poor compliance with treatment constitutes a major limitation to achieving the aim of preventive chemotherapy and should be urgently addressed through effective advocacy.

CONCLUSION

The present study has confirmed high prevalence of Schistosomiasis in the study area. Factors such as closeness of water bodies and swimming were found to be associated with Schistosomiasis among the Secondary School Students. This implies that urinary schistosomiasis is still a major health concern that requires urgent and effective medical interventions.

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