

ORIGINAL ARTICLE

Prevalence of urinary schistosomiasis and associated haemato-proteinuria in Wurno Rural Area of Sokoto State, Nigeria

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ABSTRACT

Background: Schistosomiasis is the second most predominant tropical disease in the world, next to malaria. Nigeria is one of the countries in Africa, where urinary schistosomiasis is endemic with an estimated 25 million people living with the disease, and 101 million others at risk. On account of these, there is need to devise a rapid, affordable and reliable detection technique for this highly endemic disease.

Methodology: A cross-sectional study involving 300 randomly selected participants. Socio-demographic data, risk factors and symptoms of schistosomiasis were obtained using questionnaires. The sedimentation method was utilized to examine *Schistosoma haematobium* ova in urine samples.

Results: The prevalence of *Schistosoma haematobium* infection, determined by a positive filtration result, was 37.7% (95% Confidence Interval), of which 54% were irrigation farmers, and 43% children. Schistosomiasis was found to be associated with hematuria (97.3%) and proteinuria (79.6%).

Conclusion: Haematuria and proteinuria have a potential value in the screening for community diagnosis of urinary schistosomiasis in endemic areas. Vesical schistosomiasis is recognized as a significant public health problem among Kwargaba, Tutudawa, Lugu and Tunga rural farmers and children, and this, calls for effective intervention by the local government authority and Sokoto State government.

Keywords: Kidney, *schistosoma haematobium*, urinary bladder, parasite

INTRODUCTION

Schistosomiasis has been recognized as the second major cause of infection among the soil transmitted helminthic parasites in the world. Five schistosome species infect humans namely *Schistosoma haematobium*, *S. mansoni*, *S. japonicum*, *S. intercalatum* and *S. mekongi*.¹ Approximately 75 countries are affected by this particular parasite where this disease has been reported to be endemic, with an estimated 200 cases reported annually.^{2,3} About 70million individuals experience haematuria (blood in the urine), 32million dysuria (painful urination), 18million bladder wall pathology and 10million 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, following the disease caused by the haematobium species.

Among the several complications caused by *S. haematobium*, the mortality rate due to non-functioning kidneys and haematemesis was put at 150,000 annually.³ According to the 1993 WHO reports, the above figure clearly showed that urinary schistosomiasis is an important public health problem in sub-Saharan Africa next to malaria in morbidity.² Granulomatous inflammation, severe ulceration and pseudopolyposis of the ureteral and vesical walls are the major complications/damages caused by the eggs of *S. haematobium*. The common signs of the infection include hematuria, dysuria, pollakisuria and proteinuria. However, *S. haematobium* mediated renal failure deaths due to UTI scarring, ureter and bladder deformities are less common nowadays due to the emergence of novel and highly systematic anti-helminthic drugs with promising anti-schistosome activity.^{4,5}

In recent years, complex morbidities resulting in fatigue, cognitive impairment and co-infections in immunosuppressed individuals have been reported.⁴ Some reports on the impact of schistosomiasis in humans have suggested that there exists a causal relationship between schistosomiasis and

anaemia, even after successful treatment of co-infections, especially, in children and pregnant women.^{5,6,8} A rough estimate on the prevalence of schistosomiasis in Nigeria puts the figure at 14.7% (25 million) and most of them are at the risk of infection.⁹

In Sokoto and its neighbouring States, urinary schistosomiasis has been reported in several communities.^{10,11,12,13} However, none of these studies focused on Kwargaba, Tutudawa, Lugu and Tunga regions of this state. Moreover, most districts in Sokoto State do not have their local estimates to guide planning and implementation of control interventions at local government level. Following a thorough search of the literature, no such studies have been done in the said communities.

A prospective cross-sectional study of urinary schistosomiasis infection among adults and children of the 4 villages in Sokoto State was, therefore, conducted. In the midst of a number of schistosomiasis-related morbidity indicators, there was generally the use of simple, indirect method of measuring egg counts through urine filtration and proteinuria and hematuria, using dipsticks testing. However, egg count for both stool and urine examinations have been frequently used as a measure of disease and associated with severity of schistosoma infection.² This study described the prevalence, as well as the factors associated with *S. haematobium* infection and the reliability of self-reported hematuria compared to the "gold standard" parasitological examination.

METHODOLOGY

Study site

The study was carried out in four villages (Wurno Local Government Area, LGA) of 2 districts in Sokoto State, North-West Zone of Nigeria. Urine samples were collected over a period of 3 months from August to October, 2011.

Wurno LGA is bordered by Sabon Birini LGA in the east, Isa LGA in the south, Rabah LGA in the west, Goronyo LGA in the north-east

and Gwadabawa and Kware LGA in the north-western border.¹⁴ The Wurno LGA is made up of 3 districts namely Wurno, Wargaba and Achida districts. The villages Kwargaba and Tutudawa (Kwargaba district), Lugu and Tungu (Wurno district) were located south-west of Sokoto city, the capital of the State. The Wurno LGA has a land area of 685km² with a population estimate of 162,307 according to the 2006 census. The inhabitants are mainly of Fulani, Hausa and Gobirawa ethnic groups. The rainy season in Wurno is from June to September and the dry season, March to May. The annual average temperature is 28.3 °C. Temperatures may hit a maximum of 42 °C whilst the mean average rainfall is 750mm (Sokoto State Ministry of Agriculture and Natural Resources, 2007).

The Wurno LGA has water projects like Lugu Dam in Wurno district as well as swamps distributed all over the villages. These swamps (small water bodies with inadequate water supply) are mainly utilized by the inhabitants for domestic usage, rice farming, fishing, swimming, etc. The study areas have no history of treatment for schistosomiasis and this study is the first of its kind in this setting.

Sample Population

A pre-survey visit was paid to the villages in the study area during which consultation was held with village heads and religious leaders who assisted in mobilizing the people for the study. The sampling procedure and techniques employed in conducting a cross-sectional survey to obtain baseline data on rates of infection with *S. haematobium* and *S. mansoni* was done as described previously.⁴

A total of 300 subjects [Kwargaba ($n=75$), Tutudawa ($n=75$), Lugu ($n=75$) and Tungu ($n=75$)] were randomly selected for the study. Samples were collected from children and adults of both genders. Those who were in the villages on a visit were excluded from the study. Also, women on their monthly menstrual periods were excluded from the study. This was necessary to avoid false positive results from menstrual blood.¹⁵

Sample Collection

A house-to-house visit was conducted and dark (black), sterile, plastic universal containers (labelled) were given to the selected individuals to collect urine samples. This was done between the day time hours 11AM – 2PM. Within one hour, the collected urine samples were transported to the General Hospital Wurno for laboratory analysis.

Urine Microscopy

About 10mL urine, for each subject, was dropped in plastic conical tube labelled with patient's names and tightly covered and placed in a centrifuge. The urine was spinned according to the manufacturer's directions at a RCF (relative centrifugal force) of 400 x g for 5-10 minutes the RPM rotation was calculated for a specific centrifuge, using the following formula:

$$RCF = 1.118 \times 10^{-5} \times r \times N^2$$

r = the radius in cm (from the centre of the spindle to the bottom of the tube)

N = rotations per minute

After spinning, the supernatant were discarded leaving the sediment at the bottom of the tube, after which the remaining liquid and sediment were mixed with a plastic pipette and a few drops of the mixture was removed and a drop of it placed on a glass slide and covered. The sediment was examined under the microscope using phase contrast or bright light at low (10x) and high (40x) power magnifications, scanning several fields to obtain average numbers of formed elements, number of eggs and then, the samples were characterized as positive or negative, based on the presence or absence of eggs.

Determination of Haematuria

Each urine sample was observed for any visible signs of turbidity, which was documented. Microhaematuria was determined using reagent strip combi-9 (Medi-Test MACHERY-NAGEL, Germany) which was dipped into each urine sample and the colour was matched with the standard

colour by the side of the container as recommended by the manufacturer. All urine samples were spun for 5min at 3000rpm and the sediments were examined for blood capsule using a light field microscope at 40x high power objective.

Urine Protein Analysis

The protein excretion in the urine was determined using simple reagent strips (Medi-Test Combi-9). Urinary protein results were categorized as positive or negative according to the manufacturer's instruction provided in the kit inserts.

Ethical Consideration

Consent to carry out this study was obtained from the health department of Wurno LGA as well as the General Hospital of Wurno. Informed consent was, also, obtained from the selected subjects; the purpose of the study was explained to them, and their contributions were treated confidentially (Helsinki Declaration). All subjects with schistosomiasis were treated with single dose of praziquantel 40mg/kg body weight and mebendazole 500mg which were provided by the local authority.

Data Analysis

The data from the findings were analyzed using SPSS statistic version 21 (2013 Chicago, Illinois). The prevalence of infection was calculated using percentages. Relationship of age, proteinuria, hematuria and occupation of the study subjects were tested using Chi square analysis.

RESULTS

Socio-demographic Characteristics

In this study, 300 individuals were involved, 212 (70.7%) were male and 88 (29.3%) were female. Majority of the individuals were adults ($n=217$; 72.3%) and the remaining 27.7% ($n=83$) were children. The socio-demographic characteristic of the participants is shown in Table 1.

Table 1. Socio-demographic characteristics of study participants, Wurno LGA

Variable	Category	No.	%
Domicile	Kwargaba	75	25
	Tutudawa	75	25
	Lugu	75	25
	Tungu	75	25
Sex	Male	212	70.7
	Female	88	29.7

Prevalence of Urinary Schistosomiasis

Urine samples were taken from all individuals ($n=300$); children and adults in Kwargaba, Tutudawa, Lugu and Tungu villages of Wurno LGA. In total, 113/300 (37.7%, 95% Confidence Interval (CI); 33.06-42.26) individuals harboured schistosoma eggs. The overall prevalence of schistosomiasis infection in the 4 villages were; 54.66% in Lugu, 36% in Tutudawa, 32% in Kwargaba and 24% in Tungu. The prevalence was significantly higher (54.66%, 95% CI; 45.2-64) in Lugu compared to the other villages ($p < 0.001$).

Similarly the prevalence was significantly higher (58.1%) among adults compared to children (42%) ($p < 0.001$). Likewise, the prevalence was significantly higher in males (77.2%, 95% CI; 64.69-78.67) compared to females (23%, 95% CI; 14.89-27.57) ($p < 0.005$) with majority (50.3%, $n=151$) of the study population being irrigation farmers, followed by dependents (27.7%, $n=88$) and house wives (18.0%, $n=54$). Taking occupation as a variable, the prevalence of schistosomiasis was high in irrigation farmers (54%). The ages of the study population were normally distributed with mean age of 27years (SD 15.5).

Table 2. Relationship of age, proteinuria and haematuria

	S. E.	Df	Sig.	95% C. I.	
				Lower	Upper
Age	0.020	1	0.083	0.996	1.075
Haematuria	1.082	1	0.000	146.397	10189.613
Proteinuria	0.661	1	0.038	1.077	14.368
Constant	0.780	1	0.000		

Haematuria and Proteinuria levels among Individuals

The overall ova density (egg/10 mL of urine) among the infected in the study population was 99.1%, 95% CI (range 98.97-99.24). The severity of infection was classified as <100eggs, 100-400 and >400 as mild, moderate and severe, respectively, with prevalence of severe infection among those infected at 3.33%. Among schistosomiasis positive individuals, 92.9% of the subjects were found with haematuria. Haematuria was present in 58.1% of adults, 41.9% of children. Majority of the individuals found with haematuria were male (77.1%) compared to female (22.9%). Protein excretion in urine was determined using simple reagent strips and the intensity of protein excretion is expressed as trace, +1, +2 and +3, which indicated <30mg/dl, 30mg/dl, 100mg/dl and 500mg/dl, respectively. Of the total urine samples examined, 79.6% were positive for proteinuria. Microhaematuria and proteinuria together, were found to be significantly associated with vesical schistosomiasis ($p<0.05$) as shown in Table 2

DISCUSSION

To the best of our knowledge this is the first survey that has been conducted in Wurno LGA of Sokoto State to determine prevalence and risk factors associated with *S. haematobium* infection. The present study showed a prevalence rate of 37.7% of urinary schistosomiasis among the inhabitants of Wurno LGA. Male gender and occupation in the area, previous history of schistosomiasis, age and proximity of water reservoir, especially, schools and houses situated near to a water reservoir were independently associated with infection in our study. The occurrence of schistosomiasis in this study area may be the result of water pollution by *S. haematobium* eggs, water contact activities, presence of fresh water snail (intermediate host) and frequent water contact activities which corroborated the findings of schistosomiasis surveys conducted in northern parts of Nigeria.^{13,16}

In the present study, inhabitants of Lugu LGA were found to be more infected with *S. haematobium*. Lugu village is surrounded by lots of water reservoirs, channels and a large dam which can be attributed to the very strong association of infection in the region. The infection rate was higher in Lugu, compared to the infection rate of Tutudawa, Tungu and Kwargaba. However, the stream, river water and dam situated in Lugu region are the major sources of drinking water for the inhabitants as well as their domestic and occupational activities (irrigation). Therefore, the high rate of infection may be a result of intense water contact by the respondents (mainly farmers and children) and dependence on the river water.

Similar observations on the prevalence of schistosomiasis in other districts of Sokoto had been reported previously.^{1,13,16,17} The higher prevalence among males (77%) than females could be due to the greater water contact activities by males compared to females in the Kwargaba, Lugu, Tutudawa and Tungu. It was observed that females were less prone to long periods of swimming and, therefore, has less exposure to water activities (swimming) compared to males. One possible reason might be that females mature earlier and were therefore restricted socially compared to males to swim naked in the stream.^{18,19}

Among males, the rise in prevalence of schistosome infection with age could be attributed to the exposure factor. Consequently, at early age, water contact activities such as swimming, washing and bathing inside the water (river) body are less and these activities could increase with age and maturity. In a separate analysis of the infection prevalence among genders, the male gender was more likely to be infected with *S. haematobium*. This particular finding was a very common factor observed in several surveys conducted elsewhere.^{3,20,21,22} They showed in their findings that boys had more water-contact compared to girls (1:06). Occupation, frequent exposure to water bodies, adventurous water activities etc. are

some of the factors associated with male gender which expose them to schistosomiasis.

However, some studies had reported that there was no association between schistosomiasis and gender, with no significant difference between the incidence for males and females, respectively, whereas one study conducted elsewhere in Nigeria reported that *S. haematobium* was associated more with the female gender.^{22,23,24} This, strongly reinforced the notion that the association between gender and *S. haematobium* infection varied in different communities. Consequently, this would need to be confirmed by national level surveys throughout the country, in areas where schistosomiasis infections are endemic.

A massive strategy to evaluate control methods of urinary schistosomiasis was launched by the Health Ministries of several endemic countries including Botswana, Egypt, Madagascar, Mauritius and Zanzibar in association with the WHO. They had come up with a conclusion suggesting the use of rapid simple test for blood in the urine as more reliable than microscopic examination, most especially, in the field (WHO, 2004). This has been corroborated by this study in which 99.1% of subjects that had schistosomiasis also had haematuria in their urine, while 79.6% had proteinuria.

Similar observations had been reported in schistosome endemic areas of Gambia and Sudan^{14,25} Previous research studies in different African settings had reported sensitivities of reagent strips for haematuria ranging from 67 to 93%, and specificities of 67 to 99%, including a sensitivity of 87% in White Nile Province in Sudan.^{26,27} Reagent strip testing had been proposed as a simple, indirect method for identifying children with *S. haematobium* and therefore, a useful way of rapid mapping of the prevalence of infection to identify areas warranting mass treatment with praziquantel.²⁸

RECOMMENDATION

The authors strongly recommend the introduction of an effective schistosomiasis control programme in Wurno LGA as well as other areas bordering it and Sokoto State at large.

CONCLUSION

Infection with *S. haematobium* has been established in these study areas. However, there is no control programme on the disease in Wurno LGA for now. Hematuria and proteinuria can serve as a good screening tool in communities with schistosomiasis, with closeness to the body of water constituting a higher risk.

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