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# Epidemiology of Urinary Schistosomiasis among Secondary School Students in Kaduna State, Nigeria

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## Abstract

This study investigated the prevalence and risk factors associated with urinary schistosomiasis among secondary school students in Kaduna State, Nigeria. Eight hundred urine samples were randomly collected and analyzed from students attending two secondary schools. Schistosoma eggs were detected in 160 (20%) of the 800 urine samples collected and processed. The highest prevalence of 27% was recorded in Kufena. Overall males had a higher prevalence rate (23.49%) compared to females (2.94%) with a higher prevalence (35.29%) among older students (≥ 20 years old). The ova were detected more in males (23.5%; CI: 17.7–30.5) compared to females (2.9%; CI: 0.5–14.9). Also there was no statistically significant association (P=0.058) between time of last deworming and detection of ova. In terms of sources of water, the highest prevalence was found among those using well water for drinking and bathing (28.97% and 22.66% respectively). Among those found positive for the infection, 57.9% and 15.7% had haematuria and proteinuria respectively while 30.0% had a combination of hematuria and proteinuria. The findings of this study suggest that schistosomiasis is prevalent within the study population. We therefore recommend that measures should be taken to purify water supply in the area and school students should be dewormed routinely with appropriate drugs to prevent this infection. Public health education on the associated risk factors and dangers posed by the disease and further studies on the prevalence of schistosomiasis also need to be carried out.

**Keywords:** Urinary schistosomiasis; *Bolinus globosus*; Kaduna; Haematuria; Proteinuria

## Introduction

Schistosomiasis, a neglected tropical disease (NTD), is endemic in Africa and is reported to be second to malaria affecting over 200 million people [1]. Schistosomiasis is a parasitic disease caused by a digenetic trematode blood fluke with an indirect life cycle involving several species of fresh water snails [2,3]. Molluscs serve as intermediate hosts to *Schistosoma haematobium* [4,5]. People generally become infected when the infective larvae mechanically penetrate their skin by contact with fresh water bodies where mollusks are prevalent and hygiene is undermined [6]. It is estimated that about 436 million people are at risk of *S. haematobium* infection and 112 million are infected [7,8].

Reports on schistosomiasis indicate that it is endemic in different parts of Nigeria [9-21]. The prevalence of schistosomiasis in North western states of Nigeria could be as high as 93% [13]. In Zaria, Sady et al. [22] reported a prevalence of 2.38% among school age children while Gadzama and Akpiri [23], reported 13.89%.

Schistosomiasis has been on the increase in Nigeria due to inadequate prevention, control and treatment [24]. More than 60 million people needed treatment for schistosomiasis in 2013 but only a fraction could access the treatment [25]. Global 2000 testing children for haematuria using dipstick found that half of all Nigerian villages are infected with schisitosomiasis [26]. Carter Center with other Development and Implementation Partners with the Federal Ministry of Health in Nigeria are working to mitigate the burden of this disease among school age children in priority states. Nevertheless, control programs are yet to draw attention of policy makers to expedite action on schistosomiasis hence creating doubts if its control is feasible [27]. The recognized method of diagnosis of urinary schistosomiasis in endemic areas is the detection of ova in urine using light microscopy.

## Materials and Methods

### Study location

The study was carried out in two senior secondary schools (GSSS kufena and GSSS Bomo) in Zaria (latitude 110 3' N and longitude 7042' E), Northwest, Nigeria. The area is characterized by a tropical savannah climate with distinct wet (May-October) and dry (November- April) seasons [28]. Zaria draws its water from two slow flowing rivers, Ahmadu Bello University Dam, and seasonal burrow pits which harbor schistosomiasis transmitting snail hosts e.g., *Bolinus globosus and Biomphalaria pfeifferi* [29,30].

### Study design and population

A cross sectional design for the study. Urine samples were randomly collected from 800 students (400 in each school) in the schools between June and July, 2017.

### Ethics statement

Consent of was obtained from individuals willing to participate in the study in addition to consent of the Education Officer in the State Ministry of Education. In the case of students below 18 years consent was obtained from their parents or guardians.

### Questionnaire

A structured questionnaire was also used for the study. The questionnaires contained questions relating to the knowledge of urinary schistosomiasis, demography, symptoms, sources of water, history of deworming were administered to the participants.

### Urine collection and processing

Each respondent was given a clean 20 mL of universal bottle for the collection of mid-stream to terminal urine between the hours of 10: 00-1400 [31]. Turbidity and biochemical parameters of all urine samples such as haematuria, proteinuria, bilirubin, PH, specific gravity, urobilinogen, glucose, ketones, nitrite, leucocytes and ascorbic acid were tested using a commercially prepared reagent strip Combi 11™ (Boehringer Mannheim GmbH co Korea) after collection. To each urine sample with visible blood/cloudiness, two drops of saponin reagent was added to deheamoglobinize the red blood cells to enhance easier egg detection [31]. Ten milliliters of urine was transferred to the test tubes and centrifuged at 3000g for 5 minutes using bench centrifuge (Unico® PowerSpin ™ centrifuge, USA).

### Identification of schistosoma eggs

After centrifugation, the supernatant was discarded, and 10 µL the urine sediments was examined for the eggs of *Schistosoma* using ×10 objective nose of Olympus light microscope (USA). The number of eggs was counted on several fields of the preparation with ≥ 50 eggs/10 mL of urine considered heavy infection according to standard method [32].

## Results

The results are displayed on Table 1. *Schistosoma* ova were detected in 40 (20%; CI: 15.1–26.1) of the 800 urine sampled evaluated. The ova were detected more in males (23.5%; CI: 17.7–30.5) compared to females (2.9%; CI: 0.5–14.9). There was no statistically significant association (P=0.058) between time of last deworming and detection of ova. The most prevalent pathologies detected among positive subjects were hematuria (57.9%), proteinuria (15.7%) and both hematuria and proteinuria (30%) Tables 2 and 3.

| Variables | No. of samples examined | No. positive for Schistosoma ova | %positive; (95% CI) | p value |
|---|---|---|---|---|
| **School** | | | | |
| Govt. Sci. Sec. Sch. Kufena | 400 | 108 | 27 (19.3−36.4) | |
| Govt. Sci. Sec. Sch. Bomo | 400 | 52 | 13 (0.7–21.0) | |
| Total | 800 | 160 | 20 (15.1–26.1) | 0.0216 |
| SEX | | | | |
| Males | 664 | 156 | 23.5 (17.7–30.5) | |
| Females | 136 | 4 | 2.9 (0.5–14.9) | 0.0041 |
| **History of Deworming** | | | | |
| <3-5 months | 96 | 24 | 50.5 (28.0–78.7) | |
| 6-9 months | 52 | 12 | 23.1 (8.2–50.3) | |
| 1 year | 100 | 16 | 16.0 (6.4 – 34.7) | |
| >1 year | 60 | 8 | 13.3 (3.7 – 37.9) | |
| Never | 540 | 100 | 18.5 (12.9 – 25.9) | 0.058 |
| **Urinalysis Result** | | | | |
| Hematuria | 76 | 44 | 57.9 (36.3 – 76.9) | < 0.0001 |

| | | | | |
|---|---|---|---|---|
| Proteinuria | 356 | 56 | 15.7 (9.0 – 24.7) | |
| Both hematuria and proteinuria | 80 | 24 | 30.0 (14.6 – 51.9) | |
| None | 288 | 36 | 12.5 (6.7 – 22.1) | |

**Table 1:** Risk factors analysis for occurrence of Schistosoma among school children in two Local Government Areas of Kaduna State, Nigeria.

| Biodata | No. examined | No. positive | % positive |
|---|---|---|---|
| **Age** | | | |
| 5-10 | 4 | 0 | 0.00 |
| 11-15 | 212 | 72 | 33.96 |
| 16-20 | 516 | 64 | 12.4 |
| >20 | 68 | 24 | 35.29 |
| Total | 800 | 160 | 81.65 |
| **Sex** | | | |
| Male | 664 | 156 | 23.49 |
| Female | 136 | 4 | 2.94 |
| Total | 800 | 160 | 26.43 |
| **Parents occupation** | | | |
| Trader | 112 | 20 | 17.86 |
| Primary School | 108 | 20 | 18.52 |
| Secondary School | 292 | 48 | 16.44 |
| Tertiary | 288 | 72 | 25 |
| Total | 800 | 160 | 77.82 |

**Table 2:** Demographic variables showing the prevalence of urinary Schistosomiasis among school age children in Zaria.

| Domestic Uses | No. examined | No. positive | %positive |
|---|---|---|---|
| **Drinking** | | | |
| Well | 428 | 124 | 28.97 |
| Stream | 24 | 0 | 0.00 |
| River | 44 | 8 | 18.18 |
| Tap | 140 | 28 | 20 |
| Borehole | 164 | 40 | 24.39 |
| Total | 800 | 160 | 91.54 |
| **Washing** | | | |
| Well | 254 | 100 | 19.08 |
| Stream | 20 | 4 | 20 |
| River | 56 | 16 | 18.57 |
| Tap | 108 | 20 | 18.51 |
| Borehole | 92 | 20 | 21.74 |
| Total | 800 | 40 | 97.90 |
| Well | 512 | 116 | 22.66 |
| Stream | 56 | 0 | 0.00 |
| River | 24 | 4 | 16.67 |
| Tap | 84 | 20 | 23.81 |
| Borehole | 124 | 20 | 16.31 |
| Total | 800 | 160 | 79.27 |

**Table 3:** Prevalence of Urinary Schistosomiasis based on sources of water for domestic uses among school age children.

## Discussion

The findings of this study suggest that Zaria and Sabo Gari LGAs fall within the level classified "moderate" by the World Health Organization classification [32]. The prevalence was higher among male students compared to female students. Also the finding of the present study supports other studies carried out in Zaria [23,33] which reported a similar prevalence in males and females. The low prevalence observed in females could be attributed religious and moral principles that results in the sheltered and reserved lifestyles of the women and thus brings them in less frequent contact with water bodies potentially harbouring the helminth. This however is in contrast to the findings of Etim [34] who observed that more females are exposed to urinary schistososmiasis due to water contact activities than males in rural areas.

Various reports across Nigeria have shown that schistosomiasis is a burden, varying prevalence ranging from [35].9% in Cross River, South-South, Nigeria [35], 43.7% in Ondo State Southwest Nigeria, 41.6% in Kano state, Northwest, Nigeria [18,36]. The result obtained in this study is lower than reports of Sulyman et al. [37] who recorded 71.1% in four states (Borno, Niger, Ondo and Ogun State) of Nigeria and 65% in Edo state respectively. The findings of this study is however higher that reported in Zaria, 11.3% in Imo and 18.7% in Kebbi [19,22,38]. Similar studies in other African countries have reported a prevalence of 47.6% in Dar-es-Salam, Tanzania [39]. 8% in South-west Cameroon [40], 60% in Zimbabwean school children [41], 37.5% in, Kwazu lu-Natal, South Africa [42].

Studies have shown that cultural differences and behaviors with regards to water uses and contact play a role in the spread of urinary schistosomiasis thus making sex related preponderance insignificant [20]. Therefore the changes in the mode of infection could be as a result of the differences in civilization, religion, geographic and environmental settings [20]. Males are however engaged in a lot of risk activities which make them have contact with infested water bodies.

These activities range from irrigation farming (known as fadama), recreation, molding of blocks and inadequate access to schools which predispose the children to increased contact with the water bodies when the eggs are shed during the day 5 [14-20].

The high infection observed in those who dewormed themselves in 3 months or more and those that never dewormed may be attributed to the dewormer used which is not effective against Schistosoma because the commonly administered dewormers from the study are pyrantel pamoate and albendazole which were not effective and also not the drug of choice against parasite [32]. Praziquantel has been shown to be the drug of choice for the treatment of schistosomiasis administered at 40 mg/kg body weight.

Program that entails the mitigation of morbidity due to schistosomiasis have used a target treatment strategy. This depends on the epidemiology of schistososmiasis, deworming should be done about two to three times per year. The teachers should administer the drugs with the supervision of the health personnels. It is a good practice that the teachers do the public health education on schistosomiasis to the school age children and those not enrolled in school [43]. Targeting the non-enrolled children can be achieved through the enrolled pupils when they meet at the field of play or at a community level [44-45]. In Seychelles, they have included the pre-schoolers and school age among their target population for deworming. In the recent past, pre-schoolers have been neglected because it is believed that schistosomiasias only affects school age children. Recent studies have shown that the preschool children also come intact with water contaminated by snails and hence get infected [20].

The high prevalence rate of urinary Schistosomiasis may be as a result of high exposure and dependence of these secondary school students on sources of water other than the pipe borne water due to its non-availability. These water bodies are sources of water supply for most of their domestic and recreational use. Zaria on most occasion is known to suffer in sufficient water supply and as such most water used for domestic activities are obtained from streams, dams and burrow pits supplied by the males after school hours and as such have increased contact with infected water bodies. Proliferation of dams has contributed to the scourge of schistosomiasis example, Aswan Dam in Egypt and Diama Dam and Manantali Dam in the Senegal basin. Despite the fact that irrigation farming contributes to food safety and increased agricultural production, it has had impact on people's health by creating snail habitats which has been encouraged in some areas by poor sanitation and access to safe water for local communities [5].

Proteinuria and hematuria are seen with urinary Schistosomiasis [30,46]. High prevalence of the students with these symptoms is a reflection of the level of renal involvement which may need further investigation. G.S.S.S Kufena which is a male school had a highest prevalence rate of infection 27%, this may be because there is no provision of pipe borne water or any form of treated water in the area thus students depend on other water bodies like the Ahmadu Bello University Dam which is in close proximity to the school. There also exists water bodies close to G.S.S. Bomo which supports domestic and agricultural activities in this locality. Several molluscan species are found there and may serve as intermediate host of this parasite [30].

## Conclusion

The study shows that the preponderance of urinary Schistosomiasis in male students and could be a threat to their academic performance. Public health education on the associated risk factors and the danger posed by the disease and further studies on the prevalence of Schistosomiasis in Zaria need to be carried out for intervention by Government and concerned organizations.

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