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Prevalence and Risk Factors of Schistosomiasis among School-Age Children and Adolescents in Zaria, Kaduna State, Nigeria

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Abstract

Nigeria bears the world's highest burden of schistosomiasis, with school-aged children and adolescents experiencing particularly high prevalence and infection intensity. In Zaria metropolis, the abundance of water bodies and frequent water-contact activities, including irrigation farming and swimming, may increase the risk of transmission. This study aimed to determine the prevalence of schistosomiasis and identify its associated risk factors among school-aged children and adolescents in Zaria metropolis. A community-based cross-sectional study was conducted among individuals aged 6–19 years using a multistage sampling technique to select communities, clusters, and households. Stool and urine samples were collected from eligible participants and examined for ova of *Schistosoma* species using standard laboratory techniques. Demographic characteristics and potential risk factors were assessed using a structured questionnaire, and the data were analysed using SPSS version 26. A total of 423 participants were recruited from the Biye, Bomo, Wuchichiri, and Kufena communities. The overall prevalence of schistosomiasis was 10.6% (45/423), comprising 9.5% (40/423) urinary schistosomiasis caused by *Schistosoma haematobium* and 1.2% (5/423) intestinal schistosomiasis caused by *Schistosoma mansoni*. Frequent water contact through swimming and irrigation farming was significantly associated with increased odds of infection (adjusted odds ratio [AOR] = 2.688, 95% confidence interval [CI]: 1.341–5.386, p = .005), while geographical location was also independently associated with schistosomiasis (AOR = 0.275, 95% CI: 0.102–0.740, p = .011). These findings indicate a high prevalence of schistosomiasis among school-aged children and adolescents in Zaria metropolis and demonstrate the importance of water-contact behaviour and geographical context in sustaining transmission. The study provides epidemiological evidence to support geographically targeted interventions, health education, reduced exposure to infested water bodies, and strengthened schistosomiasis prevention and control programmes.

Keywords: Adolescents; Risk Factors; School-Aged Children; Schistosomiasis; Water Contact

INTRODUCTION

The burden of infectious diseases is high, particularly in Africa, leading to a high morbidity and mortality, especially in children.[1] Schistosomiasis, is a parasitic disease caused by a fluke of the genus *Schistosoma* and manifests in two major forms; urogenital Schistosomiasis caused by *Schistosoma haematobium* and intestinal schistosomiasis caused by *Schistosoma mansoni, Schistosoma japonicum*, *Schistosoma mekongi, Schistosoma intercalatum* and *Schistosoma guineensis*,[2] *Schistosoma haematobium* and *Schistosoma mansoni* are predominantly found in Sub-Saharan Africa, South America, Middle East and the Caribbean.[2] Transmission to humans requires contamination of fresh water by faeces or urine containing Schistosoma ova. While in water, the ova hatch to form miracidia which infect an intermediate snail host and develop into the larval stage (cercaria). The intermediate hosts for the two major *Schistosoma* species prevalent in sub-Saharan Africa are *Biomphalaria sp*. and *Bulinus sp*. For *Schistosoma mansoni* and *Schistosoma haematobium* respectively.[3]

Schistosomes are water-borne human pathogens common in areas with poor sanitation like in Nigeria.[4] Sub-Saharan Africa makes up about 13% of the world's population and accounts for up to 90% of schistosomiasis cases and about 280,000 deaths annually. The prevalence and intensity of schistosomiasis are highest in school-aged children (5–14 years old).[5] Nigeria is endemic for the disease, with average prevalence of 9.5%.[6] A higher prevalence of 79.4% is reported in rural eastern Nigeria.[7] However, a lower prevalence of 10.5% has also been reported among school children in Zaria.[8]

The risk factors for Schistosomiasis include: male sex, younger age group (less than 15 years), frequent exposure to contaminated water including swimming and irrigation farming.[9]

The gold standard for diagnosis is the detection of ova in urine or stool microscopy.[10] Praziquantel (PZQ) is the cornerstone of the treatment and control of schistosomiasis in endemic regions of Africa

This current study aims to provide data on the prevalence of *Schistosoma* infection among School-age children and adolescents in Zaria metropolis, identify factors that may be associated with it, thereby enabling tailoring of control measures to reduce the burden in this limited-resources setting.

MATERIALS AND METHODS

Study area

Zaria metropolis is in Kaduna state, located in North-West Nigeria. It shares borders with Kubau, Kara, makarfi, Kudan Birnin gwari, Igabi, local government areas. Zaria is characterised by slow flowing water and ponds e.g river galma, kubanni dam, river Saye, river Shika among others; which harbour the intermediate host of *Schistosoma* and children often go there to swim. There is practice of open defecation which can be washed into water reservoirs contaminating them and contributing to Schistosoma spread.

Zaria metropolis has an estimated population of 766,007 in 2023, projected from the 2006 census. It is located between latitude 11° 5 '7.9476" N and longitude 7° 43' 11.8020" E with a total land mass 563km2. Zaria metropolis has 4 local government areas namely: Sabon gari LGA, Zaria LGA, Soba LGA and Giwa LGA.

Zaria metropolis is inhabited predominantly by the Hausa – Fulani, and to a lesser extent by other tribes like Igbos, Yorubas etc. the major religions are Islam and Christianity.

The major occupation of the inhabitants includes farming, fishing and trading.

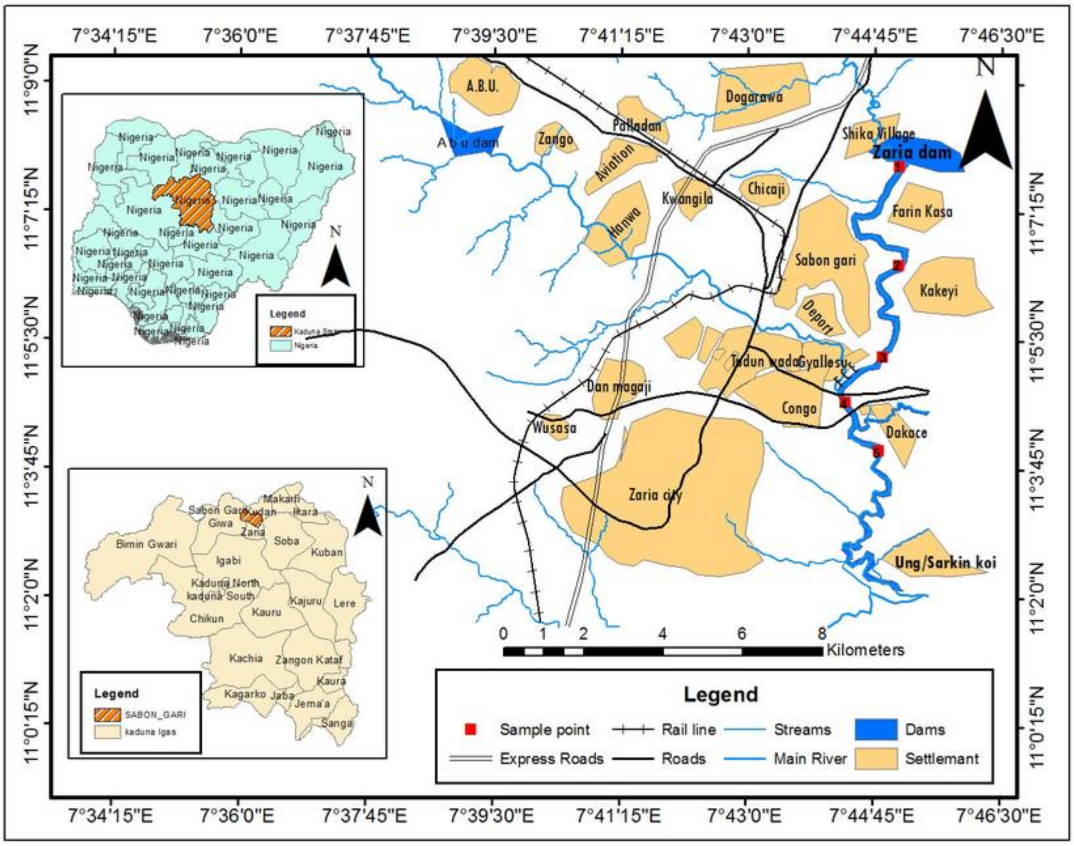

Image 1. Map of Zaria and its Environment showing Zaria metropolis.
Source: Satellite Image (2013)

Study design and population

A community-based descriptive cross-sectional study was carried out among school – age children and adolescents from ages 6 - 19 years in Biye, Wuchichiri, Kufena and Bomo communities in the Zaria metropolis.

Inclusion criteria

All school-age children and adolescents within ages 6 - 19 years in selected areas of Zaria metropolis present during the study.

Exclusion criteria

Recent Medication: participants who had taken Praziquantel within the last 2 weeks, which could affect the shedding of Schistosoma were excluded.

Sample size determination

Estimated using the formula for estimating the minimum sample size for descriptive studies.

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

$$= 423$$

Sampling technique

A multi-stage sampling technique was used to select the 423 school-age children and adolescents that made up the study population to ensure even spread across the diverse population.

Data collection

Data collection was by close-ended, pre-tested interviewer-administered questionnaire. The questions addressed the knowledge of Schistosomiasis, risk factors and commonest presentations. Consent was obtained from parents and Assent was obtained from minors.

Specimen collection and transportation

Twenty milliliters (20mls) terminal urine and 20g stool was collected in sterile universal bottles and wide mouth screw-capped plastic specimen bottles respectively and immediately transported within 2 hours to the laboratory of the Medical Microbiology unit of ABUTH Shika, Zaria for examination.

Stool and urine microscopy

Basic urine sedimentation and Formol-ether concentration methods were used to examine urine and stool specimens respectively.[12]

Ten milliliters (10 ml) of urine was added to a centrifuge tube and placed in a centrifuge and spun at 5000 rev/min for 5 mins. The supernatant was discarded and the sediment gently shaken to homogenize. A drop was placed on a slide, covered with a cover slip and viewed at x40 objective magnification of a light microscope. Schistosoma ova were identified by their oval shape with a spine.

One gram (1g) of stool sample was placed in a centrifuge tube containing 10ml of 10% formalin. The mixture was shaken vigorously and strained through a gauze unto a conical flask. The filtrate was placed in a centrifuge tube and centrifuged at 1500 rpm. The supernatant was decanted and distilled water was added to the sediment, thoroughly mixed and then spun at 1500 rpm for 2 mins. The supernatant was discarded and distilled water was added up to 10mls. Three milliliters (3mls) formol-ether was added to each tube and thoroughly mixed. The mixture was centrifuged at 1500 rpm for 2 min. The debris was loosened and the top 3 layers were discarded. The sediment was gently shaken and a drop placed on a slide, covered with a cover slip and viewed under a light microscope at x40 objective magnification.

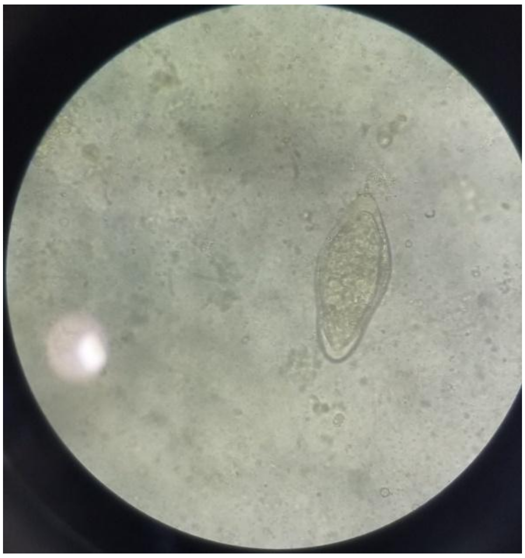

Image 2. Schistosoma haematobium ova at x40 magnification

Statistical analysis

The completed questionnaires were uploaded to SPSS (Statistical Package for Social Sciences) version 26 and analysis was done. Tables, charts, graphs were used for descriptive data. The prevalence of *Schistosoma* was calculated as a number of positive samples divided by the total number of samples. A bivariate analysis was done to test the relationship between the factors associated with *Schistosoma* infection and the infection rate using chi square at p = 0.05.

RESULTS

Socio-demographic Characteristics of study participants

A total of 423 school-age children and adolescents were enrolled in the study across four communities in Zaria Metropolis, Kaduna State. The mean age was approximately 12.4 ± 3.1 years, with the highest proportion of participants in the 11–15 years group (143, 33.8%), and lowest in the 6–10 years group (139, 32.7%). The gender breakdown indicates a predominance of males (311, 73.5%). A significant majority (287, 67.9%) of participants' parents were engaged in farming.

Prevalence of Schistosomiasis

Of the 423 urine and stool samples collected from the study participants, 45 (10.6%) *Schistosoma* ova were isolated, out of which 40 (9.5%) were *Schistosoma haematobium* and 5 (1.2%) were *Schistosoma mansoni.*

Table 1: Prevalence of Schistosomiasis among school school-age and adolescents in Zaria communities in 2025

Variables	Frequency n = 423	Percent (%)
Presence of Schistosoma in urine and stool		
S. Haematobium (Urine)	40	88.8
S mansoni (Stool)	5	11.1

Predictors of Schistosomiasis

The predictors of Schistosomiasis include male sex and geographical location of participants

The odds of having Schistosomiasis is lower in individuals residing in Kufena (AOR = 0.275, p = 0.011) and Bomo (AOR = 0.236, p = 0.017) when compared to those living in Biye community.

Table 2: Predictors of Schistosomiasis infection (Bivariate-Chi-square, Multivariate-Adjusted Odds Ratio)

				95% C.I.		
Variable	$\chi 2$	p-value	AOR	Lower	Upper	p-value
Age (in years)						
6-10			Ref			
11-15	2.649	0.270	0.434	0.177	1.063	0.068
16-19			0.488	0.16	1.486	0.207
Gender						
Male			Ref			
Female	4.469	0.048***	0.423	0.16	1.121	0.084
Address						

				95% C.I.		
Biye			Ref			
Kufena	17.421	0.001***	0.275	0.102	0.74	0.011***
Wuchichiri			0.784	0.263	2.343	0.663
Bomo			0.236	0.072	0.771	0.017***
Enter stream						
No			Ref			
Yes	11.728	0.001***	2.688	1.341	5.386	0.005***

***$P < 0.05$ Statistically significant, AOR: Adjusted Odds Ratio

DISCUSSION

The prevalence of Schistosomiasis among School-age and Adolescents in Zaria Metropolis were found to be 10.6% in this study. The prevalence is high and supports the findings in a similar study among school children in Zaria where a prevalence of 10.5% of Schistosomiasis was found.[13] The similarity to previous studies can be explained due to similar geographical location for the studies and similar methods used in detecting *Schistosoma* ova. Age distribution of *Schistosoma* in this study showed higher prevalence in the age group 6-10 years (42.2%) as compared to the older age groups. This contrasts the peak age found in previous studies which showed a higher prevalence in older age groups 13-14 years (30%) in Dakace community in Zaria.[14] This is because the study was carried out within a higher age range (9-14years) than the age for this current study (6-19years). Males accounted for over three-quarters of *Schistosoma* infections in this study (86.66%). This is similar to the study in Dakace, Zaria which showed higher rates in males (14%) than Females (8.15%).[13] This can be explained by the fact that males engage in more water-related activities like swimming, than females.[6] Although females engage in activities like fetching water from the stream, they are less likely to bath in streams due to cultural reasons, thereby reducing their risk of getting infested with *Schistosoma*.

The factors significantly associated with Schistosomiasis in this study include frequent contact with water bodies and geographical location of participants. Contact with stream predisposed more participants to Schistosomiasis (AOR = 2.688, CI = 1.341, 5.386). In this study, it has been seen that two-thirds of the respondents (66.3%) go to the stream for recreational purposes like swimming, about half of them visit the stream in the afternoon which coincides with the peak period for Schistosome cercarial shedding. About 34.2% visit the stream every day and a vast majority (68.5%) do so without protective foot coverings like boots. These associated factors are comparable with the existing literature.[6]

Among the communities surveyed, about half of those having Schistosomiasis are from Biye community as compared to Kufena (AOR – 0.275, CI = 0.102, 0.74) and Bomo (AOR = 0.784, CI – 0.263, 0.740). This can be explained by the fact that Biye community lacks portable water supply, thereby resorting to using water from a nearby stream suspected to be contaminated with cercaria of *Schistosoma*.

CONCLUSION

The prevalence of *Schistosomiasis* among School-age and Adolescents in Zaria Metropolis is high (10.6%). The factors associated with Schistosomiasis found include geographical location (close to a stream) and frequent contact with water bodies.

Recommendations

1. More studies on *Schistosoma* should be embarked upon by other researchers to cover wider areas that might be affected

2. The knowledge about Schistosomiasis is low, hence the need to create awareness about the diseases by the health care workers

3. Mass drug administration of deworming agents is quite low; there is therefore need for the ministry of health to extend such programs to affected communities

4. Health education should be planned by community health workers to educate the community on preventive measures for the diseases

5. The streams in Biye community (Sabon Fegi) should be screened for the presence of snails vectors that transmit Schistosomiasis and eradicated.

Limitations

1. The study was limited to a few communities; some other endemic areas were not covered due to inadequate funds.

2. Inadequate electrical power supply slowed down the pace of the work

Conflict of interest: Nil to declare

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