Sahel Journal of Life Sciences FUDMA (SAJOLS)
June 2026 Vol. 4(2): 415-420
ISSN: 3027-0456 (Print)
ISSN: 1595-5915 (Online)
DOI: https://doi.org/10.33003/sajols-2026-0402-44

Research Article

Prevalence and Risk Factors of Urinary Schistosomiasis among Patients Attending Two Healthcare Facilities in Kaduna State, Nigeria

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ABSTRACT
Urinary schistosomiasis remains a major public health problem in Nigeria, particularly in areas with frequent human contact with contaminated water. This study determined the prevalence, and associated risk factors of urinary schistosomiasis among patients attending Barau Dikko Teaching Hospital and Tudun Wada Primary Health Care, Kaduna State. A total of 400 urine samples were collected from participants aged 5 years and above and examined using syringe filtration and Combi-9 reagent strips for microhaematuria. Data were analysed using descriptive statistics and Chi-square tests at a significance level of $p<0.05$. Overall prevalence of *Schistosoma haematobium* infection was 13.5%, while microhaematuria prevalence was 61.75%. Infection was highest among males, participants aged 11-20 years, and those attending Barau Dikko Teaching Hospital. Frequent contact with untreated water was significantly associated with the infection. The findings indicate that urinary schistosomiasis remains endemic in Kaduna State and highlight the need for improved screening, health education, safe water supply, and targeted control interventions.

Keywords: Haematuria; Kaduna State; Nigeria; Prevalence; Risk Factors; *Schistosoma haematobium*; Urinary Schistosomiasis

Citation: Apollos, G.I., Amuga, G.A., Ombugadu, R.J., Yako, A.B., Olayinka, M.D., & Thomas, C.D. (2026). Prevalence and Risk Factors of Urinary Schistosomiasis among Patients Attending Two Healthcare Facilities in Kaduna State, Nigeria. *Sahel Journal of Life Sciences FUDMA*, 4(2): 415-420. DOI: https://doi.org/10.33003/sajols-2026-0402-44

INTRODUCTION

Schistosomiasis is an acute and chronic parasitic disease also known as bilharziasis or snail fever caused by a parasitic flat worm commonly called blood flukes (trematode worms) of the genus *Schistosoma*. Human schistosomiasis is one of the oldest most widespread of all human parasitic diseases, ranked second after malaria in terms of socio-economic and public health importance in the tropics (WHO, 2022). The disease is endemic in 78 developing countries, infecting almost 240 million people worldwide, and more than 700 million people live in endemic areas. Twenty million individuals suffer severe consequences from the disease; 120 million are symptomatic and the rest are usually asymptomatic (WHO, 2017).

Urogenital schistosomiasis is caused by *Schistosoma haematobium* and intestinal schistosomiasis by any of the following organisms: *S. mansoni, S. japonicum, S. intercalatum* and *S. mekongi* (WHO, 2022). The most common of all these are *S. haematobium* and *S. mansoni* which are more prevalent in African countries. In urinary schistosomiasis, there is the risk of terminal haematuria (blood in last drops of urine), dysuria (painful urination), bladder cancer or kidney problem, nutritional deficiencies in children, poor cognitive development, decreased physical activity, poor school performance, decreased productivity and work capacity, and growth retardation are well established (Colley *et al*., 2014).

Transmission occurs when people suffering from schistosomiasis contaminates freshwater sources with their excreta containing parasite eggs, which hatch in water (WHO, 2022; CDC, 2023).

In the body, the larvae develop into adult schistosomes. The adult worms live in the blood vessels where the females release eggs. Some of the eggs are passed out of the body in the faeces or urine to continue the parasite's lifecycle. Others become trapped in body tissues, causing immune reactions and progressive damage to organs (Colley *et al*, 2014; WHO, 2022).

Despite several control efforts, urinary schistosomiasis remains endemic in many parts of Nigeria. In Kaduna State, limited information exists regarding the burden of infection among patients attending healthcare facilities. Most available studies have focused on community-based surveys among school-aged children, leaving gaps in knowledge concerning infection patterns among hospital attendees and other age groups (Oluwole *et al.,* 2022). This study therefore aimed to determine the prevalence of urinary schistosomiasis, evaluate the diagnostic utility of microhaematuria detection using reagent strips, and identify factors associated with the infection among patients attending Barau Dikko Teaching Hospital (Kaduna North) and Tudun Wada Primary Health Care Kujama (Chikun) within Kaduna, Kaduna State, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted in two healthcare facilities in Kaduna State, northwestern Nigeria: Barau Dikko Teaching Hospital Lafiya road Kaduna, Kaduna North Local Government Area, and Tudun Wada Primary Health Care Kujama, Chikun Local Government Area. Barau Dikko Teaching Hospital is a tertiary healthcare institution located in an urban setting, while Tudun Wada Primary Health Care serves a predominantly rural population.

Collection of Samples

A group information session was organized for the patients to get their consent after which the urine samples were collected. A total of 400 urine samples were collected from patients attending Barau Dikko Teaching Hospital Lafiya road and Tudun Wada Primary Health Care Kujama, after explaining the purpose of the study and obtaining informed written and verbal consent from them. The study participants were given a labelled plastic sterile, wide mouthed, screw-cap bottle and asked to provide a urine sample (mid-day urine) between 10:00am and 2:00pm, the period of peak egg excretion. Samples were transported in an iced pack to the laboratory for examination. Demographic information including age, gender, source of water, occupation and residence was recorded (WHO, 2022).

Laboratory Analyses

Detection of microhaematuria

On the day of collection, all urine samples (one single sample per person) were examined immediately for microhaematuria using urinalysis reagent strip (combi 9). The haemoglobin concentration (intensity of haematuria) in urine was recorded and graded as negative (0), trace (±), small (1+), moderate (2++) and large (3+++) according to the manufacturer's instruction. Urine reagent strips are widely used as a rapid screening method for urinary schistosomiasis because microhaematuria is strongly associated with *S. haematobium* infection, especially in endemic settings (King *et al*., 2013; Ochodo *et al*., 2015).

Detection of *Schistosoma haematobium* Eggs

The urine syringe filtration technique was used for parasitological examination of urine samples using a 10 ml plastic syringe, filter paper, forceps and some clean test tubes to collect filtered samples. After thorough mixing of the urine samples to ensure eggs are evenly distributed, 10 ml of urine was drawn into a syringe and passed gently through a membrane filter into a test tube. The filter membrane was carefully removed using a sterile forceps, placed on a clean glass microscopic slide and examined under a light microscope using the 10x and 40x objective lenses for presence of *S. haematobium* eggs. The presence of characteristic terminal-spined eggs was recorded as a positive result. This technique remains the reference method for detecting urinary schistosomiasis in epidemiological studies (WHO, 2022; CDC, 2023).

Risk Factor Assessment

A pre-validated questionnaire was applied to the participants in order to collect demographic data (age and gender), socio economical background (educational level and occupation), water contact activities (swimming, fishing, farming, washing, and domestic water collection), environmental sanitation and living conditions (types of water supply, latrine system, presence of domestic animals, water proximity) and health conditions (history of infection, haematuria).

Data Analysis

Descriptive statistics were used to find out the percentages of prevalence of infection. Chi-square test was used to determine the significance of the relationship. Significant differences were taken at the probability level of $p \leq 0.05$.

Ethical Considerations

Ethical approval for this study was obtained from Barau Dikko Teaching Hospital Lafiya road Health Review Ethics Committee and Kaduna State Primary Health Care Board Chikun Local Government Health Authority for Tudun Wada Primary Health Care, Kujama. Participation was voluntary; informed consent was obtained from all adult participants, and parental or guardian consent was obtained for participants younger than 18 years. Confidentiality of participants' information was maintained throughout the study.

RESULTS

A total of 400 urine samples were collected from 400 participants, comprising 200 males and 200 females. Using the urine syringe filtration technique, (13.50%) of participants were positive for *S. haematobium*, detecting the presence of parasite eggs in urine sample. The prevalence of micro-haematuria among the participants was (61.75%). The difference between the prevalence of confirmed infection and microhaematuria was statistically significant ($p<0.001$) as shown in Table 1.

Patients who attended Barau Dikko Teaching Hospital were significantly more infected (22.50%; $p=0.001$) than those who attended Tudun Wada Primary Health Care (Table 2).

In respect to gender, urinary schistosomiasis occurred higher among the male patients (18.0%) than among the females (9.0%), but the difference was not statistically significant ($p=0.083$). However, microhaematuria was significantly more prevalent among the female patients (83.5%) than among males (40.0%; $p <0.01$) as shown in Table 3.

The distribution of *S. haematobium* infection varied significantly across age groups ($p< 0.001$). The highest occurrence was recorded among participants aged 11-20 years (25%), followed by those aged 21-30 years (11.34%), while children aged 5-10 years had the lowest occurrence (5.26%) as presented in Table 4.

Analysis of potential risk factors showed significant associations between urinary schistosomiasis and educational level ($p = 0.001$), water contact activities ($p = 0.011$), source of water ($p = 0.003$), and proximity to water bodies ($p = 0.005$). No statistically significant associations were observed with occupation, toilet type, or previous history of schistosomiasis (Table 5).

Table 1: Prevalence of *S. haematobium* and haematuria test among patients attending selected hospitals in Kaduna State

Test	Number examined	Number positive (%)	χ2	p-value
Syringe filtration (*S. haematobium*)	400	54 (13.5)	30.316	<0.001
Micro-haematuria	400	247 (61.75)		

Table 2: Distribution of urinary schistosomiasis among the patients based on study hospitals

Hospital	Number examined	*S. haematobium*	χ2	P-value
PHC Kujama (Rural)	200	09(4.50)	11.571	0.001
Barau Dikko (Urban)	200	45(22.50)		

Table 3: Distribution of urinary schistosomiasis and haematuria test among the participants based on gender

Gender	Number Examined	*S. haematobium* (%)	χ2	P-value	Haematuria (%)	χ2	P-value
Male	200	36 (18.00)	3.000	0.083	80 (40.00)	15.613	<0.001
Female	200	18 (9.00)			167 (83.50)		
Total	400	54 (13.5)			247 (61.75)		

Table 4: Prevalence of *S. haematobium* and Haematuria by Age (n=400)

Age Group (Years)	Number Examined	*S. haematobium* (%)	χ2	P-value	Haematuria (%)	χ2	P-value
≤10	38	02 (5.26)	24.000	<0.001	14 (36.84)	18.216	0.001
11-20	132	32 (25.00)			79 (59.85)		
21-30	79	09 (11.34)			19 (24.05)		
31-40	94	07 (7.45)			38 (40.43)		
>40	57	04 (7.01)			19 (33.33)		
Total	400	54 (13.5)			247 (61.75)		

Table 5: Risk factors associated with urinary schistosomiasis in the study areas

Variables	Number examined	Number Positive (%)	χ2	P-value
Educational Level				
Non educated	64	17 (26.5)	13.321	0.001
Primary	233	13(5.5)		
Secondary/Tertiary	103	24 (23.3)		
Occupation Status				
Not Working	180	35 (19.4)	3.571	0.059
Working	220	19 (8.6)		
Type of Toilet Used				
Pit Latrine	288	15 (5.2)	0.111	0.739
Water Closet	112	39 (4.8)		
Water Contact				
Yes	309	31 (10.0)	6.429	0.011
No	91	23 (25.2)		
Reasons for Water Contact				
Swimming	107	11 (10.2)	16.194	0.003
Fishing	42	4 (9.5)		
Domestic Purpose	73	7 (9.5)		
Farming	66	5 (7.5)		
Crossing	21	4 (19.0)		
No Reason	91	23 (25.2)		
Sources of Water Contact				
Unsafe Sources (Stream, well, river)	183	21 (11.4)	0.615	0.433
Safe Sources (Pipe borne)	217	33 (15.2)		
Water Source Proximity				
Near (≤250 meters)	229	16 (6.9)	7.759	0.005
Far (≥250 meters)	171	38 (22.2)		
History of Schistosomiasis				
Yes	0	0 (0.0)	0.000	0.000
No	400	54 (13.5)		

DISCUSSION

The present study determined the prevalence of urinary schistosomiasis and its associated risk factors among patients attending Barau Dikko Teaching Hospital and Tudun Wada Primary Health Care, Kaduna State, Nigeria. The overall prevalence of *Schistosoma haematobium* infection (13.5%) confirms that urinary schistosomiasis remains endemic in the study area despite ongoing control efforts. Although the prevalence observed in this study is lower than that reported in some highly endemic communities in Nigeria, it indicates continued transmission and highlight the need for sustained surveillance, periodic screening and integrated control measures.

The prevalence of microhaematuria detected using the Combi-9 reagent strip (61.75%) was considerably high, these findings shows that while microhaematuria is commonly associated with urinary schistosomiasis, it is not specific to the disease. Micro haematuria may also result from urinary tract infections, kidney disorders, urinary stone, trauma, or menstrual contamination in females. Therefore, reagent strips should be regarded as rapid screening tools rather than definitive diagnostic methods, whereas microscopic detection of *S. haematobium* eggs remains the reference standard for confirming infection. These findings agree with those of King *et al*. (2013) and Ochodo *et al*., (2015), who recommended urine reagent strips for screening in endemic settings while emphasizing microscopy for definitive diagnosis.

This study showed that the prevalence of infection was significantly higher among male participants compared to females ($p<0.05$) and this is consistent with previous reports in Nigeria (Anosike *et al*., 2001). Likewise, this finding is in agreement with previous studies from Ezeh *et al*., (2019) which notes that males are more frequently infected in many Nigerian surveys. In the present study, we found that males have a more intense exposure to the sources of infection compared to females. The percentage of male participants who had contact with a water body (swimming) was high. Moreover, males were more likely to be knowledgeable of the existence of an open water source in their area compared to females (Anosike *et al*., 2001). In contrast, the significantly higher prevalence of micro haematuria observed among females may reflect the reduced specificity of reagent strips in women because haematuria can arise from menstrual contamination or other urinary conditions unrelated to schistosomiasis.

Age was significantly associated with urinary schistosomiasis, with the highest prevalence observed among participants aged 11-20 years with infection rate of (25.00%). Individuals within this age group are generally more involved in recreational and domestic water-contact activities, increasing their exposure to cercariae-infested water. Similar observations have been reported by Sady *et al*., (2013), Senghor *et al*., (2014), and Etim *et al*., (2012), who identified adolescents as the age group at greatest risk of infection in endemic communities. Okoli *et al*., (2004), and Ezeh *et al*., (2019) also reported adolescents as the highest-risk age group in Nigeria. The relatively low prevalence among children <10 years may reflect reduced exposure to contaminated water compared with older children and young adults.

Significant associations were observed between urinary schistosomiasis and educational level, water-contact activities, source of water, and proximity to freshwater bodies. Participants who relied on unsafe water sources or had frequent contact with natural freshwater through swimming and domestic activities were significantly more likely to be infected (Ofoezie *et al*., 1998) demonstrated that swimming, fishing and other freshwater contact behaviours drive transmission in south-west Nigeria. Likewise, residence close to streams, rivers, or ponds increased the likelihood of exposure to infected intermediate host snails. These findings agree with previous studies conducted in Nigeria and other endemic countries, which identified environmental exposure and human water-contact behaviour as major determinants of urinary schistosomiasis transmission (Ngele, 2011; Oluwole *et al*., 2022).

The findings of this study emphasize that effective control of urinary schistosomiasis requires an integrated approach that combines preventive chemotherapy, improved access to safe water, environmental sanitation, health education, and regular screening of at-risk populations. Strengthening these interventions will contribute significantly to reducing disease transmission and achieving the goals of schistosomiasis control programmes.

CONCLUSION

This study demonstrated that urinary schistosomiasis remains an important public health concern among patients attending Barau Dikko Teaching Hospital, Lafiya road and Tudun Wada Primary Health Care, Kujama, Kaduna State, Nigeria, with an overall prevalence of 13.5% confirmed by urine syringe filtration. Infection was highest among participants aged 11-20 years and was significantly associated with educational level, water-contact activities, unsafe water sources, and proximity to freshwater bodies. Although the Combi-9 reagent strip detected a high prevalence of microhaematuria, it should be regarded as a rapid screening tool rather than a confirmatory diagnostic method. These findings highlight the need for sustained surveillance, health education, improved access to safe water, and targeted control interventions to reduce the burden of urinary schistosomiasis in the study areas.

Based on the findings of this study, routine screening and periodic mass drug administration with Praziquantel should be strengthened among high-risk groups, particularly school-aged children, adolescents, farmers and fishermen. Government and relevant stakeholders should improve access to safe drinking water and sanitation facilities to reduce dependence on contaminated freshwater sources and lastly. Continuous community Health Education and Behavioral Change Programmes should be implemented to increase awareness of the transmission, prevention, and control of urinary schistosomiasis and to encourage safer water-contact practices.

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