



<https://doi.org/10.47430/ujmr.25101.010>

Received: 21st March, 2025

Accepted: 22 May, 2025



## Epidemiological Study of Schistosomiasis among School Pupils in Kurfi Lga, Katsina State, Nigeria

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### Abstract

*Schistosomiasis is a disease associated with poverty that leads to chronic ill-health. Infection occurs through coming into contact with fresh water infested with the larval forms (cercariae) of parasitic blood flukes, known as schistosomes. This study was conducted to determine the prevalence of Schistosoma haematobium and Schistosoma intercalatum among primary school pupils in Kurfi Local Government Area of Katsina State, Nigeria. Questionnaires were administered to 300 randomly selected pupils to assess the socio-demographical information, risk factors, and human water contact behavior. Sedimentation techniques were used to determine the prevalence, while the medi-test combi-9 test strip was used for chemical examinations. Out of 49 samples collected, 300 are positive for hematuria, 26 are positive for proteinuria; 59 are positive for S. haematobium and only 6 are positive for S. intercalatum. Comparatively, the prevalence is significantly higher in Amadi Kurfi Qur'anic Primary School with 29 (54%) of S. haematobium and 4(66.7%) of S. intercalatum, which could be due to the closeness of school with water body when compared to other schools. The infections are not influenced by gender and age group (OD = 1.00 and 1.53) and (P = 7.03 and <0.01), respectively, but pupils whose parents have no formal education are at a significantly higher (OR 38.9) risk of getting infections compared to those with no formal education (P = 0.02). Conclusively, the study area is endemic with S. haematobium. Molecular identification and characterization of S. intercalatum is recommended, in addition to personal hygiene, to control the disease in the study area. Keywords: Contaminated Water, Prevalence, Pupils, S. haematobium and S. intercalatum*

### INTRODUCTION

Schistosomiasis was found in Egyptian mummies that were 5,000 years old. Early Egyptian papyri mention its distinctive symptoms (Zhou *et al.*, 2021). In 1851, German physician and pathologist Theodor Maximilian Bilharz, who worked in several Cairo hospitals during the mid-1800s, discovered the worm in white bumps on the mucous membranes of the colon, bladder, ureters, and seminal glands. Nearly 240 million people globally are afflicted by Schistosomiasis, and over 700 million reside in endemic regions. The infection is common in impoverished communities without access to clean water and proper sanitation in tropical and subtropical regions.

*Schistosoma haematobium* causes urogenital Schistosomiasis, while any of the following organisms can cause intestinal Schistosomiasis: *S. guineensis*, *S. intercalatum*, *S. mansoni*, *S. japonicum* and *S. mekongi* (WHO, 2023). The disease is prevalent in every West African country, including Nigeria (Aula *et al.*, 2021). In

tropical and subtropical regions, urinary Schistosomiasis is one of the parasite illnesses with the greatest socio-economic and public health significance. Despite extensive investigation, there are currently no simple control methods.

Contact with fresh water contaminated with parasitic blood fluke larvae (cercariae), also known as schistosomes, can result in infection (Haseeb and Fried, 2024). The veins that drain the intestines and urinary system are home to the microscopic adult worms. The majority of their eggs are stuck in the tissues, and the body's response to them can be quite harmful (WHO, 2023).

Since there hasn't been much research done in the field in the study area, this study will help draw attention to the Schistosomiasis issue and provide literature for further research. The research area's high incidence of Schistosomiasis is likely to be caused by poverty, inadequate sanitation, a lack of public awareness, and poor health education.

Schistosomiasis has a very significant impact on students' academic performance and output in the study area.

### Scope of the Study

The scope of this study was limited to pupils of primary school in Kurfi LGA of Katsina State and the water bodies close to the schools from the study area were carefully selected.

## MATERIALS AND METHODS

### Study Area

This survey was conducted in the Kurfi Local Government town in Katsina State, which is

situated at latitude 12.7099N and longitude 7.4626E. It was established in 1989 and is estimated to have a population of 369732 people living in an area of 572 square kilometers. Birchi, Wurma, Barkiya, Tsauri, Yar Unguwa, Sabon Layi, Tamawa, Kurfi, and Fadumawa are among the cities and villages that make up the Kurfi Local Government Area, which is a part of the prestigious Katsina Emirate. The majority of the population is a peasant farmer (Abdullahi, 2024). The Hausa-Fulani ethnic groups make up the majority of the local population. (Abdullahi, 2024).

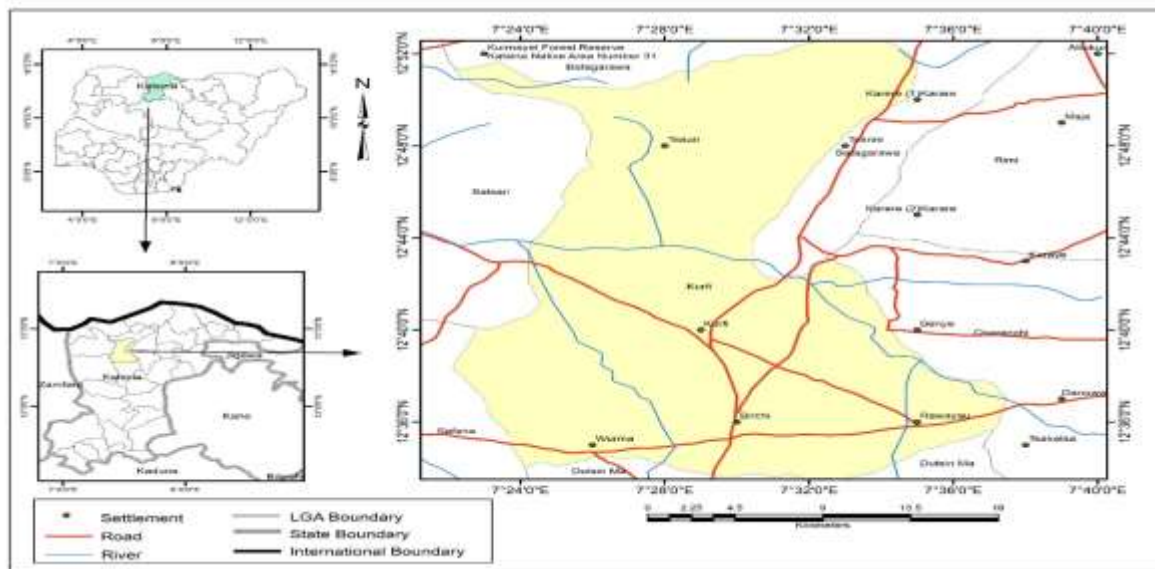


Figure 1: Map of Kurfi Local Government showing the study sites

Source: Tayo (2024)

### Sample Size

300 samples was considered according to Fisher's formula of sample size for this research

$$N = \frac{Z^2 P(1-P)}{d^2}$$

### Sampling Techniques

Systematic sampling techniques were used to select the participating pupils, and all other pupils had an equal chance to participate.

### Schools Sampling

A homogeneous sampling method was used to select the participating schools close to water bodies.

### Collection and Processing of Samples from Pupils

A class record that contained the names of schoolchildren (pupils) acquired from the individual school headmasters was used to gather data on age and gender. Between the ages of 5 and 13, 300 urine and 300 fecal samples (600 total) were taken from students in the chosen schools. The selected students were given two clean, labeled, screw-capped plastic

containers with a wide mouth. They were instructed to deposit their urine midstream, and the other container had a stick attached for stool samples. This was done between 10:00 and 14:00 hours to ensure the best possible egg passage. In order to maintain the eggs' viability, the samples were brought to the laboratory within two hours after collection. They were analyzed under a microscope for *Schistosoma haematobium* eggs using the sedimentation technique (Hamiliti, et al., 2021).

### Hematuria and Proteinuria Test

Using the reagent strip method (Medi-test Combi-9 Macherey Negel D -5348 Duren, U.S.A.), fresh urine samples were examined for the presence of protein (proteinuria) and blood (hematuria). In order to avoid altering the urine's chemical composition, the analysis was carried out prior to storage. The extra urine was eliminated after the medi-test combi-9 test strip was fully stripped (submerged) in a new urine bottle containing the urine sample for approximately one minute.

After a minute, the test strip's colors were compared to the reference chart on the strip container after the strip had been placed on a dry, clean surface. Blood and protein were recorded.

**Parasitological Examination of Urine Sample**

Each sample had around 10 ml taken out and centrifuged for 4 minutes at 4,000 rpm. After discarding the supernatant, one drop of the sediment was put on the microscope slide, covered with a cover slip, and examined at x10 and 40 magnification. The eggs with terminal spines (characteristics of *S. haematobium*) were counted (Deribew et al., 2022).

**Parasitological Examination of Stool Samples**

About a gram of stool was taken and emulsified it in 10 mL of 10% formalin in a centrifuge tube. It was stirred well until the solid material broke. The mixture was filtered through gauze into another clean centrifuge tube, where large debris was removed. 3 mL of ethyl acetate was added to the filter and was shaken vigorously for 40 seconds. The mixture was centrifuged at 4000rpm for 4 minutes. After discarding the supernatant, one drop of the sediment was put on the microscope slide, covered with a cover slip, and examined at x10 and 40 magnification. The eggs with lateral spines (characteristics of *S. intercalatum*) were counted (Tabios et al., 2022).

**Data Analysis**

The data was saved using the Special Package for Social Science (SPSS) software, version 22.0. The relationship between the infection and risk factors was determined using descriptive statistics (Odd Ratio), and the prevalence was statistically analyzed using prevalence tables.

**Ethical Approval and Informed Consent**

The research ethics committee of the Katsina State Ministry of Health granted ethical

authority to conduct this study (MOH/ADM/SUB/1152/1/917). Additionally, permission was obtained from the Ministry of Education in Katsina State. Parents and guardians of the sampled pupils as well as the parent-teacher associations (PTAs) of the various individual schools, received the informed consent form.

**RESULTS**

**Hematuria and Proteinuria among the Selected Pupils in Kurfi Local Government Area**

With 25 positives out of 100 students tested, or 51% of all positive results in Kurfi, Table 1 demonstrates that Amadi Kurfi Qur'anic Primary School (AKQPSK) had the highest rate of hematuria (blood in urine) infection among pupils in Kurfi Local Government. Out of 100 students tested for hematuria, 13 at Maradi Ahmadu Model Primary School Kurfi (MAMPSK) had positive hematuria infections. It shows that the infection rate in the area is about 27%. On the other hand, only 11 of the pupils assessed at Sama'ila Mamman Pilot Primary School Kurfi had the infection, which equates to 23% of all the students tested throughout the entire Local Government. This represents the lowest incidence of the infection (hematuria). Additionally, of the 300 students in the entire Local Government who were tested for hematuria, 49 (16.3%) had an infection throughout the entire school.

However, out of 100 samples analyzed, students from Amadi Kurfi Qur'anic Primary School Kurfi had the highest percentage of proteinuria (the presence of protein in urine) (12, or 46.2%), while Sama'ila Mamman Pilot Primary School had the lowest percentage (6, or 23%). Out of the 300 students who participated, 26 (8.7%) from the three participating schools had proteinuria overall.

**Table 1: Hematuria and Proteinuria among the Selected Pupils in Kurfi Local Government Area**

SN	Schools	Number of Urine Screened for Hematuria (Positive)	Percentage of the Hematuria (%)	Number of Urine Screened for Proteinuria (Positive)	Percentage of the Proteinuria (%)
1	MAMPSK	100(13)	26.5	100(8)	30.8
2	AKQPSK	100(25)	51	100(12)	46.2
3	SMPPSK	100(11)	22.5	100(6)	23
4	Total	300(49)	16.3	300(26)	8.7

**Key**

MAMPSK= Maradi Ahmadu Model Primary School Kurfi  
 AKQPSK= Amadi Kurfi Qur'anic Primary School Kurfi  
 SMPPSK= Sama'ila Mamman Pilot Primary School Kurfi

**Prevalence of Schistosomiasis in Kurfi Local Government**

*Schistosoma hematobium* and *Schistosoma intercalatum* are the two species that are reported in Table 2 for the prevalence of Schistosomiasis in three primary schools selected in Kurfi Local Government. Only 14 of the 100 samples analyzed at Maradi Ahmadu Model Primary School Kurfi (MAMPSK) tested positive for urinary Schistosomiasis, representing a 26% prevalence of the disease in the region, compared to 29 positive samples at

Amadi Kurfi Qur'anic Primary School Kurfi (AKQPSK), which had a 54% infection rate. Of the 300 students who took part in the study, 54 (18%) had urinary Schistosomiasis overall. In the schools that were selected, only 6 (2%), of which 2 out of 100 were from Maradi Ahmadu Model Primary School Kurfi (MAMPSK), 4 were from Amadi Kurfi Qur'anic Primary School Kurfi (AKQPSK), and Sama'ila Mamman Pilot Primary School Kurfi (SMPPSK) had no infections. Consequently, *Schistosoma intercalatum's* prevalence in the chosen area is negligible.

**Table 2: Prevalence of Schistosomiasis in Kurfi Local Government**

SN	Schools	No. of Samples Screened for <i>hematobium</i> (positive)	Infection of <i>S. hematobium</i> (%)	No. of Samples Screened for <i>S.intaclatum</i> (positive)	Infection of <i>S.intaclatum</i> (%)
1	MAMPSK	100(14)	26	100(2)	33.3
2	AKQPSK	100(29)	54	100(4)	66.7
3	SMPPSK	100(10)	19	100(0)	0
4	Total	300(54)	18	300(6)	2

**Key:** MAMPSK= Maradi Ahmadu Model Primary School Kurfi, AKQPSK= Amadi Kurfi Qur'anic Primary School Kurfi and SMPPSK= Sama'ila Mamman Pilot Primary School Kurfi

**Prevalence of Schistosomiasis in Relation to Respond on Clinical Sign and Symptoms among the Pupils in Kurfi Local Government**

The study evaluates the relationship between clinical symptoms and the existence of *Schistosoma haematobium* infection in students in Kurfi Local Government, according to Table 3. 40 (74.1%) of the 170 students who reported having hematuria tested positive, while 14 (24.9%) of the 130 did not. The odds ratio (OR) is 41.1, indicating that those with hematuria are 41.1 times more likely to have the infection than those without.

not; 24 tested positive (44%) with OR = 78, suggesting a substantial correlation between infection and dysuria. Out of 197 students who reported having nocturia, 37 tested positive (68.5%), while 101 students who did not have nocturia had 17 positives (31.5%). OR = 49, showing a significant link between nocturia and infection with 49 times more likely to have urinary Schistosomiasis compared to those without nocturia. 129 responded to have abdominal pain had 29 positives (53.7%) while 171 without pain had 25 positives (46.3%) with OR = 19.

Of the 167 students who reported having dysuria, 30 tested positive (56%), and 133 did

**Table 3: Prevalence of Schistosomiasis in Relation to Respond on Clinical Sign and Symptoms among the Pupils in Kurfi Local Government**

SN	Clinical Sign and Symptoms	Number of Samples Screened (Positive)	Percentage of Positives (%)	Odd Ratio
1	Do you experience Hematuria?			
	Yes	170(40)	74.1	41.1
	No	130(14)	24.9	
2	Do you experience Dysuria?			
	Yes	167(30)	56	78
	No	133(24)	44	
3	Do you experience Nocturia?			
	Yes	197(37)	68.5	49
	No	101(17)	31.5	
4	Do you experience Abdominal Pain?			
	Yes	129(29)	53.7	19
	No	171(25)	46.3	

Odds Ratios >1 indicate a strong relationship between symptoms and infection, but the magnitude varies

**Prevalence of Schistosomiasis in Relation to Demographical Response of the Pupils in Kurfi Local Government**

According to Table 4 the demographic data, males are more likely than females to have *Schistosoma haematobium* (34, or 63%) compared to 20 or 37 percent, with an odd ratio of 1.005. While *Schistosoma haematobium* infections are not statistically correlated with

either gender (OR=1.00) or respondent years (OR=1.53), students with parents who have formal education are more likely to be free of the parasite (37, or 68.5%) than those whose parents have no formal education, even though parent formal education can statistically contribute to the spread of urinary schistosomiasis transmission (Odd Ration 38.9).

**Table 4: Prevalence of Schistosomiasis in relation to Demographical Response of the Pupils in Kurfi Local Government**

SN	Demographical Characteristics of the Respondents	Number of Samples Screened (Positive)	Percentage of Positives (%)	Odd Ratio	P.Value
1	Gender				
	Male	150(34)	63	1.00	7.03
	Female	150(20)	37		
2	Age (Years)				
	5-7Years	100(16)	29.6	1.53	<0.01
	8-10Years	101(20)	37.1		
	11-13Years	100(18)	33.3		
3	Does your Parent Have any Formal Education?				
	Yes	187(37)	68.5	38.9	0.02
	No	113(17)	31.5		

**DISCUSSION**

Urinary Schistosomiasis, a disease commonly linked to hematuria and proteinuria, is common in this study and is consistent with the higher infection rate of hematuria among students with schistosomiasis 49 (16.3%). For instance, school-age children in rural Nigerian communities are more at risk because of their increased exposure to water bodies tainted with *Schistosoma haematobium* (Aula et al., 2024). The predominant diagnostic sign for urinary Schistosomiasis, which was quite common among primary school pupils in southwest Nigeria, was hematuria, according to a related study by Folahan et al. (2021). The high infection rate at Amadi Kurfi Qur’anic Primary School Kurfi (AKQPSK) may be due to increased exposure to contaminated water sources in that area, as determined by similar research from Ghana (Essien-Baidoo et al., 2023) and Sudan (Suliman et al., 2021) have shown that schools near stagnant or slowly moving bodies of water reported higher prevalence rates. Additionally, 26 (8.7%) of the total had proteinuria across the three schools. A study by Rinaldo et al. (2021) on renal impairment linked to endemic illnesses in sub-Saharan Africa claims also that. According to a study by Trienekens et al. (2022), children who regularly engaged in recreational activities like swimming, fishing, and fetching water were most at risk of developing Schistosomiasis. This condition may be linked to

kidney damage caused by Schistosomiasis or other underlying illnesses.

According to worldwide epidemiological data, *S. intercalatum* is a less common *Schistosomes species* that is primarily found in Central and West Africa. This rarity is consistent with these findings (Aula et al., 2024). Because of its restricted range of habitat, *S. intercalatum* has a lower transmission rate than *S. haematobium*, according to earlier studies by Gaye et al. (2024).

The high incidence of hematuria 170 (74.1%) reported in this study are consistent with studies by Midzi et al. (2024) and Bunza et al. (2024), which found that the most specific clinical marker for *S. haematobium* infection in Nigerian school children was hematuria; similar trends were reported in Ghana (Essien-Baidoo et al., 2023), where a high prevalence of hematuria was a reliable indicator of urinary Schistosomiasis; Ofori and Forson (2024). A considerable association was also detected between nocturia and infection, with 68.5% of individuals having nocturia testing positive, compared to 31.5% of those without it. Similarly, Dobrek et al., 2023 found. Although less obvious than hematuria or dysuria, the 129 students who reported abdominal pain showed a strong correlation with Schistosomiasis, according to a study by Carbonel et al. (2021). Abdominal pain in Schistosomiasis is more common in males (63%) than in females (37%), as

males are more likely to be exposed to infected water bodies due to their participation in activities like fishing, swimming, and water-fetching, which increases the risk of infection (Trienekens *et al.*, 2022), and the study's odds ratio (OR = 1.00) indicates that gender has little bearing on infection risk.

This is consistent with research by Ayabina *et al.* (2022), which discovered that both sexes are equal in transmission, and this is in line with studies by Ayabina *et al.* (2022), which found that although males often exhibit greater prevalence rates due to behavioral patterns, both sexes are equally vulnerable when exposed to contaminated water sources. But according to this study, school-aged children (8-10 years old) are more at risk for Schistosomiasis since they frequently come into contact with tainted water sources (Lamberti *et al.*, 2021). According to research conducted in Nigeria (Gabaake *et al.*, 2022), younger children are more susceptible since they frequently have less knowledge about how Schistosomiasis is spread. The study's most important finding is that parental education and infection rates are inversely related. Pupils with parents who had no formal education had a higher infection prevalence (68.5%) than those with parents who had formal education (31.5%). This finding is consistent with research from Ethiopia (Alemayehu *et al.*, 2025), Tanzania (Mushi *et al.*, 2022), and Nigeria (Joof *et al.*, 2010), which found that children from households with higher parental formal education levels have lower prevalence of Schistosomiasis. Educated parents are more likely to understand disease prevention strategies, such as the value of hygiene, access to clean water, and avoiding contaminated sources (Anthonj *et al.*, 2021).

#### CONCLUSION

The study findings indicated that *Schistosoma haematobium* infections are still endemic in Kurfi Local Government of Katsina State, Nigeria, and are associated with several risk factors related to water contact activities and the presence of contaminated freshwater bodies in the study area in addition to the conspicuous presence of intermediate host snails (*Bulinus* species) which help in completing the life cycle of the parasites. There is also a likely expansion

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of these infections among the school-age children in the study area if appropriate control measures are not put in place urgently by the stakeholders and community leaders in the area. The results also show that *Schistosoma intercalatum* is not considerably prevalent in the study area.

#### RECOMMENDATIONS

By implementing the following recommendations, the risk of schistosomiasis transmission can be effectively reduced, leading to a better quality of life and improving the cognitive domains of the pupils.

- i. Molecular diagnostics are crucial to confirm the existence of these parasites, especially *S. intercalatum*.
- ii. Continued disease surveillance and selected praziquantel chemotherapy for infected children
- iii. Health education of the children for improved perception of all the behavioral and socio-economic activities associated with diseases
- iv. Development of water sources would likely improve the living conditions of the rural population and the pupils inclusive with consequent reduction in the burden and transmission of diseases
- v. Further studies of Schistosomiasis in these communities should also include a specific analysis of water bodies as well as quantification of the water body contact activities of pupils and out-of-school-age children
- vi. Other members of the communities shall also be tested, like Almajiris, out-of-school children, secondary school children, and farmers, and the infected individuals should also be treated by relevant authorities to combat the further spreading of the disease in the community

#### Conflict of Interest

No conflict of interest.

#### Funding Source

Non

#### Acknowledgment

Thanks to our parents, who insisted that we must be educated.

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Plate 1: Some of the *Schistosoma hematobium* eggs seen under microscope