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Prevalence of Urogenital Schistosomiasis Among Primary School Children in Kafin Madaki, Ganjuwa Local Government Area, Bauchi State.

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Abstract

Schistosomiasis remains a major neglected tropical disease and public health challenge in sub-Saharan Africa, with Nigeria bearing a substantial proportion of the global disease burden. The paucity of recent, location-specific epidemiological data in many endemic communities, including Kafin Madaki, Bauchi State, constrains effective surveillance and targeted control interventions. This study determined the prevalence of urinary schistosomiasis and associated risk factors among primary school children in Kafin Madaki. A cross-sectional study was conducted among 384 children aged 5–13 years selected from eight primary schools using a multistage sampling technique. Urine samples were collected and examined for *Schistosoma haematobium* eggs using the sedimentation technique, while a structured questionnaire was administered to obtain sociodemographic, behavioural, and environmental information. The overall prevalence of urinary schistosomiasis was 6.3%, with all positive cases attributed to *S. haematobium*. Infection prevalence was significantly higher among males than females ($p < 0.05$), suggesting greater exposure of boys to risky water-contact activities. The highest prevalence was recorded among children aged 8–10 years, although differences across age groups were not statistically significant ($p > 0.05$). Higher infection rates were also observed among children whose parents had no formal education, those from larger households, users of bush sanitation and stream water, and children residing near water bodies. These findings demonstrate ongoing transmission of urinary schistosomiasis in Kafin Madaki, influenced by behavioural, socioeconomic, and environmental factors. Integrated control strategies incorporating periodic mass drug administration, health education, improved sanitation, safe water provision, and sustained epidemiological surveillance are recommended to reduce transmission and protect school-age children.

Keywords

Prevalence,
Urogenital Schistosomiasis,
Bauchi State.
Risk Factors;
School-Age Children;
Kafin Madaki;

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Introduction

According to estimates of the disease burden worldwide, 200–300 million people are sick in 78 countries, 779 million are at risk of infection, and 200,000 deaths are reported each year. Africa is home to 660 million people who are at risk, accounting for 90% of all cases worldwide (WHO, 2023). There are an estimated 29 million infected individuals in Nigeria (Istifanus, 2025).

Schistosomiasis, also known as bilharzia or "snail fever," is a debilitating parasitic disease caused by digenetic blood trematodes of the family Schistosomatidae. It is a major intravascular infection with serious public health consequences and significant socioeconomic impact, particularly in the developing world. In tropical regions, it is the second most prevalent parasitic disease after malaria. The disease mainly presents in two clinical forms: urinary schistosomiasis, caused by *Schistosoma haematobium*, and intestinal schistosomiasis, caused by *S. mansoni*, *S. intercalatum*, *S. japonicum*, and *S. mekongi.*

Transmission is facilitated through contact with freshwater bodies harbouring cercariae released by infected intermediate snail hosts of the genus *Bulinus* for *S. haematobium* and *Biomphalaria* for *S. mansoni* in Nigeria. Factors promoting transmission include age, gender, occupation, water contact activities, poor sanitation, and inadequate hygiene (WHO, 2018). School-aged children are particularly vulnerable due to their frequent involvement in domestic chores and recreational activities in infested water bodies.

Despite the known endemicity of schistosomiasis in Nigeria, there is no baseline data on the specific prevalence of schistosomiasis and the local transmission dynamics in the study area. Therefore, this study was necessitated by the urgent need to generate current epidemiological data to inform evidence-based public health action and prevent potential outbreaks in this community.

Materials and Methods

Study Area

The survey was conducted in Kafin Madaki is which is the administrative headquarters of Ganjuwa Local Government Area (LGA) in Bauchi State, northeastern Nigeria. It is located at latitude 10.688° N and longitude 9.761° E (10°41′18″N, 9°45′41″E) and lies about 45 km north of Bauchi city. It occupies a built-up area of approximately about 1.2 km² with an estimated population of approximately 20,000–24,000 inhabitants with Gerawa, Hausa, Fulani, Denawa, Miyawa, and Kariyawa as the predominant ethnic groups in the area with Hausa serving as the principal language of communication alongside Fulfulde.

Islam is the dominant religion. The economy is largely agrarian, with the majority of residents engaged in crop farming and livestock rearing, while others participate in cottage industries such as weaving, iron-working, soap-making, brick-making, and local trading, reflecting the traditional rural economy of the area.

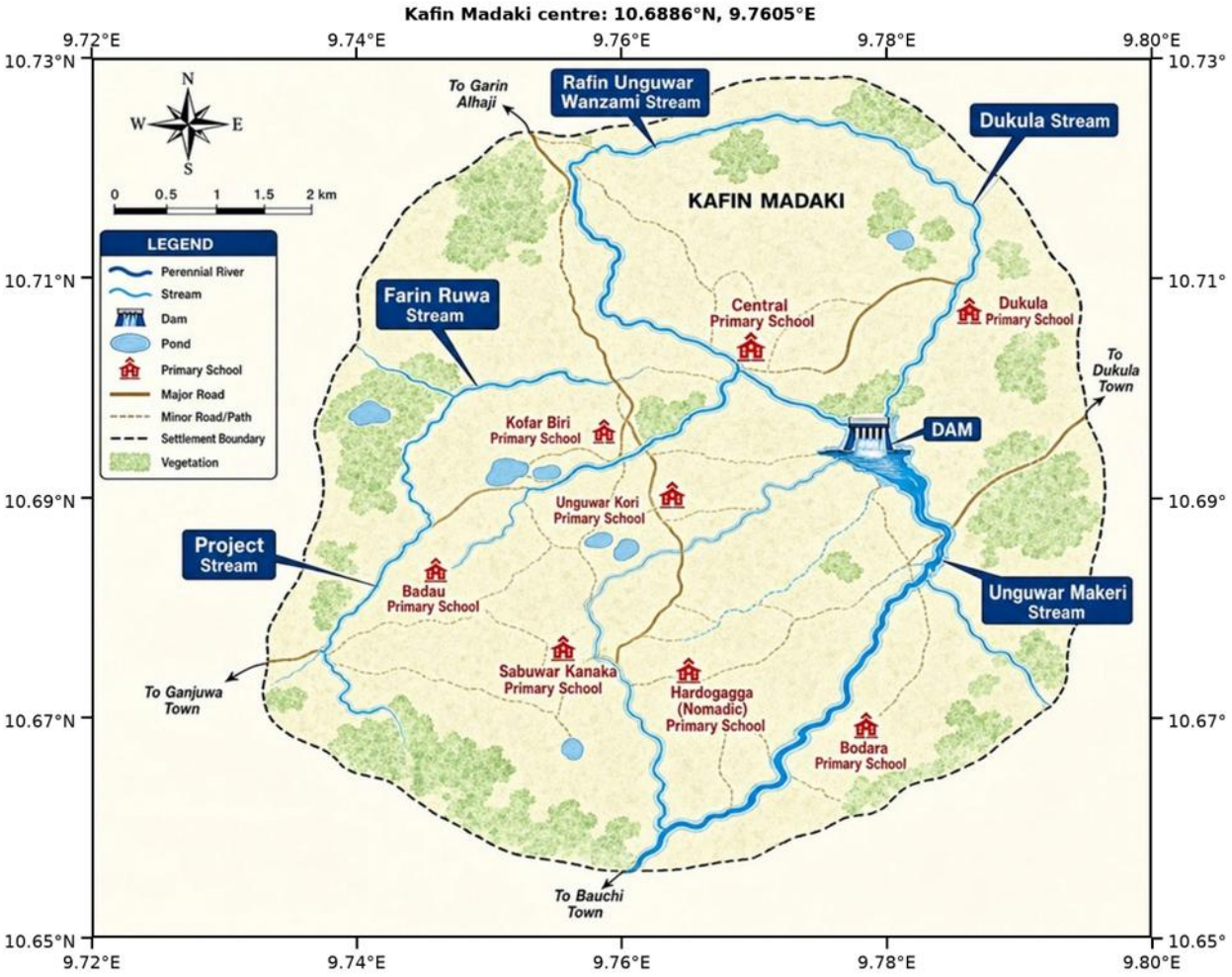

Figure 1: Map of Kafin Madaki, Ganjuwa LGA Bauchi State, Showing Sampled Sites.
Source: www.google.com

Selection of the Study Population and Schools

The target population for this study consisted of primary school children aged five to thirteen (5-13) years in Kafin Madaki, Ganjuwa Local Government Area, Bauchi State, Nigeria. This demographic category was selected due to their high vulnerability to schistosomiasis infection, which is often associated with water-contact activities common among school-aged children in endemic areas. The study was conducted across eight primary schools as shown in Fig.1 randomly selected in kafin Madaki namely: Central Primary School, Kofar Biri, Badau, Unguwar kori, Sabuwar Kanaka, Hardogagga (Nomadic), Dukula, and Bodara Primary Schools. The selection of these schools was based on their proximity to water bodies and easy accessibility to facilitate sample collection.

Sample Size Determination

The sample size for the pupil population was determined using the Bennett Fisher's formula for calculating sample size for a known population (Daniel and Cross, 2018). The calculation was as follows:

$$\frac{n = z^2 p q}{e^2}$$

where n = sample size,
z = value on the z table at 95% confidence level = 1.96
e = sample error at 5% (0.05)
p = Maximum variability of the population at 50% (0.5)
q = 1 – p = 1 – 0.5 =0.5

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$

$$n = \frac{3.8146 \times 0.5 \times 0.5}{0.0025}$$

$$n = \frac{0.9604}{0.0025}$$

$$n = 384$$

Therefore, a sample size of 384 consenting pupils was chosen. This number was proportionally allocated across the eight selected schools, giving a total of 77 pupils per school. Pupils within each school were selected using simple random sampling.

Urine sample collection and Processing

Clean, dry, labelled universal bottles were used for urine collection. Terminal urine samples (the last portion of urine passed) were collected from pupils between 10:00 hours and 14:00 hours, as this period corresponded to the peak excretion time for *S. haematobium* eggs according to Cheesbrough, (2005). Each sample bottle was clearly labelled with the participant's unique identification code, age, gender, and school name. Upon collection, the urine samples were transported to the laboratory in a cool box with ice blocks to preserve the integrity of the eggs and prevent degradation. Samples that could not be examined immediately were stored in a refrigerator at 4°C and processed within 24 hours of collection to ensure accurate detection of eggs.

S. haematobium eggs recovered from urine samples were identified based on their morphological characteristics with reference to standard keys Cheesbrough, 2005; WHO, (2022). The presence of any Schistosome eggs was recorded as positive. The intensity of infection was recorded as the number of eggs per 10 ml of urine, and infections were classified according to WHO, (2022), with light infection defined as 1-49 eggs per 10 ml of urine and heavy infection defined as 50 or more eggs per 10 ml of urine.

Administration of Questionnaire

A pretested, structured questionnaire was administered to the participants or their guardians to obtain information on sociodemographic characteristics like age and gender, Knowledge, Attitude and Practices (KAP) related to schistosomiasis, water-contact activities such as swimming, bathing, and farming, and the environmental sanitation conditions of their households.

Data Analysis

The data generated were analysed using the Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics (frequencies and percentages) were used to summarize the demographic, socioeconomic, and environmental characteristics of the respondents, as well as the prevalence of schistosomiasis.

The chi-square (χ^2) test was used to examine the association between schistosomiasis infection and various categorical independent variables like gender and Age. To identify risk factors, bivariate logistic regression was first used to calculate crude odds ratios (OR). Variables with a significant p-value ($p < 0.05$) in

the bivariate analysis were subsequently entered into a multivariable logistic regression model to determine the adjusted odds ratios (AOR) and control for potential confounders. The level of statistical significance for all tests was set at $p < 0.05$.

Result

Prevalence of Schistosome Infection in the Study Area

Out of the 384 pupils examined, 24 pupils (6.3%) were positive for schistosomes, all of which were *S. haematobium*. The infection is thus, hypoendemic in the community.

Prevalence of Schistosome Infection with Respect to Gender in the Study Population

A striking gender disparity was observed. Males had a prevalence of 10.2%, while females had only 1.2% and this difference was statistically significant ($p<0.05$). This is set out in Table 1.

Table 1: Prevalence of Schistosome infection with respect to gender

Gender	No. Examined	No. Positive	Prevalence (%)
Male	216	22	**10.2**
Female	168	2	**1.2**
Total	**384**	**24**	**6.3**

χ^2Cal=13.05, χ^2tab=10.28, df=1,p=< 0.001

Prevalence of Schistosome Infection with Respect to Age

Among the three age groups examined, the infection was slightly more prevalent in the 8-10 years age group and least prevalent among the 5-7 years age group. This is shown in Table 2. However, this difference was not statistically significant ($p>0.05$).

2: Prevalence of Schistosome infection with respect to age

Age group (years)	No. Examined	No. Positive	Prevalence (%)
5–7	80	4	5.0
8–10	119	8	6.7
11–13	185	12	6.5
Total	**384**	**24**	**6.3**

χ^2Cal=0.28, χ^2tab=2,706, df=1, p=< 0.87

Impact of Some Selected Epidemiological Variables on Schistosome Infection

Assessment of impact of some selected variables on schistosome infection among the pupils is depicted in Table 3. Infection was higher among children whose parents had no formal education compared to those whose parents had formal education. Children from larger families of more than 10 members recorded a higher prevalence than those from families with fewer than 10 members. Based on parental occupation, the highest prevalence was observed among children of farmers, followed by civil servants, while the least was recorded among children whose parents were involved in fishing. Sanitation type also showed variation, with children who used the bush having the highest prevalence of infection, compared with those who use pit latrines and water system. Similarly, prevalence in that decreasing order of infection was highest among children who used stream water for drinking, while the lowest prevalence was recorded among those who use borehole water. Children living within <250 m of a water body had a higher prevalence of infection, compared to those living >250 m away.

Table 3: Impact of some selected Epidemiological variables on schistosome infection among pupils examined.

Socioeconomic Variable	Category	No. Examined	No. Positive	Prevalence (%)
Parental Education	No formal	135	16	11.9
	Formal	249	8	3.2
Family Size	>10 members	257	18	7.0
	<10 members	127	6	4.7
Parent Occupation	Farmer	131	11	8.4
	Civil servant	161	10	6.2
	Fishing	61	2	3.3
Sanitation Type	Bush	44	12	27.3
	Pit latrine	205	7	3.4
	Water cistern	135	5	3.7
Drinking Water	Stream	43	10	23.3
	Well	142	8	5.6
	Borehole	164	4	2.4
	Rain	35	2	5.7
Water Proximity	<250 m	144	12	8.3
	>250 m	240	12	5.0

Discussion

Prevalence of Schistosome Infection in the Study Area

The overall low prevalence of 6.3% is however lower than many earlier reports from northern Nigeria like Adamu *et al.*, (2004) who reported 32.6% among school children at Firo near Gubi Dam, Bauchi, Agere *et al.*, (2009) who reported 40% in Taraba state, Umar (2009) who reported 12.9% in Kaduna metropolis and Mafuyai *et al.*, (2016) who reported 33.3% in Ganjuwa LGA. This result is still lower than that of Usman *et al.*, (2016) who found 35.3% in some part of Bauchi state, and Yohanna *et al.*, (2018) who recorded a prevalence of 40.2% around Gubi dam. The overall prevalence is further lower than several other studies in Northern Nigeria where prevalences of 23.2% was reported by Yaro *et al.*, (2020) along river Benue in Benue state and Chiroma (2023) reported a prevalence rate of 37.7% in Yobe State.

The result of this study is nevertheless higher than figures reported by other workers like Zamdayu *et al.*, (2023) who reported 5.2% in Adamawa State as well as Usman *et al.*, (2024) who obtained 0.5% in Biu, Borno Sate. The reason for this disparity is not very clear but it may be associated with the influence of season In Nigeria, the dry season generally drives a higher prevalence of schistosomiasis, though the exact pattern depends on the specific water body and local ecology. Higher infection rates are typically seen in the dry season.

Prevalence of Schistosome Infection with Respect to Gender

The gender disparity to schistosome infection as observed in this study is a well-known fact in northern Nigeria and corroborates several earlier reports like those of Inuwa *et al.*, (2003), Adamu *et al.*, (2004), Agere *et al.*, (2009), Usman *et al.*, (2016), and Abbas *et al.*, (2023) who similarly observed that boys were significantly more infected than girls during their study in Alau dam Borno State, Gubi Dam Bauchi State, parts of Taraba, Kwanar Areh Dam in Kurfi LGA of Kastina state repectively. The result of this study however contrast that of Imalele *et al.*, (2024) who observed predominance of infection among the female gender (10.8%) than the males (8.7%). The primary reason of this predominance of infection among the male gender is based on their water contact behaviour of swimming, bathing, fishing, irrigation farming, canoe paddling, playing in streams, and other prolonged water-contact activities as opposed to girls who are restricted to domestic chores in northern Nigeria.

Prevalence of Schistosome Infection with Respect to Age

The difference in the prevalence of the infection among different age group in this study area was not statistically significant ($p>0.05$). The absence of a significant age trend contrast with most other studies in Nigeria. For instance, Usman *et al.*, (2016), Birma *et al.*, (2017), Abubakar *et al.*, (2022), and Sylvester *et al.*, (2025) all showed that infection peaked in older school aged children between the ages of 10-15. This study nevertheless corroborates other studies that did not similarly observe any age dependence of infection. For instance, Usman, (2020) in his study in Bauchi Central senatorial zone did not similarly observe significant age trend to the infection and Usman *et al.*, (2024) observed a

lack of age gradient in their study in Biu, Borno State.

Impact of Some Selected Variables on Schistosome Infection

In this study, the increased prevalence of infection among children whose parents lacked formal education, as compared to those whose parents possess formal education, aligns with the report of Musa *et al.*, (2022) who similarly reported in Maiduguri, Borno State, that the highest infection rates were observed among individuals without formal education, while the lowest rates were among those with tertiary education. This trend may be attributed to the fact that educated parents are more aware of the risks associated with unsafe water contact, promote hygienic practices, and seek early medical intervention. However, this observation contrasts with the findings of Houmsou *et al.*, (2016) in Gashaka, Taraba State, where no significant difference was noted between children of educated and non-educated parents. This suggests that in highly endemic rural areas, environmental exposure may sometimes supersede the protective benefits of education.

Similarly, the increased prevalence observed among children from larger families may be attributed to factors such as overcrowding, inadequate household hygiene, and diminished parental oversight of children's water-contact activities. Musa *et al.*, (2022) had similarly identified a significant disparity in the number of children per room or tent between schistosome-positive and -negative respondents in IDP camps in Maiduguri. This finding suggest that household crowding and substandard living conditions can elevate the risk of infection, particularly when access to safe water and sanitation facilities is limited.

Also, the higher prevalence of infection observed among children of farmers in the present study is consistent with the findings from Zaki LGA, Bauchi State, where Abubakar *et al.*, (2022) reported a greater likelihood of infection among children of farmers than among those whose parents were civil servants. Similarly, Houmsou *et al.*, (2016) identified dry-season farming, rice farming, and fishing as significant risk factors for urinary schistosomiasis in the Murbai and Surbai communities of Taraba State. Birma *et al.*, (2017) also documented a high prevalence among children of fishermen and farmers around Kiri Lake, Adamawa State.

The high prevalence of *S. haematobium* among children using bushes as a sanitation facility agrees with reports on the contribution of poor sanitation to the persistence of schistosomiasis in endemic communities. In Maiduguri IDP camps, Musa *et al.*, (2022) noted that inadequate toilet facilities, poverty, and limited sanitation aggravated environmental contamination. Poor sanitation encouraged urination or defaecation around water bodies, thereby maintaining the parasite life cycle in the presence of snail intermediate hosts.

The observation that children utilizing stream water or various purposes had the highest prevalence of infection agrees with findings from studies conducted elsewhere in North-Eastern Nigeria. In Zaki LGA, Bauchi, for example, Abubakar *et al.*, (2022) reported elevated infection rates among children using river water as opposed to tap water. Similarly, Musa *et al.*, (2022) reported in Maiduguri, Borno state. identified that individuals whose primary water source was an open water body

experienced a significantly higher prevalence of infection compared to those using treated tap/pipe water or well/borehole water. Furthermore, Sylvester *et al.*, (2025) reported that in Lau LGA of Taraba State, activities such as drinking from untreated sources, bathing, and washing clothes in rivers were significantly correlated with urinary schistosomiasis. In this context, stream water should be understood not only as a source of drinking water but also as an indicator of frequent interaction with natural water sources during activities such as fetching, washing, bathing, or playing.

The increased prevalence among children residing within 250 meters of water bodies aligns with the spatial distribution reported by Houmsou *et al.*, (2016) in (Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe) Nigeria, where proximity to water bodies was identified as a significant risk factor for schistosomiasis. Similarly, Birma *et al.*, (2017) attributed the high infection rates around Kiri Lake, Adamawa State, in part to the proximity of communities to the lake and the frequent interaction of residents with water bodies.

This evidence supports the notion that children living near rivers, streams, lakes, or ponds are more likely to participate in activities such as swimming, washing, fetching water, fishing, and farming, thereby increasing their exposure to infective cercariae. Sannu et al., (2022) also revealed that kiri dam harbours diverse species of fresh water snails indicate that the people engageging in various activities in the dam, are predisposed to infections harboured by these snails.

Conclusion

This study demonstrated the occurrence and continued transmission of urinary schistosomiasis among primary school children in Kafin Madaki, Bauchi State, Nigeria. Based on the observed prevalence, schistosomiasis may be considered to occur at a relatively low or hypoendemic level within the study community. Nevertheless, the detection of *Schistosoma haematobium* infection among school-age children indicates that active transmission persists and remains a public health concern requiring sustained surveillance and appropriate control interventions.

The higher prevalence observed among males compared with females suggests differences in behavioural patterns and exposure to cercariae-infested water, particularly through swimming, bathing, fishing, farming, and other recreational or occupational water-contact activities. Although infection varied across demographic groups, the findings further demonstrate the important influence of socioeconomic and environmental conditions on the transmission of urinary schistosomiasis. Poor sanitation practices, dependence on unsafe water sources, low parental educational attainment, large household size, farming-related exposure, and residence close to natural water bodies were important factors associated with increased exposure and persistence of infection within the community.

The findings underscore the need for an integrated and sustainable approach to schistosomiasis control in Kafin Madaki. Such interventions should combine periodic mass drug administration with praziquantel, provision of safe and accessible water supplies, improved sanitation and hygiene facilities, targeted health education, and reduction of

unnecessary contact with potentially contaminated surface waters. Regular epidemiological surveillance, particularly among school-age children, is also essential for monitoring transmission patterns, evaluating the effectiveness of control programmes, and preventing resurgence of infection. Collectively, these measures could substantially reduce transmission and contribute to the long-term control and eventual elimination of urinary schistosomiasis in the study area.

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