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Endemicity of Urogenital Schistosomiasis and Its Associated Risk Factors among Children in Danbatta, Northwestern Nigeria

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ABSTRACT

Urogenital schistosomiasis, also known as bilharzias is a digenean parasitic infection, classified among the neglected tropical diseases, which has remained endemic in Nigeria, despite efforts in mass drugs administration (MDA) across the country. This study reported the endemicity of urogenital schistosomiasis and its associated risks factors among children in Danbatta, Northwestern Nigeria. A cross-sectional study was conducted among children of Danbatta, Kano State, Northwestern Nigeria. A total of 400 urine samples were collected from children in 4 conventional Primary Schools (198) and 4 Tsangaya (almajiris) schools (202). Urine sedimentation microscopy technique was used in sample analysis. A semi-structured questionnaire was used to collect socio-demographic and other exposure information to explore associated risk factors for the infection. Data were expressed in prevalence (%) and subjected to chi-square analysis at 95%CI, p≤0.05. Out of the 400 children, 282 70.5% turned out positive, with Tsangaya children having highest infection prevalence, 92.6% compared to Primary School children, and was significant with type of school (x^2=95.611, p=0.000). Those who visited water body for irrigation purposes and those who visited daily had highest prevalence of 83.3% and 88.6% respectively. In addition, those who visited water bodies in the afternoon hours had highest prevalence of 85.6%. Urogenital schistosomiasis is hyper-endemic in Danbatta despite previous MDAs and activities that involve contact with water bodies are predisposing factors. Strategic and all-inclusive MDAs should be deployed to Danbatta to arrest the surge in endemicity of urogenital schistosomiasis.

1. Introduction

Schistosomiasis (bilharziasis) is an infectious disease of poverty that is endemic in mostly poverty dominated settings which include Sub-Saharan Africa, the Middle East, Brazil, and the Caribbean. According to WHO, about 112 million people are infected annually; 436 million are at risk of infection while 163, 300 people die annually due to urogenital schistosomiasis (WHO, 2020). Urinary schistosomiasis is endemic in many sub-Saharan African countries where suitable habitats for Bulinus snails, the intermediate hosts of schistosomiasis are abundant (Sarkinfada, et al., 2009). World Health Organization (2015) reported that more than 200,000 deaths are annually caused by the disease. Just like other neglected diseases, schistosomiasis is endemic in poor and marginalized communities (World Health Organization, 2002; Mbah & Useh, 2008). Nigeria is reported to account for the greatest number of schistosomiasis cases globally (Hotez et al., 2013), accounting for about 29 million infection, among which 16 million are children and with about 101 million people at risk of infection (World Health Organization, 2013).

The aetiological agents of schistosomiasis are digenetic trematodes in the genus *Schistosoma* (Deol, et al., 2019). The urogenital form of schistosomiasis (UgS) is caused by

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the infective stage (cercariae) of *S. haematobium* (Afiukwa et al., 2019). Humans become infected in unwholesome water bodies (river, ponds, streams, and so on) when they come into contact with the microscopic cercariae shed by some gastropod snails in the genus *Bulinus sp* (Ridi & Tallima, 2013). The infection becomes symptomatic when human bodies react to the terminal spined eggs of the parasite. Such symptoms include diarrhoea, abdominal pain, haematuria, hydronephrosis, kidney dysfunction, bladder cancer, and genital sores (Deol, et al., 2019). The disease is mostly prevalent among school-age children, who become exposed because of their tendency to indulge in group swimming and fishing in snail infested water bodies usually at noon when the cercariae are active (Van der Werf et al., 2003). In children, studies have reported schistosomiasis to be associated with anaemia and physical weakness, consequently reducing their ability to learn, which are reversible with appropriate treatment. Chronic schistosomiasis infection could result in death. Studies have also identified age, gender, parental occupation etc. as risk factors of urogenital schistosomiasis (Senghor et al., 2014; Geleta et al., 2015). Furthermore, people in developing countries such as Nigeria have poor healthcare facilities that are needed for proper control of the disease.

Despite the endemicity of urogenital schistosomiasis in Danbatta Local Government Area of Kano State report by Abdullahi et al. (2009), there is paucity of information of study that took into cognizance infection among the almajiris, who have remained reservoirs of UgS (Auta et al., 2020). In view of the myriads, this study was therefore, designed to investigate the prevalence and risk factors of urinary schistosomiasis amongst primary (formal) school and Almajiri (informal) school pupils who live in conditions that favour transmission and have no access to proper healthcare or effective preventive measures. This study investigated the prevalence and risk factors of urogenital schistosomiasis among Primary and Tsangaya (almajiris) school children in Danbatta Local Government Area, Kano State.

2. Materials and Methods

Samples were collected from Danbatta Local Government Area in Kano State, Nigeria, located between Longitudes 12° 25′ and 12"N and Latitudes 8°38′ and 4"E. The local government is about 49 miles north of Kano city at the Northern border of Kano State with Jigawa State. It has an approximate area of 732 km² and a population of 207,968 at the 2006 census. It is bordered to the north and east by Kazaure and Babura Local Government areas of Jigawa State respectively, and to the south and west by Minjibir and Makoda Local Government Areas of Kano State respectively.

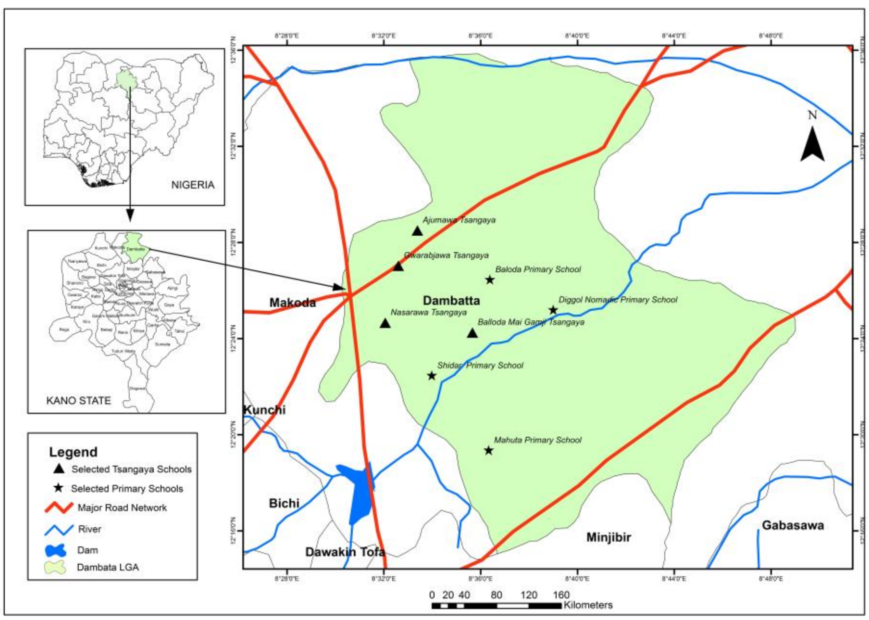

Fig. 1. Map Showing the Sampled Schools in Danbatta Local Government Area, Kano State, North-Western Nigeria

Study Design

The study design was descriptive and specifically cross-sectional in approach that involves studying a representative population of school-age children from some public Primary and Tsangaya (Almajiri) Schools. The study was carried out between June and September 2021. The study targeted primary school (formal) and almajiri (informal) children, irrespective of their ages within the study location. Only respondents who volunteered were included in the survey. Those who declined to participate were excluded. However, enrolled respondents who failed to submit urine sample after interview were withdrawn from the study. A simple random sampling technique was used to select the required number of study subjects. The following stages were followed. First stage involves selection of wards, due to a large population size, eight wards were randomly selected using balloting as follows; each of the wards was assigned a unique serial number. Stage 2 involves random sampling (by balloting) selection of primary and almajiri schools from each ward. Stage 3 involves selection of primary and Almajiri school pupils.

Ethical clearance for the conduct of the study was obtained by the written permission from the Research and Ethics Committee, Kano State Ministry of Health with approval number; NHREC/17/03/2018, and Local Government Authorities. All the primary (formal) and almajiri (informal) school who agreed voluntarily to participate were included in this study (universal sampling). The informed written consent was obtained from parents or guardians for each child before their recruitment into the study.

Sample Size Determination and Sampled Population

Pourhoseingholi's sample size estimation method was used (Pourhoseingholi et al., 2013), using the single proportion formula and assuming a 44.22% proportion of urinary schistosomiasis from previous study conducted in Kano State by Duwa et al. (2009). 95% level of confidence and a 5% absolute precision were used; adjusted for a 10% non-response rate. A two-stage sampling technique was used. First, four primary schools and four Tsangaya (almajiris) schools were chosen in Danbatta Local Government Area using a cluster sampling technique. Using a simple random sampling technique, we recruited the required number of children from each school. Briefly, eligible students were mobilized, informed about the study, and instructed to select one folded paper labelled "YES" or "NO" Those who chose a folded piece of paper with the word "YES" on it were recruited.

A total of four hundred (400) participants were selected by systematic random sampling technique for this study. Nevertheless, for each group (public primary and Almajiri schools), two hundred and eight (208) participants were selected.

Data Collection

Questionnaire Survey

A semi-structured questionnaire was applied to the four hundred (400) participants in order to collect demographic data (age and gender), behavioural risks (water contact activities), environmental sanitation and living conditions (types of water supply and water proximity) and health conditions (history of infection, haematuria).

Urine Sample Collection

Following the administration of the questionnaire, each of the participant was given a labelled clean dry screw capped container and wooden applicator, and guided on when and how to collect their urine samples. The 100ml wide mouth screw-capped containers pre-labelled with the participant's name and code was distributed to each participant for the collection of urine samples. Terminal urine samples were collected between 10:00am and 2:00pm (Cheesbrough, 2005). The timing of collection was warranted by the need to catch up with the peak of egg excretion due to circadian rhythm of the parasite (Muhammad et al., 2019). The urine samples were collected on ice in thermo box at temperatures between 4 and 6 °C and were transported within 5 hours of collection for parasitological examination at the Department of Microbiology Laboratory, Bayero University, Kano State, Nigeria.

Urine Samples Centrifugation

10 ml of each urine sample collected was centrifuged at 400 revolutions per minute (r.p.m) for 4 minutes using C2 series Centurion Scientific Centrifuge (United Kingdom).

Urine Samples Microscopic Examination for *Schistosoma haematobium* Eggs

Microscopic examination was performed using x10 objective nose of Motic Binocular Compound Light Microscope (China). Eggs of *S. haematobium* were identified with their terminal spines (Ford & Blankespoor, 1979). In addition, 20% of the samples were re-examined for the presence of *Schistosoma* eggs by another parasitologist for quality control.

Statistical Analysis

The Statistical Package for Social Sciences (SPSS) software version 23.0 (IBM Corp., Armonk, NY, USA) was used to enter and analyse data. Overall prevalence of urogenital schistosomiasis was estimated; descriptive statistics were calculated and stratified by type of school and school. To compare the prevalence among groups, the chi-square test was used (95% confidence interval (CI) and a *P*-value <0.05% considered significant).

3. Results and Discussion

Results obtained during the study on prevalence and associated risk factors among children in conventional Primary Schools and Tsangaya Pupils (Almajiris) in Danbatta Local Government Area of Kano State, Nigeria between June and November 2021 is as presented in this section.

Socio-demographic Characteristics of the Study Population

A total of 400 children were included in the study. There were considerably more males, 327 (81.75%) than females, 73 (18.25%); more 5–10 years age group, 310 (77.5%) children than 11–16years, 90 (22.5%). Between the types of school, Tsangaya had more sampled children, 202 (50.5%) than Primary School 198 (49.5%). Among the schools sampled, Nasarawa Tsnagaya had the highest proportion (n=52, 13.0%) of children and Shiddar Primary School (n=48, 12%) had the lowest proportion of children. Table 1 shows the sociodemographic characteristics of the study population in Danbatta Local Government Area, Kano State, Nigeria.

***Schistosoma haematobium* Infection Stratified by Type of School and School of Sampled Children**

Results of *Schistosoma haematobium* infection, stratified according to the type of school and schools are as presented in Table 2. Out of the 400 urine samples diagnosed for the presence of *Schistosoma haematobium* ova, 282 urine samples tested positive, giving a prevalence of 70.5%. The prevalence was highest among the Tsangaya children, with 187 (92.6%) infection out of the 202 children recruited for the study. Infection of *S. haematobium* was significantly associated with type of school in this study (x^2 = 95.611, p = 0.000). Among the 8 schools, where these samples were collected, higher prevalence of 94% occurred in Ajumawa, Gwarabjawa and Balloda Mal. Gamji Tsangayas, while the lowest prevalence of 30.0% occurred in Mahuta Primary School. Significant statistical relationship of infection with *S. haematobium* and schools was established in this study (x^2 = 117.625, p = 0.000).

Prevalence Rate of *Schistosoma haematobium* Infection, Stratified by Environmental Factors and Father's Occupation

Results of *Schistosoma haematobium* infection, stratified according to environmental factors and father's occupation among children in Danbatta Local Government Area are as presented in Table 3. Two sources of water to the children, river and stream were reported during this study. The prevalence was highest among the children who sourced their water from rivers, with 194 (72.9%) infection out of the 266. Infection of *S. haematobium* was not significantly associated with source of water in this study area (x^2 = 2.259, p = 0.163). In relation to purpose of water source, children who use the source of water for farming (irrigation) purposes recorded higher prevalence of 83.3%, while the lower prevalence of 65.0% was among children who used the water source for drinking. Significant statistical relationship of *S. haematobium* infection and purpose of water source was established in this study (x^2 = 7.065, p = 0.029).

Frequency of visit to water body had a statistically significant association with *S. haematobium* infection (x^2 = 83.691, p = 0.000), with children who visit water body daily having the highest prevalence of 88.6% and those who visit about monthly having the lowest prevalence of 42.1%. Visiting hours to water body also showed a statistically significant association with *S. haematobium* infection (x^2 = 41.274, p = 0.000), with the highest prevalence among those children who visit the water body during the afternoon period (85.6%) while those who visit mostly in the evening having lowest prevalence (48.9%).

Father's occupation also showed statistically significant association with *S. haematobium* infection (x^2 = 8.697, p = 0.034), with the highest prevalence rate among children whose parents' occupation is Civil Service (89.7%) and the lowest prevalence rate among those whose fathers are business men (64.4%).

Prevalence Rate of *Schistosoma haematobium* Infection According to Clinical Manifestation and History of Praziquantel Administration in Children

Results of *Schistosoma haematobium* infection, stratified according to clinical symptoms and praziquantel history among children in Danbatta Local Government Area are as presented in Table 4. According to clinical symptoms reported among the children who participated in the study, the prevalence was highest among children who had feverish conditions with 215 (84.6%) infection rate out of the 254. Infection of *S. haematobium* was significantly associated with feverish symptoms in this study (x^2 = 66.954, p = 0.000). In relation to headache, children who had headache symptoms recorded higher prevalence of 82.0%, while the lower prevalence of 38.1% was among children who had no headache symptoms. Significant statistical relationship of *S. haematobium* infection and headache was established in this study (x^2 = 71.884, p = 0.000).

Dysuria had no statistically significant association with *S. haematobium* infection (x^2 = 2.073, p = 0.173), with children who had no dysuria having the highest prevalence of 73.0%. Haematuria in urine samples showed a statistically significant association with *S. haematobium* infection (x^2 = 21.018, p = 0.000), with the highest prevalence among those children whose urine samples had haematuria (85.8%). Urine colouration showed that children whose urine samples were bloody had the highest *S. haematobium* infection prevalence of 76 (96.7%) out of 79, while those whose urine samples were plain (white) had the lowest prevalence rate of 62.5%. Association of *S. haematobium* infection with urine colouration was statistically significant (x^2 = 33.261, p = 0.000).

Children who had no history of praziquantel administration in the last two years recorded the highest *S. haematobium* infection prevalence of 85.6%, with 184 out of 215 children sampled, while those who indicated praziquantel administration in the last two years had only 53.0% prevalence rate. Statistically, there was association of *S. haematobium* infection with the history of praziquantel administration (x^2 = 50.839, p = 0.000).

Table 1

Socio-demographic characteristics of the study population subjected to *Schistosomiasis haematobium* diagnosis in Danbatta Local Government Area of Kano State, Nigeria

Variable	Category	Sex		Age Group (Years)	
		Male (%)	Female (%)	5–10 (%)	11–16 (%)
Type of School	Primary School (n=198, 49.5%)	125 (63.13)	73 (36.87))	113 (57.07)	85 (2.93)
	Tsangaya (n=202, 50.5%)	202 (100)	0 (0.0)	197 (97.52)	5 (2.48)
	Total (%)	**327 (81.75)**	**73 (18.25)**	**310 (77.5)**	**90 (22.5)**
School	Shiddar Primary School (n=48, 12%)	29 (60.42)	19 (39.58)	29 (60.42)	19 (39.58)
	Mahuta Primary School (n=50, 12.5%)	30 (60.0)	20 (40.0)	25 (50.0)	25 (50.0)
	Balloda Primary School (n=50, 12.5%)	36 (72.0)	14 (28.0)	31 (62.0)	19 (38.0)
	Diggol Primary School (n=50, 12.5%)	30 (60.0)	20 (40.0)	28 (56.0)	22 (44.0)
	Ajumawa Tsangaya (n=50, 12.5%)	50 (100)	0 (0.0)	48 (96.0)	2 (4.0)
	Gwarabjawa Tsangaya (n=50, 12.5%)	50 (100)	0 (0.0)	49 (98.0)	1 (2.0)
	Balloda Mal. Gamji Tsangaya (n=50, 12.5%)	50 (100)	0 (0.0)	49 (98.0)	1 (2.0)
	Nasarawa Tsangaya (n=52, 13.0%)	52 (100)	0 (0.0)	51 (98.1)	1 (1.9)
	Total (%)	**327(81.75)**	**73(18.25)**	**310(77.5)**	**90(22.5)**

Table 2

Prevalence rate of *Schistosoma haematobium* infection, stratified by sex, age group, type of school and school among children in Danbatta Local Government Area, Kano State, Nigeria

Variables	Category	Sample Size	Number Negative	Number Positive	Prevalence (%)	Statistical Analysis (95% CI)
Type of School	Primary School	193	103	95	48.0	$x^2 = 95.611$, df = 1, p = 0.000
	Tsangaya	202	15	187	92.6	
	Total	**400**	**118**	**282**	**70.5**	
School	Shiddar Pri. Sch.	48	29	19	39.6	$x^2 = 117.625$, df = 7, p = 0.000
	Mahuta Pri. Sch.	50	35	15	30.0	
	Balloda Pri. Sch.	50	24	26	52.0	
	Diggol Pri. Sch.	50	15	35	52.0	
	Ajumawa Tsangaya	50	3	47	94.0	
	Gwarabjawa Tsangaya	50	3	47	94.0	
	Balloda Mal. Gamji Tsangaya	50	3	47	94.0	
	Nasarawa Tsangaya	52	6	46	88.5	
	Total	**400**	**118**	**282**	**70.5**	

Table 3

Prevalence rate of *Schistosoma haematobium* infection, stratified by environmental factors and father's occupation among children in Danbatta Local Government Area, Kano State, Nigeria

Variables	Category	Sample Size	Number Negative	Number Positive	Prevalence (%)	Statistical Analysis (95% CI)
Source of Water	River	266	72	194	72.9	$x^2 = 2.259$, df = 1, p=0.163
	Stream	134	46	88	65.7	
	Total	**400**	**118**	**282**	**70.5**	
Purpose of water Source	Drinking	214	75	139	65.0	$x^2 = 7.065$, df = 2, p = 0.029
	Farming (Irrigation)	12	2	10	83.3	
	Bathing	174	41	133	76.4	
	Total	**400**	**118**	**282**	**70.5**	
Frequency of visit to water body	Daily	228	26	202	88.6	$x^2 = 83.691$, df = 2, p = 0.000
	Weekly	153	81	72	47.1	
	Monthly	19	11	8	42.1	
	Total	**400**	**118**	**282**	**70.5**	
Visit hours to water body	Morning	134	46	88	65.7	$x^2 = 41.274$, df = 2, p = 0.000
	Afternoon	174	25	149	85.6	
	Evening	92	118	45	48.9	
	Total	**400**	**118**	**282**	**70.5**	
Father's Occupation	Farmer	203	60	143	70.4	$x^2 = 8.697$, df = 3, p = 0.034
	Fishing	99	33	66	66.7	
	Business	59	21	38	64.4	
	Civil Servant	39	4	35	89.7	
	Total	**400**	**118**	**282**	**70.5**	

Table 4
Prevalence rate of *Schistosoma haematobium* infection, stratified by clinical manifestation among children in Danbatta Local Government Area, Kano State, Nigeria

Variables	Category	Sample Size	Number Negative	Number Positive	Prevalence (%)	Statistical Analysis (95% CI)
Fever Symptom	Feverish Symptoms	254	39	215	84.6	x 2 = 66.954, df = 1, p = 0.000
	No Feverish Symptoms	146	79	67	45.9	
	Total	**400**	**118**	**282**	**70.5**	
Headache	Yes	295	53	242	82.0	x 2 = 71.884, df = 1, p = 0.000
	No	105	65	40	38.1	
	Total	**400**	**118**	**282**	**70.5**	
Dysuria	Yes	148	50	98	66.2	x 2 = 2.073, df = 1, p = 0.173
	No	252	68	184	73.0	
	Total	**400**	**118**	**282**	**70.5**	
Haematuria	Present	127	18	109	85.8	x 2 = 21.018, df = 1, p = 0.000
	Absent	273	100	173	63.3	
	Total	**400**	**118**	**282**	**70.5**	
Urine Colouration	White	261	98	163	62.5	x 2 = 33.261, df = 2, p = 0.000
	Yellowish	60	17	43	71.7	
	Bloody	79	3	76	96.7	
	Total	**400**	**118**	**282**	**70.5**	
History of praziquantel	Has praziquantel history	185	87	98	53.0	x 2 = 50.839, df = 1, p = 0.000
	No praziquantel history	215	31	184	85.6	
	Total	**400**	**118**	**282**	**70.5**	

This study was designed to determine the prevalence of human urogenital schistosomiasis infection and to identify risk factors associated with infection among children in both conventional Primary Schools and unconventional Tsangaya (Almajiris) schools in Danbatta Local Government Area of Kano State, Nigeria. Centrifugation (sedimentation) diagnostic technique for detection of *Schistosoma haematobium* eggs in urine samples was deployed during the study. This study found an overall prevalence of 70.5% for *S. haematobium* infection, which classify our study settings as highly endemic area for urogenital schistosomiasis according to WHO guidelines (World Health Organization, 2006). This recorded prevalence is far above the existing national average of 9.5% recorded in 2015 (Nduka et al., 2019). In an earlier report on prevalence of *S. haematobium* in Danbatta by Abdullahi et al. (2009), a high prevalence of 54% was reported, while higher prevalence of 65% was reported for Kura LGA. The relatively lower prevalence earlier reported for Danbatta by Abdullahi et al. (2009) could be due to urinalysis reagent strip method (Medi-Test Combi-9) deployed in their study, which is less accurate than the urine sedimentation microscopy technique used in the current study. Awosolu et al. (2019) reported higher prevalence of *S. haematobium* infection using microscopy than using reagent strip, on the same urine samples in Ikota, Ifedore Local Government Area, Ondo State.

Similarly, a high infection prevalence of 70% has previously been reported among communities in Minjibir Local Government Area, Kano State (Umar et al., 2016), with a relatively lower prevalence rate of 37% reported in community around Wasai Dam, in Minjibir of Kano State (Enabulele et al., 2021). Balogun et al. (2022) reported similar high prevalence of 65.7% and 69.0% in the Jidawa and Zobiya communities of Jigawa State.

The high prevalence reported in this study is quite higher than the 17.3% prevalence a,ong Primary School children in Dustin-Ma (Bawa et al., 2016), 30.0% prevalence reported in Zamfara, 21.3% prevalence reported among vulnerable children in security challenged district of Safana (Auta et al., 2020). The 3.71% reported among Secondary School children in Dutsin-Ma and lower than the 37% prevalence reported by Iduh and Bwari (2021) in Sokoto. The location of Thomas Dam in Danbatta LGA is a key environmental factor that plays major role in *S. haematobium* infection transmission, as Dams are water bodies with low water current, which favours the breeding of the intermediate hosts (vectors) of schistosomes. The findings in this study indicate that Kano State is highly endemic for schistosomiasis and appears to be among the hotspots for transmission of urogenital schistosomiasis in Nigeria.

Higher *S. haematobium* infection prevalence among the Tsangaya (almajiris) children than their Primary (conventional) School children is similar to the report of urogenital schistosomiasis prevalence among vulnerable children in Safana, Katsina State, where schistosomiasis was significantly almajiris-biased (Auta et al., 2020). The very high prevalence (92.6%) of *S. haematobium* infection among the Tsnagaya children is similar to the high prevalence of 96.8% reported for Babaroto in Mali (Dabo et al., 2021). The extremely high prevalence reported in this study, among the Tsangaya children (almajiris) could be associated with the exclusion of children in the Tsangaya schools in the implementations of Mass Drug Administration/Mass Administration of Medicine (MDA/MAM) program using praziquantel in Kano, which is a common challenge in the national programme.

This study showed higher prevalence of urogenital schistosomiasis infection among children who used rivers as their source of water. This is similar to the reports of Iduh and Bwari (2021), who all reported that use of water as source of water predisposes children to infection than the use of other sources of water. Presence of haematuria or visible blood in urine is often taken as a reliable sign of urogenital schistosomiasis, most especially among school-age children (Knopp et al., 2018). The very high prevalence of *S. haematobium* infection in urine samples that had haematuria is similar to the 98 – 100% prevalence reported in urine samples with haematuria by Balogun et al. (2022). The implication of this is that in endemic regions, it is fair to conclude that the presence of blood in urine of children serves as strong prognosis of urogenital schistosomiasis (Balogun et al., 2022). A high rate of macrohaematuria among children in this study is an indication of high infection intensity which portends risk of bladder carcinogenesis at old age (Umar et al., 2016).

The higher risk of *S. haematobium* infection among children involved in water contact activities such as irrigation, bathing, and fishing recorded in this study is similar to the findings of Balogun et al. (2022). The higher prevalence among children who had no praziquantel history in this study is similar to the reports of James Agada et al. (2022) who reported higher prevalence among untreated children in Benue State. The highest prevalence of urogenital schistosomiasis infection among children whose father's occupation is public service reported in this study differ from the reports of Auta et al. (2020), who reported higher prevalence of urogenital schistosomiasis among children whose fathers are farmers and lowest among those whose fathers are Civil Servants in Safana, Katsina State. Iduh and Bwari (2021) also reported higher prevalence among children whose parents are farmers than among those whose parents are civil servants in Sokoto State.

4. Conclusion

Despite the Mass Drug Administration (MDA) efforts by Governments at all levels and the interventions of Nongovernmental Organisations (NGOs), urogenital schistosomiasis remain endemic among children in Danbatta Local Government Area of Kano State. The Tsangaya (almajiri) children are more at risk of infection and could serve as reservoirs of urogenital schistosomiasis and other diseases of public health risk. Source of water, use of river and streams for irrigation (farming) purposes, frequent visit to water bodies, visiting water bodies in the afternoon time and whose fathers are farmers are more exposed to urogenital schistosomiasis infection. Haematuria and bloody colouration of urine are reliable signs of urogenital infection and children with praziquantel history were less susceptible to urogenital infection.

Detailed epidemiological monitoring of schistosomiasis in Danbatta LGA is urgently needed to allow direct evaluation of the impact of the ongoing mass administration of praziquantel on schistosomiasis prevalence. Strategic (all inclusive) praziquantel administration across Danbatta needs to be embarked upon. Public enlightenment programme is needed amon children and parents/wards in Danbatta.

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Availability of Data and Materials

The data set supporting the conclusions of the study are available from the corresponding author on reasonable request.

Declarations

The study protocol was reviewed and approved by the State Ministry of Health, Kano State with approval number; NHREC/17/03/2018, Nigeria. Local Government, District authorities, Head Teachers, Classroom teachers, and children were informed about the study procedures, objectives and usefulness. Informed consents were obtained from parents/guardians of sampled children enlistment. Anyone not willing to participate or children whose parents did not give consent were not recruited for the study. Participants also had the option of withdrawal from the study at any time.

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Competing Interests

The authors had no competing interests.

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