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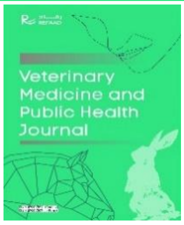

Prevalence and Risk Assessment of Schistosoma haematobium among Children and Adolescents in Selected IDP Camps in Maiduguri Metropolis, Borno State, Nigeria

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Abstract:

Objectives: The study aims to detect Schistosoma haematobium and identify associated risk factors among children and adolescents.

Methods: A cross-sectional study was conducted in El-Miskin and Fariahh internally displaced persons (IDPs) camps in Jere Local Government Area (LGA), Borno State, to identify risk factors associated with Schistosoma haematobium infection among children and adolescents. A total of 279 urine samples were collected and transported to the laboratory for analysis. Detection of Schistosoma eggs was performed using the centrifugation–sedimentation technique.

Results: Among male participants (n = 160), the prevalence was 16.9%, while females (n = 119) had a prevalence of 10.9%; however, no significant association was found between gender and infection status ($\chi^2 = 1.47$, $p = 0.23$). The highest prevalence was observed in the 9–11year age group (n = 24; 62.5%), with a statistically significant association between age and Schistosoma infection ($\chi^2 = 27.96$, $p < 0.05$).

Conclusion: The study recommends further research into the risk of Schistosoma haematobium in children among IDPs, especially among male respondents who are more at risk of the infection due to their constant exposure to contaminated water around the IDP camps.

Keywords: *Adolescence; Children; Maiduguri; IDP-Camps; Schistosomiasis.*

1 Introduction

Urogenital schistosomiasis; also known as '*Bilharziasis*' caused by *Schistosoma haematobium* remains a major neglected tropical disease in tropical and subtropical regions, with an estimated 250 million people infected worldwide and about 90% of the burden in subSaharan Africa (Agniwo et al., 2023; Zongo et al., 2025; Adenowo et al., 2015; Kokaliaris et al., 2021). Transmission occurs when people are exposed to freshwater containing cercariae shed by infected Bulinus snails, typically during domestic, occupational or recreational water contact such as washing, bathing, swimming or fishing (Agniwo et al., 2023; Mohammed et al., 2023; Adenowo et al., 2015; Manz et al., 2020). Children, especially preschool and school aged groups, bear the highest prevalence and intensity of infection, largely because of frequent, unprotected water exposure and limited access to safe water and sanitation (Agniwo et al., 2023; Isaiah et al., 2023; Mazigo et al., 2022; Mohammed et al., 2023; Adenowo et al., 2015). Hardtoreach and marginalized populations, including those in remote rural areas, fishing communities and displacement/refugee settings, show substantial infection levels and are often missed by routine control programmes (Isaiah et al., 2023; Elzain et al., 2025; Manz et al., 2020).

In Nigeria and other highly endemic countries, tens of millions remain infected or at risk, and national prevalence can exceed 50% in some areas (Mazigo et al., 2022; Musa et al., 2022; Kokaliaris et al., 2021). In *S. haematobium* infection, adult worms reside in the venous plexus of the bladder and pelvic organs. Eggs trapped in tissues provoke chronic granulomatous inflammation, leading to bladder wall thickening, polyps, ureteric obstruction, hydronephrosis and, in severe or longstanding infection, increased risk of bladder cancer and kidney damage (Agniwo et al., 2023; Wilczyńska et al., 2025; Mohammed et al., 2023; Adenowo et al., 2015). Clinically, terminal hematuria and dysuria are classic early signs; repeated infection in children is associated with anemia, undernutrition, impaired growth, cognitive deficits and reduced school performance (Agniwo et al., 2023; Wilczyńska et al., 2025; Mohammed et al., 2023; Adenowo et al., 2015).

Diagnosis in endemic field settings still relies primarily on urine filtration for egg detection and reagent strips for micro or macrohematuria and proteinuria, which are inexpensive, rapid and useful for mapping and monitoring morbidity, though sensitivity declines in low intensity settings (Vaillant et al., 2024; Vere et al., 2025; Mazigo et al., 2022; Mediavilla et al., 2024; Feleke et al., 2023). Recent systematic reviews show hematuria dipsticks retain high specificity, and molecular tests (PCR/NAATs) and ultrasensitive antigen or antibody assays can substantially improve detection, particularly in preschool children and low endemic areas (Vaillant et al., 2024; Mindu et al., 2025; Mediavilla et al., 2024; Feleke et al., 2023). Despite more than a decade of mass drug administration (MDA) with praziquantel, *S. haematobium* transmission persists in many African foci, with marked geographical heterogeneity and environmental and behavioral risk factors such as proximity to water bodies, agricultural or fishing livelihoods, and poor WASH infrastructure (Agniwo et al., 2023; Mazigo et al., 2022; Mohammed et al., 2023; Zongo et al., 2025; Adenowo et al., 2015; Manz et al., 2020; Kokaliaris et al., 2021). Schoolaged and preschool children in such high risk, underserved settings—including camps for internally displaced persons, remain particularly vulnerable, and there is limited data on their specific risk factors (Isaiah et al., 2023; Mohammed et al., 2023; Manz et al., 2020).

This study investigates prevalence and risk factors of Schistosomiasis among children under five in Maiduguri IDP camps, addressing a significant public health gap, where insurgency and poor sanitation increase Schistosomiasis risk, aiming to determine the prevalence of *S. haematobium* infection, identify environmental and behavioral risk factors that drive transmission in these camps, and assess urinary morbidity through detection of *S. haematobium* ova and hematuria/proteinuria in urine samples. The findings are intended to fill a local evidence gap and inform targeted control measures for this vulnerable population.

2 Materials and Methods

2.1 Study Area

This research work was conducted in two IDP Camps, namely El-Miskin and Fariahh IDP Camps, Maiduguri, Borno State. Maiduguri is the capital and the largest city of Borno State in North-eastern Nigeria. The study was undertaken between May and July 2023 to investigate the risk factors of *Schistosoma haematobium* among children and adolescents. The decimal latitude and longitude coordinate for Maiduguri, Nigeria: 11.8464° N, 13.1575° E. The city is situated about 325 meters above sea level. The two main vegetation zones in the state are the Sudan Savannah in the South and the Sahel Savannah in the North. Maiduguri actually consist of two cities: Yerwa to the West and old Maiduguri to the east. Maiduguri is one of the sixteen LGAs that constitute the Borno emirate, a traditional state located in Borno state, Nigeria (National Bureau of Statistics, 2015). The geographical location of the area is between latitudes 11^{o} 50^{o} north, 13^{o} 09^{o} east. It is part of the Sahelian region and has an area of 543KM^2 with an estimated population of 1,907,600 (National Population Commission, 2006). The capital is located in the central part of the state and shares a common boundary with *Jere* and *Magumeri* local government areas of the state.

2.2 Sample Size Determination

The sample size for this investigation was determine with the Cochrane formula (Naing et al., 2006).

$$N=Z^2 P (1-P)/e^2$$

Where Z=1.96, P=13.9% (0.139) is the prevalence expected according to a previous study (Isa et al., 2015), d is the precision or margin of the error (5%, d= 0.05), and the N is the sample size. A minimum sample of 184 was calculated, however, the sample size was adjusted to 279 as the baseline sample size of the study to avoid bias in the selection of the respondents in the selected IDP camps.

2.3 Study Design and Target Population

A cross-sectional study was designed to detect the occurrence of urinary schistosomiasis among children under five (0-5 years) and adolescents at the IDP Camp Maiduguri, Borno State. The samples obtained were analyzed in Parasitology and Entomology Laboratories at the University of Maiduguri.

The study population comprised of individuals displaced from different parts of the state into Maiduguri IDP camps i.e. El-Miskin and Fariahh IDP camp, Maiduguri, Borno state. The children between the ages of 1 to 10 years and above were selected. Whereas a minimum of 279 samples was required from the two (2) camps mentioned in the study.

This research study includes children from the aged of five to thirteen years of age who are living within the selected IDP camps. The inclusion criteria of this work was strictly base on children from the two IDP Camps (El-Miskin and Fariahh). However, urine sample was collected from children under five years whose parents voluntarily agreed to participate in the study at El-Miskin, and Fariahh IDP camps, Maiduguri Metropolis. This research study does not include respondents who are not living within the IDP camp premises and are above the age bracket of thirteen years.

2.4 Sample Collection and Transportation

A small urine container was provided to each of the parents who has been allowed to participate in the study, they were advised to fill half of the container by collecting the first and last drop of the urine into the container. They were advised also to carefully close it to avoid subsequent contaminations using the clean-catch method. The samples were collected, labelled and brought to the parasitology laboratory for further analysis. A urine sample was collected in a clean containers known as universal container and then was sent to the Parasitology and Entomology laboratories, University of Maiduguri for analysis which includes both macroscopic and microscopic examinations.

Laboratory Analysis: Macroscopic and Microscopic Examination:

The urine sample brought to the laboratory was observed macroscopically for the colour of the urine either pale, pale- yellow, turbid or clear and to check if the color of the urine is red, showing a clear sign of *Schistosoma* infection before onward analysis is been carried out. In the macroscopic examination, the appearance of the urine sample was taken into cognizance, like the color, such as pale yellow, yellow, turbid or clear and it turbidity, like it being turbid or slightly turbid. And the results can be as follows: pale yellow and turbid, pale yellow and slightly turbid, turbid and clear etc.

Centrifugation and Sedimentation Technique:

Centrifugation and sedimentation techniques were used to analyze the samples (Deribe et al., 2011). About 10ml of the urine sample was measured and centrifuge at 15000 rpm for 5 minutes. After spinning, the supernatant was decanted and the sediment was mixed using a pipette. Alternatively, place in a centrifuge, balance the sample to avoid damaging the machine and spin for 4-5minutes under the speed of 350-500rpm. Decant the upper layers of the urine sample leaving the sedimented (bottom) part to analyze. Then, get a clean and sterile glass slides and dispense about 50-100 microlitres of sediment sample to the slide and cover with slip. Examine under microscope using x10 objectives to focus and x40 to observe for the presence of *S. haematobium* parasite egg in urine, as presented in (Figure 1). Record the result as observed and repeat the process to all the available samples (Cheesebrough, 2008; Carter Centre, 2015). Microscopically, the sediment was examined with X10 and X40 objective lenses to identify *S. haematobium* eggs. As distinguished by a terminal spine, urine samples containing *S. haematobium* eggs were classified as positive, where as those without *Schistosoma* eggs were considered negative. All respondents who returned a positive result were referred for further treatment at the Camp Clinic.

2.5 Ethical Consideration

Ethical clearance was obtained from the state emergency management agency (SEMA) which was then forwarded to the IDP Camp Coordinator and Camp Management (CCM). Parents/guardians and participants were informed about the objectives, procedure, and potential risks and benefits of the study. When seeking the consent from each camp, the objectives and procedures were clearly explained to them in their local languages and were also informed that, it is voluntary and they can withdraw from participating in the study without any consequences.

2.6 Data Analysis

All collected data from the samples and questionnaire were entered into Microsoft excel for Windows 10 for collation and data cleaning. The statistical analysis was performed using SPSS-IBM statistic for Macintosh (version 23.0; IBM Corp, Armon, NY, USA). A detailed descriptive analysis was performed for the respondents concerning the risk factors of *S. haematobium*. The chi-squared test of association was used to determine association between the dependent and independent variables as described by (Brown et al., 2001). The strength of the association was determined using the odds ratio (OR) with a 95% confidence interval. Values of P less than 0.05 were considered statistically significant throughout the study.

3 Result

3.1 Sex Specific Prevalence of *Schistosomiasis* among Adolescent and Children in IDP Camps in Maiduguri Metropolis Borno State, Nigeria

This study revealed an overall prevalence of 14.3% of *Schistosoma haematobium.* Male had the highest prevalence of 16.9% compared to the female with 10.9%. However, there was no statistically significant (χ^2=1.48; p=0.23) association between prevalence of *Schistosoma haematobium* and sex of the children sampled (Table 1). The study detected the *Schistosoma* eggs from the urine samples analyzed.

Table 1: Sex Specific Prevalence of *Schistosomiasis* among Adolescent and Children in IDP Camps in Maiduguri Metropolis Borno State, Nigeria.

Sex	No. examined	No. Positive (%)	Prevalence (%)
Male	160	27(16.87)	16.9
Female	119	13(10.92)	10.9
Total	**279**	**40(14.3)**	**14.3**

P=0.23; χ^2=1.48

3.2 Age Specific Prevalence of *Schistosoma haematobium* among Children in IDP Camps in Jere LGA, Maiduguri Metropolis Borno State, Nigeria

The age range of 9-11 had the highest number of positive and a prevalence of 62.5%, with the age range of 3-5 appeared to have the lowest prevalence rate of (9.0%). There was a statistical significant association between the presence of *Schistosoma haematobium* and the age of the children (χ^2=27.96, p=0.001). In addition, the Fariah camp had the highest prevalence rate (22.7%) compared to the El-Miskin camp with a prevalence of (9.9%). This difference shows a statistical significant (χ^2=6.12, p=0.02) association between *Schistosoma haematobium* infection and the IDP camp location. The details are presented in Table 2.

Table 2: Distribution and Age-Specific Prevalence of *Schistosoma haematobium* among children in Internally Displaced Persons (IDPs) Camps Jere LGA, Maiduguri Metropolis, Borno State, Northeastern Nigeria.

Variables	Number examined	Number positives	Prevalence (%)	OR	95%CI	χ^2	P-value
Age (Years)							
3-5	133	12	9.0	Ref		27.96	*0.001
6-8	105	10	9.5	13.3	6.99 - 25.3		
9-11	24	15	62.5	8.87	5.19 - 15.12		
12 & above	17	3	17.6	44.3	14.12- 139.21		
Location							
El-Miskin	182	18	9.9	2.29	1.17 - 4.48	6.12	*0.02
Fariah	97	22	22.7	Ref			
Total	**279**	**40**	**14.3**				

** Statistically significant.*

3.3 Location and sex specific prevalence of *Schistosoma haematobium* among children in Selected IDP Camps in Jere LGA, Maiduguri Metropolis Borno State, Nigeria

The study revealed that *Fariah* IDP Camp had higher prevalence rate (21.7%) than *El-Miskin* (10.7%). However, there was a statistically significant difference (χ^2 = 8.3; p = 0.004) between the two IDP camps and the level of *Schistosoma haematobium* detected. The details are presented in Table 3.

Table 3: Location Based Sex-Specific Prevalence of *Schistosoma haematobium* among children in Selected IDP camps in Jere LGA, Maiduguri Metropolis, Borno State, Nigeria.

Location	Number examined	Number Positive	Prevalence (%)	χ^2	p-value
El-Maskin					
Male	90	10	11.1	0.025	1.000
Female	97	10	10.3		
Total	**187**	**20**	**10.7**		
Fariah					
Male	51	18	35.3	8.3	0.004*
Female	41	2	4.9		
Total	92	20	21.7		
Overall	**279**	**40**	**14.3**		

**Statistically Significant P-value*

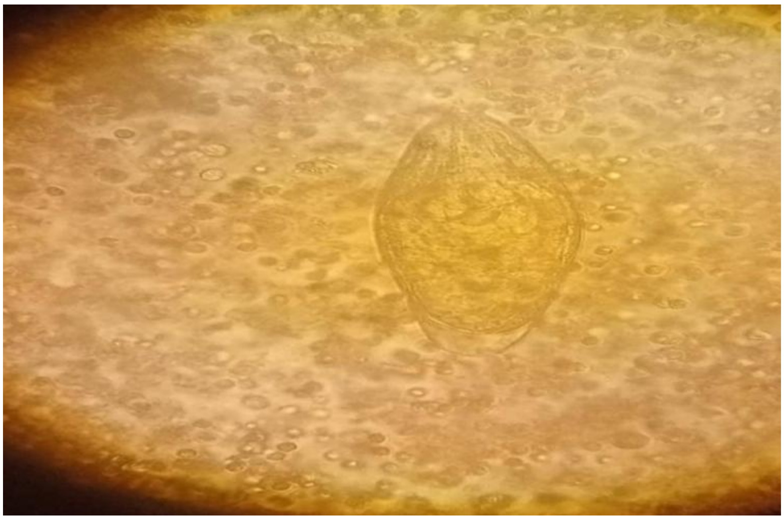

Figure 1: Picture of *Schistosoma heamatobium* egg at x100 magnification.

3.4 Knowledge, Attitudes and Practices of the Respondents Regarding *Schistosoma* Infection Household information of individual participants from different IDP Camps in Maiduguri.

The characteristics analyzed shows that educational background with Qur'anic form of education been the highest with (76.34%) and *kanuri* been the most dominant tribe with a rate of (38.70%) of the participants. The occupation of the father's was also studied with farmers been the majority of the occupation at a rate of (74.91%) which is a risk factor that exposes the father's to schistosomiasis due to the contact with open water source such as rivers and streams used for irrigation farming and also portrait the socio-economic status and living conditions of the household which will have an impact on how they respond to *Schistosoma* infection. The details are presented in Table 4.

Table 4: Household Demographic Information of Individual Participants from Different IDP Camps in Jere LGA, Maiduguri Metropolis, Borno State, Northeastern Nigeria.

Characteristics	Respondents	Rate (%)
Educational background		
Qur'anic	213	76.34
Primary	1	0.35
None	64	22.93
Ethnic background		
Shuwa	94	33.69
Kanuri	108	38.70
Hausa	63	22.58
Others	14	5.01
How long have you been in the camp (years)		
1-3	23	8.24
4-6	116	41.57
7-9	98	35.12
10-12	42	15.05
Occupation		
Farming	209	74.91
Business man	27	9.67
Government employee	0	0
Others	48	17.20

3.5 Assessment of Hygiene and Sanitation Practices of the Respondents in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria

This study shows that a high percentage of the households of the camps have access to clean drinking water with a rates of (96.77%) and (84.94%) have borehole as their primary source of water in the camp, this results shows that the risk of contracting *Schistosoma* parasites in drinking water is there, since the sanitation is very poor. From the results above, 96.41% of the respondents have access to improved sanitation facilities, of which 95.69% share the facilities with other households, which might pose a major risk factor for *Schistosoma* infection if hygiene practices are not enforced at all times.

Hand washing is fair with (46.6%) of the respondents practices it with (26.52%) not practice hand washing practices. Other assessment carried out such as walking bare footed was high with (94.26%) of the participants at risk of schistosomiasis due to walking barefoot. Also, (20.78%) of the participants are swimming in freshwater bodies which will lead to *Schistosoma* infection. The details are presented in Table 5.

Table 5: Assessment of Hygiene and Sanitation Practices of the Respondents in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria.

assessment	Respondents	Rate (%)
Does the camp have access to clean water		
Yes	270	96.77
No	9	3.22
Primary source of water		
Tap water	6	2.15
Trucking	26	9.32
Borehole	237	84.94
Others	10	3.58
Assess to improve sanitation facilities		
Yes	269	96.41
No	10	3.58
Sharing of sanitation facilities with other household		
Yes	267	95.69
No	12	4.30
How often does the child wash hands with Soap and Water		
Once	34	12.18
Twice	41	14.69
Regular	130	46.59
None	74	26.52
Does the child play or swim in fresh water bodies		
Yes	58	20.78
No	221	79.21
Does the child play or walk around bare footed		
Yes	263	94.26
No	16	5.73

3.6 Assessment of Knowledge, Attitudes and Practices of the Respondents in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria

The knowledge of urinary schistosomiasis is high among the participants, with about (96.77%), which is acquired through different means, such as hospital health talks, with about (40.14%) of the participants acquiring the knowledge from the hospital. The experience of pain and blood in urine as a result of *Schistosoma heamatobium* infection among the participants is poor (10.39%), which shows a low rate. The details are presented in Table 6.

Table 6: Assessment of knowledge, Attitudes and Practices among Children in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria.

Assessment	Number Respondents	Rate (%)
Knowledge of urinary Schistosomiasis		
Yes	270	96.77
No	9	3.22
If yes, through what avenue		
Awareness campaign (NGO/GOV)	73	26.16
Hospital	112	40.14
School	0	0
Others	85	30.46
Experience of itching, pain and blood while Urinating		
Yes	29	10.39
No	250	89.61
If yes, how long		
1-2 weeks	15	51.72
3-4 weeks	8	27.58
1- months	3	10.34
2-months and above	3	10.34

3.7 Assessment of practice and attitude of the Respondents among Children in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria

The assessment of contact with water bodies shows that (78.66%) are constantly expose to the risk of *Schistosoma* infection from frequent contact with stagnant water, this rate might lead to constant reinfection with schistosomiasis. Only (12.18%) of the respondents add Aqua-Tab or boil their water before drinking, which will increase the risk of *Schistosoma* infection especially among children with impaired immunity. The details are presented in Table 7.

Table 7: Assessment of practice and attitude of the Respondents among Children in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria.

Assessment	Number of Respondents	Rate (%)
Do you have contact with water bodies		
Yes	225	80.64
No	54	19.35
If yes, what form of water bodies		
Rivers	9	4.0
Stagnant water	177	78.66
Ponds/lakes	2	0.88
Others	27	12.0
Rivers	9	4.0
Do you boil water or add Aqua-Tab before drinking		
Yes	34	12.18
No	245	87.81
Do you play with other children who present signs of Bilharzia		
Yes	248	88.89
No	31	11.11
Type of water contact		
Fetching	130	46.59
Washing of clothes	18	6.45
Regular bathing	65	23.29
Swimming	12	4.30

3.8 Assessment of Exposure and Travel History of the Respondents among Children in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria

The travel of respondents to areas endemic with schistosomiasis increases the possibility of infection, about (17.20%) have traveled to areas endemic with schistosomiasis of which some (12.9%) play and swim in open water bodies, (6.8%) were once tested or treated of schistosomiasis and (24.37%) have a close family relative that is known to be infected with Schistosomiasis. The details are presented in Table 8.

Table 8: Assessment of Exposure and Travel History of the Respondents among Children in IDP Camps in Maiduguri Metropolis, Borno State, Northeastern Nigeria.

Assessment	Number of Respondents	Rate (%)
Was your child travelling to areas known to be endemic with schistosomiasis		
Yes	48	17.20
No	231	82.79
If yes, how long		
1 week	16	5.73
2 weeks	6	2.15
1 month	18	6.45
2 months and above	8	2.89
During the visit, did the child swim/play in water bodies		
Yes	36	12.90
No	243	87.09
Has the child ever tested or treated for schistosomiasis		
Yes	19	6.81
No	260	93.19
Any known cases of schistosomiasis infection in the child close circle		
Yes	156	55.91
No	123	44.08
Does the child have any known health conditions		
Yes	68	24.37
No	211	75.63
If yes, what kind of health conditions		
Malaria	22	32.35
Guinea worm	8	11.76
Others	38	55.88

4 Discussion

The cruel displacement of the population by Boko haram has harmed healthcare delivery in the north-eastern part of Nigeria. Having it in mind, the condition in the IDP camps, it is expected that the threat of contamination of surrounding water bodies is inevitable due to the insufficient toilet facilities in the camps. This is considered to be triggered by poverty and limited sanitation (Weerakoon *et al.,* 2015). As presently observed in the camps. Control of the problem in the camps may prove ineffective as long as these underlying issues are not tackled. Water contamination with urine reflets human behavior and this often seems remarkably resistant to change, despite efforts to improve sanitation and educate school children on the basics of the schistosome life cycle and basic hygiene (Rollinson et al., 2013). Also, infection with *S. haematobium* is known to decrease bladder elasticity and increase the frequency of urination.

The gold standard diagnostic technique, urine microscopy was employed in this study which revealed the overall prevalence of urinary *schistosomiasis* as 14.3% among the study population. This prevalence rate can be considered to be moderate based on the WHO (WHO, 2012) report that classified *schistosomiasis* prevalence rate from 0.1–9.9% as low, 10.0–49.9% as moderate and 50% and above as high. The prevalence in this study was however higher than some previously reported rates in Nigeria; where an overall prevalence in Adamawa State was reported as 24.0% among school-aged children, on the contrary the overall prevalence rate reported in this study was observed to be lower than that of Adamawa and some reported prevalence in other States, such as an overall prevalence of 15.4% in Ebonyi State as reported by (Invoke *et al.,* 2014) and 17.8% in Kano (Dawaki *et al*., 2016). The disparities observed could be attributed to the differences in demography and methodology used. In this study, the target population is made up of IDP's of a specified age group while the target population in the previous studies were mostly adults. The higher prevalence in the previous studies could also be due to the nearness of the study areas with contaminated open water bodies (Invoke et al., 2014).

The logical regression analysis in this study showed a significant association between *Schistosoma* infection and sex, which showed that the chances of the disease infection is higher in males compared to females, similar findings was reported by (Invoke et al., 2014; Bala et al., 2012; Dawaki et al., 2016; Hotez and Kamath, 2009; Yelwa et al., 2025). This is because males are more exposed and mostly visit the water bodies to swim. Also, a higher prevalence was recorded among male pupils (34.09%) than the females (24.00%), with no significant statistical association between the two groups. The report is in agreement with the findings of (Craik et al., 2023), who reported a prevalence of 14.8% among the male pupils and 5.4% among female pupils in Zaria. This could be due to socio-cultural and religious factors that expose males to water contact activities at the infested water bodies such as swimming, fishing and washing, more than the females. Schistosomiasis remains a major public health problem in many developing countries, particularly among the rural population in sub-Saharan Africa. Nigeria is considered the most endemic country for schistosomiasis, with approximately 29 million infected people and 101 million people at risk of infection (Adenowo et al., 2015; Opara et al., 2021; Boakye, 2025).

The present of study areas have been impacted negatively from the long period of Boko Haram insurgency which has ravaged the community where the study was carried out and the negligence of the government and government agencies which are responsible for the care of the displaced persons and the inadequate funding and activity of the NGOs in charge of the IDP camps and the nature of the surrounding environment predispose the displaced persons to the risk of contamination with Schistosomiasis. The socio-economic conditions of the displaced persons in the study of area and their response to some of this challenges is crucial to eliminating the threat of contamination from surrounding water bodies due to lack of proper drainage in the camps as observed, this might prove difficult if continuous sensitization of health implications of some of the behavioral practices and sanitation practices are not been addressed head on due to the resistance to change from the displaced persons. Also, toilet facilities in the camps should be upgraded to meet standard specification because water contaminated with urine reflects human behavior.

This study shows that educational attainment of the respondents was found not to be a significant factor that contributes to the risk factors of *Schistosoma* infection but rather the educational background of the parent/guardians of the respondents, this is because parent/guardians who are educated tends to be able to make sure that the factors that exposes their wards to the infection are mitigated. This is also supported by the WHO assertion that there is an increased risk of acquiring schistosomiasis among non-educated individuals in a given community consequent of the low socio-economic and educational attainment in such communities. The occupation of the fathers of the respondents in this study shows that there might be an association of *Schistosoma* infection with farming since majority of the farmers make use of an irrigation farming system due to the location of the study area, thus making contact with fresh water sources frequent which exposes them to the risk factors of Schistosomiasis (Abbakariya et al., 2025; Musa et al., 2022).

The respondents that walk bare footed and have frequent contact with open water bodies or contaminated water have a higher risk of being infected compared to those that do not walk bare footed and have minimal open water contact. The open water source may serve as means of transportation in addition to being used for household and trade needs, this may lead to increased water contact time in the given community thereby increasing chances of infection with schistosomiasis (Abbakariya et al., 2025; Onyekwere et al., 2022). The finding in this study also agrees with the findings from previous studies (Degarege, et al., 2025; Ogefere and Osvolale et al., 2017) who also reported that frequent contact/significant contact with the water poses a significant risk for the occurrence of Schistosomiasis.

On a final note, the present study reported an overall prevalence of 14.3% of Schistosoma infection among children and adolescents in the Fariah and El-Miskin IDP camps, indicating a moderate but important burden of urinary schistosomiasis in these displaced populations. However, marked spatial variation was observed, with a substantially higher prevalence in the Fariah camp (22.7%) than in the El-Miskin camp (9.9%). This heterogeneity likely reflects differences in water contact patterns, sanitation infrastructure, and access to safe water sources between the two camps.

The higher prevalence in Fariah camp is consistent with studies from other endemic Nigerian settings, which have shown that frequent contact with untreated surface water for domestic activities such as bathing, washing, and recreation significantly increases the risk of *S. haematobium* infection among children. In IDP settings, such exposure is often exacerbated by overcrowding, limited water points, and inadequate sanitation, forcing residents to rely on nearby open water bodies. In contrast, the lower prevalence observed in El-Miskin camp may be attributable to relatively better sanitation facilities, reduced exposure to infested water, or improved access to health services.

Overall, these findings reinforce existing evidence that water contact behavior and poor sanitation are key drivers of schistosomiasis transmission, particularly in vulnerable humanitarian settings. The observed camp-specific differences underscore the need for targeted interventions, including improved WASH infrastructure, regular praziquantel mass drug administration, and focused health education, tailored to local risk profiles within IDP camps.

5 Conclusion

In this present study, it can be concluded that the overall prevalence of urinary schistosomiasis among the studied population was 14.3%. Male had the highest prevalence of 16.9% compared to female with 10.9%. Also the age specific prevalence of *Schistosoma haematobium* among the children in the IDP camp was recorded. With age group 9-11 years has the highest prevalence (62.5%) while the age group 3-5 has the lowest prevalence (9.0%). The study also revealed a statistical significant association between the presence of *Schistosoma haematobium* and the age of the children (χ^2=27.96, p=0.001). Variables from the questionnaire analysis revealed that, knowledge of the disease, sources of water, type of water contact, sanitation and hygiene practices were found to have significantly influenced the occurrence of the disease among the respondents and were considered as major risk factors of the disease. Other key risk factors for schistosomiasis include poor sanitation, contaminated water sources, and poor hygiene practices. Mitigation strategies: improve water access, sanitation, and health education; reduce water contact; and ensure availability of treatment drugs (Schistosomicides and Molluscicides), to treat those infected with *Schistosoma* infection. Further research is needed to inform effective control measures.

5.1 Recommendation

Improved sanitation and safe water supply, alongside proper drainage and waste management, are needed in IDP camps. Regular praziquantel mass drug administration (MDA) with periodic screening, supported by targeted health education and community engagement, should be implemented to reduce urinary schistosomiasis. Strengthening clinic capacity, routine surveillance, and operational research should be prioritized by government and NGOs, with a focused control program in El-Miskin and Fariah IDP camps to reduce risk and improve diagnosis.

5.2 Limitations

Limitations include inadequate molecular biology facilities, highlighting the need for further research on *Schistosoma haematobium* risk factors in IDP camps. Lack of funding for the research.

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5.4 Conflict of Interest

The authors declare that they have no competing financial, professional or personal conflicts that could influence this research work.

5.5 Authors' Contributions

A.S.S, S.M. and A.M.: Conceived and designed the experiments; performed the experiments; analysed and interpreted the data; contributed reagents, materials, and analysis tools; and wrote the paper. M.A., Y.M., and M.M.G.: Supervised the experiments; analysed and interpreted the data; and contributed reagents, materials, etc. S.T.O. and H.M.: Performed the experiments; analysed and interpreted the results. A.S.S., A.M. and S.T.O.: Analysed the results and wrote the first paper draft. All authors read and approved the final version of the manuscript.

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