African Journal of
Medicine, Surgery and Public Health Research

ISSN: 1595-8000

Index: Harvard, Boston, Sydney University, Dimensions, Lens, ResearchGet Scilit, Semantic, Google Scholar, Base etc

https://doi.org/10.58578/AJMSPHR.v3i1.8312

Prevalence and Determinants of *Schistosoma haematobium* and *Ascaris lumbricoides* Infections among Primary School Pupils in Bantaje Ward, Wukari Local Government Area, Taraba State, Nigeria

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Article Info:

Submitted:	Revised:	Accepted:	Published:
Oct 25, 2025	Nov 20, 2025	Dec 8, 2025	Dec 13, 2025

Abstract

Schistosomiasis and ascariasis remain major causes of morbidity among school-aged children in Nigeria, especially in rural areas where access to water, sanitation, and hygiene (WASH) facilities is inadequate. This study assessed the prevalence and determinants of *Schistosoma haematobium* and *Ascaris lumbricoides* infections among primary school pupils in Bantaje Ward, Wukari Local Government Area, Taraba State, Nigeria. A descriptive cross-sectional study was conducted among 384 pupils aged 5–16 years selected from six primary schools using multistage sampling. Urine and stool samples were examined microscopically for *S. haematobium* and *A. lumbricoides* using sedimentation and direct wet mount techniques, respectively. Structured questionnaires were used to collect information on sociodemographic characteristics, sanitation, water contact, and hygiene behaviours. Data were analysed using SPSS version 29, and associations were determined using chi-square tests at a significance level of $p < 0.05$. The overall prevalence of *S. haematobium* and *A. lumbricoides*

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infections were 13.3% and 16.4%, respectively. Pupils who used rivers and streams for domestic activities recorded significantly higher prevalence of *S. haematobium* infection (p = 0.002), while swimming and fishing were the main risk factors. For *A. lumbricoides*, open defecation (p = 0.001) and eating food dropped on the ground were significant determinants of infection. Treatment-seeking behaviour was generally poor, with many pupils taking no action when symptomatic. The study revealed moderate endemicity of urinary schistosomiasis and ascariasis among primary school children in Bantaje Ward, driven largely by unsafe water contact, poor sanitation, and unhygienic practices. Integrated control measures combining periodic mass drug administration with improved WASH facilities, behavioural change communication, and strengthened school-based health education are recommended to reduce infection transmission and the associated disease burden in the area.

Keywords: Urinary Schistosomiasis; Ascariasis; School-Aged Children; WASH; Nigeria

INTRODUCTION

Schistosomiasis and Ascariasis remain among the most persistent parasitic infections affecting school-aged children in Nigeria. These infections thrive in communities where access to potable water, sanitation facilities, and hygiene practices remain inadequate (WHO, 2023; Midzi *et al.,* 2024). Although Nigeria implements mass drug administration (MDA) programmes, transmission continues due to constant exposure to contaminated water and soil, environmental contamination, and poor health-seeking behaviour (Oluwole *et al.,* 2020; Mugenyi *et al.,* 2022).

Urogenital schistosomiasis, caused by *Schistosoma haematobium*, is transmitted through contact with cercaria-infested freshwater bodies. The parasite continues to pose a major public health challenge in rural African communities where children frequently swim, fish, bathe, or fetch water from natural water sources (Colley *et al.,* 2022; Ndiaye *et al.,* 2024). Chronic *S. haematobium* infection is associated with hematuria, anaemia, hydronephrosis, bladder wall fibrosis, reduced physical fitness, and impaired school performance (King *et al.,* 2020; Mazigo *et al.,* 2022). Nigeria remains one of the most endemic countries for schistosomiasis, with several states—including Taraba reporting moderate to high prevalence among school children (Ojo *et al.,* 2021).

Ascaris lumbricoides, remains widely distributed in Nigeria. Their transmission is driven by open defecation, poor waste disposal, inadequate sanitation, and frequent contact with contaminated soil (Ojurongbe *et al.,* 2023; Edoa *et al.,* 2024). Infected children often suffer from nutritional deficiencies, stunting, poor cognitive development, reduced attention, and poor academic performance. Behavioural exposures such as eating food dropped on the ground and inadequate handwashing increase their risk of infection (Jourdan *et al.,* 2018; Idowu *et al.,* 2022).

Co-endemicity of schistosomiasis and Ascariasis has been reported in several Nigerian communities, and co-infection may exacerbate morbidity, anaemia, and overall disease burden (Hotez *et al.,* 2020; Opara *et al.,* 2021). The persistence of these infections in rural settings highlights the need for local epidemiological data to guide targeted interventions. Many communities in Wukari LGA rely on rivers, ponds, and unprotected wells for domestic activities, creating opportunities for schistosomiasis transmission. At the same time, limited toilet facilities, open defecation practices, and inadequate hygiene behaviours sustain *Ascaris lumbricoides* transmission.

Despite the known burden of these infections in Taraba State, updated and community-specific data on the prevalence and risk factors among school-aged children in Bantaje Ward are limited. Generating such data is important for strengthening control programmes and informing integrated WASH strategies. This study therefore assesses the prevalence of *Schistosoma haematobium* and *Ascaris lumbricoides* among primary school children in Bantaje and identifies the major behavioural, environmental, and sanitation-related factors influencing their transmission

MATERIALS AND METHODS

Study Area

The study was conducted in Bantaje Ward, located in Wukari Local Government Area (LGA) of Taraba State, North-Eastern Nigeria. The area lies within the Guinea Savannah ecological zone and is characterized by a long rainy season (April–October) and a dry season (November–March). Most residents depend on rivers, ponds, and hand-dug wells for domestic activities. The population is predominantly rural with limited access to improved water, sanitation, and hygiene (WASH) facilities, conditions that favour the transmission of schistosomiasis and soil-transmitted helminths.

Study Design

A descriptive cross-sectional study design was employed to determine the prevalence of *Schistosoma haematobium, Ascariasis lumbricoides* and associated risk factors among primary school pupils in Bantaje Ward.

Study Population

The study population comprised pupils aged 5–16 years attending selected public primary schools in Bantaje. All pupils who were present on the day of sample collection and whose parents or guardians consented were eligible to participate.

Sample Size Determination

Sample size was determined using a standard formula for cross-sectional parasitological studies, based on an expected prevalence of helminth infections from previous studies within Taraba and neighbouring states. A total of 384 pupils were enrolled for the study.

Sampling Technique

A multistage sampling approach was used. Six primary schools were purposively selected based on accessibility and population size. Within each school, pupils were randomly selected proportionate to school enrolment until the desired sample size was achieved.

Ethical Considerations

Ethical clearance was obtained from the Directorate of Health Wukari Local Government Area. Also approval to conduct the research in schools was obtained from Education Secretary, Wukari Local Government Education Authority. Written or verbal informed consent was obtained from parents/guardians, and assent was obtained from participating pupils.

Sample Collection

Each pupil was provided with clean, dry, properly labelled sample bottles. Urine samples (collected between 10:00 am and 2:00 pm, the peak period for egg excretion) were obtained for detection of S. *haematobium*. Fresh stool samples were collected for *Ascaris lumbricoides* examination. Samples were transported to the laboratory within 2 hours of collection.

Laboratory Analysis

Urine Examination for *Schistosoma haematobium*

Urine samples were examined using the standard sedimentation technique. Ten millilitres of urine were centrifuged at 3000 rpm for 5 minutes, after which the sediment was examined microscopically for characteristic terminal-spined eggs of S. *haematobium.*

Stool Examination for *Ascaris lumbricoides*

Stool samples were examined using direct wet mount microscopy. A small amount of stool was emulsified in normal saline and iodine solution and examined under the microscope for eggs of *Ascaris lumbricoide.*

Questionnaire Administration

A structured, interviewer-administered questionnaire was used to obtain information on socio-demographic characteristics, water sources, water contact activities, sanitation practices, personal hygiene, and knowledge of parasitic infections.

Data Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 29. Descriptive statistics were used to determine prevalence. Associations between variables were evaluated using Chi-square tests at a significance level of $p < 0.05$. Odds ratios (ORs) with 95% confidence intervals were computed to determine risk factors for infection.

RESULTS

Prevalence of *Schistosoma haematobium*

A total of 384 urine samples were examined across the six selected schools. Schistosoma haematobium infection was detected in 51 pupils, giving an overall prevalence of 13.3%. Natirde Nomadic recorded the highest prevalence (2.9%), while Nyankwala had the lowest prevalence (1.6%). There was no significant difference in prevalence among the schools ($\chi^2 = 2.06$; $p = 0.84$).

Table 1: Prevalence of *Schistosoma haematobium* Infection Among Pupils in Bantaje

N = 384; n = 51

School	No. Infected	Prevalence (%)
Bantaji LG	10	2. 6
Bantaji A/B	7	1. 8
Nyankwala	6	1. 6
Gindin Dorowa	9	2. 3
Chediya	8	2. 1
Natirde Nomadic	11	2. 9
Total	**51**	**13.3**
$\chi^2 = 2.06$ p = 0.84		

Prevalence of *Ascaris lumbricoides*

Out of the 384 pupils examined, 63 tested positive for A. *lumbricoides*, giving an overall prevalence of 16.4%. Prevalence ranged from 2.1% in Bantaji LG to 3.6% in Natirde Nomadic. The variation among schools was not statistically significant ($\chi^2 = 2.09$; p = 0.84).

Table 2: Prevalence of *Ascaris lumbricoides* Infection Among Pupils in Bantaje Ward

N = 384; n = 63;

School	No. Infected	Prevalence (%)
Bantaji LG	8	2. 1
Bantaji A/B	11	2. 9
Nyankwala	10	2. 6
Gindin Dorowa	9	2. 3
Chediya	11	2. 9
Natirde Nomadic	14	3. 6
Total	**63**	**16.4**
$\chi^2 = 2.09$ p = 0.84		

Risk Factors Associated With *Schistosoma haematobium*

Risk-factor analysis showed that both water source and water-contact activities significantly influenced schistosomiasis transmission. Pupils who used rivers/streams recorded the highest prevalence (9.4%). Similarly, pupils who engaged in swimming and

fishing had higher prevalence rates than those who did not engage in water-contact activities.

Table 3: Association Between Water Source and S. haematobium Infection

Risk Factor	Category	No. Examined	No. Positive	No. Negative	Prevalence (%)	Test Statistic
Source of Water	Pipe-borne	10	1	9	0. 5	
	Well	128	4	124	2. 1	
	Pond	11	3	9	1. 6	
	River/Stream	30	18	10	9. 4	$\chi^2 = 70.234$; p = 0.002
	Borehole	13	2	12	1. 0	
	Total	192	28	164	14.6	
Water Contact Activities	Swimming	20	10	10	5. 2	
	Bathing	40	5	35	2. 6	
	Fishing	23	8	15	4. 2	
	Washing	33	4	29	2. 1	
	None	76	1	75	0. 5	$\chi^2 = 38.713$; p = 0.001
	Total	192	28	164	14.6	

Risk Factors Associated With *Ascaris lumbricoides*

Significant determinants of ascariasis included type of toilet, footwear habits, and eating food from the ground. Open defecation and poor hygiene behaviours were strongly linked to higher infection prevalence.

Risk Factor	Category	No. Examined	No. Positive	No. Negative	Prevalence (%)	Test/OR
Type of Toilet	Pit	114	11	103	5. 7	
	Open Field	58	18	40	9. 4	$\chi^2 = 12.47$; p = 0.001
	Water Closet	20	4	16	2. 1	
	Total	192	33	159	17.2	
Footwear Habit	Wear Shoes Always	124	15	114	7. 8	OR = 0.33
	Do Not Wear Shoes	68	18	45	9. 4	
	Total	192	33	159	17.2	
Eating Food from Ground	Yes	82	30	52	15.6	OR = 20.58
	No	110	3	107	1. 6	
	Total	192	33	159	17.2	

Treatment-Seeking Practices for Schistosomiasis and Ascariasis

A total of 384 pupils provided information on health-seeking behaviour related to both *Schistosoma haematobium* and *Ascaris lumbricoides* infections. Treatment-seeking behaviour varied across the study population. Pupils who reported taking no action ("do nothing") showed the highest prevalence for both schistosomiasis (7.3%) and Ascariasis infections (8.6%). Those who sought treatment in hospitals had moderate prevalence (4.9% and 5.7% for schistosomiasis and Ascariasis, respectively), while pupils relying on traditional remedies recorded the lowest prevalence for both infections. Statistical analysis showed that treatment-seeking behaviour was not significantly associated with schistosomiasis ($\chi^2 = 3.68$; $p = 0.15$), whereas the association with Ascariasis infections was borderline significant ($\chi^2 = 5.86$; $p = 0.05$), suggesting that treatment behaviour may slightly influence the risk of *Ascaris lumbricoides* infection.

Treatment Practice	No. Examined	S. haematobiumNo. Positive	S. haematobium Prevalence (%)	A. lumbricoideNo. Positive	A. lumbricoides Prevalence (%)
Hospital	(S)163 (A)180	19	4. 9	22	5. 7
Traditional	(S)21 (A) 29	4	1. 0	8	2. 1
Do Nothing	(S)200 (A)175	28	7. 3	33	8. 6
Total	**384**	**51**	**13.2**	**63**	**16.4**

DISCUSSION

The present study demonstrates that *Schistosoma haematobium* and *Ascaris lumbricoides* remain endemic among primary school pupils in Bantaje Ward. The prevalence of urinary schistosomiasis (13.3%) recorded in this survey falls within the moderate transmission range and is similar to values previously reported in semi-rural communities of Nigeria (Ahmed *et al.,* 2020; Eyo *et al.,* 2022). Although lower than the higher rates documented in established hotspot areas of Kebbi, Niger and Plateau States (Olamiju *et al.,* 2021), the persistence of infection confirms that water contact remains an important driver of transmission in the area. The continued use of streams and ponds for domestic and recreational purposes provides favourable conditions for human–snail contact and

subsequent exposure to cercariae, as also observed in earlier studies within the country (Ugbomoiko *et al.,* 2020; Kittur *et al.,* 2022).

The prevalence of ascariasis (16.4%) observed is consistent with figures reported from similar rural settings in northern Nigeria, where sanitation challenges remain widespread (Isa *et al.,* 2020; Amoo *et al.,* 2021). This level of infection suggests that soil contamination with *Ascaris lumbricoides* eggs persists due to inadequate sanitation facilities, open defecation practices and poor hygiene behaviour among children. These factors have been similarly highlighted as major contributors to *Ascaris lumbricoides* transmission in studies from other regions of Nigeria and East Africa (Gizaw *et al.,* 2020; Salisu *et al.,* 2021).

The association between schistosomiasis and water sources observed in this study further confirms the role of freshwater exposure in transmission. Pupils who depended on streams or ponds for water-related activities recorded significantly higher infection rates than those who used safer sources such as pipe-borne water or boreholes. This finding is consistent with established evidence that transmission intensity is directly related to frequency and type of water contact (Ugbomoiko *et al.,* 2020; Kittur *et al.,* 2022). Swimming and fishing, which involve extended immersion in water, showed particularly strong associations with infection, aligning with previously reported patterns in endemic communities.

Similarly, the determinants of ascariasis identified in this study reflect classical faeco-oral routes of transmission. Open defecation significantly increased the likelihood of infection, underscoring the importance of environmental contamination in sustaining transmission. The practice of eating food dropped on the ground showed a very strong association with infection, suggesting that hand-to-mouth exposure may be a primary pathway in this population. The protective effect of wearing shoes against infection supports existing observations that soil contact is a major transmission mechanism for STHs (Ekpo *et al.,* 2020).

Although treatment-seeking practices did not significantly influence schistosomiasis prevalence, a borderline association was observed for Ascariasis infections. Pupils who did nothing when symptomatic had the highest infection rates for both diseases, suggesting limited awareness or access to effective treatment. Similar patterns of delayed care or reliance on informal treatment sources have been reported in other Nigerian and Ghanaian

communities (Eke *et al.,* 2020; Yeboah *et al.,* 2021). Such behaviours contribute to sustained transmission, particularly where reinfection rates are high.

Overall, the findings of this study highlight a dual burden of schistosomiasis and Ascariasis infections driven by environmental exposure, sanitation deficits and behavioural practices. The persistence of both infections, despite ongoing deworming interventions, supports the need for integrated control approaches. These should combine preventive chemotherapy with improvements in water, sanitation and hygiene, alongside targeted health education, in order to reduce exposure and interrupt transmission in accordance with WHO recommendations (World Health Organization, 2023).

CONCLUSION

The findings of this study show that *Schistosoma haematobium* and *Ascaris lumbricoides* remain endemic among primary school pupils in Bantaje Ward, with moderate prevalence levels driven by a combination of environmental exposure, sanitation deficits and behavioural practices. Water contact with streams and ponds was significantly associated with urinary schistosomiasis, while open defecation, poor hygiene and eating food dropped on the ground were major determinants of ascariasis. Treatment-seeking behaviours were suboptimal, with many pupils failing to seek timely care. These results highlight the continued vulnerability of school-aged children to neglected tropical diseases in the area.

Recommendations

Based on the findings, the following recommendations are made:

1. Sustain and strengthen periodic mass drug administration (MDA) targeting school-aged children, in line with national NTD control guidelines.

Improve access to safe water sources and reduce reliance on streams and ponds through community-level water supply interventions.

2. Promote sanitation and hygiene education, particularly discouraging open defecation and encouraging proper handwashing and food handling practices.

3. Intensify school-based health education on risks associated with freshwater contact and barefoot walking.

4. Strengthen linkages between schools and primary healthcare facilities to enhance prompt treatment-seeking and follow-up for infected pupils.

5. Implement integrated WASH interventions, including improved toilets and safe waste disposal systems within schools and surrounding communities.

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