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Prevalence of *Schistosoma haematobium* Infection among Schoolchildren Dewormed within the Past Year in Agulu, Anambra State

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Abstract

Background: Urinary schistosomiasis caused by *Schistosoma haematobium* remains a significant public health concern in sub-Saharan Africa, particularly among school-aged children who are highly exposed to infested water bodies. Although mass drug administration (MDA) with praziquantel is widely implemented, reinfection continues to limit its long-term effectiveness in endemic communities.
Objective: This study determined the prevalence of *S. haematobium* infection among schoolchildren dewormed within the past year in Agulu, Anambra State, Nigeria, and examined associated demographic and clinical factors.
Methods: A cross-sectional study was conducted among 60 schoolchildren. Midday urine samples were collected and examined microscopically for the presence of *Schistosoma haematobium* eggs. Information on age, sex, water contact, urine appearance, and haematuria was obtained using structured questionnaires and standard urinalysis procedures. Data were analysed using descriptive statistics.
Results: The overall prevalence of infection was 11.7%. Infection was most common among children aged 11–13 years and occurred more frequently in females than in males. Haematuria was present in 14.7% of participants and was strongly associated with infection, with a higher proportion of positive cases among those with haematuria than among those without. In contrast, urine turbidity did not show a consistent relationship with infection. A considerable proportion of participants reported water contact, indicating ongoing exposure to transmission sources despite prior treatment.
Conclusion: The persistence of *S. haematobium* infection one year after MDA suggests ongoing transmission and rapid reinfection in the study area. These findings highlight the need for integrated control strategies, including improved water supply, sanitation, and hygiene, as well as sustained health education, to complement chemotherapy and achieve long-term reductions.

Keywords: *Haematuria; prevalence; Schistosoma haematobium; school-children.*

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Introduction

Schistosomiasis remains one of the most prevalent neglected tropical diseases (NTDs), posing a significant public health burden in low- and middle-income countries, particularly in sub-Saharan Africa. The disease is caused by parasitic trematodes of the genus *Schistosoma*, with *Schistosoma haematobium* responsible for urogenital schistosomiasis, a condition associated with chronic morbidity, including hematuria, bladder fibrosis, and an increased risk of bladder cancer(1, 2). Despite sustained global control efforts, schistosomiasis continues to affect over 200 million people worldwide, with over 90% of cases occurring in Africa(3).

School-aged children are the most vulnerable group due to frequent contact with contaminated freshwater bodies during domestic, recreational, and occupational activities(4, 5). Infection occurs when cercariae released by infected freshwater snails penetrate human skin, leading to repeated exposure and reinfection in endemic areas with limited access to safe water and sanitation(6). Chronic infection in children has been associated with anaemia, growth retardation, impaired cognitive development, and poor educational outcomes[7,8].

Control efforts have largely focused on preventive chemotherapy through mass drug administration (MDA) using praziquantel, as recommended by the World Health Organisation[9]. Although MDA has significantly reduced infection intensity in many endemic settings, its long-term impact is constrained by rapid reinfection and continued exposure to infested water sources[10,11]. Studies have shown that reinfection can occur within months after treatment, particularly in high-transmission areas. Previous studies on parasitic disease control have also demonstrated that gaps in knowledge, attitudes, and preventive practices can sustain transmission despite treatment interventions[12,13], while schistosomiasis-specific investigations have similarly reported rapid reinfection following praziquantel administration in endemic communities[14].

In Nigeria, schistosomiasis remains endemic in many rural and peri-urban communities, where reliance on untreated surface water sources is widespread[15,16]. The persistence of infection in such settings is driven by environmental exposure, inadequate sanitation, and behavioural factors that sustain transmission cycles. Assessing the prevalence of *Schistosoma haematobium* among previously treated children is therefore critical for understanding reinfection patterns and evaluating the effectiveness of ongoing control programs.

Given the ongoing implementation of school-based deworming initiatives, there is a need for localised data on the prevalence of infection among children treated during a defined period. Such data are essential for identifying gaps in intervention strategies and guiding evidence-based control measures. Therefore, this study aims to determine the prevalence of *Schistosoma haematobium* among schoolchildren treated within the past year, to provide insights into reinfection dynamics and improve schistosomiasis control efforts in endemic communities.

Materials and Methods

Study design and study site

The study was conducted in Agulu, a town in the Anaocha Local Government Area of Anambra State, Southeastern Nigeria, located at 6.117°N, 7.067°E. The area lies within the tropical rainforest zone and is characterised by undulating terrain, red lateritic soil, and multiple freshwater bodies, including streams, ponds, and Agulu Lake. The climate consists of a rainy season (April–October) and a dry season (November–March). These water bodies support domestic and economic activities, but also increase exposure to waterborne infections such as schistosomiasis. Agulu has been previously identified as endemic for urinary schistosomiasis.

A cross-sectional descriptive design was employed to determine the prevalence of *Schistosoma haematobium* infection among schoolchildren who had received deworming treatment in the previous year. This design enabled estimation of infection prevalence and assessment of possible reinfection. The study was conducted over a three-month period, during which sample collection and laboratory analysis were carried out.

Study population and sampling technique

The study population comprised schoolchildren aged 5-15 years enrolled in primary schools in Agulu, Anambra State, a group considered at high risk of schistosomiasis due to frequent contact with natural water bodies. Only pupils who had received deworming treatment within the preceding 12 months were included. Deworming status was verified using parental or guardian consent forms and, where necessary, confirmation from school authorities. Children were excluded if they were outside the age range, lacked consent, had no confirmed deworming history within the past year, were absent during sample collection, or were unable to provide urine samples.

Schools were selected using a simple random visit approach, and permission was obtained from school authorities prior to recruiting eligible pupils, with parental consent and child assent. The sample size was estimated using Cochran's formula, assuming a prevalence of 14%, a 95% confidence level, and a 5% margin of error, yielding a minimum of 185 participants. However, due to limited parental consent, cultural concerns, uncertainty regarding treatment history among pupils and guardians, and a smaller pool of eligible participants, only 60 pupils were ultimately recruited. Despite being below the calculated minimum, this sample size is adequate for an exploratory cross-sectional study. Results are presented with 95% confidence intervals to account for reduced statistical power.

Sample Collection and Parasitological Examination

Following ethical approval and informed consent procedures, urine samples were collected from eligible pupils. Each participant was provided with a sterile, wide-mouthed, screw-capped container labelled with a unique identification code and instructed to provide a midstream urine sample. Approximately 10–20 mL of urine was collected between 10:00 am and 2:00 pm, corresponding to the peak period of *Schistosoma haematobium* egg excretion.

Samples were transported promptly to the laboratory and processed within 2-4 hours of collection to preserve egg morphology and ensure diagnostic accuracy. Where immediate processing was not feasible, samples were temporarily stored at 4°C prior to analysis. Each sample was thoroughly mixed, and a 10 mL aliquot was centrifuged at 1000 g for 3 minutes using the standard method described by Cheesbrough (2005).

The supernatant was discarded, and the sediment was transferred onto a clean glass slide, covered with a coverslip, and examined under a light microscope using ×10 and ×40 objective lenses.

Identification of *S. haematobium* infection was based on the presence of characteristic ova with a terminal spine. Results were recorded as positive or negative, and egg counts were documented for positive samples. Infection intensity was classified as light (<50 eggs/10 mL of urine) or heavy (≥50 eggs/10 mL) in accordance with World Health Organisation guidelines.

Data analysis

Data were entered into Microsoft Excel and analysed using descriptive and inferential statistical methods. Descriptive statistics, including frequencies, means, standard deviations, and prevalence rates, were used to summarise the data. The prevalence of *Schistosoma haematobium* infection was calculated as the proportion of urine samples positive for eggs among all examined, expressed as a percentage.

Inferential analyses were performed to assess associations between categorical variables, such as sex and class, using the chi-square test, and to evaluate differences in infection intensity between male and female pupils using the independent-samples t-test. Results were presented in tables and graphical formats as appropriate, with all values reported to two decimal places. Statistical significance was set at $p < 0.05$.

Results

The study evaluated urine samples from 60 school children for Schistosoma *haematobium* infection, with Table 1 presenting the demographic and clinical characteristics of the study group. The study population comprised 34 males (56.7%) and 26 females (43.3%), indicating a slightly higher representation of males. Age distribution showed that most participants were within the 11–13 years age group (33.7%, n = 20), followed by 14–15 years (27.8%, n = 17), 8–10 years (26.2%, n = 16), and 5–7 years (12.3%, n = 7).

Overall, 7 of the 60 participants enrolled in the study tested positive, yielding a prevalence of 11.7%. Age-specific distribution showed that infection was highest among children aged 11–13 years (3 cases), followed by those aged 14–15 years (2 cases), while younger age groups (5–10 years) had fewer cases.

With respect to sex, females accounted for a higher proportion of infections (3 cases) compared to males (2 cases), although both sexes were similarly represented in the study population.

Urinalysis findings indicated that 31.7% of participants had cloudy urine, while 68.3% had clear urine. However, more infections were detected among children with clear urine than those with cloudy urine, suggesting that urine turbidity alone is not a reliable indicator of infection (Table 2).

Table 1: Demographics and clinical characteristics

Variable	Frequency	Percentage
Gender		
Male	34	56.7
female	26	43.3
Age range (Years)		
5 – 7	7	12.3
8 – 10	16	26.2
11 – 13	20	33.7
14 and 15	17	27.8
Urine colour		
Clear	41	68.3
Cloudy	19	31.7
Haematuria		
Present	9	14.7
Absent	51	85.3

Table 2: ***Distribution of positive samples across different variables***

Variable	Status	
	Positive (%)	Negative (%)
Age range (years)		
5 – 7	1 (8.7)	6 (91.3)
8 – 10	1 (14.1)	15 (95.9)
11 – 13	3 (14.3)	17 (85.7)
14 and 15	2 (9.6)	15 (90.4)
Gender		
Male	2 (6.4)	32 (93.6)
Female	3 (12.9)	23 (87.1)

The prevalence of haematuria was 14.7%, and a strong association was observed between haematuria and infection status. As shown in Figure 1, the prevalence of infection among participants with haematuria was markedly higher, approximately 40%, than among those without haematuria, indicating a strong association between haematuria and *S. haematobium* infection.

Water contact is a key risk factor in the transmission of *Schistosoma haematobium*. In this study, 24 participants reported a history of water contact, while 36 reported no contact, indicating that a notable proportion of the study population engages in activities that may expose them to potential sources of infection within the community. This distribution suggests varying levels of exposure among participants and reflects the continued presence of environmental conditions that may support transmission within the study area.

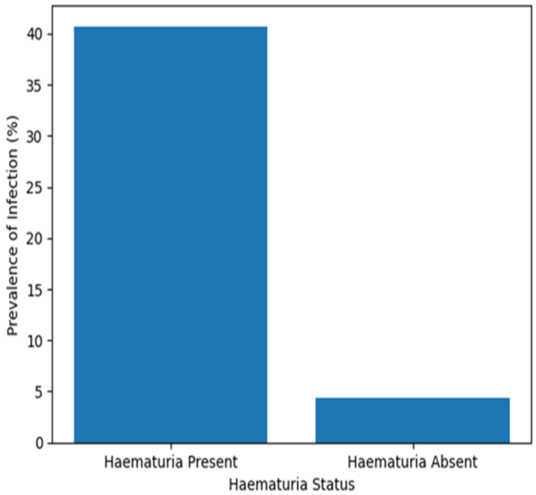

Figure 1: Prevalence of *Schistosoma haematobium* Infection by Haematuria Status

Discussion

This study demonstrates an 11.7% prevalence of Schistosoma haematobium infection among schoolchildren one year after mass drug administration (MDA) with praziquantel, indicating that transmission persists despite prior treatment. While this prevalence is lower than values reported in untreated endemic communities in Nigeria, it nonetheless reflects incomplete interruption of transmission and possible rapid reinfection, a pattern widely documented across sub-Saharan Africa[17, 18].

The age-related pattern, with peak infection among children aged 11–13 years, is consistent with the well-established epidemiology of urinary schistosomiasis. This age group typically exhibits the highest prevalence due to increased independence and more frequent contact with infested water bodies[19]. From a clinical perspective, this group is also at higher risk of cumulative morbidity, including bladder wall pathology and long-term complications such as hydronephrosis if infections are sustained over time[20]. The variation across age groups in this study likely reflects differences in behaviour rather than immunity, as younger children are often under closer supervision and have reduced exposure.

The slightly higher proportion of infection among females observed in this study highlights the influence of sociocultural roles on exposure risk. Females accounted for 3 of the 7 infections, compared to 2 cases in males, despite a higher proportion of males in the study population. In many Nigerian communities, female children are more involved in domestic water-related activities, including washing, bathing their siblings, and fetching water, thereby increasing their exposure to potentially contaminated water[21]. This contrasts with studies reporting male predominance due to recreational exposure, suggesting that gender-specific exposure patterns vary by setting[22]. From a public health standpoint, this underscores the need for gender-sensitive interventions, including targeted health education and improved access to safe water for domestic use.

A key clinical finding in this study is the association between haematuria and infection. Although only 9 participants (14.7%) presented with haematuria, infection was more frequent among those affected, with a substantially higher proportion of positives occurring in this group. This supports haematuria as a useful screening tool in endemic settings, particularly in resource-limited environments where microscopy may not be readily available[23]. However, the presence of infection among participants without haematuria suggests that some cases may be asymptomatic or of light intensity, which is common following recent MDA[1]. Clinically, this is important because even light infections can still contribute to chronic morbidity and ongoing transmission.

In contrast, urine turbidity showed poor correlation with infection, reinforcing evidence that it is a non-specific and unreliable indicator of urinary schistosomiasis[24]. This variation in haematuria relative to other urinary parameters highlights the importance of selecting appropriate diagnostic indicators in both clinical practice and epidemiological surveys.

Water contact remains central to understanding both infection persistence and treatment outcomes. Although only 76 participants reported direct water contact, this exposure is critical, as reinfection can occur within weeks of praziquantel treatment if individuals return to contaminated water sources[18, 25]. The persistence of infection in this study population, despite prior MDA, strongly suggests ongoing transmission driven by environmental exposure. From a treatment perspective, praziquantel is highly effective against adult worms but does not prevent reinfection, nor does it effectively target immature schistosomes[26]. Therefore, children who maintain frequent water contact are at increased risk of rapid reinfection following treatment, which may explain the continued prevalence observed in this study.

The variation in infection status between those with and without reported water contact may also reflect underreporting or indirect exposure, as children may not recognise all forms of contact, particularly during routine domestic activities. Additionally, the presence of transmission foci within the community suggests that even limited or occasional exposure may be sufficient to sustain infection.

From a public health perspective, these findings highlight key limitations of relying solely on annual MDA programmes. While MDA reduces worm burden and morbidity, it does not address the underlying environmental and behavioural determinants of transmission. The persistence of infection one-year post-treatment indicates that integrated control strategies are required, including improved access to safe water, sanitation infrastructure, health education, and snail control measures[27]. Without these complementary interventions, reinfection cycles will persist, undermining the long-term effectiveness of treatment programmes.

Clinically, the persistence of low-level infection following MDA raises concerns about chronic disease progression, particularly in repeatedly exposed children. Even light infections can lead to subclinical inflammation, anaemia, and impaired growth and cognitive development, emphasising the need for regular monitoring and repeated treatment in high-risk populations[20, 1].

Conclusion

In summary, the findings of this study demonstrate that urinary schistosomiasis remains endemic despite prior mass treatment, with infection patterns influenced by age, gender roles, haematuria status, and water contact behaviour. The results underscore the need for integrated, context-specific control strategies that combine chemotherapy with environmental and behavioural interventions to achieve sustainable reductions in transmission.

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Conflict of Interests

The authors declare no conflict of interest.

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Ethical Approval

Ethical approval for the study was obtained from the Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Ethics Committee, reference number COOUTH/HREC/Vol.II/FN:05/046. Permission to conduct the study was also obtained from school authorities. The purpose and procedures of the study were clearly explained to parents or guardians, teachers, and pupils before participation. Written or oral informed consent was obtained from parents or guardians, and assent from the children. Participation was entirely voluntary, and the confidentiality of all participants was strictly maintained. Participants were informed of their right to withdraw from the study at any time without any consequences.

Authors Contributions

CKE., concept, study design and manuscript drafting; NT data collection and analysis; UMO data collection and manuscript editing; All authors approved the final manuscript.

Availability of Data and Materials

Data can be accessed on reasonable request to the corresponding author.

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