Scientific Reports in Life Sciences 5 (3): 48-56

DOI: https://doi.org/10.5281/zenodo.13781025

Urinary Schistosomiasis in pupils of Almajiri Schools in Zangon-Shanu, Zaria, Kaduna State, Nigeria

Folashade Sarah Ojeleye[1], Zainab Usman Bello[1,] Ochuko Orakpoghenor[2]*

[1]Science Laboratory Technology, Nigerian Institute of Leather and Science Technology, Zaria, Nigeria
[2]Veterinary Pathology, Bayero University Kano, Nigeria
**Email; ochuko.orakpoghenor@gmail.com*

Received: 13 July 2024 / Revised: 25 August 2024/ Accepted: 29 August 2024 / Published online: 18 September 2024.
How to cite: Ojeleye, F. S., Bello, Z. U., Orakpoghenor, O. (2024). Urinary Schistosomiasis in pupils of Almajiri Schools in Zangon-Shanu, Zaria, Kaduna State, Nigeria, Scientific Reports in Life Sciences 5(3), 48-56. **DOI:** https://doi.org/10.5281/zenodo.13781025

Abstract

Schistosomiasis is a significant public health concern due to its widespread prevalence and the associated risks to the well-being of affected populations. This study investigates the prevalence and determinants of urinary schistosomiasis among pupils in Zangon-Shanu Zaria, Kaduna State, Nigeria. Two hundred pupils between the ages of 8-17 years in four Almajiri schools were selected randomly in four Almajiri schools, from June 2021 to January 2022, in the study area. A urine sample was collected from each pupil and analyzed for *Schistosoma* using the sedimentation technique. A questionnaire was also administered to obtain demographic data. Results revealed that out of the 200 pupils examined, 26 (13.0%) were positive for schistosomiasis, with the highest prevalence in Malam Aminu school (18.3%) and the lowest in Malam Jafar school (5.0%). There was a higher prevalence of schistosomiasis among pupils using well water (54.0%) and borehole water (31.0%) compared to those using tap water (10.0%) or pond water (0.0%). Furthermore, 90% of pupils who swim were infected, 53.0% of the infected pupils used open field toilet facilities, while 47% used pit latrines. The study provides valuable insights into the prevalence of urinary schistosomiasis and its associated risk factors among pupils in the area. It, therefore, underscores the importance of water sources and contact activities in transmitting the disease. Hence, there is a need for targeted interventions, such as health education and improved access to safe water and adequate sanitation facilities, to reduce the burden of schistosomiasis among school-going children in the area.

Keywords: Schistosomiasis, Pupil, Urine, Sedimentation, Zaria

Introduction

Urinary schistosomiasis, caused by the parasitic flatworms of the genus *Schistosoma*, remains a persistent public health challenge in many tropical and subtropical regions, affecting millions of individuals worldwide (Verjee, 2019; Comelli et al., 2023). Among the vulnerable populations, school-aged children are particularly susceptible, often exposed to contaminated freshwater sources during routine activities (Stothard et al., 2013; Aula et al., 2021). In this context, our study focuses on the prevalence and associated factors of urinary schistosomiasis among pupils attending Almajiri schools in the Zangon-Shanu Zaria, Kaduna State, Nigeria. This area's unique demographic and environmental characteristics provide an opportunity to gain valuable insights into schistosomiasis transmission dynamics within a specific regional context.

Zangon-Shanu Zaria, located in the Kaduna State of Nigeria, represents a region where access to clean water and sanitation facilities is often limited, creating an environment conducive to spreading waterborne diseases (Sulaiman et al., 2018). Understanding the prevalence of urinary schistosomiasis among pupils in this locality is crucial, given its potential impact on the health and educational outcomes of the younger population. In addition, identifying specific risk factors, such as school-specific variations, age distribution, water sources, water-related activities, and sanitation practices associated with schistosomiasis transmission in schools, can inform targeted public health interventions. These can contribute to developing effective and contextually relevant disease prevention and control strategies.

The significance of our study lies not only in its potential to contribute to the global understanding of schistosomiasis but also in its capacity to offer actionable insights to local health authorities in Zangon Shanu Zaria. By elucidating the prevalence rates and factors influencing the transmission of urinary schistosomiasis, our research seeks to provide a foundation for evidence-based interventions that address the unique challenges faced by pupils in this region. Ultimately, our collective efforts in unraveling the intricacies of schistosomiasis in Zangon-Shanu Zaria would contribute to the broader goal of improving the health and well-being of the affected communities. This study, therefore, aimed to determine the prevalence and associated factors of schistosomiasis among pupils attending different Almajiri schools in Zangon-Shanu Zaria, Kaduna State, Nigeria.

Material and methods

Study area

The study area, Zaria, lies between 11°3'N and 7°42'E in Nigeria's northern Guinea savannah zone. It has a tropical savannah climate with distinct wet (May to October) and dry (November to April) seasons (Happold, 1987). Zaria draws its water from slow-flowing rivers and seasonal burrow pits, which harbor Schistosomiasis-transmitting Snail hosts, e.g., *Bulinus species.* Intensive irrigation programs and dams also characterize Zaria.

Ethical consideration

Permission for the work was collected from the teacher (Malam) of the selected school. The Pupils of the selected schools were informed and consented to the objective of this study.

Study population

The study population comprises Almajiri Schools of Zangon Shanu Samaru Zaria. Four almajiri schools were selected randomly for the study. Permission was sought from the Malams (scholars) of the schools selected. The Malams (scholars) of the selected schools were visited and briefed on the purpose of the research and a date was fixed for sample collection. The study population comprised 200 Almajiris aged between 8-17 years.

Collection of urine sample

200 urine samples were collected separately in specimen bottles from the Almajiri schools. The samples were collected between 10:00 a.m. and 12 noon in each school and analyzed the same day. Each child was given 10 mL of sterile plastic container for the urine collection. The sample was arranged in a polythene bag and then transported to the Laboratory for analysis.

Analysis of urine for *Schistosoma* ova

The sedimentation technique was used for the samples' parasitological examination, as Cheesbrough (2006) outlined. To each urine sample with visible blood or cloudiness, two drops of saponin agent were added to dehaemoglobinize the red blood cells so as tower added to dehaemoglobinize the red blood cells to enhance easier egg detection. About 10 mL of urine was transferred to test tubes and centrifuged at 3000 rpm for 5 minutes to sediment the *Schistosoma* egg. The supernatant fluid of the centrifuged urine was discarded, and the sediment was transferred to a slide using a Pasteur pipette covered with a cover slip. It was examined microscopically at x 10 and x 40 objectives for the *Schistosoma* egg.

Data Analysis

Data were presented in tables using descriptive statistics. The specific prevalence of the disease was calculated and expressed as a percentage.

Results

Out of the 200 pupils examined, 26 (13.0%) tested positive for schistosomiasis, with the highest (18.3%) from Malam Aminu and the lowest (5.0%) from Malam Jafar schools (Table 1). Based on age distribution, 13.4% were 8-12 years old, and 12.5% were 13-17 years old (Table 1).

Based on the sources of water, the highest prevalence of schistosomiasis was in pupils who used well water (54.0%), followed by borehole water (31.0 %), then tap water (10.0%). No infection in the pond (0.0%) (Fig. 1). Water contact activities revealed that 90% of those who swam were infected, and from toilet facilities, 53.0% used open fields while 47% used pit latrines (Fig. 1).

Table 1. Prevalence of schistosomiasis, based on school and age, among pupils attending different Almajiri schools in Zangon-Shanu Samaru Zaria, Kaduna State, Nigeria

	No. examined	**No. positive**	**Proportion (%)**	**95% CI**
School				
Malam Aminu	60	11	18.3	8.5-28.1
Malam Jafar	40	2	5.0	1.7-11.7
Malam Shehu	50	8	16.0	5.8-26.2
Malam Habibu	50	5	10.0	1.7-18.3
Age				
8-12	112	15	13.4	7.1-19.7
13-17	88	11	12.5	5.6-19.4
Overall	**200**	**26**	**13.0**	**8.3-17.7**

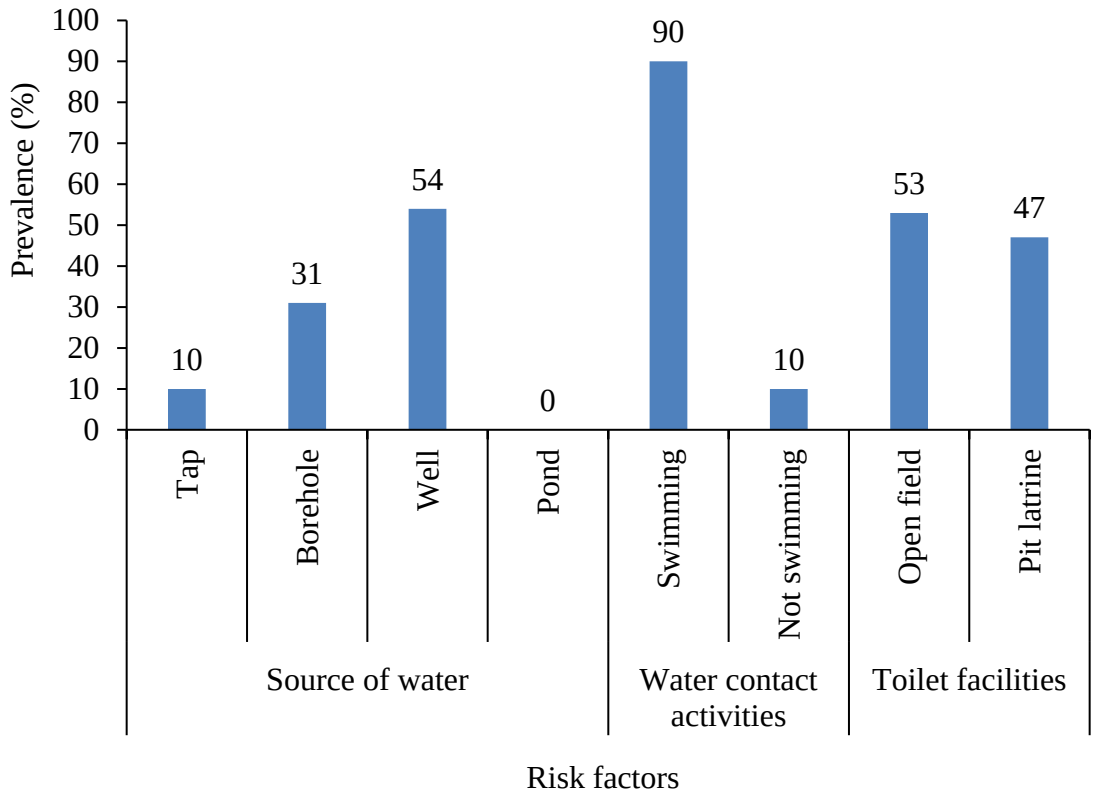

Figure 1. Prevalence of schistosomiasis, based on sources of water, water contact activities, and toilet facilities, among pupils attending different Almajiri schools in Zangon-Shanu Samaru Zaria, Kaduna State, Nigeria.

Discussion

As revealed in this study, the reported overall schistosomiasis prevalence of 13.0% among pupils in the Zangon-Shanu Zaria area underscores the significant health burden posed by this parasitic infection. This prevalence rate reflects that a substantial portion of the school-aged population suffers from urinary schistosomiasis, emphasizing the urgent need for targeted public health interventions in the area. Previous studies in Zaria, Kaduna State, and Nigeria have reported varying prevalence rates of urinary schistosomiasis among school children, ranging from 10.5% to 23.8% (Omenesa et al., 2015; Bishop & Akoh, 2018; Sulaiman et al., 2018; Adamu et al., 2019; Gamde et al., 2021; Balogun et al., 2022; Kone et al., 2022).

The identification of variations in prevalence rates among different schools in the current study, notably with Malam Aminu recording the highest prevalence at 18.3% and Malam Jafar the lowest at 5.0%, raises critical questions about the localized factors influencing the transmission dynamics

of the disease. The observed disparity in schistosomiasis prevalence between these schools suggests that the risk factors contributing to infection may be heterogeneous and influenced by specific contextual elements within each school environment. Factors such as differences in water sources, sanitation facilities, or local ecological conditions could play a key role (Sulaiman et al., 2018). Further investigation into the unique characteristics of these schools, including their water access and sanitation infrastructure, would be crucial in unraveling the reasons behind these varying prevalence rates.

Based on age distribution, the study reveals that 13.4% of pupils aged 8-12 years and 12.5% of those aged 13-17 years tested positive for urinary schistosomiasis. While the difference in prevalence between the two age groups is minimal, these findings highlight the importance of considering age-specific factors when assessing the burden of schistosomiasis in this population (Stothard et al., 2013; Bartlett et al., 2022).

Several factors may contribute to the observed age-related differences in the prevalence of schistosomiasis. Younger children (8-12 years) may be more engaged in water-related activities, given their proclivity for play and recreation in water bodies. At the same time, older children (13-17 years) may have increased awareness of the risks associated with water contact, potentially altering their behaviors and reducing the risk of infection. Social and cultural factors may also play a role in influencing the likelihood of exposure to contaminated water sources and engagement in high-risk activities (Stothard et al., 2013; Bartlett et al., 2022).

The findings from this study also underscore the critical role that water sources play in the transmission of schistosomiasis within the studied population. The most striking revelation is the substantially high prevalence of schistosomiasis among pupils using well water, with a prevalence rate of 54.0%. This rate suggests that well water may be a significant source of contamination, potentially due to freshwater snails acting as intermediate hosts for the Schistosoma parasite (Dodangeh et al., 2019). Understanding the specific factors contributing to the contamination of well water becomes imperative for devising targeted interventions to mitigate the risk of schistosomiasis transmission through this source.

The study further identifies borehole and tap water as alternative sources contributing to schistosomiasis prevalence, although at lower rates of 31.0% and 10.0%, respectively. These findings imply that even seemingly improved water sources are not free of the risk of contamination. Borehole water, often considered a safer alternative to surface water, may still

harbor the parasites, emphasizing the need for water quality assessments and continuous monitoring to ensure the safety of such sources. Similarly, detecting schistosomiasis among tap water users suggests contamination may occur at various points along the water distribution system (Evan Secor, 2014), thus, the need for careful assessment of water supply infrastructure.

A notable and unexpected finding is the absence of schistosomiasis infections among pupils using pond water. Although this result may initially seem counterintuitive, given the historical association between ponds and schistosomiasis transmission (Houmsou et al., 2021), it could be indicative of specific ecological factors mitigating transmission in the studied ponds. Further research exploring the unique characteristics of these ponds would be essential to unravel the reasons behind this lack of infection.

The high prevalence rate among swimmers emphasizes the vulnerability of individuals engaging in water contact activities, particularly swimming, to schistosomiasis. Prolonged exposure to infested water bodies, where freshwater snails act as intermediate hosts for the *Schistosoma* parasite, increases the likelihood of transmission (Reitzug et al., 2023). This finding has critical implications for public health interventions, emphasizing the need to educate communities on the risks of swimming in open water sources and promoting alternative recreational activities that do not involve direct water contact.

Also, in this study, 53.0% of infected pupils reported using open fields, while 47% used pit latrines. The higher prevalence among those using open fields highlights the potential role of open defecation in the transmission of schistosomiasis. Poor sanitation practices, especially in areas lacking adequate toilet facilities, may contribute to the contamination of water sources with Schistosoma eggs, perpetuating the cycle of infection (Grimes et al., 2015; Hailu et al., 2020; Phillips et al., 2022).

In conclusion, the variation in schistosomiasis prevalence among schools in the Zangon-Shanu Zaria area underscores the complex interplay of environmental, ecological, and socioeconomic factors influencing disease transmission. Tailored interventions, informed by a thorough understanding of these factors, are essential to mitigate the prevalence and improve the health outcomes of pupils in the studied schools and, by extension, the wider community. Further research into the specific determinants driving these differences is needed, thus providing a foundation for more effective and targeted public health measures.

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