Prevalence and Risk Factors of Urinary Schistosomiasis Among Children Living Near Streams in Kpakungu, Fadukpe, and Chanchaga area of Minna, Niger State

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Abstract

Background: Urinary schistosomiasis, caused by *Schistosoma haematobium*, is a significant waterborne disease predominantly affecting children in sub-Saharan Africa. This study aims to assess the prevalence and associated risk factors of urinary schistosomiasis among children living near streams in the Kpakungu, Fadukpe, and Chanchaga areas of Minna, Niger State.

Methods: A cross-sectional study was conducted involving 200 school-aged children (3-15 years) from Kpakungu, Fadukpe, and Chanchaga municipal areas. Urine samples were collected and analyzed for the presence of *S. haematobium* eggs using standard diagnostic techniques, including wet preparation, sedimentation, and filtration methods. Data were stratified based on age, sex, and geographical location, and statistical analysis was performed using SPSS version 24, with significance set at $P<0.05$.

Results: The overall prevalence of urinary schistosomiasis was 15%. Age-specific prevalence showed 0% in children under 6 years, 5% in those aged 6-10 years, and 10% in those aged 11-15 years. Males had a significantly higher prevalence (13%) compared to females (2%). Geographically, Kpakungu had the highest prevalence (8%), followed by Chanchaga (4%) and Fadukpe (3%).

Conclusion: The study highlights a moderate prevalence of urinary schistosomiasis among children in Minna, with higher risks associated with male gender and proximity to streams. Interventions focusing on improved water access and targeted health education are essential to reduce the burden of the disease.

Keywords: Urinary schistosomiasis, *Schistosoma haematobium*, prevalence, children, Minna, Niger State, risk factors, public health

Introduction

Urinary schistosomiasis, also known as bilharziasis, is a waterborne disease caused by the parasitic species *Schistosoma haematobium*, a digenic trematode that resides in the blood vessels of humans and livestock. Among the species of *Schistosoma* that commonly infect humans are *S. mansoni*, *S. haematobium*, *S. japonicum*, and *S. intercalatum*. Globally, schistosomiasis affected approximately 236.6 million people in 2019 (1). The disease leads to an estimated 4,400 to 200,000 deaths annually (2). Nigeria has the highest burden of schistosomiasis worldwide, with around 29 million people infected, including 16 million children, and approximately 101 million people at risk (3). This study focuses on *S. haematobium*, the causative agent of urinary schistosomiasis, which is one of the most significant neglected tropical diseases, affecting over 200 million people globally and causing an estimated 280,000 deaths annually in Africa alone (4). *S. haematobium* is most prevalent in Africa, with the highest prevalence and intensity typically observed in school-age children, adolescents, and young adults (5,6).

Urinary schistosomiasis manifests in a variety of clinical symptoms, including hematuria (presence of blood in urine), dysuria, and suprapubic pain. In sub-Saharan Africa, *S. haematobium* infections are known to cause dysuria, bladder-wall pathology, and significant hydronephrosis (7). Additional health impacts include an increased risk of anemia, bladder cancer, nutritional deficiencies, delayed puberty, stunted growth, and impaired cognitive development in affected individuals, leading to decreased physical activity, school performance, work capacity, and productivity (8). Environmental and socio-economic factors such as poor sanitary conditions, lack of potable water, inadequate housing, and poverty have been identified as key contributors to the persistence of this parasitic infection (9,10). Additionally, the infection is associated with rural agricultural practices and activities around freshwater bodies, such as swimming, fishing, washing, and bathing, where the snail intermediate hosts breed, further perpetuating the spread of the disease (11).

The primary aim of this study is to evaluate the prevalence of urinary schistosomiasis among children residing near streams in the Kpakungu, Fadukpe, and Chanchaga municipal areas of Minna, Niger State. Specifically, the study seeks to determine the distribution of urinary schistosomiasis across different age groups, assess variations in prevalence between male and female children, and analyze the geographical distribution of the disease within the specified locations.

Methodology

The study was conducted to assess the prevalence of urinary schistosomiasis among school-aged children (3-15 years) residing near streams in the Kpakungu, Fadukpe, and Chanchaga municipal areas of Minna, Niger State. A total of 200 urine samples was determined as adequate sample size using Raosoft scientific calculator (12), at margin of error 6.9% and confidence level of 95%. The sample were collected from students/pupils in these areas, with a distribution of 100 samples from Kpakungu, 50 from Fadukpe, and 50 from Chanchaga, based on the school population of ratio 2:1:1 respectively. The samples were carefully analyzed to determine the presence of *Schistosoma haematobium* eggs, with data stratified based on the demographic profiles of the participants, including age and sex. The study was carried out at the Gasiya Medica Diagnostic Laboratory Services in Minna.

The analysis of urine samples involved several diagnostic techniques, including wet preparation, sedimentation, and filtration methods. Microscopic examination was performed to detect the presence and intensity of *S. haematobium* eggs, using both ×10 and ×40 objectives for confirmation. In addition, chemical reagent strips were utilized to detect microscopic hematuria, a common indicator of schistosomiasis. The data collected were inputted into Microsoft Excel for cleaning and exported to SPSS version 24 for statistical analysis, with significance set at $P<0.05$ for the comparison of parasite discovery rates.

Results

Table 1: Distribution of urinary schistosomiasis based on age after microscopic examination (N=200)

Age (years)	Frequency (n)	Percentage Infected (%)
<6	30	0
6-10	70	5
11-15	100	10

Table 2: Prevalence of urinary schistosomiasis based on sex (N=200)

Sex	Frequency (n)	Percentage Infected (%)
Male	140	13
Female	60	2

Table 3: Rate of urinary schistosomiasis based on place of study

Place of Study	Frequency (n)	Percentage Infected (%)
Kpakungu	100	8
Fadukpe	50	3
Chanchaga	50	4

Discussion

This study aimed to assess the prevalence of urinary schistosomiasis among children living near streams in the Kpakungu, Fadukpe, and Chanchaga areas of Minna, Niger State. The overall prevalence observed in this study was 15%, which is slightly lower than the 19% prevalence reported by Damen et al. in Kaduna (13) and higher than the 0.67% recorded by Okpala et al. in Jos (14). The differences in prevalence rates across various studies could be attributed to several factors, including differences in environmental conditions, levels of exposure to infested water bodies, and local health interventions. The lower prevalence among younger children (0-5 years) compared to older children (6-15 years) suggests that younger children may have less exposure to contaminated water, possibly due to closer supervision by parents and limited engagement in high-risk activities such as swimming in streams.

The analysis by sex revealed a significantly higher prevalence of urinary schistosomiasis among male children (13%) compared to female children (2%). This finding is consistent with previous studies in Northern parts of Nigeria (13-16), which also reported higher prevalence rates among males. The increased risk in males is likely due to their greater participation in activities such as swimming, fishing, and irrigation, which are commonly associated with water contact and exposure to the infective stage of Schistosoma haematobium (cercariae). Additionally, socio-cultural factors may play a role, as girls are often discouraged from swimming in open water bodies, thereby reducing their risk of infection.

Geographical analysis showed that Kpakungu had the highest prevalence of urinary schistosomiasis (8%), followed by Chanchaga (4%) and Fadukpe (3%). The relatively lower prevalence observed in this study compared to previous reports, such as the 49.7% prevalence in Ohaukwu LGA and 11% in Onicha LGA as noted by Uneka et al. (17), may be attributable to several factors. Firstly, the introduction of the WHO's praziquantel treatment program in 2014 may have contributed to a reduction in infection rates in the studied areas (1). Secondly, the increasing development of private boreholes for water supply in some communities may have reduced the reliance on natural water bodies for domestic use, thereby decreasing exposure to infested waters. However, it is important to note that access to borehole water is still limited, particularly among lower-income populations, which may explain the continued presence of schistosomiasis in the study areas.

One of the strengths of this study is its focus on a vulnerable population i.e. children living in close proximity to streams, who are at higher risk of contracting urinary schistosomiasis due to their frequent exposure to contaminated water sources. Additionally, the study's sample size was adequately calculated to ensure representativeness, and the use of well-established diagnostic methods, such as urine microscopy and chemical reagent strips, provided reliable data on infection rates (18). However, the study also has some limitations. The cross-sectional design only provides a snapshot of the prevalence at a single point in time, which may not capture seasonal variations in infection rates. Furthermore, the reliance on urine microscopy, while effective, may not detect low-intensity infections, potentially underestimating the true prevalence of the disease (19). Finally, the study did not include an assessment of water contact behavior or access to sanitation facilities, which are important factors in understanding the transmission dynamics of schistosomiasis in these communities.

Conclusion

The study highlights the significant burden of urinary schistosomiasis among children living near streams in Minna, Niger State, revealing that older children and males are particularly at risk. The variation in prevalence across different geographical areas, with Kpakungu showing the highest rates, underscores the role of local factors such as water source access and sanitation practices in the transmission of the disease. Although the cross-sectional design of this study provides valuable insights, it also presents limitations, particularly in capturing the impact of seasonal changes on infection rates. Therefore, there is a clear need for future research to include longitudinal studies and behavioral assessments to deepen our understanding of schistosomiasis transmission and to guide the development of more effective, targeted interventions.

To address the findings of this study, several recommendations are put forward. Firstly, there is a pressing need for public enlightenment campaigns to raise awareness about urinary schistosomiasis and its risks, particularly in high-prevalence areas. The government should prioritize the provision of potable water and proper waste disposal facilities, especially in rural communities and settlements near rivers and dams. Additionally, mapping the distribution of schistosomiasis and other neglected tropical diseases (NTDs) with comprehensive surveillance systems is crucial for effective disease management and national reporting. Finally, reducing the frequency of water contact for leisure and domestic activities, such as swimming, fishing, and washing, is recommended to minimize exposure to contaminated water sources and reduce the risk of infection.

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Nil conflict of interest