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Research Article

Urinary Schistosomiasis Among Pupils in Public Primary Schools at Riverine Areas in North-Central Nigeria

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Abstract

Background: Schistosomiasis is a disease caused by parasitic flatworms called the Schistosomes and do spread within its hosts by contacts with fresh water that is contaminated with the infective cercaria. A study was conducted to determine the prevalence of urinary schistosomiasis among public primary school pupils at Riverine areas in North-central Nigeria.

Methods: Urine samples were collected from 1,393 pupils aged 4-12years and analysed using microscopy to detect the presence of Schistosoma haematobium eggs.

Results: The prevalence of urinary schistosomiasis was significantly high (39.8%), $p<0.05$ and the egg counts revealed that most of these infections were light infections (≤ 50 eggs/10 mL urine). A comparison of the intensity of infection between light, moderate and high infections was not statistically significant $p>0.05$. This infection cuts across all age groups with the highest prevalence from the 7-9 years age group. More males were infected compared to female pupils with no statistically significant difference ($p>0.05$).

Conclusion: The prevalence of Urinary schistosomiasis was significantly high among primary school pupils in the study area. This study underscores the urgent need for targeted interventions, including health education about this infection and mass medication to mitigate the burden of urinary schistosomiasis among primary school pupils.

Keywords: urinary schistosomiasis; pupils; public primary schools; riverine areas; nigeria

Introduction

Background of the Study

Schistosomiasis, a chronic progressive parasitic disease characterized by its persistent nature and the formation of granulomas and poses a significant public health challenge. Although not causing immediate fatality, the disease holds severe and enduring implications for affected individuals due to its debilitating nature [1]. The prevalence of Schistosoma infections ranks second among the major Neglected Tropical Diseases linked with poverty [2]. Globally, approximately 240 million individuals are infected, with an estimated 534,000 fatalities annually [3].

The worldwide impact of schistosomiasis was calculated to result in 1.4 million disability- adjusted life-years, according to estimates. In 2015, the World Health Organization (WHO) reported that 229 million individuals were afflicted by schistosomiasis, with over 90% of these cases occurring in sub-Saharan Africa. Among those affected, 54% were children of school age, ranging from 5 to 15 years old [4].

Urinary schistosomiasis, primarily caused by Schistosoma haematobium, displays higher prevalence rates in remote areas of Nigeria [5]. The prevalence of this disease within communities is linked to the presence of water reservoirs such as dams, rivers, or streams, crucial for meeting the domestic and recreational water needs of the local population [6]. Infection in humans occurs when individuals come into contact with water contaminated by the infective stage of the parasites, known as free-swimming cercariae. These cercaria possess the ability to directly penetrate the skin of individuals engaged in water-related activities such as fishing, laundry, bathing, and swimming [7]. Individuals at the highest risk are those residing in or visiting areas where the disease is widespread and come into contact with water hosting the intermediate host [8]. Farmers and fishermen bear the brunt of this ailment due to its association with their occupations, exacerbated further by inadequate sanitary practices. Open urination and defecation in ponds, rivers, and streams which are utilized for various water-related activities contribute significantly to this issue [9]. Children, in particular, are highly susceptible to contracting urinary schistosomiasis due to their inclination to playing in water, which increases their vulnerability to infection [10]. In Sub-Saharan Africa, more than 90% of schistosomiasis cases are prevalent, with Nigeria leading with an estimated 29 million cases reported [11]. Throughout Nigeria, urinary schistosomiasis has been identified in various regions, showing

varying intensity and prevalence rates, with incidences believed to be increasing [12]. Despite the absence of current estimates, past assessments indicate approximately 29 million infected individuals, including 16 million children, with101 million at risk in the country [13]. Given the identification of urinary schistosomiasis across various regions in Nigeria with varying intensity and prevalence rates, coupled with indications of increasing incidences [12], the absence of current estimates underscores the importance of past assessments. These assessments indicate a substantial burden, with approximately 29 million infections nationwide, disproportionately affecting 16 million children and putting 101 million individuals at risk [11]. With chronic infections more prevalent in endemic regions due to repeated exposure to infective cercaria, the impact is particularly pronounced among school-aged children and young adults, whose susceptibility and peak egg excretion rates decline with age [14].

Nigerian school children continue to face significant morbidity due to schistosomiasis [15]. The highest infection intensities are typically observed in children aged 5 to 15 years in endemic areas. Localized studies, such as those in Kwara State, have consistently reported high prevalence and intensity, indicating enduring endemicity [16].

Therefore, investigating the prevalence and intensity of schistosomiasis in Kwara State, North-central Nigeria is crucial for informing targeted public health interventions aimed at reducing the disease burden and improving the health outcomes of affected children and communities. This research not only provides valuable epidemiological data but also supports the development and implementation of effective strategies to mitigate the impact of schistosomiasis in Nigeria.

This study aimed to determine the prevalence and intensity of urinary schistosomiasis among pupils attending public primary schools at riverine areas in North-central Nigeria.

Material and Methods

Description of Study Area

This study was carried out in Public Primary Schools in riverine areas in Kwara State, North-central Nigeria. Ilorin the state capital is situated in the transitional zone between the Northern and Southern parts of Nigeria. Generally, the overall sanitation conditions of some part in this study area are poor and the provision of portable water, electricity, and toilet facilities is insufficient. Some residents heavily rely on natural water sources like the rivers, streams or ponds for household usage, particularly during the dry season from November to April. There is the presence of Rivers like River Asa, originating from Oyo state, flows through Ilorin in a South-North direction and serves as a natural demarcating boundary between Eastern and Western Ilorin which serves as source of irrigation water to farmers and other recreational activities that remain as a suitable habitat for the intermediate host [17].

The Study area lies within latitude 8°30′00″N and longitude 4°35′00″E and the inhabitants in the study area mainly comprise of civil servants, farmers, traders, artisans, and individuals from the organized private sector. Notably, key agricultural produce in this area includes maize, yam, beans, vegetables, and cassava. The vegetation of the study area lies within the Tropical Savannah Zone and the natural vegetation of the area is dominated by grasslands, scattered trees, and shrubs adapted to the alternating wet and dry conditions. The Area do experience a diverse climate marked by distinct wet and dry seasons. The rainy season typically commences towards late April, extending through October, while the dry season prevails from November to April. Temperatures in the study area range from33°C to 35°C between November and January, increasing to 34°C to 37°C from February to April with an Annual rainfall varying between 990.3mm and 1318mm. The city's rainfall follows a double maximal pattern and exhibits considerable variability both temporally and spatially.

Study Design

The research is a school based cross-sectional study using qualitative method of data collection to access information on possible risk factors and using 325 µm wire Mesh for urine filtration techniques from urine samples collected from primary school pupil attending public primary school.

Study Population

The research focusses on primary school pupils aged 4-12 years attending Public Primary Schools in the randomly selected communities in riverine areas in Kwara State, North-central Nigeria.

Sampling Techniques

A random sampling technique using the balloting method was employed to select representative schools and sampling units. The names of the primary schools were gotten from the Education authority of the state. Number of samples collected was determined by proportionate sampling method and the targeted population (pupils within the age group 4 to 12 years) were selected by simple random sampling technique in each of the selected schools.

Sample Size Determination

The sample size for the study was determined by as described by Abdulkareem et al.,[19] and overall, 1,393 pupils were sampled for this study.

Ethical Considerations

Ethical approval was obtained from the Ethical Review Committee at the Kwara State Ministry of Health with Reference No: ERC/MOH/2023/12/170 and Kwara State Universal Basic Education Board (KWSUPEB) with reference No. KWSUBEB/SUB/1400/VOL.I/42.

Intense Advocacy and community mobilization was carried out to ensure that community leaders and parents in the selected communities are engaged actively. The comprehensive nature of the study, including its associated risks and benefits, were fully disclosed and communicated to community heads, school administrators, class teachers, parents, and selected pupils. This was done to ensure their complete understanding and awareness of the study's scope and implications. Prior to the participation, informed consent was acquired from the parents or legal guardians of the involved pupils. Safety measures such as the use of Personal Protective Equipment (PPE) such as Disposable Hand gloves, use of sterile universal bottles for collection of urine, proper disposal was ensured using disposable Bio hazard bags during sample collection and processing.

The confidentiality of all gathered data was rigorously upheld and comprehensive measures were implemented to safe guard the privacy and rights of all participants.

Sample Collection and Transportation

Sample collection was conducted between 10:00am and 14:00 pm, which is the period when Schistosoma haematobium egg secretion reaches its peak. Before collecting urine specimens, pupils were encouraged to run a distance of 200 meters across the school field to stimulate urination. Participants were provided with disposable plastic cups labeled with codes for school age, class, and serial number. Hand soap and sanitizers was provided for all participants to disinfect their hands before and after sample submission. From the urine specimens collected in the disposable cups, 10ml of urine was transferred into appropriately labeled universal bottles using a syringe. The collected samples were preserved by adding 10ml of 70% alcohol and were carefully stored in sturdy paper cartons and secured with adhesive tape to prevent any spills or displacement during transportation to the laboratory for further analysis.

Data Collection

Semi-well-structured, and standardized pro-forma was administered to the pupils with the assistance of research staff and school teachers. The pro-forma aims to collect demographic data, including the pupils' names, ages, genders, ethnicities, and durations of stay in the community, parents' educational backgrounds, water contact habits, and history of deworming. This process took place while the pupils submit urine samples at the selected public primary schools.

Laboratory Analysis of Samples

Microscopy Examination Procedure for Urine Filtration Technique

The preserved urine samples were examined using the filtration technique as described by Edungbola et al [20] involving a 325 Wire Mesh. Then urine samples were passed through the Wire Mesh filter, folded conically and placed in a small plastic funnel atop an empty beaker or flask. The sediment obtained was transferred to a cross-hatched Petri dish and examined under a dissecting microscope at 20x magnification to identify characteristic Schistosoma haematobium eggs. Eggs were counted using a hand tally counter, expressing the infection intensity as eggs per 10ml of urine. The number of eggs present per 10ml urine was counted and graded as follows: light (50 eggs/10 ml urine), moderate (51- 499 eggs/10mlurine) and heavy (>500 eggs/10 ml urine) according to the guidelines of World Health Organization. For quality control, egg counting will be done twice to ensure precision and accuracy.

Interpretation of Result

Presence of ova with a conspicuous terminal spine indicates positive while absence indicated negative.

Data Analysis

All data was entered and organized in a Microsoft Excel 2016 spreadsheet subsequently, data analysis was performed using SPSS version 23.00. Descriptive statistics were utilized to ascertain participant characteristics, frequencies, percentages, means, and standard deviations for relevant variables. Chi-square tests were used to compare these parameters and ANOVA was also used to determine the associations between observed variables at a 95% confidence interval.

Results

As shown in table 1, the overall prevalence of urinary schistosomiasis in the studied population is 39.8%. The prevalence rates in individual schools in the communities ranged from27.8% to 50.9%. While 4 schools in community F had the highest prevalence of 50.9% the least prevalence of 27.8% was seen among 5 schools in community C. The overall prevalence of 39.9% was statistically significant p<0.05 but the differences in the rates among schools in these communities was not statistically significant P>0.05.

Table1: Prevalence of urinary schistosomiasis among Public Primary School Pupils in the study area.

Number of schools in Communities	Examined	Infected (%)	ANNOVA (p-value)
5 Schools in community A	279(20.0)	121 (43.4)	-
6 Schools in community B	281(20.2)	109(38.8)	-
5 Schools in community C	269(19.3)	72(27.8)	0.0068
5.Schools in community D	285(20.5)	110(38.6)	-
4 Schools in community E	279(20.0)	142 (50.9)	-
Total	**1,393(100.0)**	**554 (39.8)**	-

P<0.05

Table 2 described the distribution of pupils examined for urinary schistosomiasis by age range across different schools in different communities. The highest prevalence of 45.2% was observed in the age range of 10-12 years and the least of 23.0% was seen in the age group of 4-6 years. The difference in the prevalences across the age groups was not statistically significant (p > 0.05).

Table 2: Prevalence of Urinary Schistosomiasis by Age Groups

Age range	Number Examined	Infected(+ve)	p-value
4 -6years	363(26.1)	98(23.0)	
7–9years	458(32.9)	192(41.9)	0.0623
10–12years	572(41.0)	264 (45.2)	
Total	**1,393(100.0)**	**554 (39.8)**	

P>0.05

The table 3 presents the intensity levels of urinary schistosomiasis infection among pupils from different schools in different communities. As shown, 74.2% of the intensity of the infection was light and 25.8% show moderate infection. Only 5.3% had high infection in the study area. The differences in the intensity of this infection in the study area was statistically significant (p>0.05).

Table 3: Intensity of infection by egg count among pupils in different schools in the study area.

Intensity					ANNOVA (p-value)
Level		**Light**	**Moderate**	**Heavy**	
Score range	**Infected (+ve)**	**≤50eggs/10 mL urine**	**<51-499 eggs/10mL urine**	**<500 eggs/10mL urine**	-
5 Schools in community A	121 (43.4)	84(69.4)	37(30.6)	13(10.7)	-
6 Schools in community B	109(38.8)	67(61.5)	42(38.5)	12(11.0)	-
5 Schools in community C	72(27.8)	61(84.7)	11(15.3)	3(4.25)	0.00196
5.Schools in community D	110(38.6)	101(91.8)	9(8.2)	4(1.0)	-
4 Schools in community E	142 (50.9)	98(69.0)	44(32.0)	1(0.7)	-
Total	**554 (39.8)**	**411 (74.2)**	**143(25.8)**	**29(5.3)**	-

P<0,05

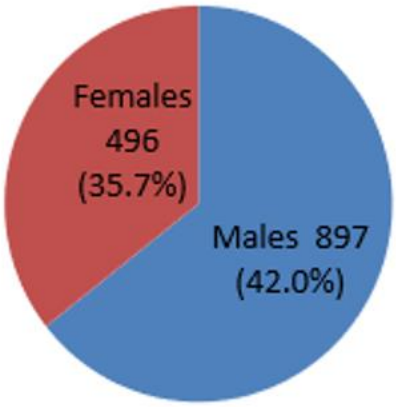


Figure:1 In fig 1 shows more males (42.0%) were infected than females (35.7%) however the difference in this infection rate was not statistically significant P>0.05

Discussion

Overall Prevalence of Schistosomiasis

This study examined 1,393 pupils across 25 public primary schools in 5 communities in Kwara state North-central Nigeria and the findings all school are proportionately affected with a significant infection rate of schistosomiasis. The overall prevalence rate of urinary schistosomiasis among public primary school pupils in the riverine areas in Kwara State, North-central Nigeria was found to be 39.8%, indicating that the infection is high in the study area. This prevalence aligns with the World Health Organization's classification of the area as moderately endemic, highlighting the urgent need for intensified control measures [21]. This suggest that environmental and socio-economic factors significantly influence the transmission of urinary schistosomiasis in the communities as previously reported by Zamdayu et al [22] highlighting that children living near rivers and lakes were more susceptible to infection, additionally, Joseph et al [16] reported a prevalence rate of 8.9%, which is slightly lower but still comparable in their study area. Conversely, Onyenkwe et al. [5] recorded an overall prevalence of 7.1%, which is still lower than the 39.8% observed in this study. The variations in prevalence rates could be attributed to differences in local water contact behaviours, environmental factors, and the effectiveness of local control measures.

However, the prevalence rate from this study was lower compared to previous findings in Kwara State where Abdulkareem et al. [19] recorded a very high prevalence of 45.6% and Bolaji, [23] recorded 58.7%, in similar communities in Kwara State attributing the higher rate to the presence of extensive irrigation projects, water reservoirs and frequent river contact, which significantly impact local socio-economic practices. Similarly, Awosolu et al [24] reported a prevalence of 55.8%, emphasizing the role of extensive agricultural activities and frequent river contact increases the risk of schistosomiasis infection. Findings from this study and similar ones highlight the significant influence of local environmental and socio-economic factors on the transmission of urinary schistosomiasis.

Our studies indicate that urinary schistosomiasis remains a considerable public health concern across Kwara State, North-central Nigeria.

Prevalence of Urinary Schistosomiasis by Age Groups

Although the prevalence rates varied across different age groups, this variation does not show any significant difference. The higher rate of infection seen among the age group of 10-12 years can be explained that this age group appears to be the most active age group in the study population compared to the least prevalence as seen in the age group of 4-6 years who apparently are still tightly under the care of their mothers. Abdullahi et al [25] reported a similar prevalence rate of 2.0% in this same age group in their study. According to them, the lower prevalence in this age group was because of less frequent contact with water sources that harbor Schistosoma parasites due to their younger age and limited outdoor activities. However, contrasting findings were reported by Muhammad et al [26], who recorded a higher prevalence of 62.86%, and Obonogbigho et al [27], who recorded a prevalence of 19.3% among children in the same age group. In their studies, the increased risk can be attributed to more frequent engagement in water-related activities such as swimming and playing in rivers, which are common sources of schistosomiasis transmission.

Prevalence of Urinary Schistosomiasis by Gender.

This study observed that more males 42.0% were infected as compared to females 35.7% but this difference was no statistical significance. This data indicates that social stigma associated with open bathing may hinder the females from actively participating in high water contact activities thus showing a slow rate of infection in the females. But the relatively high prevalence seen in the females should also be that the farming activities in these communities may not segregate them

much from the males. The slightly higher prevalence rate among males aligns with findings from other studies. For instance, Abdullahi et al. [25] recorded a prevalence of 10.0% among males and 5.0% among females. Similarly, Obonogbigho et al [27] found a prevalence of 20.0% among males and 18.8% among females, Joseph et al (16) also recorded a prevalence of 20.2% among males and 14.2% among females in a previous study conducted in the same area. Although Muhammed et al [26] reported a higher prevalence in males, with 49.49% among males and 43.93% among females, the trend of higher infection rates in males remains consistent. This gender disparity in infection rates can be attributed to several factors such as boys been more likely to engage in outdoor activities such as swimming, fishing, and playing in rivers, which increases their exposure to Schistosoma-infested waters. But Ekpo et al., [28] reported that females had a slightly higher prevalence of the disease compared to their male counterparts. This discrepancy can be attributed to several factors, including regional differences in water contact behaviour or activities, cultural practices, and socio-economic conditions that influence the risk of infection.

Quantification of Eggs by Schools in The Communities

The quantification of Schistosoma eggs in urine samples provides a critical insight into the intensity of infection among pupils in different schools in these communities. The intensity of eggs distribution of infected pupils across 25 schools in 5 communities Kwara state, North-central Nigeria categorizing the egg counts into light, moderate, and heavy intensities show that most of the infections were in the light category. This light intensity is with a geometric mean of 16.88 (≤ 50 eggs/10 mL urine). From our findings from these communities, we can say that there is partial awareness but because of the water contact activities as a means of livelihood in these same communities, we can only hypothesize that more needs to be done concerning schistosomiasis in these communities because infections can be viewed as light but it may progress to moderate and even severe in a very near future. Similarly, Balogun et al., [29] observed a predominance of light infections among school children and noted that children with light infections of ten had lower egg counts, correlating with less severe disease symptoms but still contributing to the transmission cycle. The presence of infection in our finding can equally be seen as a danger for dissemination of infection among other people or even re-infection among the same group of people thereby portraying a severe danger of the spread of schistosomiasis in these communities.

Conclusion

We conclude that the overall prevalence rate of urinary schistosomiasis among pupils in public primary school in the riverine areas of Kwara State, North-central Nigeria is high. The intensity may be reported to be light now but the propensity of wide spread of schistosomiasis in these communities remain very high. All ages as well as sexes were proportionately affected. Although the quantification of Schistosoma eggs showed that most infections were of light intensity, the possibility of wide spread of infection or even re-infection among the same age group in these communities remain high.

To mitigate this burden of urinary schistosomiasis in riverine communities, we recommend that targeted interventions focusing on reducing water contact, improving sanitation, and health education are introduced. An integrated control strategy should prioritize large-scale preventive chemotherapy, enhanced hygiene and sanitation, educational initiatives, provision of potable water, snail control measures, and environmental modifications. This comprehensive approach is particularly important in Kwara state, North-central Nigeria and other riverine communities where schistosomiasis poses a significant public health challenge, especially among schoolchildren.

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