

Prevalence of Urinary Schistosomiasis among Children from Three Selected Local Government Areas in Adamawa State, Nigeria

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Abstract

Schistosomiasis is a socio-economic and public health important human parasitic disease in the tropics. This study was carried out to determine the prevalence of urinary schistosomiasis among children in Ganye, Jada and Mayo Belwa Local Government Areas (LGAs) of Adamawa State. Urine samples were collected from 600 children between the ages of 5-16, analyzed using modified concentration sedimentation method and examined using microscopy. Diagnosis was based on the presence of Schistosoma haematobium eggs in urine samples. The overall prevalence of urinary schistosomiasis was 5.2% (32/600). Ganye LGA had the highest number positive cases with the prevalence of 9.5% (19/200), followed by Mayo Belwa LGA 4.0% (8/200) and the least in Jada LGA 2.5% (5/200). There was statistically significant difference in the prevalence of schistosomiasis among children and the different LGAs ($X^2 = 10.761$; $p < 0.05$). Highest prevalence of 8.3% was recorded between age groups of 13-16 years, followed by 4.9% in 5-8 years and least of 4.8% in 9-12 years. There was no statistical significant difference between prevalence of schistosomiasis among the age groups ($p > 0.05$). Male children showed higher prevalence (7.5%) than female children (3.1%) with statistical significant difference ($p < 0.05$). Based on parent education, children whose parents had non-formal education had higher prevalence (7.8%) and the least (0.0%) was recorded in children whose parent had tertiary education. Children whose parents were farmers had higher prevalence (5.8%) and the least prevalence was recorded in the children of civil servants (2.7%). No statistical significant association was found between prevalence of schistosomiasis with parent education and occupation ($p > 0.05$). The present study reveals low prevalence of urinary schistosomiasis among children. A further expanded study that may cover the entire state as well as control measures designed to target the parasite and its intermediate host to prevent higher prevalence in future is recommended.

Keywords: Adamawa State, Children, Nigeria; Prevalence, Urinary Schistosomiasis

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INTRODUCTION

Parasitic diseases are a major cause of morbidity and mortality worldwide and disproportionately affects the poorest population in Sub-Saharan Africa (Webster *et al.*, 2016). Schistosomiasis is one of the most widespread of all human parasite diseases ranked second after malaria in terms of socio-economic and public health importance in the tropics (WHO, 2016). It is an acute and chronic parasite disease caused by blood fluke (trematode worms) of Genus *Schistosoma*. The disease is prevalent in tropical and subtropical areas especially in poor communities without access to safe drinking water and adequate sanitation. It is estimated that at least 90% of those requiring treatment for schistosomiasis live in Africa (WHO, 2023). Schistosomiasis estimates showed that at least 251.4 million people required preventive treatment in 2021, out of which more than 75.3 million have been treated (WHO, 2023). However preventive chemotherapy for schistosomiasis, where people and communities are targeted for large scale treatment is only required in 51 endemic countries with moderate to high transmission (Kokaliaris *et al.*, 2022).

The economic and health effects of schistosomiasis are considerable and the disease disables more than it kills (WHO, 2023). In children, schistosomiasis can cause anaemia, stunting and reduced ability to learn, although the effects are reversible with treatment. Chronic schistosomiasis may affect people ability to work and in some cases can result to death (Zeh *et al.*, 2019). World Health Organization has estimated death due to schistosomiasis at 11,792 globally per year. However, these figures are likely underestimated and need forre-evaluation (WHO, 2023).

In Nigeria, urinary schistosomiasis is a severe health setback with about 29 million infected cases and 101 million people at threat of the infection (Hotezet *al.*, 2012; Dawakiet *al.*, 2015). Sadly not much has been achieved in the control of urinary schistosomiasis in the country basically because the disease being an occupational disease affects peoples in rural and semi-rural areas who depend solely on agricultural activities as source of livelihood (Ezeh *et al.*, 2019). There is also high risk of people becoming infected as a result of low literacy level, poverty, sub-standard hygiene and inadequate public infrastructure (Mufe *et al.*, 2005; Zeh *al.*, 2019).

However, there is scarcity of research on urinary schistosomiasis among children in some LGAs in the southern senatorial zone of Adamawa State. In the present study, Ganye, Jada and Mayo Belwa LGAs were selected for a comprehensive investigation. The objectives of the study were to determine the prevalence of urinary schistosomiasis in the different communities, prevalence based on gender and age groups and to relate infection with parent's education and occupation. Results obtained will help in disease control and allow for comparison with other studies on urinary schistosomiasis from different regions.

MATERIALS AND METHODS

Study Area

The study was conducted in Ganye, Jada and Mayo Belwa LGAs of Adamawa State, Nigeria (Figure 1). Adamawa state is located in the north-eastern part of Nigeria. It lies between Latitude 7° and 110°N and between Longitude 11° and 140°E. It shares interstate boundary with Taraba state in the South and West, Gombe state in its North-West and Borno state to the North. The state has an international boundary with the Cameroon Republic along its eastern side, covering a total area of 1,213.30 km² and has population of 3,178,950 based on 1991 National Population Commission (NPC) Census (Adebayo & Tukur, 2020). Most

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inhabitants are civil servants, traders, fishermen, farmers and cattle rearers (Adebayo & Tukur, 2020). Ganye Local Government Area (LGA) is located between Latitude 8°26'5.89N and Longitude 12°03'3.85E with an estimated population of 163,948 inhabitants. Jada LGA is located between Latitude, 8°44'35.60N and Longitude 12°9'22.93E with an estimated population of 168,445 inhabitants. Mayo Belwa LGA is located between Latitude 9°31'16.15N and Longitude 12°3'35.96E with an estimated population of 152,803 inhabitants all used on 2006 NPC Census. Most inhabitants of Ganye, Jada and Mayo Belwa LGAs are farmers, traders and cattle rearers (Adebayo & Tukur, 2020).

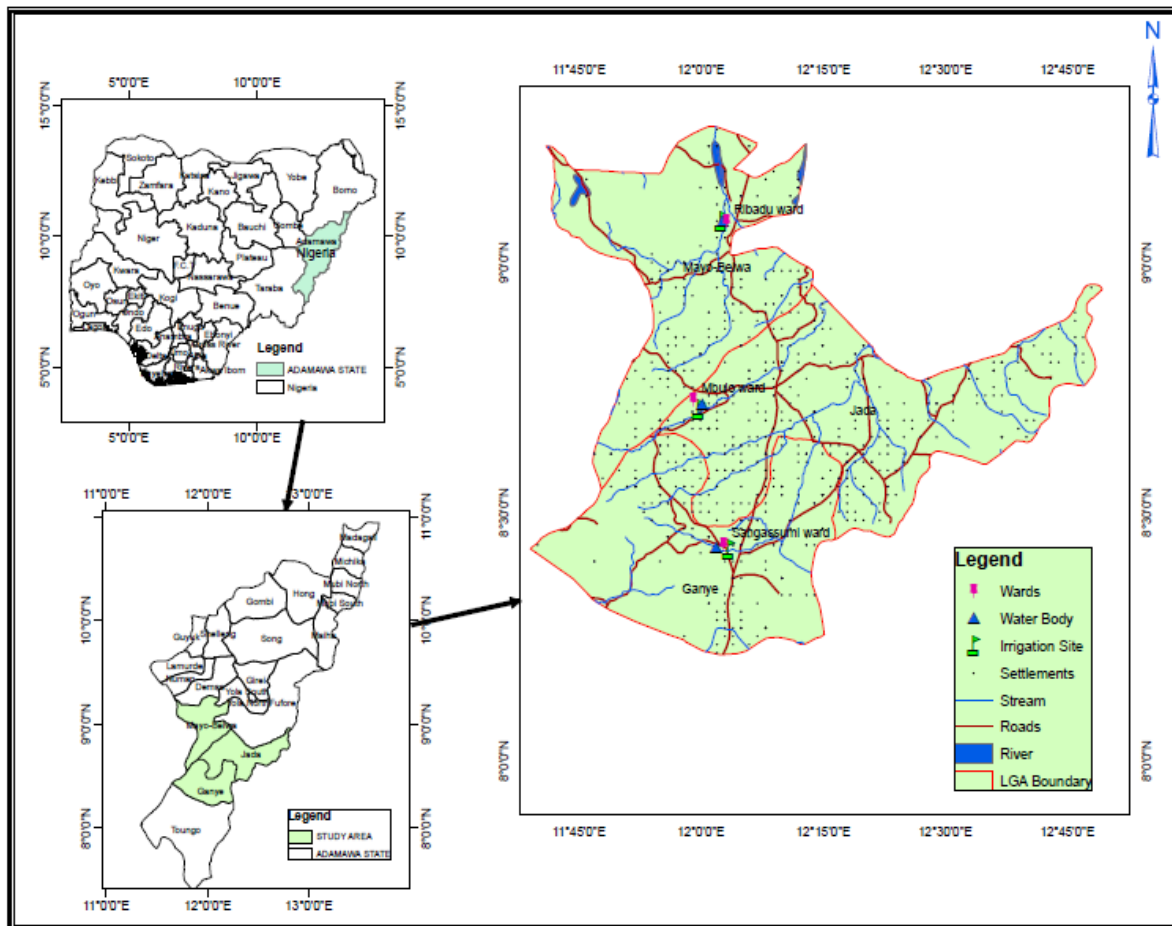


Figure 1: Map of Adamawa state showing the study area
Source: Geography Department MAU, Yola (2023)

Sample Size

The sample size was determined through conventional statistical method as described by Thrusfield, (2007).

$$n = \frac{z^2 Pq}{d^2}$$

n = sample size

p = prevalence

d = derived absolute precision (0.05)

q = 1 - p.

z = standard deviation for 95% confidence level (1.96)

Using 48% prevalence for the sample size (Birna *et al.*, 2017)

$$n = 1.96^2 \times 0.48 \times (1 - 0.48) / 0.05^2 = 383.5$$

Sample size 383.5 was approximated to 600 samples to increase precision.

Ethical Approval

Permit for the study was obtained from Adamawa State Ministry of Health. Approval was also given by community heads in all the sampling sites. Informed consent was sought from parents and participants about the purpose and procedures of the study.

Sample Collection

Data on socio-demographic profile was obtained by interviewing the participants at the time of urine sample collection. The children were enlightened on how to collect the urine samples. Well labeled clean universal bottles were distributed to the children to collect the urine between mid and last drop. The urine was collected between 12.00 noon and 2.00 pm. This is the period of greatest egg output (Onile *et al.*, 2017). The urine samples were gently packed in a carton and sealed to prevent spillage during transportation to the laboratory. Information on age, gender, parent's education, and parent's occupation were recorded for each participant.

Laboratory Procedure

Examination of urine sample was done both macroscopically and microscopically. Macroscopically, the urine samples were checked for blood and colour as previously described (Cheesebrough, 2006). For microscopic identification of *Schistosoma haematobium* eggs in the urine samples, about 20 ml of urine collected from each person was allowed to stand for 30 minutes for the Schistosome eggs to settle to the bottom of the plastic container by ordinary sedimentation method. The supernatant was gently decanted until almost 10ml was left. The 10ml was mixed and poured into clean centrifuge tubes and centrifuged at 2,000 rpm for 5 minutes. The supernatant was gently decanted off to leave only the deposits. Using a clean Pasteur pipette, a drop of the sediment was placed on a clean grease-free microscope slide and a cover slip was gently placed on it, avoiding air bubbles. Then, characteristic terminal spine of *Schistosoma haematobium* eggs were observed and counted using light Microscope under the x10 and x40 objectives (Cheesebrough, 2014).

Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) Version 26.0. Percentage and Chi Square (X^2) were used to evaluate the association between different variables and the value of $p < 0.05$ was considered statistically significant.

RESULTS

The overall prevalence of urinary schistosomiasis among children in the three selected LGAs of Adamawa State was 5.2% (32/600) as shown in Table 1. Ganye LGA had the highest number of *Schistosoma* egg detection with the prevalence of 9.5% (19/200); followed by Mayo Belwa LGA 4.0% (8/200) and least in Jada LGA 2.5% (5/200). The difference in the prevalence of schistosomiasis among children in the study areas was statistically significant ($X^2 = 10.761$; $p = 0.005$; $p < 0.05$).

Data on the prevalence of the infection based on age, gender, parent education and parent occupation are presented on Table 2. Highest prevalence of 8.3% was recorded between age group 13-16, followed by prevalence of 4.9% in 5-8 age group and least prevalence of 4.8 was recorded in 9-12 age group. There was no statistically significant difference in urinary schistosomiasis among children of different age groups ($X^2 = 1.742$; $p = 0.419$; $p > 0.05$).

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Out of the 600 children collected, 292 female and 308 male were examined. Out of which 3.1% (8/292) female and 7.5% male (23/308) were positive for schistosomiasis. The difference in gender and schistosomiasis was statistically significant ($X^2 = 5.709$; $p = 0.007$; $p < 0.05$).

Children whose parents had non-formal education were the most examined with the highest prevalence 7.8% (20/257). Followed by children whose parents had secondary education with prevalence 5.3% (6/114). Children of parent with primary education had prevalence of 2.9% (6/206), whereas children whose parents had tertiary education had prevalence 0.0% (0/23). There was no statistical difference observe between schistosomiasis and parents' education ($X^2 = 6.740$; $p = 0.081$; $p > 0.05$)

Furthermore, based on parent occupation, highest prevalence of 5.8% (26/448) was recorded among children of farmers, followed by 5.6% (3/55) among children of fishermen, then 3.3% (2/60) among children of traders, while the children of civil servants had the least prevalence of 2.7% (1/37). There was no significant difference between infection with schistosomiasis and parent occupation ($X^2 = 0.829$; $p = 1.314$; $p > 0.05$).

Table 1: Prevalence of Urinary Schistosomiasis among Children in the Three Selected LGAs of Adamawa State

Study Area	Number examined	Number Positive	Prevalence (%)
Ganye	200	19	9.5
Jada	200	5	2.5
Mayo Belwa	200	8	4.0
Total	600	32	5.2

$X^2 = 10.761$ $p = 0.005$

Table 2: Prevalence of Schistosomiasis in Children Based on their Socio-demographic Profile

Parameter	Number Examined	Number Positive	Prevalence (%)	X^2	p-value
Age (years)					
5-8	320	18	4.9	1.742	0.419
9-12	147	7	4.8		
13-16	84	3	8.3		
Gender					
Female	292	9	3.1	5.709	0.017
Male	308	23	7.5		
Parent Education					
Non-Formal	257	20	7.8	6.740	0.081
Primary	206	6	2.9		
Secondary	114	6	5.3		
Tertiary	23	0	0.0		
Parent Occupation					
Civil	37	1	2.7	0.829	1.413
Servant					
Farming	448	26	5.8		
Fishing	55	3	5.6		
Trading	60	2	3.3		
Total	600	32	5.2	10.761	0.005

DISCUSSION

The overall prevalence of urinary schistosomiasis obtained in this study was low based on WHO guideline which stated that “prevalence of schistosomiasis among school-aged children <10% by parasitological method in *Schistosoma mansoni* endemic areas is said to be of low prevalence settings” (WHO, 2022). The finding was in agreement with previous study conducted in Fufore LGA of Adamawa State and reported the prevalence of 5.02% (Ameh *et al.*, 2014). However, our findings contradicted previous prevalence of 48% reported by Birma *et al.* (2017) in Kiri Dam, Shelleng LGA of Adamawa state; 33.3% reported by Naphtali & Ngwamah (2019) in communities living around River-Benue valley in Adamawa state; 23.2% reported by Yaro *et al.* (2020) in Girei LGA of Adamawa state; and 24.9% reported by Olamiju *et al.* (2021) in Takum, Taraba state all in northeast Nigeria. The difference between these reports might be attributed to the presence of dams and other water bodies, which serve as a major source of water to those surrounding communities. The dams might serve as breeding sites for the snails intermediate host and as well increases both recreational (swimming and playing) and occupational (fishing and irrigation farming) water contact activities of the residents of communities around the dam which have been reported to increase the prevalence of schistosomiasis (Zeh *et al.*, 2019; Ezeh *et al.*, 2019).

Higher prevalence of urinary schistosomiasis recorded in Ganye LGA might be due to the presence of large water bodies in the area and the residents whose major occupation was farming tend to be involved in large scale irrigation farming than Mayo Belwa and Jada LGAs.

The present study recorded higher prevalence in older children than in younger children, This findings corroborated with earlier findings of Ameh *et al.* (2014) who reported higher prevalence of 4.21% in children between the ages of 6-15 years as compared to youger ones in Fufore LGAs of Adamawa state; Mohammed *et al.* (2018) reported 37.7% prevalence in children between the ages of 11-14 years than children of 5-10 years in Kwalkwalawa area of Sokoto state; and Amuga *et al.* (2020) reported 53% prevalence amog 11-16 years age-group than 5-10 years age-group (47%) in 19 states of Nigeria. The higher prevalence reported might be attributed to the fact that older children frequent water bodies more often, they are also involved in farming and fishing activities more than the younger children, they also have fun of swimming, bathing and playing in these water bodies when coming back from farm at the end of the working day, these might predispose them to infection with schistosomiasis than the younger ones. However, the result contrasted with previous findings (Muhammad *et al.*, 2019; Umoh *et al.*, 2020). The difference might be attributed to different recreational and agricultural practices in the different geographical localities of the studies.

Findings of this study revealed that boys had higher prevalence of urinary schistosomiasis than the girls. This might be associated with males tendency and habit of having regular water contact activities like swimming, bathing, playing, fishing and irrigation farming, they stay longer in these water bodies harbouring cercariae which might likely predispose them to *Schistosoma* infection (Biman *et al.*, 2022). The higher prevalence reported in boys in the study area agreed with the previous reports of Muhammad *et al.* (2019) who reported 49.9% prevalence in males than in females (43.9%) in Wammako LGA of Sokoto state; Akindele *et al.* (2020) reported 52.7% prevalence in male students than female students (47.3%) in Ore, Osun state; and Yaro *et al.* (2020) reported higher prevalence of 25.5% in male than female (20.8%) among residents along River-Benue in Adamawa state.

However, the present finding contrasted with the previous reports (Birma *et al.*, 2017; Mohammed *et al.*, 2018; Oluwafemi *et al.*, 2022) who reported higher prevalence of urinary schistosomiasis in females than males. They attributed their findings to variations in water contact activities among the residents of the different study areas where the female are more engaged in domestic activities like fetching water and washing than the male children.

Parent education also influenced the prevalence of schistosomiasis in the present study, with children whose parents' had non formal education had higher prevalence of urinary schistosomiasis than children whose parents' had tertiary education. Similar findings was reported in a study conducted at Buruku and Katsina Ala LGAs of Benue State (Houmsou *et al.*, 2012). However, this result disagreed with previous findings of Mohammed *et al.* (2018) who reported a higher prevalence in children whose parents' had formal education than those children whose parents' had non-formal education in Wamakko-Sokoto State. Findings from this study revealed higher prevalence in children whose parents were farmers and fishermen than in children whose parents were civil servants. The following authors reported similar findings (Kalu *et al.*, 2016; Mohammed *et al.*, 2018; Umoh *et al.*, 2020).

CONCLUSION

This study reveals low prevalence of urinary schistosomiasis among children with higher prevalence recorded in male than female. The result from the study although low can serve as a pointer to areas that still need total elimination of schistosomiasis as a public health problem. The need for public education and intervention measures such as periodic prophylaxis and chemotherapy, provision and use of safe water and also promote personal hygiene and good sanitary practices. Safety measures such as wearing boots and hand gloves during farm work should be encouraged.

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