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Full Length Research Article

PREVALENCE AND RISK FACTORS OF URINARY SCHISTOSOMIASIS AMONG SCHOOL AGED CHILDREN IN SHAWARA AND BAKWARGA COMMUNITIES IN JIGAWA STATE, NIGERIA

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ABSTRACT
Schistosomiasis is a serious public health problem in many parts of the world especially in sub-Saharan Africa where diseases are endemic. This study investigated the prevalence of urinary schistosomiasis and its associated risk factors among schoolchildren in the Shawara and Bakwarga communities of Jigawa State. A random sampling technique was employed, and 240 school-aged children from Shawara and Bakwarga Primary and Junior school were selected. Questionnaire was administered to gather data on demographics and water-contact activities. Sediment of each urine sample were examined for *Schistosoma haematobium* eggs using microscopy. The findings revealed a moderate prevalence of 33.1%, confirming the disease is endemic in the area. Multivariate analysis identified the community of residence of the children, their age, and participation in irrigation farming as independent risk factors. The finding of this study showed that urinary schistosomiasis is prevalent in Shawara and Bakwarga. Awareness of schistosomiasis should be promoted, improve access to healthcare services and regular intervention are desirable in these communities.

Keywords: Urogenital Schistosomiasis, Questionnaire, Shawara, Bakwarga schoolchildren.

INTRODUCTION
Schistosomiasis is one of the neglected tropical diseases (NTD) of poverty in many developing countries of tropical and sub-tropical Africa, the Middle East, Asia, and Latin America (WHO, 2018; McManus *et al*., 2018). The disease is generally endemic in low-income rural communities without access to potable water, proper sanitation, and adequate healthcare facilities. Sub-Saharan Africa (SSA) constitutes about 13% of the world's population but accounts for up to 90% of cases with an estimated 280,000 deaths due to schistosomiasis annually (Vander *et al*., 2003). The two major species infecting humans in sub-Saharan Africa are *Schistosoma haematobium*, which causes urogenital schistosomiasis and *Schis tosoma mansoni*, the cause of intestinal schistosomiasis. *Schistos oma intercalatum* and *Schistosoma guineensis* also cause intestin al schistosomiasis but are less prevalent (Gryssel *et al*., 2006). In recent years, there have been cases of locally acquired urinary schistosomiasis cases caused by *S. haematobium* reported in Corsica, France where it had previously not been endemic, likely imported by individuals infected in West Africa (Boissier *et al*., 2015; Boissier*et al*.,2016). There is also increasing evidence of hybridization events between human and animal schistosome species, leading to new zoonotic infections (Stothard *et al*., 2020). Like many other parasitic helminths the distribution and intensity of schistosome infections are variable by locality. This is particularly true with this parasite, mainly due to the strictly limited ecological conditions for habitats of vector snails and conditions of habitats in relation to annual rainfalls, unexpected drought, irrigation projects and industrial activities (WHO, 2020).
Current efforts to control schistosomiasis in Nigeria are being hampered by several key gaps in research and implementation. This study aimed to investigate the prevalence of urinary schistosomiasis and its associated risk factors among schoolchildren in the Shawara and Bakwarga communities of Jigawa State.

MATERIALS AND METHODS

Study Area
The study was undertaken at Shawara village of Auyakayi ward, Auyo Local Government and Bakwarga community of Buji Local Government Jigawa state, Nigeria. Shawara lies on geographical coordinator 11.36° N, 9.64° E. Bakwarga lies on geographical coordinator 12.40°, N 10.00 °E. The community was purposely selected because of their closeness to river. The water is used for irrigation, fishing, recreation and other domestic purposes.

Study Population, Sample Size Estimation and Sampling Technique
The study population consisted of schoolchildren of Shawara community and Bakwarga community, Jigawa State. The children were selected from Primary (1–6) and JSS (1-3) and using random sampling procedure. The sample size (n) was estimated using the formula $\mathbf{n} = Z^2\mathbf{Pq} \div \mathbf{d}^2$ as described by Cochran (1977). Where n is the sample size required, d is the acceptable margin of error (5%), Z is the standard normal deviate of 1.96 at the 95% confidence level; P the prevalence of urinary Schistosomiasis with 27.7% reported by (Muhammed *et al.* (2023). The proportion of negative schistosomiasis (q) is given by (q = 1-p).

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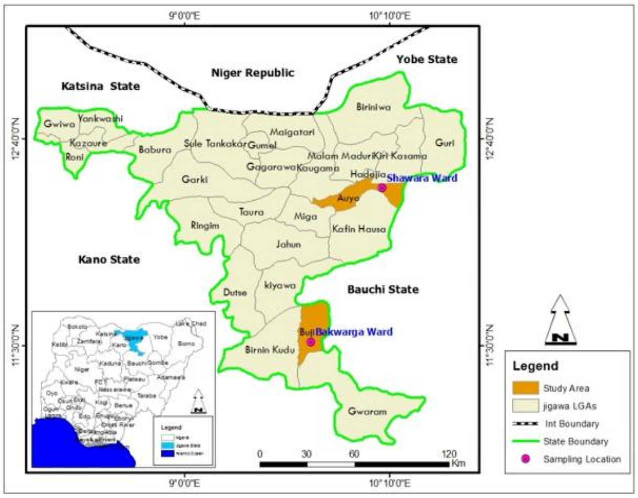

Figure 3.1: Map of Study Area showing Sampling Locations in Auyo and Buji LGA in Jigawa State.
Source: GIS Lab Department of Geography ABU Zaria, Using Arc GIS 10.3 Software.

Questionnaire Administration

Enrolled children were interviewed using a well-structured knowledge, attitude and practice (KAP) questionnaire with the help of their schoolteachers, informa tion on their socio demographic data (sex, age, grade and years of residency, hobby, perception (level of awareness of schistosomiasis)) associated risk factor (washing, swimming, fishing and irrigation farming) of urogenital schistosomiasis.

Collection of Urine Samples

Each participant was provided with a sterile urine sample container. The enrolled participants were given a labeled container and instructed on how to fill at least 10ml of urine samples as described by (Balogun *et al.,* 2022). Samples were obtained in the morning. At collection, samples were placed in a cold box with ice packs before being transported to laboratory for examination.

Visual Observation of Urine Samples and Sedimentation Technique for Analysis of Urine Samples

This was conducted according to a method used by Balogun et al. (2022), macro-haematuria was examined by careful visual examination of the urine specimens in the bottle for specific colour. Urines sample containing blood was considered as positive for visible haematuria and recorded accordingly; while urine sedimentation techniques were used to determine the presence or absence of *S. haematobium* eggs in the urine samples (Cheesbrough, 2014; WHO, 2024). The number of eggs was recorded and expressed as eggs per 10ml of urine (Balogun *et al.,* 2022). Intensity of infection was classified according to WHO guideline as light (1-<10 eggs/10ml urine), moderate (10-49 eggs/10ml urine) and heavy (>49 eggs/10ml urine) (WHO, 2024).

Data Analysis

All collected data was entered into Microsoft Excel (MS Excel 2016) and were checked manually for their completeness. The data was further analyzed with the IBM-statistical package for the social science (SPSS) version 19 (IBM-SPSS, Inc, Chicago, IL, USA), Descriptive measure such as the mean, standard deviation (SD), Median (interquartile), frequency was used to summarize the data. Difference in proportion between populations was obtained using Chi (x) test. Median (interquartile) parasite density by Village, sex and age-group were compared using Kruskal-Walli's test. Both bivariate and multivariate analyses were used in determining risk factors associated with the transmission of *Schistosoma haematobium.*

RESULTS

Characteristics of Study Participants

The 240 study participants were schoolchildren evenly split between the Shawara and Bakwarga communities shown in Table 1. The group was composed of slightly higher proportion of males (52.1%) with an overall mean age of 7.8 ± 2.9 years. The mean age of participants was similar in both communities, with Bakwarga having a mean age of 7.9 ± 3.5 years and Shawara having a mean age of 7.7 ± 2.2 years. The age distribution differed significantly between the communities, with Bakwarga having more children in the youngest and oldest age groups, while Shawara had more in the 6–8-year age group. The majority (91%) were primary school pupils, but Bakwarga had children up to the junior secondary level, whereas Shawara did not.

Figure 1 illustrates the distribution of water contact activities among school children in Shawara and Bakwarga communities in Jigawa State. Most participants (95%) reported water bodies in their community, and 85.4% reported water contact. The most common activities were washing, irrigation farming, and swimming. Significant differences in behavior existed between the communities: irrigation farming was more prevalent in Shawara, while swimming was more common in Bakwarga. Fishing was rare in both communities.

Table 2 revealed an overall prevalence of urinary schistosomiasis of 33.1%. The infection was substantially higher in Shawara (49.2%) compared to Bakwarga (15%). Furthermore, the intensity of infection was also greater in Shawara, which had a higher median egg count and a greater percentage of moderate intensity infections; while all infections in Bakwarga were classified as light intensity.

The analysis in (Table 3) found several significant associations with occurrence of urinary schistosomiasis among the schoolchildren. The community of residence was strongly linked to infection, with Shawara having a much higher prevalence (49.2%) than Bakwarga (15.0%, $p < 0.001$). Age was also significant ($p = 0.001$), with the highest prevalence in children aged 6-11. Among water activities, only irrigation farming showed a significant association ($p < 0.001$), with higher prevalence rates among those who participated. No significant associations were found for sex, swimming, washing and fishing.

A multivariate analysis identified community of residence, age, and irrigation farming as independent risk factors for schistosomiasis as shown in Table 5. Living in Shawara has increased the odds of infection by 3.59 times compared to Bakwarga. Furthermore, children aged 9-11 years had 4.06 times higher odds of infection than 12–15-year-olds. Finally, those engaged in irrigation farming had 2.56 times higher odds of infection.

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Table 1: Characteristics of Study Participants by Community

Variable	Bakwarga(n = 120)	Shawara(n = 120)	Total(n = 240)	χ^2	P-value
Sex					
Female	62 (51.7)	53 (44.2)	115 (47.9)	1.352	0.24
Male	58 (48.3)	67 (55.8)	125 (52.1)		
Age (years)					
Mean ± SD	7.9 ± 3.5	7.7 ± 2.2	7.8 ± 2.9	27.237	<0.001
3 – 5	39 (32.5)	19 (15.8)	58 (24.2)		
6 – 8	29 (24.2)	63 (52.5)	92 (38.3)		
9 – 11	30 (25.0)	31 (25.8)	61 (25.4)		
12 – 15	22 (18.3)	7 (5.8)	29 (12.1)		
Educational level				30.977	<0.001
Primary 1	13 (10.8)	9 (7.5)	22 (9.2)		
Primary 2	31 (25.8)	23 (19.2)	54 (22.5)		
Primary 3	23 (19.2)	39 (32.5)	62 (25.8)		
Primary 4	9 (7.5)	17 (14.2)	26 (10.8)		
Primary 5	15 (12.5)	21 (17.5)	36 (15.0)		
Primary 6	8 (6.7)	11 (9.2)	19 (7.9)		
Junior sec.	21 (17.5)	0	21 (8.7)		
Water body(s) in community				12.632	<0.001
No	0	12 (10.0)	12 (5.0)		
Yes	120 (100)	108 (90.0)	228 (95.0)		
Water contact				5.653	0.02
No	24 (20.0)	11 (9.2)	35 (14.6)		
Yes	96 (80.0)	109 (90.8)	205 (85.4)		

χ2 = Chi-square test, SD: Standard deviation

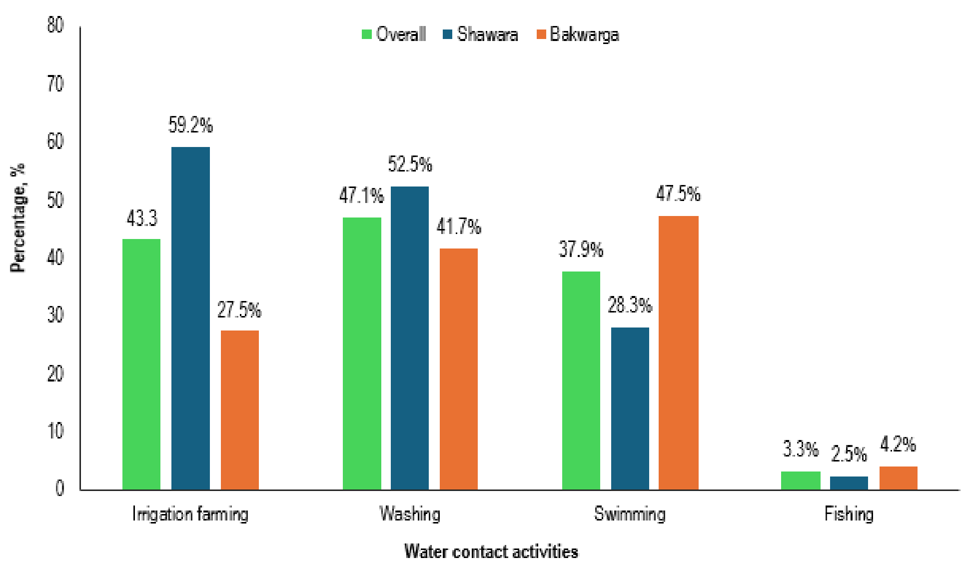

Figure 1: Water Contact Activities among School Children in Bakwarga and Shawara Communities in Jigawa State

Table 2: Prevalence and Intensity of Schistosomiasis Infection among School Children in Bakwarga and Shawara Communities in Jigawa State

Variable	Bakwarga(n = 120)	Shawara(n = 120)	Overall(n = 240)
Prevalence			
n (%)	18 (15)	59 (49.2)	77 (32.1)
95% CI	9.1 – 22.7	39.9 – 58.4	26.2 – 38.4
No. of eggs/10ml			
Median (IQR)	2 (1 – 2)	7 (4 – 10)	6 (3 – 10)
Intensity of infection			
Light	18 (100)	36 (61.0)	54 (70.1)
Moderate	0	23 (39.0)	23 (29.9)

Light infection: 1-<10 eggs/10ml; Moderate infection: 10-49 eggs/10ml and heavy (>49 eggs/10ml urine) (WHO, 2024).; IQR: interquartile range

Table 3. Bivariate Analysis of Association between Demographic Characteristics and Schistosomiasis

	Urinary Schistosomiasis			
Factors	**Negative n (%)**	**Positive n (%)**	**χ^2**	**P-value**
Community			32.144	<0.001
Bakwarga	102 (85.0)	18 (15.0)		
Shawara	61 (50.8)	59 (49.2)		
Sex			0.275	0.60
Female	80 (69.6)	35 (30.4)		
Male	83 (66.4)	42 (33.6)		
Age			16.123	0.001
3 – 2	48 (82.8)	10 (17.2)		
6 – 8	54 (58.7)	38 (41.3)		
9 – 11	36 (59.0)	25 (41.0)		
12 – 15	25 (86.2)	4 (13.8)		
Educational level			12.341	0.05
Primary 1	16 (72.7)	6 (27.3)		
Primary 2	41 (75.9)	13 (24.1)		
Primary 3	34 (54.8)	28 (45.2)		
Primary 4	18 (69.2)	8 (30.8)		
Primary 5	21 (58.3)	15 (41.7)		
Primary 6	15 (78.9)	4 (21.0)		
Junior sec.	18 (85.7)	3 (14.3)		
Water body in community			1.378	0.24
No	10 (83.3)	2 (16.7)		
Yes	153 (67.1)	75 (32.9)		
Swimming			0.052	0.82
No	102 (68.5)	47 (31.5)		
Yes	61 (67.0)	30 (33.0)		
Irrigation farming			19.032	<0.001
No	108 (79.4)	28 (20.6)		
Yes	55 (52.9)	49 (47.1)		
Washing			1.729	0.19
No	91 (71.6)	36 (28.3)		

Factors	Urinary Schistosomiasis Negative n (%)	Positive n (%)	χ²	P-value
Yes	72 (63.7)	41 (36.3)		
Fishing			1.219	0.27
No	159 (68.5)	73 (31.5)		
Yes	4 (50.0)	4 (50.0)		

χ2 = Chi-square test

Table 4. Multivariate AnalysisFactors Contributing to the Prevalence of Schistosomiasis

Factors	N	Prevalence n (%)	Adjusted OR (95% CI)	P-value
Community				
Bakwarga	120	18 (15.0)	1.0 (Reference)	
Shawara	120	59 (49.2)	3.59 (1.82, 7.07)	< 0.001
Age				
12 – 15	29	4 (13.8)	1.0 (Reference)	
9 – 11	61	25 (41.0)	4.06 (1.17, 14.11)	0.03
6 – 8	92	38 (41.3)	2.67 (0.80, 8.97)	0.11
3 – 5	58	10 (17.2)	1.43 (0.38, 5.38)	0.59
Irrigation farming				
No	136	28 (20.6)	1.0 (Reference)	
Yes	104	49 (47.1)	2.56 (1.35, 4.84)	0.004

OR: Odds ratio, CI: Confidence interval

DISCUSSION

Urinary schistosomiasis is prevalent in the Bakwarga and Shawara communities of Jigawa State, with a moderate prevalence of 33.1% among schoolchildren, which suggests a substantial risk from exposure to contaminated water (WHO, 2011). This finding is lower than studies in other parts of Nigeria, such as Jidawa and Zobiya in Jigawa (67.3%) (Balogun *et al.,* 2022) and Ogun State (52.7%) (Ojo *et al.,* 2021), and globally in places like Senegal with reported 57.6% (Senghor *et al.,* 2014) and Kenya with reported 60.5% (Odiere *et al.,* 2012). However, it is higher than other Nigerian studies in Jigawa 27.7% (Muhammed *et al.,* 2023) and Kano 17.8% (Dawaki *et a*l., 2016), and findings have been reported in other regions of the world such as Gambia 0.03% (Camara *et al.,* 2021) and Sudan 4.2% (Cha *et al.,* 2019). The study agreed with several findings that schistosomiasis is prevalent in tropical and sub-tropical countries of the world of which Nigeria is part of it.

The difference in urinary schistosomiasis infection between the present and previous studies might be attributable to variations in geographical location and environmental factors across the countries (M'bra *et al*., 2018). The prevalence of urinary schistosomiasis in Nigeria is location dependent (Ezeh *et al.,* 2019) Such variation makes estimating the national prevalence difficult and is compounded by the relatively slow pace of progress towards control of the disease, despite the availability of praziquantel as an effective chemotherapy (Awosolu*et al*., 2020).

The study reveals that age plays a major role in infection risk, as children between 9-11years are about four times more likely to contract diseases compared to those aged 12-15 (95% CI:1.17-14.11), this is comparable to the findings of (Balogun *et al*., 2022; Goselle *et al*. 2010). The study is not in agreement with the finding of Bigwan et *al*. (2012) and Muhammed *et al*. (2023) whose reported that as age increases the infection rate increases.

The higher rates in younger children are linked to their frequent engagement in water-related activities such as irrigation farming, swimming, and washing. Children involved in irrigation farming, in particular, had 2.56 times higher odds of infection (95% CI: 1.35-4.84). The lower prevalence in older children (12–15 years) is attributed to their greater awareness of the disease and its risks (Balla and Jabbo, 2013; Okworie *et al.,* 2014). The high prevalence of urinary schistosomiasis infection in 9-11 years was believed to be due to their exposure to various water associated activities, such irrigation farming, swimming, washing and fishing. The findings from the present study strongly suggest that the above-mentioned environmental risk factors are significantly associated with urinary schistosomiasis infection in the study area. Children engaged in irrigation farming appeared to be at high risk of contracting schistosomiasis infection: they are having 2.56 times higher odds of infection (95% CI: 1.35-4.84). However, the low prevalence of the infection observed in children between the ages of 12-15 was attributed to their low exposure status, because most of them have basic knowledge regarding schistosomiasis infection and its risk complication. This is in close agreement with the views expressed by previous workers (Musa and Benjamin, 2010; Houmsou *et al*., 2012; Balla and Jabbo, 2013; Okworie*et al*., 2014) who similarly showed that illiteracy or very low tier of education accounted for the observed high infection rates among the people they examined. This is also comparable with the work of (Dawaki *et al*., 2016), few previous reports elsewhere showed variation in the level of awareness amongst the Nigerian population; 33.8%-42.0% in Delta State, Southeastern Nigeria (Ukwandu*et al*., 2004;

Onyeneho *et al*.,2010) and 64.4% in Ogun and Niger states along the middle belt and southwestern region (Akinwale *et al*., 2004). Similarly, in comparison with findings from other countries, high level of awareness (80%) was reported in Kenya (Poole *et al*., 2014; Odhiambo *et al*., 2014) while a poor knowledge of schistosomiasis and its causes was reported in Malawi and Zimbabwe (Ndamba *et al*., 1998)

The study reveals that water source plays a significant role in transmission of schistosomiasis, with those engaged in irrigation farming having the highest infection rates. This is due to prolonged exposure to open water sources contaminated with the *S. haematobium* parasite. This finding is in line with previous studies that linked high infection rates to water contact activities like farming, swimming, and fishing (Senghor *et al.,* 2016; Muhammed *et al.,* 2023). Ultimately, the study concludes that community of residence, age, and involvement in irrigation farming are independent risk factors for schistosomiasis in this population.

Conclusion

Urinary schistosomiasis is a significant health problem in the Sha wara and Bakwarga communities of Jigawa State, with a moderate prevalence of 33.1% among schoolchildren. The study found that infection rates were highest in children aged 9-11 years, who were more likely to be involved in high-risk activities like irrigation farming. This is a key risk factor and suggests that exposure to contaminated water is the primary cause of transmission. The findings highlight the need for targeted public health interventions that focus on educating younger children and improving sanitation to reduce the burden of this disease.

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