



Urinary Schistosomiasis among Vulnerable Children in Security Challenged District of Safana, Katsina State - Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors TA, JJE, HSR and EDA designed the study, performed the statistical wrote the protocol. Authors TA, JJE and HSR managed the analyses of the study. Authors JJE and EA managed the literature searches. Authors EA and TA wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Schistosomiasis is among the Neglected Tropical Diseases (NTDs) which has remained a global health burden, causing illnesses of great health, social and economic implications; especially among the most vulnerable. This study assessed the prevalence of urinary schistosomiasis among *almajiri* and primary school children in Safana Town, Katsina State, Nigeria.

Study Design: Random Sampling Technique was used in collection of samples.

Place and Duration of Study: The study was carried out in a security challenged Safana District, Katsina State, Nigeria between May and September, 2019.

Methodology: A total of three hundred (300) urine samples (150 each from *almajiris* and primary school pupils) were collected using plain sample bottles, they were taken to the Laboratory of the Department of Biological Sciences, Federal University Dutsin-Ma, where they were analyzed for

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the eggs of *Schistosoma haematobium* using centrifugation technique. Data obtained were subjected to Chi-Square analysis to test for association with risk factors.

Results: Out of the 300 samples examined, 64 (21.3%) of them were infected with *Schistosoma haematobium*. The *almajiri* school had the highest prevalence infection of 42 (28.0%) out of the 150 samples examined, while the conventional schools (primary school) had the prevalence of 22 (14.6%) out of 150 examined. When prevalence was compared between males and females, 57 (25.1%) out of 227 males were infected, while only 7 (9.5%) out of 73 females had the infection. Significant associations of schistosomiasis with type of school ($\chi^2 = 0.023$) and with sex ($\chi^2 = 0.005$) were established.

Conclusion: The present study confirmed the endemicity of schistosomiasis in Safana despite several rounds Mass Drug Administration (MDA) with praziquantel; with *almajiris* remaining reservoirs of the infection in the District. Environmental improvement and snail vector elimination are required in this District, with a better coordinated MDA.

Keywords: Neglected tropical disease (NTD); *Schistosoma haematobium*; prevalence; *almajiri*; primary school; children.

1. INTRODUCTION

Schistosomiasis, also commonly known as bilharzia, is a waterborne parasitic infection caused by digenetic blood trematode worms of the family Schistosomatidae. It is one of the most prevalent neglected tropical diseases (NTDs) and still considered as a major public health problem in about 77 developing countries in the tropics and subtropics [1]. The main disease causing schistosomes are *Schistosoma haematobium* (*S. haematobium*), *S. mansoni*, *S. japonicum*, *S. mekongi* and *S. intercalatum* [2]. About 249 million people worldwide are estimated to be infected with schistosomiasis, with about 700 million people worldwide at risk of infection. About 224 million affected people (approximately 90% of global burden) live in sub-Saharan Africa, with the largest numbers in Nigeria (29 million) [1,2,3]. It ranks second only to malaria as the most common parasitic disease with almost 300,000 deaths annually from schistosomiasis in Africa [1]. High prevalence estimates and infection intensities are found in school-aged children, adolescents and adults [4,5].

Schistosomiasis reported to be on the increase in Nigeria due to inadequate prevention, control and treatment [6]. It has been reported that more than 60 million people needed treatment for schistosomiasis in 2013 but only a fraction could access the treatment [7]. Though several efforts of Mass Drug Administration (MDA) have been made in endemic Local Government Areas (LGAs) of Katsina State by the State Ministry of Health, supported by Helen Keller International (HKI), insecurity situation of Safana and other neighboring LGAs could be serious impediments

to adequate coverage and treatment with praziquantel.

Though *Schistosoma haematobium* infection is widely distributed in Nigeria and is reported to be hyper endemic in many states of the North such as Sokoto, Adamawa, Kebbi, even Katsina and many others [4,8,9], there is paucity of knowledge on its prevalence as it relates to vulnerable children (*almajiris*) and security challenged communities. Despite the economic and public health significance of Schistosomiasis, little or no effort has been made of recent to ascertain the prevalence and distribution of this disease in Safana District after rounds of Mass Drug Administration (MDA). This may be due to the security challenges faced in the area which constrained the diagnosis, treatment and control programme of schistosomiasis in Safana. This study assessed the prevalence of urinary schistosomiasis among vulnerable children in security challenged District of Safana, Katsina State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Site

Safana is a town in Safana Local Government Area in Katsina State, Nigeria. It is headquarter of Safana LGA. It is approximately located on Latitude 12°24'30"N and longitude 7°24'25"E. The western border of the LGA is shared with Zamfara State (Fig. 1). It has an area of 282 km² and a population of 183,779 at 2006 census. Safana District is one of the security challenged areas of Katsina State, with banditry, kidnapping and cattle rustling crimes ravaging the entire LGA and environs.

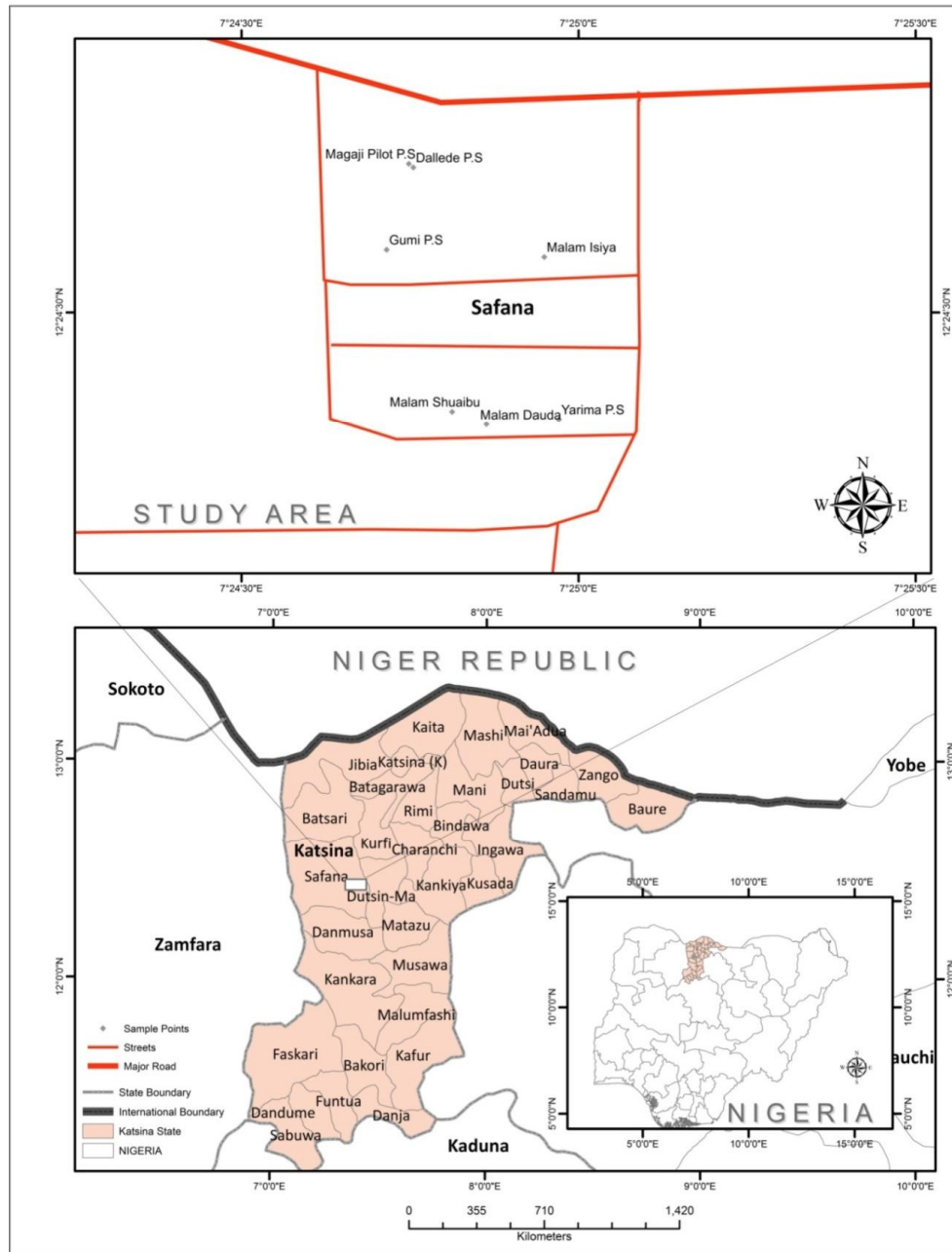


Fig. 1. A map showing Safana District with Locations of Sampled Schools and the map of Katsina State

2.2 Sampled Schools

Seven schools [Four (4) different public primary and Three (3) *Almajiri* schools] were selected using simple random sampling technique without replacement. The seven schools visited were: Yarima Abdulqadir Model primary school, Dalleje primary school, Gumi primary school, Magaji

primary school, Malamsiya School, Malam Dauda and Malam Shuaibu School all in Safana District.

2.3 Urine Sample Collection and Storage

A total of 300 urine samples were collected among school age children by stratified random

sampling method. 150 samples from public primary schools and 150 from *Almajiri* schools. Structured questionnaires were used to collect information on age, sex; source of water for drinking, parents' occupation and water contact activities from the children during samples collection. Each child was given a cleaned, dried universal bottle. The samples were collected from 10 am-2 pm during the period of the sampling. The samples were placed in black rubber cooler to prevent the ova of *Schistosoma haematobium* from hatching during transportation to the laboratory.

2.4 Laboratory Analysis of Urine Samples and Identification of *Schistosoma haematobium* Ova

Urine samples were immediately transported to the laboratory for microscopic examination. Medi-Test was used for rapid determination of blood and protein. The test strips were dipped for about 1 second into the fresh urine sample removed and draws it across the rim of the container to remove excess urine. After 30-60 second, the test strips were compared with the colour of the scale. The time for comparison is after 30 second. Colour changes that took place after more than 2 minutes were of no significance.

Sedimentation method was used: 10ml of a duly labelled urine sample was poured into a centrifuge tube and spun at 5000 rpm for five minutes in a centrifuge after which it was allowed to stand for 30 minutes [10]. The supernatant was discarded and the sediment pipetted onto clean grease free slide, covered with a cover slip and examined microscopically using x40 objective to identify *Schistosoma haematobium* ova which is characterized by the presence of a terminal spine.

2.5 Statistic Analysis

The data obtained were analysed using simple percentage (prevalence) while Chi-square test was used to compare differences at $P < 0.05$ was considered significant among variables.

3. RESULTS AND DISCUSSION

A total of 300 children, both *almajiri* (Quranic students) and primary school pupils were examined during the study. Among those examined, 64 of them, making 21.3% prevalence

were infected with *Schistosoma haematobium* (urinary schistosomiasis) (Table 1). The prevalence was similar to the prevalence reported in different countries including: Cameroon, Ghana, Chad, Niger and Nigeria [9, 11,12,13,14]. The prevalence, 21.3% was high when compared to the reports of 19.5% in Zaria Kaduna State [15], in Dutsin-Ma (17.3%) [4], 17.8% in Kano [1] and 1.4% in Bauchi [16]; but lower than the prevalence of 45.68% reported in Benue State [17], 74% reported in Gusau [18], Murtala et al. (2012) who reported 41.6% in Sokoto State, 52.7% reported in Ogun State [19], 55.8% reported in Osun State [20] and 35.9% reported in Ethiopia [2]. The higher prevalence reported by the present study could be attributed to poor integrated and cost-effective approaches of MDA implementation by the Federal Ministry of Health to eliminate this disease, frequent contact with infested water and contamination of water bodies by infected individuals. This may also be attributed to the security challenges in the area which must have constrained the diagnosis, treatment and control programme of schistosomiasis in Safana and environs.

The prevalence of urinary schistosomiasis between the sexes showed lower prevalence among the females; 9.5%, while the males recorded higher prevalence; 25.1% (Table 1). This can be attributed to culture and the religion of the region which discourages females from participating in activities such as swimming, irrigation and other activities that entails contact with water bodies. These activities increase their rate of exposure to infection [21]. This finding validates the reports from Gusau [18], in Zaria [15], in Dutsin-Ma [4] and in Malawi [5] who all associated infection with males.

Considering the prevalence with schools; *Malam* Isiya *Almajiri* School recorded the highest prevalence of 38.0%, while Magaji Primary School had the lowest prevalence of 14.0% (Table 1). The prevalence with types of school showed highest prevalence of 28.0% among children in *Almajiri* schools while conventional (Primary) schools had lower prevalence of 14.6% (Table 2), with significant association of urinary schistosomiasis with type of school ($P = 0.005$). The higher prevalence among the *almajiri* schools could be attributed to the less attention/care they mostly receive from their guardians/teachers (*Malams*) who often don't control or monitor their movements; as they are allowed to roam about to anywhere they wish to, including the water bodies (rivers and streams).

Almajirai are mostly involved in swimming, bathing, washing, fetching water in trucks for sale and other water activities, while their conventional school counterparts are often under parental monitoring and not involved in most of these activities.

Almajiri system of education is well known way of life that has been in practice from ancient time among Muslims in Northern Nigeria and other neighbouring countries; where children are entrusted to a *Malam* (teacher) to teach them on Islamic knowledge (Quran). They (*Almajirai*) usually leave their parents to stay full-time in *Almajiri* School (*Makarantar Allo*) far away from their original residence [22,23,24]. *Almajirai* are mostly sent to schools, with little or no resources to live on, to teachers having little or no support to cater for them. This exposes them to self-catering by all means at very young age; mostly between the ages of 5 to 19 years [23,24, 25].

When considering prevalence with relation to age, children within the ages of 5-7 years had lowest prevalence of infection (5.5%) while the ages of 14 and above years had highest prevalence of 36.8%, which showed significant association of infection with age ($P = 0.000$) (Table 2). The low prevalence within the ages of 5-7 years could be that at early age, water contact activities such as swimming, washing and bathing inside the water (river) body are less and these activities could increase with age and adolescence, with more independence than within the lower age groups; being more active in terms of fishing, swimming, snail hunting and washing of clothes at water bodies. This adolescent age group has the potential to contribute significantly to the contamination of the environment and consequently to the transmission of the disease, with children at that age bracket not swimming in water bodies like rivers or dams. This is similar to the findings of highest prevalence in 10 – 19 years [18], reported prevalence of 71.7% in the age of 10-14 years [14] and that of which reported highest prevalence within the age of 11-20 and lowest within the age of 4-10 [16].

Prevalence of urinary schistosomiasis with swimming activities of the children examined revealed highest prevalence (33.9%) among those involved in swimming activities, while those not involved had lower prevalence (5.9%), with significant association ($P = 0.000$) (Table 3). It is

a general knowledge that those who engage in swimming activities in rivers and streams are more likely exposed to infection with *S. haematobium* than those who don't engage in swimming in such water bodies. This is similar to the higher prevalence (62%) among school children who swim in water bodies than those who don't swim in water bodies in previous reports [26].

Urinary schistosomiasis, with history of praziquantel administration was more prevalent (61.5%) among those who were administered praziquantel two years back, while those who took praziquantel within the study year (2019) had zero prevalence (0%); (Table 3). Infection with *S. haematobium* had significant association with praziquantel history.

Considering parent's occupation, father's occupation had significant association with urinary schistosomiasis ($P = 0.000$), where children whose fathers are farmers had the highest prevalence (32.4%) and those with fathers that are civil servants had lowest prevalence (8.0%); (Table 4). Though mother's occupation had no significant association with schistosomiasis prevalence (0.193), highest prevalence (33.3%) was still among children whose mothers are farmers and lowest prevalence (10.9%) among the children of civil servants (Table 4). Similar results of highest prevalence among school children whose fathers (16.7%) and mothers (18.6%) were farmers in two Settings of Côte d'Ivoire was reported [26]. The findings of this study differ from that of which reported highest prevalence (39%) among *almajiri* school children whose fathers were businessmen [14].

Lastly, the prevalence of schistosomiasis showed significant association with father's educational qualification ($P = 0.000$), with children of illiterate fathers having highest prevalence (33.8%) and lowest among children whose fathers had basic primary school education (16.1%). Though prevalence of schistosomiasis was highest (26.3%) among children of illiterate mothers and lowest (18.9%) among children of parents with tertiary education, the association of the prevalence was not significant ($P = 0.192$); (Table 5). These findings are similar to the reports of highest prevalence among school children whose fathers (14.6%) and mothers (16%) were illiterates in two Settings of Côte d'Ivoire [26].

Table 1. Prevalence of Urinary *Schistosoma haematobium* Infection among almajiris and primary school pupils in safana in relation to sex and school

School	Male			Female			Male + Female		
	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected
Malamsiya A. S	50	19	38.0	0.0	0	0.0	50	19	38.0
Malam Dauda A. S	50	14	28.0	0.0	0	0.0	50	14	28.0
Malam Shuaibu A.S	50	9	16.0	0.0	0	0.0	50	8	16.0
Yarima Model P. S.	10	2	20.0	28	3	11.0	38	5	13.0
Dallaje P. S.	24	5	21.0	14	1	7.0	38	7	18.0
Sheik Gumi P. S.	22	5	23.0	15	2	13.0	37	7	19.0
Magaji P. S.	21	3	14.0	16	1	6.0	37	4	11.0
Total	227	57	25.1	73	7	9.5	300	64	21.3

P = 0.023 (Schools) and *P* = 0.005 (Sex)

NB: A.S= Almajiri School

P.S=Primary School

Table 2. Prevalence of *Schistosoma haematobium* Infection in relation to type of school and Age

Variable	No. Examined	No. Infected	% Infected	<i>P</i> -value
Type of School (n=300)				
Almajiri	150	42	28.0	0.005
Conventional	150	22	14.6	
Age (in years) (n=300)				
5-7	18	1	5.5	0.000
8-10	110	10	9.0	
11-13	134	39	29.1	
14 and above	38	14	36.8	

Table 3. Prevalence of urinary *Schistosomiasis* in relation to swimming and praziquantel history

Variable	No. Examine	No. Infect	% Infected	P-value
Swimming (n = 300)				
Yes	165	56	33.9	0.000
No	135	8	5.9	
Praziquantel History (n = 300)				
Never	273	52	19.0	0.000
This year	3	0	0.0	
One year back	7	3	42.8	
Two years back	13	8	61.5	
Three years back	4	1	25.0	

Table 4. Prevalence of *Schistosoma haematobium* in Relation to Parents' occupation

Variable	No. Examine	No. Infect	% Infected	P-value
Father's Occupation (n = 300)				
Business	75	13	17.3	0.000
Farming	114	37	32.4	
Civil servant	87	7	8.0	
Civil servant /Farming	24	7	29.1	
Mother's Occupation (n = 300)				
Business	164	38	23.2	0.193
Farming	6	2	33.3	
Civil servant	55	6	10.9	
Civil servant /Farming	0	0	0	
House wife	75	18	24.0	

Table 5. Prevalence of *Schistosoma haematobium* in relation to parent's educational qualification

Variable	No. Examine	No. Infect	% Infected	P-value
Father's Qualification (n = 300)				
Illiterate	68	23	33.8	0.000
Primary	74	12	16.1	
Secondary	116	21	18.1	
Tertiary	42	8	19.0	
Mother's Qualification (n = 300)				
Illiterate	72	19	26.3	0.193
Primary	116	23	19.8	
Secondary	75	15	20.0	
Tertiary	37	7	18.9	

4. CONCLUSION

This study revealed high prevalence of urinary schistosomiasis among vulnerable children in security challenged District of Safana; which confirms that urinary schistosomiasis is still endemic in the study area, despite rounds of Mass Drug Administration (MDA). The *almajiri* school children are more at risk of infection and could serve as reservoirs of schistosomiasis and other diseases of public health risk. Infection with urogenital schistosomiasis is associated with

males and children of older age. Swimming and parents' occupation are risk factors of schistosomiasis. There is need for Governments (Federal, State and Local) and Non-Governmental Organizations (NGOs) to intensify efforts in elimination of urinary Schistosomiasis in Safana District and other endemic districts. This can be achieved through well-coordinated MDA, public sensitization and awareness, snail control and proper disposal of human waste (environmental improvement). Adequate security should also be provided to ensure the security of

personnel to be involved in any of the elimination programmes. It is also recommended that the survey on infection prevalence to be expanded to cover the entire Local Government Area and the entire Katsina State to ascertain the current status of endemicity.

CONSENT

All authors declare that informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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