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Prevalence of Urinary Schistosomiasis among Primary School Children in Kwalkwalawa Area, Sokoto State, North-Western Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors KM and MS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors THIS and SUN managed the analyses of the study. Authors OFA, AN and UIA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study was conducted to determine the prevalence of urinary schistosomiasis among primary school children in Kwalkwalawa Area of Sokoto, State, Nigeria.
Study Design: This was a cross-sectional, descriptive study.
Place and Duration of Study: This study was conducted among school-aged children in, Wamakko Local Government, Sokoto state, between March to June, 2016.
Methodology: A total of 200 participants were enrolled in the study. Ten (10 ml) of urine samples were collected from each participant into universal containers. Samples were examined macroscopically for Haematuria. Samples were preserved with 10% formal saline and then

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transported to the laboratory for analysis. Samples were filtered using Vacuum pump filtration machine and Whatman No.1 filter paper and were then examined under the microscope to determine the presence of ova of *Schistosoma haematobium*.
Results: Out of 200 urine samples 128(33.5%) had infection with statistically significant difference (p<0.005) in infection rates among males (35.3%) and female (32.8%). Children between ages 11-14 years had a higher prevalence of 33.7% (p<0.001) compared with children between the ages 5-10 years (33.3%).
Conclusion: Prevention and control of Schistosomiasis is based on disease surveillance, health education, mass chemotherapeutic treatment of population at risk using praziquantel to reduce morbidity.

Keywords: Prevalence; urinary schistosomiasis; school children; Kwalkwalawa; Sokoto State; Nigeria.

1. INTRODUCTION

Schistosomiasis is one of the most widespread of all human parasitic diseases, ranking second only to malaria in terms of its socio-economic and public health importance in tropical and subtropical areas [1]. It is caused by blood flukes Schistosome. Schistosomiasis is known as bilharzia or bilharziasis in many countries, after a German physician Theodor Bilharz, who first described the cause of urinary schistosomiasis in 1851 [2]. The first physician who described the entire disease cycle was Brazilian parasitologist Pirajá da Silva by examining 6,200 years old skeleton [3]. Most human schistosomiasis is caused by *S. haematobium, S. mansoni,* and *S. japonicum*. Less prevalent species, such as *S. mekongi* and *S. intercalatum*, may also cause systemic human disease. Less importantly, other Schistosomes with avian or mammalian primary hosts can cause severe dermatitis in humans (e.g., swimmer's itch secondary to Trichobilharziaocellata).

In 2010, approximately 238 million people were infected with schistosomiasis, 85 percent of whom live in Africa [4]. An earlier estimate from 2006 had put the figure at 200 million people infected [5]. In many of the affected areas, schistosomiasis infects a large proportion of children under 14 years of age. An estimated 600 to 700 million people worldwide are at risk from the disease because they live in countries where the organism is common [6,7]. In 2012, 249 million people were in need of treatment to prevent the disease [8]. This likely makes it the most common parasitic infection with malaria second and causing about 207 million cases in 2013 [7,8]. Schoolchildren, adolescents and young adults have been found to have the highest prevalence and morbidity rate due to Schistosomiasis [9]. Thus, the negative impacts caused by untreated infections demoralize both social and economic development on school performance among infected children in endemic areas [10].

S. haematobium, the infectious agent responsible for urogenital schistosomiasis, infects over 112 million people annually in Sub-Saharan Africa alone [11]. It is responsible for 32 million cases of dysuria, 10 million cases of hydronephrosis, and 150,000 deaths from renal failure annually, making *S. haematobium* the world's deadliest schistosome [11]. The disease is found in tropical countries which includes; Africa, the Caribbean, Eastern South America, Southeast Asia, and the Middle East. *S. mansoni* is found in parts of South America and the Caribbean, Africa, and the Middle East; S. haematobium in Africa and the Middle East; and S. japonicum in the Far East. *S. mekongi* and *S. intercalatum* are found locally in Southeast Asia and central West Africa, respectively [12]. The disease is endemic in about 75 developing countries and mainly affects people living in rural and peri-urban areas [13].

In sub-Saharan African countries, Nigeria has the heaviest burden of the disease with an estimated 29 million people infected [14]. The disease is transmitted by freshwater snail of the genus Bulinus [15]. Man acquires the infection from the infected snail intermediate host when in contact with water containing infective larvae (cercariae) shed by the snail host [16].

Bilharziasis is widespread among the poor populations of third world countries in Africa and Asia, who live in conditions that favour transmission and who have no access to proper healthcare or effective preventive measures. The prevalence and morbidity of the infection are particularly linked to agricultural and water development schemes, plus the African lakes and rivers. Infection is predominant among school-age children, in special occupational groups (fishermen, irrigation workers and farmers), in females and other groups using infected water for their domestic purposes [17]. Many countries are working towards eradicating the disease with WHO promoting these efforts. In some cases, urbanization, pollution, and the consequent destruction of snail habitat have reduced exposure, with a subsequent decrease in new infections. Furthermore, the drug praziquantel is used for prevention in high-risk populations living in areas where the disease is common [18]. A review of 2014 found tentative evidence that increasing access to clean water and sanitation reduces schistosome infection [19].

2. MATERIALS AND METHODS

2.1 Study Area

Sokoto state, which is in the extreme Northwest of Nigeria between longitude 05° 11¹ to 13° East and latitude 13° 00¹ to 13° 06¹ North. The state shares borders with the Republic of Niger to the North, Kebbi to the West and Southeast and Zamfara to the east. The state covers a land area of about 60.33km², and based on 2006 census, the state has a population of 3,696,999. Sokoto state has an annual average temperature of 28°C (82.9°F). Sokoto is, on the whole, a very hot area. However, maximum daytime temperatures are most of the year generally under 40°C (104.0°F). The warmest months are February to April when the daytime temperature can exceed 45°C (113.0°F). The rainy season starts from June to October during which showers are a daily occurrence, although rarely last long compared to that of the wet tropical regions. There are two major seasons; wet and dry which are distinct. The indigenous inhabitants of the area are the Hausas and Fulani's. Other ethnic group residents in the area include Igbo, Yoruba, Ebira, Igala, as well as Buzus from the neighbouring Niger Republic. Hausa is the commonly spoken language. Farming and crop production is the major occupation of the people living in the study area. Major crops grown include millet, sorghum, groundnut, cowpea and tobacco. Livestock reared include cattle, sheep, goat, donkey, camel, horses and poultry [20]. The study was conducted in Kwalkwalawa, Wamakko local government area of Sokoto state. Located 2 km away from the permanent site of Usman Danfodiyo University Sokoto.

2.2 Sample Size Determination

Sample size determination for this study is calculated based on the prevalence reported from initial studies carried out around the country using the following formulae;

$$n = (Z^2pq)/d^2$$

Where;

n = Number of samples (sample size)
Z = Standard normal deviate at 95% confidence interval = 1.96
p= Prevalence from initial studies = 14.5% = 0.145 [21]
d = degree of confidence at = 0.05
q = 1-p = 1 - 0.145= 0.855

$$=([1.96]^2 \times 0.145 \times 0.855)/ 〚0.05^2$$

$$=(3.8416 \times 0.123975)/0.0025=190.5 \approx 200$$

2.3 Study Population

The study population were children attending Kwalkwalawa primary school. Age ranged between 5-14 years.

2.4 Ethical Consideration

Ethical clearance was obtained from state Ministry of education and Ministry of health ethical clearance committee. After explaining the importance, purpose and procedure of the study briefly, written consents were obtained from the school headmaster and parent or guardian of the children. Anyone not willing to take part in the study was not included.Those participants who were found to be infected with Urinary Schistosomiasis were given praziquentel drugs provided by World Health Organization through the Ministry of health. Confidentially of the study participants was also maintained.

2.5 Inclusion and Exclusion Criteria

2.5.1 Inclusion criteria

The study was limited to children attending Kwalkwalawa primary school aged between 5 to 14 years.

2.5.2 Exclusion criteria

The study excludes children that do not attend Kwalkwalawa primary school and those below and above the aged of 5 to 14 years.

2.6 Sample Collection

A total of 200 Urine samples were collected randomly from the pupil with the assistance of their teachers. About 10ml 0f urine sample was collected in a clean, dry, sterile, plastic, screw-capped 30ml universal urine bottles. It was collected between 10 am and 2 pm, because the excretion of *S.haematobium* in urine is high within that period. Each urine was macroscopically observed and was tested chemically using urinalysis strip (Medi - 9) for the presence of blood and protein before adding few drops of 10% formal saline for preservation [22]. The samples were protected from light to avoid miracidia hatching from the egg and was transported to the laboratory immediately, where it was analysed by filtration technique.

2.6.1 Procedure

It involves the use of vacuum pump filtration machine: 10ml of well-mixed urine was dispensed into the filtration unit of the filtration chamber. The urine was then drained through a Whatman No.1 filter paper. The filter paper was then removed and stained with the saturated ninhydrine solution (few drops of iodine was added to enhance the staining). It was allowed to stay overnight at room temperature for the eggs to pick up the stain [23]. It was examined under the light microscope under ×10 and ×40 objectives. Terminal spine eggs, characteristics of *S. haematobium* was counted for each positive sample. The result was express as eggs/10ml urine. All the urine samples were treated the same way [24] and [23].

2.6.2 Questionnaire survey

A questionnaire was administered to the participants in other to collect demographic data (age, and gender), socio-economic background (educational level, occupation etc), behavioural risks (personal hygiene such as hand washing, habit of wearing shoes outside the house and water contact activities), environmental sanitation and living conditions (types of water supply, latrine system, water proximity) and health conditions (dyasuria, haematuria, awareness of the disease). The participants were interviewed by the researcher and a research assistant who received specific training on how to apply the questionnaire.

2.7 Statistical Analysis

Data were entered into statistical software package (SPSS version 22) for statistical analysis. Chi-square test was used to determine the relationship between the prevalence of infection with *S. haematobium* and other categorical variables.

3. RESULTS

The result shows 200 students aged between 5 – 14 years attending Kwalkwalawa primary school, Wamakko local government, area Sokoto state. Among the two hundred, 133 were found to have no infection of urinary Schistosomiasis while 67(33.5%) were found to harbour the parasite. Tables 1 and 2 shows the summary of the demographic characteristics of the participants.

Table 1. Demographic characteristics

Variables	Frequency n	Percentage %
Gender		
Female	51	25.0
Male	149	75.0
Age Distribution		
5 – 10	108	54.0
11 – 14	92	46.0
Parent Education		
Non Formal	70	35.0
Formal	130	65.0
Parent Occupation		
Others	14	7.0
Civil Servant	65	32.5
Business Man	42	21.0
Fisher Man	33	16.5
Farmer	46	23.0
Drinking Water		
Others	24	12.0
Pipe born	54	27.0
Borehole	38	19.0
River	84	42.0
Toilet System		
Water system	62	31.0
Pit Toilet	25	12.5
Bush	113	56.5

Table 3 reveals the prevalence of urinary Schistosomiasis with regards to Gender, Age group, Parent education, Parent Occupation, Type of drinking water and Toilet System, whereby high prevalence of urinary Schistosomiasis was recorded in the female gender with 35.3% while lowest prevalence of the male gender with 32.9% (p-value = 0.440). In respect to age group, they have somehow the same prevalence percentage with only little variation of 33.7% as high among age range of 11 – 14 years and 33.3% among the age range of 5 -10 years (p-value = 0.538). With regards to parent education, higher prevalence of urinary Schistosomiasis was recorded in parent with formal education with 35.4% while least prevalence in those with non- formal education with 30.0% (p-value = 0.271).

Table 2. Demographic characteristics

Variables	Frequency n	Percentage %
Swimming		
No	99	49.5
Yes	101	50.5
Irrigation		
No	118	59.0
Yes	82	41.0
Painful urination		
No	158	79.0
Yes	42	21.0
Fishing		
No	152	76.0
Yes	48	24.0
Awareness of the disease		
No	186	93.0
Yes	14	7.0
Blood		
Absent	7	3.5
+	167	83.5
+ +	14	7.0
+ + +	12	6.0
Protein		
Absent	29	14.5
+	110	55.0
+ +	48	55.0
+ + +	13	6.5

In regards to parent occupation, higher prevalence of urinary Schistosomiasis was recorded among farmers with 69.1%, followed by those that are fishermen with 48.5% then followed by others with 42.9%, then those that are businessmen with 33.3%, while the least prevalence was recorded among those that are civil servant with 23.1% (p-value = 0.132). In respects to the type of drinking water the students consume, higher prevalence infection can be seen in those that consume river water with 100% and the least prevalence in Children who consume water from boreholes with 29.5% (p-value = 0.00).

Children who made use of pit latrine had a higher prevalence (38.7%) of urinary Schistosomiasis compared with Children who made use of water system with a prevalence of 8.0%.

Table 4 shows the prevalence of urinary Schistosomiasis with respect to swimming, fishing, irrigation, fetching water, painful urination and awareness of the disease. Pupils who swim regularly had a higher prevalence of infection with 43.6% compared to those that do not swim with 23.2% (p-value = 0.003). Pupils who go for irrigation with their parent were also found to have a higher prevalence of 35.4% compared to those that do not with 32.2% (p-value = 0.376). While those fetching water, have a higher prevalence of infection with 40.3% compared to those that do not fetch water with 16.1% (p-value = 0.001). Student who experience pain during urination, have the least prevalence of infection with 28.6% compared to those that do not with 34.8% (p-value = 0.285).

Pupils who have had some level of awareness of the disease recorded the least prevalence of 7.1% while those pupils who were not aware of the disease recorded a higher prevalence of 35.5% (p-value= 0.23).

4. DISCUSSION

The result of this study show that, the overall prevalence of urinary schistosomiasis among school children in Kwalkwalawa, Wamakko local government area of Sokoto, was 33.5% and can be categorized as moderate based on WHO categories of endemic communities [5]. This prevalence was higher compared to studies carried out in the Afar Region of Ethiopia (24.54%), the middle Awash Valley of Ethiopia (3.1%) and Somali Region (16.0%) [25,26,27] of Ethiopia. It was also higher compared to studies conducted in Sudan (16%) and Swaziland (5.3%) [28,29]. However, it was lower than a prevalence reported from Hassoba in Afar Regional state, Ethiopia (47.6%), from the White Nile River Basin of Sudan (45%), and from Benue (41.5%) [30,31,13]. The difference could be explained as a result of differences in environmental factors that can, in turn, lead to differences in transmission intensity [32].

From our study, males were more infected (49 infected) with urinary schistosomiasis than females (18 infected), but the prevalence is higher in females(35.3%) than in males (32.9%), which is due to the number of samples examined (Table 3). This was comparable with studies conducted in Sudan and Switzerland [33,34,35]. Socio-cultural factors where males are mostly engaged in water- contact activities like swimming and bathing, fishing, farming and watering cattle could lead to higher exposure among males. The significant association between urinary schistosomiasis and school children involved in farming and fishing were reported from Southern Nigeria [36]. On the contrary, studies carried out in Ghana and Osun showed higher prevalence of urinary schistosomiasis among females than males [37,38].

The prevalence of urinary schistosomiasis increased with age. The high prevalence (33.7%) was observed in the age group 11-14, as compared to (33.3%) prevalence observed in the age group 5-10 (Table 3). The previous study from southwestern Nigeria indicated that children in the 10 to 14 years age group excrete large numbers of S. haematobium eggs [39]. This could be explained by more involvement of older children in field activities and relatively higher risk of exposure to infection.

Occupation of father is associated with urinary schistosomiasis where children whose fathers are farmer were more infected (69.1%). This result agreed with studies from Sudan, Ghana and Nigeria [27,30,40] where children participated in field activities with their fathers. This shows lack of awareness towards risk of urinary schistosomiasis among fathers to make their children aware of the risk of urinary schistosomiasis. A protective role of the head of the family being literate and informed on urinary schistosomiasis was reported from an earlier study in South-western Nigeria [34].

High prevalence among children with the habit of swimming, Fetching of water from the rivers, lack of portable water for drinking, and washing of cloth in the ponds, was observed with a significant association to urinary Schistosomiasis (p-value >0.005) (Table 4). Similar results were reported from an earlier study in Nigeria [27]. Despite the high prevalence of urinary schistosomiasis with the habit of swimming, children swimming regularly accounted for 21% while those swimming sometimes accounted for 79% of the current total prevalence of urinary schistosomiasis. This indicates that long duration of hours of water contact was considered as an important risk factor for exposure to urinary schistosomiasis rather than frequency of water contact [36].

Table 3. Prevalence and distribution of Urinary Schistosomiasis with respects to Gender, Age group, Parent Education, Parent Occupation, Type of Drinking water and Toilet System

Variables	*S. haematobium* **No infection**	Infection	Total	p-value
Gender	n (%)	n (%)	N(%)	
Female	33(64.7)	18(35.3)	51(100.0)	0.440
Male	100(67.1)	49(32.9)	149(100.0)	
Age group (yrs)				
5 – 10	72(66.7)	36(33.3)	108(100)	0.538
11 – 14	61(66.3)	31(33.7)	92(100)	
Parent Education				
Non Formal	49(70.0)	21(30.0)	70(100.0)	0.271
Formal	84(64.6)	46(35.4)	130(100.0)	
Parent Occupation				
Others	8(57.1)	6(42.9)	14(100.0)	
Civil Servant	50(76.9)	15(23.1)	65(100.0)	0.132
Business Man	28(66.7)	14(33.3)	42(100.0)	
Fisher Man	17(51.5)	16(48.5)	33(100.0)	
Farmer	30(30.9)	67(69.1)	97(100.0)	
Type of Drinking water				
Others	16(69.6)	7(30.4)	23(100.0)	
Pipe born	62(69.7)	27(30.3)	89(100.0)	
Bore hole	55(70.5)	23(29.5)	78(100.0)	0.001
River	0(0.0)	10(100.0)	10(100.0)	
Toilet System				
Water system	23(92.0)	2(8.0)	25(100.0)	
Pit Toilet	38(61.3)	24(38.7)	62(100.0)	0.015
Bush	72(63.7)	41(36.3)	113(100.0)	

Table 4. Showing the Prevalence of Urinary Schistosomiasis infection with respects to Swimming, Fishing, Irrigation, Fetching of water, Painful urination and Awareness of the disease

Variables	*S. haematobium* No infection	Infection	Total	p-value
Swimming	n(%)	n(%)	N (%)	
No	76(76.8)	23(23.2)	99(100.0)	0.003
Yes	57(56.4)	44(43.6)	101(100.0)	
Fishing				
No	104(68.4)	48(31.6)	152(100.0)	0.381
Yes	29(60.4)	19(39.6)	48(100.0)	
Irrigation				
No	80(67.8)	38(32.2)	118(100.0)	0.376
Yes	53(64.6)	29(35.4)	82(100.0)	
Fetching of water				
No	47(83.9)	9(16.1)	56(100.0)	0.001
Yes	86(59.7)	58(40.3)	144(100.0)	
Washing of Cloth				
No	54(80.6)	13(19.4)	67(100.00	0.002
Yes	79(59.4)	54(40.6)	133(100.0)	
Painful Urination				
No	103(65.2)	55(34.8)	158(100.0)	0.285
Yes	30(71.4)	12(28.6)	42(100.0)	
Awareness of the Disease				
No	120(64.5)	66(35.5)	186(100.0)	0.23
Yes	13(92.9)	1(7.1)	14(100.0)	

There was a close association between haematuria and the presence of *S. haematobium.* Data from the previous studies indicated that people who tested positive for schistosomiasis are at greater risk of haematuria as compared to those who tested negative. The result further indicated that haematuria may be a very useful clinical tool for the diagnosis of schistosoma infections. This agrees with the reports of [37,41] and [42] that had such association.

5. CONCLUSION

In conclusion, results obtained shows that the study area is endemic for urinary schistosomiasis which is revealed by the high prevalence of 33.5%. It also reveals that knowledge about the cause, transmission, symptoms and prevention of urinary Schistosomiasis in Kwalkwalawa is inadequate and that this could be a challenging obstacle to the elimination of Schistosomiasis in the village. Mass chemotherapy should be emphasized. Other measures to be employed apart from mass chemotherapy includes, school and community-based health education regarding good personal hygiene and sanitary practices are imperative among these communities in order to significantly reduce the transmission and morbidity of schistosomiasis.

6. RECOMMENDATION

Treatment of all school-age children, farmers and fishermen are required until the prevalence of infection falls below the level of public health importance. It is also recommended to complement the praziquantel for the treatment of those infected with the disease. Enlightenment programmes and periodic snail survey should also be carried out and appropriate control measures should be applied. Most importantly, government should provide safe and portable drinking water in the study area.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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