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PREVALENCE OF URINARY SCHISTOSOMIASIS AMONG SECONDARY SCHOOLSTUDENTS IN CHIKUN LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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Abstract— The prevalence of urinary schistosomiasis among secondary school students between the ages 10 – 15 years was investigated in Chikun Local Government Area of Kaduna State, Nigeria. Urinary schistosomiasis is caused by *Schistosoma haematobium*. *S. haematobium* is a class 1 carcinogen and has also been shown to increase the risk of infertility, sexually transmitted infections, including HIV infection. Two hundred and forty two (242) urine samples were collected and examined for the eggs of *Schistosoma haematobium* using sedimentation and microscopy method. Questionnaires were used to obtain demographic data from the study subjects. Chi-Square test for independence was carried out and $P < 0.05$ was considered as level of significance of association. This study revealed a 12.8% prevalence rate of urinary schistosomiasis based upon direct egg detection method. It was observed that, urinary schistosomiasis has no direct association with the following demographic risk factors; Gender (*P 0.*144), washing in streams or stagnant water bodies (*P* 0.102), swimming in river or stagnant water (*P* 0.889), Walking through a river or stagnant water at (*P* 0.125), the location of river or stagnant water body close to the houses (*P* 0.727), the practice of irrigation farming (*P* 0.303). Individual's socioeconomic status (*P* 0.134). The result of the survey indicates the presence of *Bulinus globosus* in one of the water bodies visited at Angwan Boro. Chikun Local Government Area could be a moderate risk community, based on the World Health Organization (WHO) standard. The direct egg detection method is both sensitive and specific. Unlike other methods it gives the picture of current infection.

Index Terms— Prevalence, Urinary schistosomiasis, Sedimentation and microscopy, Water bodies, Chi-Square test.

1 INTRODUCTION

Schistosomiasis is one of the Neglected Tropical Diseases (NTDs) and a major source of morbidity and mortality in developing countries in Africa, South America, the Caribbean, the Middle East, and Asia. Over 650 million people globally are at risk of infection, with more than 200 million people infected. Of these (200 million), 120 million are estimated to have symptoms, with 20 million people experiencing serious consequences [1]. Of the 200 million persons affected with the disease, 80 to 90 million are infected with *S. haematobium* [2]. A national prevalence survey carried out in Nigeria 1990/91 among children age 5-14 years, reported the prevalence of Schistosomiasis in all 36 states of Nigeria with an estimate of 20 million people infected [3; 4; 5]. The affected people are largely hidden, concentrated in remote rural areas or urban slums and shantytowns. They are also largely silent, as the people affected or at risk have little political voice [6].

Urinary schistosomiasis is caused by *Schistosoma haematobium*. Schistosomes (blood flukes) are digenetic trematodes of the super family *Schistosomatoidea*. Hence, schistosomiasis is a helminthic water-borne disease [7].

S. haematobium is a class 1 carcinogen and has also been shown to increase the risk of sexually transmitted infections, including HIV infection, especially in female genital schistosomiasis hematobia. Infection with *S. haematobium* can occasionally cause hepatic complications as well [8].

The World Health Organization (WHO) strategic plan 2012–2020 for schistosomiasis aims at morbidity control by 2020 and elimination of schistosomiasis as a public health problem and interruption of transmission in selected areas by 2025 [9].

In partnership with Nigerian health authorities, the Carter Center's Schistosomiasis Control Program works to help control schistosomiasis in Delta, Ebonyi, Edo, Enugu, Nasarawa, and Plateau states, integrating the treatment of several diseases at once. Studies show that integrating treatment saves about 41 percent in operating costs [10].

This study was aimed at providing prevalence data and to determine the possible association between urinary schistosomiasis and certain demographic risk factors among students attending selected secondary schools in Chikun Local Government Area of Kaduna State, Nigeria, with a view to making recommendations that could contribute to reducing the spread of infection.

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2 MATERIALS AND METHODS

2.1 Materials

1. Urine sample containers,
2. A centrifuge machine,
3. Glass slides,
4. Cover slips,
5. Light microscope,
6. Hand gloves,
7. Gram's iodine stain
8. Formal saline

2.2 Methods

Considering the current global situation with regard to schistosomiasis, as well as the goal of elimination, an effective and practical diagnostic test should be inexpensive and easy to use. It should also retain the requisite level of technical accuracy and be readily available for use at the community level and in point of care facilities [8].

The ideal diagnostic test should be cost-effective in terms of labour, sample processing, equipment, reagents and it should provide an accurate diagnosis by use of an assay ideally performed once. [8].

Description of Research Area

The Chikun Local Government Area of Kaduna State, Nigeria is located geographically between latitudes 10° 03.00'N and 10° 50.00'N, and longitudes 6° 40.00'E and 7° 50.00'E. Annual rainfall ranges between 850mm to 1200 mm. The mean monthly temperature varies between 20°C and 29°C, depending on the season, but may increase up to 35°C at the end of the dry season. The area is drained by a network of rivers, the drainage pattern is dendritic and the streams are all subject to seasonal water level fluctuations [11]

The study area includes Angwan Romi, Kara-Tudu, and Angwan Boro which are located in Chikun Local Government Area of Kaduna State. The people of this locality are mostly farmers, fishermen, traders and civil servants.

Angwan Romi and Kara-Tudu, have slow flowing streams that empty into a major river (River Kaduna) that pass through their community. The streams and the only river serve as one of the major sources of their lively hood. They supply water for their block industries located close to streams and river bank, irrigation practices, fishing and recreation activities like swimming. In the absence of a bridge the people cross the river by wading through the water. The absence of tap borne water in Kara-Tudu makes the river and streams the major sources of water for domestic activities.

The location of Firoro Dam, river and streams in Angwan Boro encourages fishing, irrigation farming, block making, spiritual activities, and swimming. Most of the people prefer washing and bathing in the river after a long day work of farming, fishing, rock breaking and block making.

Figure 1: Map of Nigeria Showing Kaduna State

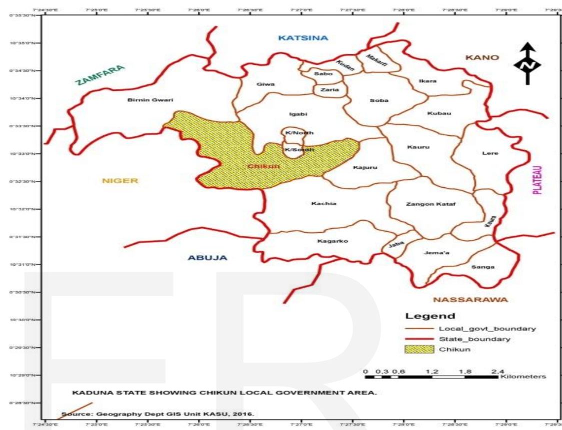

Figure 2: Map of Kaduna State Showing Chikun Local Government Area

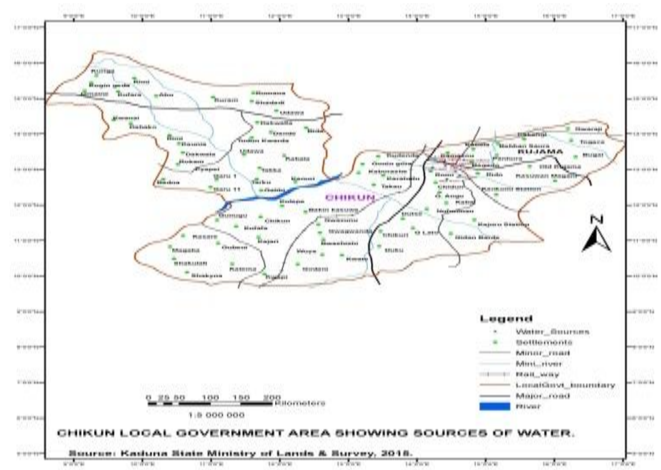

Figure 3: Map of Chikun Local Government Area Showing Points of Sample Collection with Blue Triangle

ETHICAL APPROVAL

- Ethical approval was obtained from Kaduna State Ministry of Health.
- Permission was obtained from the Kaduna State Ministry of Education through letter to the schools.
- Two public and four private schools were contacted, but only two public and one private school consented

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and participated (Filkom Sec. Sch., Unguwan Boro; Govt, Sec. Sch., Unguwan Romi; Govt. Sec. Sch., Unguwan Boro).

CONSENT FORMS AND QUESTIONNAIRES

- Consent forms and questionnaires were administered to junior secondary school students between the age group of 10-15 years.

SELECTION CRETERIA

Inclusion Criteria

1. Students from consented secondary schools.
2. All consented junior secondary school students ages 10 – 15years attending the selected schools in Chikun Local Government Area of Kaduna State in Nigeria.
3. All consented students whose parent signed their consent form.

Exclusion Criteria

1. Students not in the schools selected for study,
2. Students not present in school during sample collection or distribution of consent form,
3. Non-consented individuals,
4. Students whose parent did not consent,
5. Students not in the age group specified,
6. Female students on menstrual period,

SEARCH FOR SNAIL VECTORS

The search for *B. globosus* was performed using a scoop net and hand picking.

SAMPLE COLLECTION

Sterile bottle containers were given to consenting students whose parents agreed by signing the consent forms. Urine samples were collected between the hours of 10am – 2pm in sterile screw cap sample bottle. A total of 242 samples were collected.

Sample Sedimentation and Microscopy

Ten millilitres (10ml) of each urine sample was dispensed in a test tube and centrifuged at 3000rpm for 5 minutes to concentrate the schistosome eggs. After centrifugation, the supernatant was discarded. The sediment was tapped and a drop was placed on a clean glass slide. A cover slip was placed on the drop. Wet mounts were examined microscopically using x10 and x40 objectives of the light microscope for the characteristic eggs [12]. The result was tabulated according to demographic risk factors.

Data from the questionnaires were imputed to the computer using IBM SPSS Statistics 20 package, and Chi-Square tests for independence were carried out at 0.05 level of significance. All results were tabulated according to demographic risk factors.

3 Results

From all the points visited at the river and water bodies in search for the possible intermediate host snails in the community, *B. globosus* was found only at one of the isolated channels of the Firoro Dam and absent at most of the other water bodies visited.

The general prevalence of 12.8% was obtained (Table 1). Out of the 111 males examined 18 (16.22%) reveal the presence of *S. haematobium* eggs, while 13 (09.92%) females were positive out of a total of 132. Gender was observed not to have significant association with the infection *P* 0.144 > 0.05.

Table 1: Prevalence of Urinary Schistosomiasis among Subjects

Gender	Number of Subjects	Infection Status Positive	Infection Status Negative	Prevalence Value (%)
Male	111	18	93	16.2
Female	131	13	118	09.9
Total	242	31	211	12.8
Chi-Square Value				2.130
P Value				0.144

Out of 31 positive samples, only 10 (32.28%) do wash in river or stagnant water, while 21 (67.74%) do not. The statistical association between infection and washing in stream or stagnant water body was *P* 0.102 > 0.05. This implies that, there was no significant association between infection and washing in streams or stagnant water bodies (Table 2).

Table 2: Association between Urinary Schistosomiasis and Subjects that Wash in River or Stagnant Water Bodies

Infection Status	Do you wash in river or stagnant water body?			
	Yes	No	Total	
Positive	10	21	31	
Negative	41	170	211	
Total	51	191	242	
Chi-Square Value				2.674
P Value				0.102

The 5 (16.13%) positive subjects do swim in river or stagnant water while 26 (83.87) do not. The statistical association was found to be *P* 0.889>0.05 (Table 3). This study did not find any significant association between Swimming in river or stagnant water with the disease.

Table 3: Association between Swimming and Infection

Infection Status	Do you swim in a river or Stagnant water?			
	Yes	No	Total	
Positive	5	26	31	
Negative	32	179	211	
Total	37	205	242	
Chi-Square Value				0.019
P value				0.889

A total of 14 (45.16%) positive subjects walk through a river or stagnant water to certain locations, 17 (54.84 %) do not. The association between infection and walking through a river or stagnant water body was *P* 0.125< 0.05. This implies that

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Urinary Schistosomiasis has no significant association with walking through a river or stagnant water (Table 4).

Table 4: The Association between Infection and Walking Through a River or Stagnant Water Body

Infection Status	Do you walk through a river or stagnant water to certain locations?			
	Yes	No	Total	
Positive	14	17	31	
Negative	66	145	211	
Total	80	162	242	
Chi-Square Value				02.354
P Value				0.125

A total of 9 (29.03%) positive subjects have water river or stagnant water body located close to their houses, while 22(70.97%) do not. The association between infection and location of houses close to river or stagnant water body is *P* 0.727< 0.05. In this study, Urinary Schistosomiasis had no significant association with the location of river of stagnant water body close to the house (Table 5).

Table 5: The Association between Infection and Location of Houses Close to River or Stagnant Water Body

Infection Status	Is your house located close to a river or stagnant water body?			
	Yes	No	Total	
Positive	9	22	31	
Negative	55	156	211	
Total	64	178	242	
Chi-Square Value				0.122
P Value				0.727

A total of 10(32.26%) positive subjects practice irrigation farming while 21(67.74%) do not. The association between infection and irrigation practices was found to be *P* 0.303 > 0.05. We found that Urinary Schistosomiasis has no significant association with the practice of irrigation farming (Table 6).

Table 6: The association between Infection and Irrigation Farming

Infection Status	Do you practice irrigation farming?			
	Yes	No	Total	
Positive	10	21	31	
Negative	50	161	211	
Total	60	182	242	
Chi-Square Value				1.062
P Value				0.303

The totals of 4 (12.90%) rich subjects and 27(87.10%) average were positive. The association between infection and financial status was *P* 0.134. This implies that Urinary Schistosomiasis has no significant association with individual's financial status (Table 7).

Table 7: Association between Infection and Financial Status

Infection Status	What best categorised your financial status?				
	Rich	Poor	Average	Total	
Positive	4	0	27	31	
Negative	28	24	159	211	
Total	32	24	186	242	
Chi-Square Value					4.014
P Value					0.134

4 DISCUSSION

The snail vectors were absent in most of the water bodies, this could be due to the absence of food and presence of competitors in those regions. But it was present at a particular spot in Firoro Dam, with abandon fishing net, most of the fish were already decaying, leaves and food particles which could serve as a source of food for the snail.

Urinary schistosomiasis will continue to be a public health problem if adequate measures are not taken to curtail its menace. The present study revealed a 12.8% prevalence rate which could be attributed to vacations and visit to regions with infested rivers and stagnant water bodies or migration from such regions [13], since the snail-vectors were found only in one of the water bodies visited in the community studied. A higher prevalence value of 19.5% was obtained in Zaria, Kaduna State [14].

Previous findings by other researchers show that there is an association between gender and the infection in South-Eastern Nigeria, part of Osun state and Brazil [15; 16; 17; 18]. It is widely acknowledged that school boys or adolescents using natural freshwater, and those pursuing specific occupations that expose them to open freshwater bodies (e.g., rice farmers) are at an elevated risk of *S. haematobium* infection [19]. But from our findings, gender had no significant association with the infection *P* 0.144 > 0.05. This is in agreement with finding from western Kenya and central district Sierra Leone. It was reported that, there was no clear association between prevalence of *S. haematobium* and sex. Women were reported to be more exposed because they do their domestic work at the lake [20; 21]. This is because the relationship between gender and risk of infection is equivocal and varies with the cultural background of the people. In some regions, higher prevalence of infection in females could be related to the fact that water-related activities were several-fold greater for women than men [22].

The use of questionnaire as a means of determining the possible association of urinary schistosomiasis with certain demographic risk factors have long been advocated [8; 9; 23; 24]. Questionnaire provided an opportunity to investigate the distribution of urinary schistosomiasis at a broad scale in Cross River State for the purpose of planning control strategy [5]. In this study the use of questionnaire was employed to determine the possible association between urinary schistosomiasis and certain demographic risk factors. Chi-square was used to ascertain those possible associations at 0.05, level of significance.

It was observed that washing in streams or dams did not have any direct association with the infection (*P* 0.102). This could be because soap and endod (a natural soap substitute) are toxic to cercariae, miracidia and specific freshwater snails, suggesting that their use during human water contact may protect from schistosome infection [22; 24].

Swimming in river or stagnant water did not have direct association with the disease (*P* 0.889). This finding is supported by report that the host's immunity and physiology for example skin thickness also plays a role in preventing infection [22; 24]. This was emphasised by finding that fewer than one in a hundred contacts with infested water results in infection with *S. haematobium*, and fewer than one in a thousand results in egg output [24]. A reduction in snail infections, in turn, might be expected to reduce the concentration of cercariae, and hence, the risk of human infection [24].

This study indicates that there is no direct association between Urinary Schistosomiasis and walking through a river or stagnant water (*P* 0.125). Contrary observation was made in Brazil, by Massara and colleagues, who found that people who crossed streams were at significantly higher risk of *S. mansoni* infection' [24]. Our observation is most likely due to the relative short duration of water contact and the relatively small surface areas of the human body exposed to infested water [22].

A study in Ghana found that high infection levels were clustered around ponds known to contain intermediate host snails of *S. haematobium* [22]. Similar observation was made in Angola that proximity to a source of water was associated with an increased likelihood of infection [25; 26; 27; 9]. It however contradicts our findings that proximity to a source of water has no direct association with the infection (*P* 0.727), which could be due to the absence of intermediate host snails in some of the water bodies visited. A study by Mota and Sleigh in Brazil concluded that the relative location of a house to snail-free or snail-colonised water sources was a key driver [22].

The practice of irrigation farming did not have any direct association with Urinary Schistosomiasis (*P* 0.303). This could be because most of the farmers wear protective boots to prevent contacts with water and use water pumping machines to supply water to the farm, at the same time they use hoe to create channels that will direct the flow of water. The relatively small surface areas of the human body exposed to infested water could be the possible reason for this observation. It contradicts the previous observation which showed, that 'in Sudan the risk for *S. haematobium* is widespread in the different regions especially in the major irrigation systems in the Gezira area between the Blue and White Nile Rivers' [18; 22].

Individual's financial status did not have direct association with the infection (*P* 0.134). This agrees with an observation that in some settings, everyone has contact with infectious water and socioeconomic status is unimportant [25]. But it contradicts other findings that strongly relate the infection with individual's socioeconomic status in Brazil and Yemen [16; 27].

The lack of direct association between urinary schistosomiasis with some of the demographic risk factors examined could be due to the absence of snail-vector in most of the water bodies and presence of infection in the community could be the case of migrants or travellers returning from endemic regions as reported in other places [22; 28; 29; 13].

5 CONCLUSION

A prevalence rate of 12.81% was observed among the school-aged population in the selected secondary schools in Chikun Local Government Area based on direct egg detection method. Such community is said to be a moderate risk community based on the World Health Organization (WHO) standard (11) and morbidity control threshold community based on the successful Chemotherapy strategies and tools for guiding treatment for schistosomiasis control in People Republic of China (P.R.C.) [30]. This calls for the adoption and implementation of WHO and PRC control plan of mass chemotherapy. This study stressed the need to enforce awareness campaign, through seminars and workshop on the negative effect of surface water contamination and safe use of water from infested water bodies. Identification and elimination of the intermediate host (*B. globosus*) from the identified spot it necessary before it could spread to neighbouring rivers and water bodies. The direct egg detection method is highly specific with no error of cross reaction or presence of antibodies from treated or previous exposure to an infection that has been cleared.

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