Asian Journal of Research in Zoology

3(4): 85-92, 2020; Article no.AJRIZ.63196
ISSN: 2582-466X

Status and Risk Factors Associated with Urinary Schistosomiasis among the Primary School Children in Some Communities of Shinkafi Local Government Area, Zamfara State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author AYB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SS and HMB managed the analyses of the study. Authors MA and JS managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRIZ/2020/v3i430102
Editor(s):
(1) Dr. Oluyomi A. Sowemimo, Obafemi Awolowo University, Nigeria.
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Reviewers:
(1) Ioannis Kyriazis, Attica KAT General Hospital, Greece.
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(3) Huma Ali, Jinnah Sindh Medical University, Pakistan.
Complete Peer review History: http://www.sdiarticle4.com/review-history/63196

Original Research Article

Received 06 October 2020
Accepted 10 December 2020
Published 28 December 2020

ABSTRACT

Urinary schistosomiasis among the primary school children remain among the major public health problems that affect cognitive domain of the pupils. The present research was conducted to investigate the status and risk factors associated with urinary schistosomiasis among the community primary schools children in Shinkafi local government area of Zamfara State Nigeria. Four risk factors (Haematuria, source of water for domestic used, river visit and purpose of river visit) were considered to be associated with urinary schistosomiasis infection in the study area;

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four community primary schools were selected, 400 pupils were recruited for this study, each selected student was asked to produce terminal end urine in a screw cap universal sample bottle, the samples were analyzed with combi_10 reagent strips and then examined microscopically after filtration to count the number of *Schistosoma* eggs/10 mils of urine. One hundred and seventy three 173 pupils were found positive which gave the prevalence of 43.1%, higher significant infections was observed among the pupils that are using river (70.0%) as their source of drinking water; those that visit river (52.5%) and those that said fishing is their purpose of river visit (70.6%). The infection was not significant with regard to presence of haematuria in the urine samples. Pupils who used river as their source of drinking water had more than 2x likelihood of been infected than those that used other source of drinking water, those that visit rivers had more than 14x likelihood of having infection than those whose did not visit river, pupils who visited the river for fishing are 22.60 times likelihood of developing the infection than the pupils who visited the river for some other reasons. Conclusively, source of drinking water, river visit and purpose of river visits are the potential risk factor that increased likelihood of higher infection among the pupils in the study area.

Keywords: Status; risk factors; urinary schistosomiasis; primary school; children.

1. INTRODUCTION

Urinary schistosomiasis is a parasitic disease spread widely with severe morbidity but relatively low mortality rate especially among the children residing in area that people practice agricultural activities which required fresh water bodies (such as irrigation farming, fishing and rearing of animals) [1]. The disease is often associated with fresh water bodies that contained snails belonging to *Biomplaria* and *Bulinus* genera which served as an intermediate host of Schistosomes [2].

Transmission of Bilharziasis take place in any type of fresh water habitat ranging from large lakes and rivers to small seasonal ponds and streams that contained the snails' species [3]. Although transmission may be intensive in both natural and man-made water bodies, the man-made water bodies were found the most important due to population density often higher where the man made water bodies were constructed [4]. Within the irrigation schemes transmission was found to be focal due to much localized contamination of habitats with human urine containing *Schistosoma* eggs and, also because of the high incidence of human water contact at a few points [5]

Infection with urinary schistosomiasis is known to cause pathological conditions such as inflammatory lesions in the bladder, uretral obstraction, kidney enlargement, and haematuria (Andrade et al., 2005). *Schistosoma haematobium* can also damage internal organs, with the most common symptom being blood in urine and an enlarged liver [6].

An estimated 700 million people are at risk in 74 endemic countries; as their agricultural, domestic and recreational activities expose them to infected water, more than 207 million people are infected worldwide, most of them live in poor communities without access to safe drinking water, adequate sanitation, and personal hygiene [7].

Playing environment make children vulnerable to higher infection and in many areas very large proportion of school-age children are infected [8]. Although, education campaigns have been established and fund have been invented to fight against infection with Schistosoma parasites in Nigeria, persistent of higher infection is been recorded in many part of the country [9].

Duwa et al. [10], reported that, 44.2% of the pupils were infected with urinary schistosomiasis in Minjibir Local Government Area of Kano State, similarly, 47% people infected in some villages around Gusau Dam Site, Zamfara State [11], from Abarma district of Gusau Local Government Area of Zamfara State, Nigeria, 74.0% were found to be infected [12], 19.0% of the people in Ebonyi central of Ebonyi State were infected [13], Moreover, in 2016, 22.7% of the pupils in two Local Government Areas around Zobe Dam in Katsina State were found infected [14].

Village primary school children are particularly vulnerable to schistosomiasis because of their natural habit and life styles which make them vulnerable to the infection, frequent contact with infested water and recreational activities, among the primary school children generally serve as potential source of transmission with schistosomiasis [15].

Therefore, all possible data on the assessment of the status and risk factors that help in the prevention and control of urinary schistosomiasis are important for adequate intervention to address the persistence of urinary schistosomiasis infection.

2. MATERIALS AND METHODS

2.1 Study Area

Shinkafi is a Local Government Area in Zamfara State, Nigeria. Its Headquarters is in the town of Shinkafi at 13°03′00″N 6°29′004″E with an area of about 674mk^2 and population of 135,649. It shares boundaries with Isa Local Government Area (Sokoto State) and Niger Republic from the north, Zurmi Local Government Area to the South and South-East, Maradun Local Government Area and Raba Local Government Area (Sokoto State) by the west. Distance from the State Capital, Gusau is approximately 116 km.

The primary schools used to conduct this research are Badarawa, Kware, Jangeru and Kurya community primary schools which are 10 km, 26 km, 29 km and 7 km respectively away from Shinkafi metropolis, the unique landscape feature associated with these primary schools is the closeness to the river. The rivers are significantly seasonal even though they often flood the surrounding villages annually (September in every year) when the rainfall is at its peak, the average amount of rainfall in the areas fluctuates between 36 and 80 millimeters in a year, the people of the selected villages are predominantly Hausas and Fulanis, however other tribes such as Igbo, Yoruba, Tivs and Zabarmawa are also found [16]. The vegetation is Sudan Savannah type characterized by plentiful short grasses of about 1.5 -2m and scarce short shrubs/trees that are hardly above 10 m tall. The texture of the topsoil is sandy clay loam soil and average monthly dry season temperature is above 35°C but significantly drop in the harmattan periods which stretch from November to February. During this period, the ambient air mass is very dry and cold, dusty during the day and chilly at night. During this period night temperature can drop to as low as between 18 and 21°C resulting in a relatively high diurnal range of temperature. In the rainy season months of July to September, temperature of about 22 -28°C

2.2 Study Design

The study was designed to target a total of 400 primary school pupils from village primary schools of Shinkafi Local Government Area of Zamfara state. Meanwhile, individual(s) who are unwilling and those who either refused to return samples were not included in the survey.

Simple random sampling technique by assigning number to each child in each class room of the primary school was employed, the pupils were asked to pick the papers and any pupil who gets number in his/her paper was requested to produce urine sample. Four hundred (400) primary school pupils (100 pupils from each school of the four villages primary) produced urine sample.

2.3 Sample Collection

Clean, screw-capped and labeled plastic universal bottles (20 ml) were offered to the respondents who produced various quantities of middle to the terminal drops of the urine samples between hours of 10:00 am and 12:00 noon and transferred to universal bottles (Cheesbrough, 1988). Each universal bottle was assigned a serial number, which, corresponded to the number on each individual-based questionnaire. The samples were transferred to the Parasitology Laboratory, Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto for analysis.

2.4 Questionnaire Administration

Individual-based questionnaires were administered to each pupil who wished to participate in the study. The questionnaires were administered to collect information on source of water for domestic use, water visit, times of water visit, knowledge of urinary schistosomiasis and previously experience of blood in urine, from each child. Finally, the questioner contained parasitological information of each participant

2.5 Reagent Strip Technique

A strip was dipped into each of the urine samples collected, and each strip was checked for color change after 1 min. Presence of haematuria was recorded when it turns the strip red color and proteinurea was recorded when green color was observed using combi_10 reagent strip [17]. Two drops of formaldehyde were added thereafter to each sample for preservation.

2.6 Analysis of Urine Samples

The urine filtration technique for detection of *Schistosoma haematobium* was used for this study. Ten militers (10 ml) volume of the urine sample to be tested was measured using measuring cylinder and transferred into the filtration machine, the machine was switched on to filter the urine sample within five minutes (5 min), after the urine passed into the filtration flask the handle and filtration cup were remove gently, The filter paper was taken to the carbon paper for staining using forceps, two to three drops of Ninhydrin solution were added followed by Lugo's Iodine on the filter paper, The filter paper was left overnight to dry, the entire filtrate was examined microscopically using 10X objective and 40X objective. For positive samples, egg counts were carried out and each average count was recorded as number of eggs per 10 ml of urine sample. Intensity of infection was categorized into light (< 50 eggs/10 ml of urine) and heavy (≥ 50 eggs/10 ml of urine) infections [17].

2.7 Statistical Analysis

Data obtained from the survey were analyzed with SPSS version 20.0. Presence of *Schistosoma haematobium,* socio economic factors (source water for domestic used) and behavioral characteristics (water visit, times of water visit, knowledge of urinary schistosomiasis and previously experience of blood in urine), were treated as categorical variable and presented as frequencies and percentages for descriptive statistics. The dependent variables were occurrence of schistosomiasis whereas the independents variables were socio-economic factors and behavioral characteristics. Mean egg intensity was calculated by dividing number of eggs counted with number infected. Multiple regression analysis was used to identify the factors significantly associated with urinary schistosomiasis at $P<0.01$, while analysis of variance (ANOVA) was used to determine significant difference between mean intensity at $P<0.05$.

3. RESULTS AND DISCUSSION

Out of 400 urine sample analyzed, it was found that, urine samples with haematuria had higher prevalence (65.1%) followed by those with proteinuria (31.6%) while that urine samples that are normal had lowest prevalence (30.3%). Similarly, urine samples with haematuria recorded the highest mean egg intensity of 16.04egg/10ml of urine followed by those with proteinuria 8.52egg/10ml of urine, while the least mean egg intensity of 5.47egg/10ml of urine was recorded among pupils with normal urine samples. However, no significant difference was observed for the mean egg intensity among the pupils in the study areas based on reagent strip at P=0.262 (Table 1)

It was found that, pupils who used river as source of water had higher prevalence (70.0%), followed by those pupils who used wells as source of water (53.6%) while those pupils with borehole as source of water had prevalence of 27.7%. Similarly, pupils with river as their source of water had highest mean egg output of 38.93 egg/ml of urine followed by those pupils who used wells as their source of water (10.05egg/ml of urine) then finally those that used boreholes as their source of water with 7.65 egg/10ml of urine. There was significant difference for the mean intensity among the pupils in relation to their source of water for domestic used at P=0.000 (Table 1).

Results from this study showed that, pupils that visit river had higher prevalence and higher mean egg intensity of 52.5% and 19.33 egg/ml of urine respectively against those who did not visit river with prevalence of 7.3% and mean egg output of 11.44egg/ml of urine sample. Although, there is no significant difference for the mean egg intensity among the children with respect to river visit at P=0.173 (Table 1).

Pupils that visit river for fishing had highest infection rate of 70.6%, followed by pupils that visit river for swimming 63.0% then washing 55.9%, passing 40.5%, watering animals 23.1%, and pupils who do not have specific reason for visiting river had least infection rate of 9.6%. Similarly, it was observed that, those pupils who visit river purposely for fishing had highest mean egg intensity of 13.92egg/10ml of urine, followed by those whose went to the river for swimming 13.42 egg/10ml of urine, then washing 12.07egg/10ml of urine, passing 11.76egg/10ml of urine and watering animals 9.54egg/10ml of urine while those who don't know specific purpose of river visit had least mean egg intensity of 6.33 egg/10ml of urine. No significant difference was found for the mean egg intensity among pupils in the study area with respect to purpose of river visit at P=0.900 (Table 1).

Table 1. Status of urinary schistosomiasis with respect to factors associated with the infections

Risk Factors	No. Examined	No. positive	Prevalence (%)	Mean egg intensity /10ml
Reagent strip				
Haematuria	146	95	65.1	16.04+ 1.73[a]
Proteinuria	79	25	31.6	8.52+ 1.40[a]
Normal	175	53	30.3	5.47+ 0.79[a]
Water Sources				
River	20	14	70.0	38.95+ 7.65[a]
Well	207	111	53.6	10.05+ 1.00[b]
Borehole	173	48	27.7	7.6+ 0.83[c]
River Visit				
Yes	318	167	52.5	11.44+1.06[a]
No	82	6	7.3	19.33+8.04[a]
Purpose of Visit				
Fishing	34	24	70.6	9.45+3.63[a]
Swimming	157	100	63.0	11.76+1.38[b]
Washing	34	19	55.9	13.42+2.77[c]
Passing	37	15	40.5	13.07+2.88[c]
Watering	13	3	23.1	6.33+3.28[d]
Do not visit	125	12	9.6	13.92+4.36[d]
Total	400	173	43.3	11.45+1.00

Considering the number of river visits among the pupils, it was found that, all pupils who visit river trice daily and twice per month were all infected (100.0%), followed by pupils who visited rivers trice per week (75.4%), then four times per week (66.7%), once time per week (55.5%), twice per week (52.1%), once time per week (51.5%), twice daily (45.5%), once daily (37.8%), five times per week (33.3%), once per month (14.3%), lastly, least prevalence of 7.3% was observed to those who did not visited river (Table 1).

3.1 Logistic Regression Showed Likelihood for the Higher Infection Rate with Urinary Schistosomiasis with Regards to Risk Factors

The results of logistic regression analysis revealed several independents risk factors for urinary schistosomiasis in the study area (Table 2). Source of water, visiting rivers and purpose of visit, were each identified as being independently associated with the prevalence of urinary Schistosomiasis in the study area.

Table 2. Logistic regression for urinary schistosomiasis infection rate among the pupils in the study area

		Likely hood ratio	95% C.I. for EXP(B)		Sig.
			Lower	Upper	
Source of water	Well				.000
	Borehole	0.332	0.216	0.511	.166
	River	2.018	0.746	5.456	.000
	Constant	1.156			.298
River visit	Yes	14.009	5.929	33.098	.000
	Constant	0.079			.000
Purpose of river visit	Do not Visit				.000
	Fishing	22.600	8.760	58.309	.000
	Swimming	16.520	8.385	32.550	.000
	Passing	6.420	2.647	15.571	.000
	Washing	11.928	4.843	29.377	.000
	Watering Animals	2.825	0.682	11.697	.152
	Constant	0.106			.000

The results showed that, With respect to source of water, it was found that pupils who used river as source of water have more than twice (>2X) likelihood to be infected than pupils with other source of water (95% C.I. 0.74/5.46). Pupils that visit river have 14.009 times likelihood of developing infection than those who did not visit river (95% C.I. 5.92/33.09). Finally, based on purpose of river visit, it was found that, pupils who visited the river for fishing have 22.600 times likelihood of developing the infection than children who visited the river for some other reasons (95% C.I 8.76/58.31).

3.2 Discussion

S. haematobium infection significantly associates with river as a source of water. This might be due to fact that children play and bath in cercariae infested water in the course of fetching water during which they might be infected with *S. haematobium*. This is in line with the report of [18,14] all in Katsina State where they reported significant association of *S. haematobium* with river. However, in Wamakko local government area, Sokoto State reported lack of significant association of *S. haematobium* infection with source of drinking water [19]. The author suggests that, all pupils regardless of sources of drinking water are equally exposed to source of *S. haematobium* infection.

The occurrence of *S. haematobium* infection significantly associates with frequency of visit to the river/stream. This could be attributed to the fact that pupils who visited river frequently were more susceptible to *S. haematobium* infection than those who visit river less frequently. Also, pupils who visit water frequently might have multiple water contact activities as a result they might get infected during one activity or the other [10]. Similar finding was observed from various researchers across the Nigerian States [20]. Also, children with greater river visit had significant higher infection while studying extent of morbidity associated with schistosomiasis infection in Malawi [21].

The significant association of *S. haematobium* infection with fishing activity could be attributed to the fact fishing was observed in the present study to being a risk factor of *S. haematobium* infection probably that the children might get expose during such activity. Similar scenario also observed where children of farmers and fishermen were found to be significantly more infected than others [22]. According to the author, farmers are unavoidably in contact with infected water due to the nature of their works, therefore being at greater risk of being infected with *S. haematobium* infection. This may apply to the children that are helping their parent in such activity.

4. CONCLUSION

Based on findings from this research, it was founded that, source of drinking water, river visit and purpose of river visits were among the potential risk factors that increased likelihood of higher infection status among the pupils in the study area. Therefore, educational awareness on risk factors becomes necessary in the study area to reduce the rate of infection among the pupils.

CONSENT

The consent was received from the participants and their parents/guardians. When seeking the consent from the participants in each school, the objectives and procedures of the study were clearly explained to them in local language (Hausa). Participants were informed that they will be withdrawn from the study without any consequences as a result of any fault. Hence, signature or thumb-print was used to indicate that each participant and his parents/guardians agreed to participate before starting the survey.

ETHICAL APPROVAL

Introduction letter was collected from Head of the Department (Biological Sciences), Usmanu Danfodiyo University, Sokoto. Permission was received from Zamfara State Ministry of Health ethical research committee, Education Secretary, Shinkafi Local Government Education Authority, District Heads of the Communities and Head Masters of the primary Schools

ACKNOWLEDGEMENTS

Appreciation goes to participants and peoples that contributed directly or indirectly to conduct this research work in the study areas

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/63196