A Multivariate Analysis on the Assessment of Risk Factors Associated with Infections and Transmission of Schistosomiasis Haematobium in Some Selected Areas of North-Western, Nigeria

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***Abstract*—Study aimed at determining prevalenceassessment of risk factors of urinary Schistosomiasis in some selected areas of Zamfara state, Nigeria. Methodsa parasitological filtration technique was used toexamined urine samples. Data were entered and analyzed using SPSS version 20.0 statistical software. Results: Of the 606 participants, 374 (61.7%) were positive for Schistosoma haematobium infections. Univariate and multiple logistic regression analysis were used to assess associated risk factor for *Schistosoma haematobium* infections. Age group 10-14 and 5-9 years are 1.24 times [OR Adj. 95% CI, 1.65, 7.23 P-value 0.001] and 1.23 times [OR Adj. 2.14, 5.51; P-value 0.001] as compared to older age. There are the needs to evaluate other potential risk factors before finding lasting and effective methods that can be used and sustained by the Communities in order to prevent or control the disease in these endemic settings.**

***Index Terms*—multivariate analysis, risk factors, S.haematobium, north-western Nigeria**

I. Introduction

Schistosomiasis is regarded as one of the major health related problems among the neglected diseases in tropical Africa, with the school aged children being the most affected. Schistosomiasis known to be caused by various species of trematodes flukes of the genus Schistosoma [1]. Currently, it is affecting hundreds of millions of people in tropical and subtropical countries [2]. According to the estimates of world healthorganization each year thousands of people are liable to die of Schistosomiasis, and billions of adult and children are at risk of being infected due to exposure to the risk factors [3]. The disease caused by parasitic blood flukes is characterized by male and females living in pairs within the mesenteric vein of the host vascular system and is capable of producing several hundred and even thousand eggs per day [4]. Prevalence and distribution of Schistosomiasis in some parts of endemic countries were attributed to changes in human migration, climatic as well as ecological changes. Environmental risk factors as well as human and snail intermediate host contribute to transmission of this disease which is highly focal and thus reflecting heterogeneity [5]. According to an experimental report carried out in Japan, to differentiate between human Schistosomes, various diagnostic methods for parasite eggs and parasite-specific antibody detection were used. The first methods based on eggs morphology distinguished between species and can directly detect infection with human Schistosoma [6].

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Five species have been identified to be responsible for Schistosomiasis, which included among others *Schistosoma mansoni, S. heamatobium S. japonicum, S. Mekongi* and *S. Intercalatum*, respectively. The first 3 species are most common and widespread in Africa and Middle East while *S. japonicum* are found in Asia. The *S. hematobium* affects urinary tract and kidneys, as well as reproductive systems [7].

Schistosomiasis haematobium was found to be a serious public health problem among school age children which are the target and most affected group in tropical and subtropical Africa [7] contact with contaminated water containing cercariae, an infective stage of the parasite during irrigation farming, swimming, fishing and other recreational activities initiate human infection with the parasites. In endemic areas Schistosomiasis is difficult to eliminate completely and however, prevalence and intensity of infection sometimes persist at low level in a survey situation. In non-endemic countries the disease is consider to be an emerging disease because of the increased in immigration of people and tourism as well as snail intermediate host distribution in some areas [8]. According to an experimental report carried out in Japan, to differentiate between human Schistosomes, various diagnostic methods for parasite eggs and parasite-specific antibody detection were used. The first methods based on eggs morphology distinguished between species and can directly detect infection with human Schistosome [6]. Due to difficulties in evaluating infection with Schistosomiasis and controlling or eradicating the disease completely, it is necessary to develop a new diagnostic tool which may be simple in-expensive, accurate and easy to maintain even in a rural settings [9]. Schistosomiasis was found to have severe detrimental impact on cognitive, intellectual as well physical growth among school children.

II. Materials and Methods

A. Study Area and Population

A community based cross sectional study was carried out in Zamfara State, in north-western Nigeria. (Latitude 37^0N and $12^0$42N and Longitudes $04^0$23E and $5^0$52E) and occupies an area of 39,762 square kilometers. The study area share borders with Sokoto state and Niger republic in the North. Katsina state in the east and Kaduna, Niger and Kebbi states in the south. Characterized by the presence of isolated hills, sandy savannah, in addition to numerous rivers, stream, and dams which constitute major water supply in all the study communities in the areas. In terms of economy, basically over 80% of the people main occupation is mainly farming and fishing. In 2006, National population census [10] Zamfara was estimated to have a population of 3,259,846 persons. The main annual rainfall in the area is about 990mm with the highest peak in August and the vegetation type is northern guinea savannah.

B. Sample Collection

1) Urine sample collection and laboratory testing

Individuals were given clean, leak proof plastic containers labelled with their names, age and identification number. Urine sample from each individual were deposited into each container and return to the collection centre. The school children participating in this research and their parents were guided on how the samples should be collected and the appropriate volume required during a meeting. In the laboratory, presence of *S. haematobium* eggs was detected by parasitological methods (filtration techniques) of about 10ml of the urine samples and the sediment were examined using X10 and X40 objectives of the Microscope.

2) Ethical consideration

The research was approved by the ethical Committee of the State Ministry of health, Zamfara. Consent was obtained from children selected for the study after explaining the purpose and procedures, possible risks and inconveniences of the study. Children who are unable to understand the purpose and procedures of the study. Written consent was obtained from their parents through their head teachers. The study was carried out between November, 2011-September, 2012.

3) Parasitological survey

A cross-sectional parasitological survey was carried out in all households and selected schools. A single urine sample of each household member as well those of school children was examined according to the parasitological technique using filtration techniques. The slides were prepared in a laboratory by a well-trained technician. After that experienced laboratory scientist of the Medical parasitology laboratory, Usmanu Danfodiyo University performed the microscopic examination. The results for *S. haematobium* were expressed quantitatively to obtain the number of eggs per 10ml of urine. For analysis on group and population levels, the intensity of infection wascalculated as the geometric mean of the egg was calculated as the geometric mean of the egg counts of positive individuals.

4) Data analysis

The Chi-square test was applied to compare proportions between groups. The odds ratio was used to determine the strength of association of have higher prevalence when compared to females in all most across all the age group ranges results from urine examinations between groups of the population. The relationship between infection with *S. haematobium* and demographic, socio-economic and water contact variables was explored sequentially removing the variable with the highest p value until all variables showed a p value <0.05 was the adapted procedure of the multivariate logistic regression to develop the final model. All tests were carried out with a 95% level of confidence. The software package SPSS 20.0 version was used to carry out these calculations.

III. Results

The result of our findings revealed that from a total of 606 participants selected for this study, 61.7% were found to be positive for *Schistosoma haematobium* infections Table I: shows the strength of the association between infections with urinary Schistosomiasis and different risk factors in univariate analysis. Different risk factors variable found to be significantly associated with infection using univariate analysis include amongst other gender, parent occupation, age group, Educational level, Ethnic group or race, and recreational activity.

TABLE I. SHOWED RISK FACTORS ASSOCIATED WITH SCHISTOSOMA HAEMATOBIUM INFECTION FROM REGRESSION ANALYSIS (N=606)

Variables	Frequency (n=606)	SH (+)*	COR (95%CI)	P-value	AOR (95%CI)	P-value
Gender						
Female	90 (14.9)	40 (10.7)	1		1	
Male	516 (85.1)	334 (89.3)	0.83 [0.27, 0.68]	0.001*	0.57 [0.33, 0.94]	0.030*
Age grp						
30+	29 [4.8]	18 [4.8]	1		1	
5-9	90 [14.9]	32 [8.6]	1.14 [2.01, 4.89]	0.001*	1.23 [2.14, 5.51]	0.001*
10-14	180 [29.7]	96 [25.7]	1.16 [1.59, 6.47]	0.001*	1.24 [1.65, 7.23]	0.001*
15-19	202 [33.3]	158 [42.2]	0..01 [0.52, 1.86]	0.973	0.04 [0.53, 2.02]	0.898
20-24	56 [9.2]	44 [11.8]	0.35 [0.64, 3.20]	0.382	0.32 [0.59, 3.21]	0.446
25-29	49 [8.1]	26 [7.0]	-0.72 [0.28, 0.81]	0.005*	-0.57 [0.32, 0.97]	0.041*
Parent Occup.						
Others	50 [16.7]	33 [66.0]	1		1	
Farming	10 [3.33]	1 [10.0]	1.09 [1.51, 5.86]	0.002*	1.03 [1.40, 5.60]	0.004*
Fishing	17 [5.7]	5 [29.4]	0.63 [0.21, 1.88]	0.001*	0.60 [0.20, 1.40]	0.231
Irrig. Farm.	28 [9.3]	3 [10.7]	0.37 [0.29, 1.63]	0.399	0.57 [0.23, 1.41]	0.221
Laundry	13 [4.3]	1 [7.7]	0.70 [0.33, 0.73]	0.001*	0.70 [0.33, 0.75]	0.001*
Level Educ						
Tertiary	20 [3.3]	7 [15.]	1		1	
Secondary	99 [16.3]	1 [25.0]	0.85 [1.23, 4.48]	0.009*	0.67 [0.98, 3.90]	0.055*
Primary	446 [73.6]	9 [39.1]	0.07 [0.44, 1.92]	0.837	0.38 [0.32, 1.47]	0.331
No Educ.	41 [6.8]	98 [43.2]	0.55 [0.57, 5.14]	0.319	0.58 [0.58, 5.48]	0.307
Ethnic group						
Others	98 [37.2]	12 [12.2]	1		1 0.82 [1.05, 4.93]	
Hausa	20 [6.7]	7 [35.0]	0.82 [1.04, 4.93]	0.038*	0.56 [0.67, 4.55]	0.038*
Igbo	62 [20.7]	26 [41.9]	0.56 [0.67, 4.55]	0.247	-0.02 [0.37, 2.52]	0.247
Yoruba	120 [40.0]	70 [58.3]	0.02 [0.37, 2.52]	0.953		0.953
Recreational						
activity			1		1	
Others	44 [7.3]	23 [6.1]				
Bathing	101 [16.7]	56 [15.0]	0.32 [0.80, 2.39]	0.243	0.27 [0.78, 2.20]	0.294
Swimming	182 [30.0]	107 [28.6]	0.85 [1.30, 4.20]	0.004*	0.86 [1.35, 4.12]	0.002*
Washing	160 [26.4	107 [28.6]	0.64 [1.04, 3.50]	0.035*	0.60 [1.02, 3.26]	0.040*
Fetching water	119 [19.6]	81 [21.7]	0.52 [0.75, 3.82]	0.202	0.33 [0.64, 3.01]	0.402

The age related prevalence of Schistosoma haematobium infections in the study community is illustrating a positive result as shown in Fig. 1. Of the 374 positive participants observed in the study, 10-14 years age group and 5-9 years has the highest prevalence rate of 42.5% and 25.7% respectively.

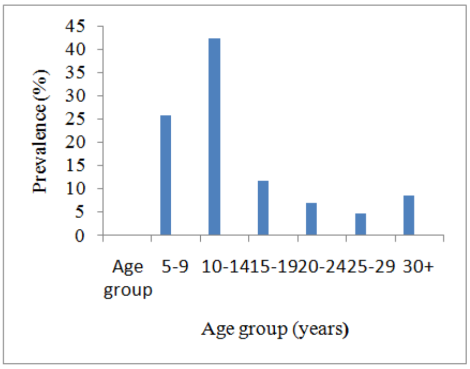

Figure 1. Age related prevalence of *schistosomahaematobium* infection in the study area

In multivariate analysis, risk factors that were found to remained significantly associated with *S. haematobium* infections are male gender 0.57 times [OR Adj. 95% CI: 0.33, 0.94; P-value 0.030], Age group 10-14 and 5-9 years are 1.24 times [OR Adj. 95% CI, 1.65, 7.23; P-value 0.001] and 1.23 times [OR Adj. 2.14, 5.51; P-value 0.001] as compared to older age group .Among male gender selected for this study 89.3% were found to be more infected compared to their counterpart female with 10.9%. Therefore male gender was found to have higher prevalence when compared to females in all most across all the age group ranges.

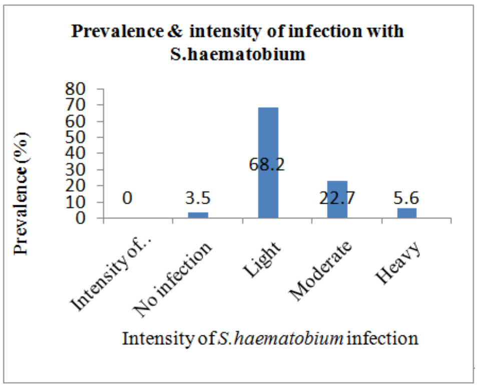

Figure 2. Prevalence and intensity of *schistosoma haematobium* infection among the subject in the study area

The findings of the present study regarding intensity of infection shows that most infected individuals had light infection intensity [68.2%] i.e. [<50 eggs/10ml of urine] and that 5.6% haveheavy infection intensity [>50 eggs/10ml urine] which were found only among small groups of the population while 22.7% have moderate eggs intensity Fig. 2. There was a significant difference between intensity of *Schistosoma haematobium* infection in gender, and age group from this study.

IV. Discussion

The result of our finding showed that Schistosoma *haematobium* was found to be endemic in the study area of Zamfara state, Nigeria. The disease was found to exist at an overall prevalence of 61.7% based on individual results discussion, it was revealed that children who undergo Swimming activities in rivers, dam and other water bodies were found to have higher prevalence. These findings were found to have agree with the report of [11] and [12] that infection in school children may be due to recreational exposure to water bodies such as washing, bathing, fishing with peak infection during rainy season.

This study revealed a statistically higher significant difference among age group 10-14 years in which they are 1.24 times (OR Adj. 95% CI, 1.65, 7.23; p-value 0.001) more likely at risk of infection than the older age groups and this is comparable with the findings of [13], [11] and [14] that older age group are less likely to play in water as compared to those less than 15 years old. Contrasting report by [12] showed that adult male were at higher risk due to their occupational exposure. [15] report that prevalence is neither sex nor age dependent as no significant difference was observed.

The present Study also observed that there was higher statistical significant difference among males when compared to the females. Males are 0.54 times (OR Adj. 95% CI, 0.33, 0.94; P-value 0.030) more likely to be at risk of infection than the females by being more knowledgeable of the existence of water bodies in their areas as well as being more active and engaged in swimming, fishing and irrigation after school hours than their females counterpart. This is similar with other study, report by [14], [16], [17]. But some researchers opposed to this idea which includes [17] and [18] in which no significant statistical difference was observed by sex.

Among the occupational activities, the study revealed statistically significant higher prevalence among those whose activities was farming as compared to other occupations. Farmers in this study were 1.03 time (OR Adj. 1.40, 5.60; P-value 0.004) and fishermen are more likely to have higher exposure to infection than other occupational groups in the study area. This is similar with other studies reported by [19].

The results of our research findings showed a high prevalence of Schistosomiasis and the participant are highly exposed to risk factors for infection and its associated implications which in turn will affect socio-economic development of the study area and the entire country at large.

V. Conclusion

The present study confirmed that Schistosomiasis due to *Schistosoma haematobium* is endemic in Zamfara state and that a strong association does exist between various risk factors and urinary Schistosomiasis. There are the needs to evaluate other potential risk factors before finding lasting and effective methods that can be sustained by the Communities in order to control the disease in these endemic settings.

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