Sokoto Journal of Medical Laboratory Science 2021; 6(3): 30 - 36

SJMLS - 6 (3) - 005

Review of Risk Factors Associated with Transmission of Urinary Schistosomiasis amongst Vulnerable Groups: School Pupils and *Almajiris* and Effect of Treatment with Praziquantel in Maiduguri Metropolis, North-Eastern Nigeria.

Balla, H.J.*, Pius, S. and Askira, U.M.
University of Maiduguri, Maiduguri, Borno State, Nigeria.
*Author for Correspondence *: ballahabiba@gmail.com/https://orchid.org/0000-0002-4616-2991*
https://dx.doi.org/10.4314/sokjmls.v6i3.5

Abstract
Human schistosomiasis is the most prevalent tropical disease in the world after malaria. Most of the countries in Sub Saharan Africa including Nigeria have not achieved the Millennium Development Goals for accessing safe drinking water and halting or reversing major disease incidences. School aged children and young "Almajiri" were selected for the cross-sectional study. Awareness lectures were given at every study site before collection of samples. Urine filtration technique was used for the diagnosis of urinary schistosomiasis. Infected subjects were given 60mg Praziquantel and followed up after 28 days and the effect was assessed by calculating the cure rate. A total of 308 subjects were enrolled comprising of 200 school children and 108 "Almajiri" respectively with a mean age of 13 years old. Female-to-male ratio is 9.6. Out of the 308 participants, 149 had urinary schistosomiasis (48.4%) with 5 among the females (17.2%) and 144 among the males (51.6%) respectively (p>0.005). A significant 26.3% of the respondents had haematuria and 77.8% were infected. Only one respondent admitted having knowledge of the disease. A total 136 of those infected received the treatment of 60mg Praziquantel and 43 (31.6%) showed eggs in their urine 28 days after taking PZQ. Highest (84.6%) cure rate was observed among the youngest age group of 5-9 years and lowest (60.3%) was observed among the oldest age group 15-19 years (p=0.005). An overall prevalence of 48.4% among these vulnerable group of the society calls for a great concern because these group of the population serve as means of maintaining the infection cycle. Dearth of knowledge about schistosomiasis, extreme weather condition, lack of potable water supply and poverty remains the reason behind the continued endemicity of schistosomiasis in the study area.

Keywords: *Almajiri, cure rate, Praziquantel, Tsangaya, Urinary schistosomiasis.*

Introduction Human schistosomiasis is the most prevalent tropical disease in the word after malaria. There are over 20 million cases of schistosomiasis in the world with 93% reported in SSA and Nigeria has the highest burden of infection (Mazigo *et al*., 2012). Most of the Countries in Sub Saharan Africa including Nigeria have not achieved the Millennium Development Goals for accessing safe drinking water and halting or reversing major disease incidences (Brindicci *et* al., 2017; Olabode *et al.,* 2014).

An "Almajiri**"** usually refers to a person who migrates from the luxury of his home to other place or to a popular teacher in the quest for Islamic knowledge. They are seen roaming the streets begging for food and alms. Therefore, they become victims of economic hardship, child neglect and abuse. As a consequence, these children find succour in bathing in streams, lakes or even rivers mostly during the hot, dry season, thereby subjecting themselves to the risk of contracting water borne diseases such as schistosomiasis (Zakir *et al*., 2014).

They have peculiar characteristics such as being far away from their parents, poor personal hygiene, living in overcrowded rooms and have to beg for what they eat every day. These characteristics predispose them to parasitic infections and studies about their health issues are dearth.

Several challenges lay ahead the ambition of achieving the goal of global elimination and some of the intervention measures are considered in this research which include; creating awareness, continuous surveillance and use of therapeutic agents to treat the infected. WHO current control strategy of schistosomiasis is based on preventive chemotherapy by periodic administration of the antischistosomal drug Praziquantel (PZQ) particularly to school-aged children considered as high-risk group alongside vector control (Koffi *et al*., 2012).

Our objectives were to describe the pattern of urinary schistosomiasis infection at baseline, to create awareness of the disease, to treat the infected subjects so as to reduce the disease transmission in communities to the minimum level possible and also to report the research findings to the relevant authorities.

Methods

Study site

The study was conducted in Maiduguri Metropolis in North Eastern Nigeria. Maiduguri covers an area of 543km^2. The water body that covers Maiduguri metropolis is River Ngada which originates from Rivers Yedzaram and Gambole. These two rivers meet at a confluent in Sambisa as River Ngada and flows into Alau Dam then stretches across Maiduguri metropolis then finally empties into the Lake Chad (Shehata *et al*., 2018).

Study population

School aged children and young adults "Almajiri" were selected for the study because they are the most afflicted by schistosomiasis and the information from this population provides the best reflection of the community disease burden (Akan *et al*., 2012).

The study population was recruited from two selected primary schools and two "Tsangaya" Schools situated within the metropolis. The target population for this study was school going age group because the infection is known to affect young children most (Dejon-Agobe *et al*., 2019). One other reason is, to create awareness of the disease before they grow older. Infected subjects were traced to their schools and given Praziquantel 60mg/kg body weight.

For the quantitative approach, 108 "Almajiri" and 200 "Pupils" were sampled in Maiduguri Metropolis. The survey team used a questionnaire and visited each selected School and "Tsangaya" unit to collect data on KAP (include full meaning) pertaining to schistosomiasis. The School head and "Mallam" of the two "Tsangaya" were interviewed by investigators who were trained in data collecting techniques in order to reduce biases.

The survey was conducted in the Hausa language the most widely spoken language in the Northern Nigeria and an interpreter translates to Kanuri language where necessary being the most dominant tribe of Borno state. Any potential bias was reduced by training the assistants for two days on basic concepts and notions related to the study and data collection methodology. The responses were firstly recorded in local languages and then translated into English.

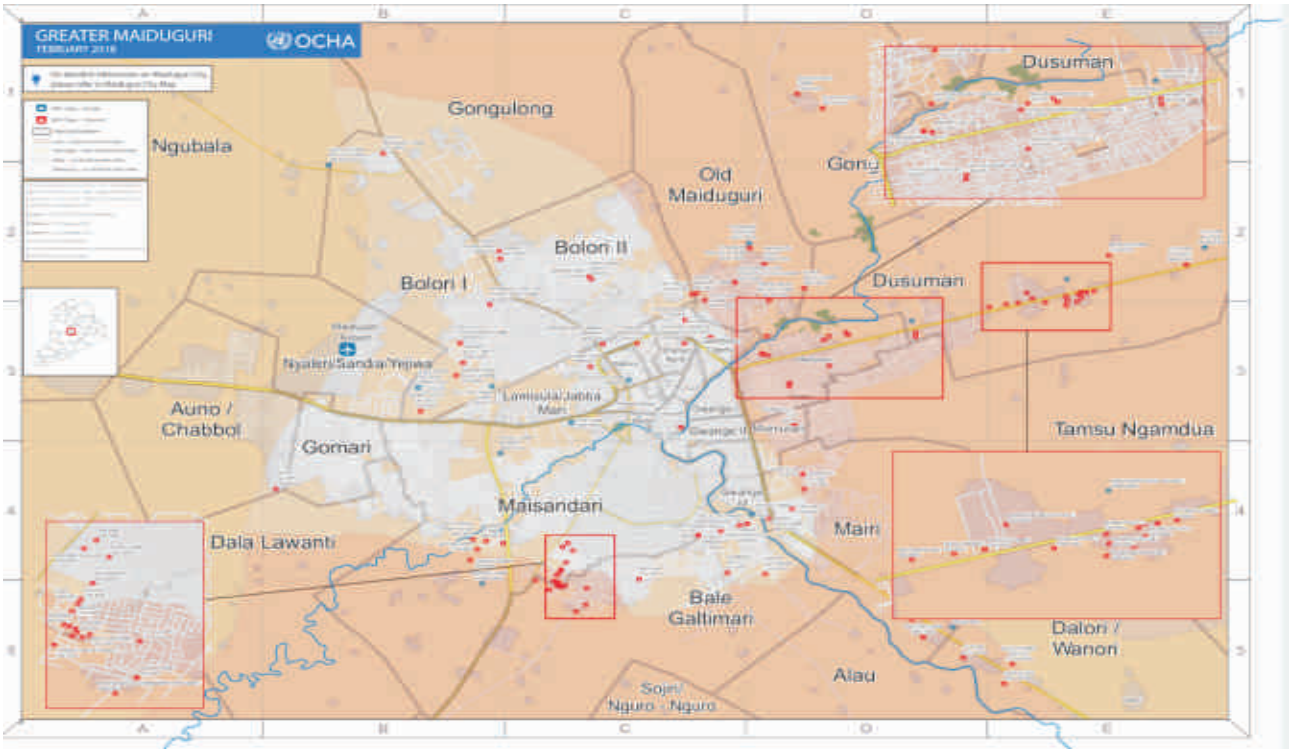
Study design

One cross-sectional survey was conducted in each of the selected site. The study was conducted between July and September, 2017. Prior to the inception of the study, both administrative and local authorities were informed about the research, its aims, procedures and benefits. Introductory letter to the Schools was obtained from the Borno State Universal Basic Education Board. Familiarity visit was carried out in the four study sites by the lead researcher and a co-researcher. The study was designed combining qualitative and quantitative approaches.

One hundred and thirty six (136) of the one hundred and fourty nine (149) subjects that tested positive were able to be traced accordingly and given Praziquantel 60mg/kg body weight.

They were then followed up to provide a second specimen after 28 days. Schools and Tsangaya were followed up in the same order as in the baseline survey. Children who were not around in the follow-up day were followed up two days later. Same method used in the baseline survey was used in the follow-up survey. The results were recorded accordingly.

Figure 1: Map of Maiduguri showing study sites



Source: reliefweb.int

Sample size estimation

To achieve the objectives of the study, sample size was estimated using the sample size formula for cross-sectional study by (Charan and Bismas, 2013). Given that an overall prevalence of 47.8% was the most recently reported (Balla *et al*., 2015) and considering 1.96 standard normal deviate and 5% precision, we estimated a minimum of 384 for inclusion in this survey. The sample size N was calculated using the formula; $N = z^2 x P(1-P)/m^2$

Where; N - Required sample size, z - Confidence interval at 95% (standard value of 1.96), P - Estimated prevalence of urinary schistosomiasis in previous studies carried out in Maiduguri, m - Margin of error at 5% (standard value of 0.05.)

Laboratory Procedures

Urine filtration technique was used to detect Schistosome eggs and determine the infection intensity as recommended by (WHO, 1991). The characteristic terminal spined egg of *S. haematobium* was counted and expressed as eggs/10ml of urine which represents intensity of infection. Evidence of haematuria was detected using Combi 9 rapid dip test.

Statistical analysis

Data were collected and expressed in tabular forms. Variables were summarized as proportions and 95% confidence interval. Chi square test was used to compare proportions. P-value was set at <0.05. was considered significant in all statistical analysis. The relationship between prevalence and risk factors such as social status, source water supply, care givers' occupation and education were obtained from the questionnaire administered. Cure rate was calculated by dividing the number of negative children after treatment that were positive at baseline by number of positive subjects before treatment and expressed as a percentage.

Results

Study population

308 subjects were recruited into the survey comprising of; 100 school children from Gwange III and Kulo Gumna Junior Secondary School respectively, then 50 *Almajiris* from *Tsangaya* I and 58 *Almajiris* from *Tsangaya* II. The age range was 5-19 years with about 90% being above the age of 9. There are no female *Almajiris* in the study area so they were only sampled in the schools and the female: male ratio was 9.6. Out of the 149 participants who tested positive and were administered with 60mg/kg PZQ, only 136 were available during the follow-up testing.

Schistosome infection morbidity

As shown in table 8, among the 308 recruited in the study, 81 (26.3%) complained of visible haematuria which was observed macroscopically and confirmed to be so by the use of Combi 9 urine test strips. They were also confirmed to be positive for urine filtration and were treated with PZQ accordingly. Hence at the initial survey, a total of 149 participants were found to be infected with S. haematobium resulting in 48.4% (95% C.I 22.8+0.53) of the study population with schistosomiasis. As presented in Table 1, urinary schistosomiasis was most prevalent among school children of Kulo-Gumna Junior Secondary School (47%, p = 0.027, $\chi 2$=82.7.) The infection among male participants was statistically significant (p = 0.0002), while that of the females was not significant (p = 0.881).

PZQ administration

Only 136 of the participants out of the 149 who tested positive for urinary schistosomiasis were available after the initial survey for PZQ administration. They were then followed up to provide a second specimen after 28 days. Schools and Tsangaya were followed up in the same order as in the baseline survey. Same diagnostic method used in the initial survey was used in the follow-up survey.

Outcome of PZQ treatment

All the 136 subjects whom were given 60mg/kg PZQ were traced accordingly after 4 weeks and another urine sample was collected and analysed as before. None showed visible haematuria but 43 remained positive.

Overall cure rate was calculated by dividing the number of negative subjects after treatment that were positive at baseline by number of positive subjects before treatment and expressed as a percentage (71.1%). The cure rate among male subject was = 70.1% and that among females = 80%.

Lack of awareness of the disease

Only one student admitted knowing about Urinary schistosomiasis and its means of transmission.

Table 1: Study population baseline socio-demographic characteristics and distribution of schistosomiasis cases. The proportions of schistosomiasis cases are distributed at the end of initial survey and follow up.

Study population at baseline			95% C.I.		Schistosomiasis cases				
					Initial survey		Follow-up		P-value [a]
	N	%	Lower	Upper	n/N	%	n/N	%	
Overall	308	-	-	-	149/308	48.4	43/136	31.6	0.001
Age									
5 – 9	33	10.7	6.4	13.2	13/33	39.4	2/13	15.4	0.122
10 – 14	127[x]/ 29[y]	41.2/ 9.4	35.7/ 6.4	47.0/ 13.2	(68/127)/ (5/29)	53.5/ 17.2	(15/68)/ (1/5)	22.1/ /20	<0.0001/0. 0.881
15 – 19	119	38.6	33.2	44.3	63/119	52.9	25/63	39.7	0.091
Gender									
Female	29	9.4	6.4	13.2	5/29	17.2	1/5	20	0.881
Male	279	90.6	86.8	93.6	144/279	51.6	42/131	32.1	0.0002
Location									
G	100	32.5	27.2	37.0	41/100	41	9/41	22	0.033
K	100	32.5	27.2	37.0	47/100	47	13/47	27.7	0.027
T I	50	16.2	12.3	20.8	27/50	54	11/22	40.7	0.302
T II	58	18.8	14.6	23.7	26/58	44.8	10/26	38.5	0.592

[a] Chi square test to compare proportion of schistosomiasis cases between initial sampling and follow up, n number of schistosomiasis cases,
N number of participants, C.I. confidence interval, [x] Male subjects, [y] Female subjects, G Gwange III, K Kulo-Gumna, T I Tsangaya I, Tsangaya II

Risk factors:

Table 2: Prevalence with respect to source of drinking water

Source	No. tested	No. infected (%)	Not infected (%)	p - value
Well	38	16 (42.1)	22 (57.9)	0.001*
Bore hole	149	58 (38.9)	91 (61.1)	
Tap	68	29 (42.6)	39 (57.4)	
Stream	53	46 (87.8)	17 (32.1)	
Total	308	149 (48.4)	159 (51.6)	

Table 3: Prevalence with respect to care giver's occupation

Occupation	No. tested	Infected (%)	Not infected	p-value
Civil servant	84	30 (35.7)	64	0.150
Trading	76	33 (43.4)	53	
Subsistence farming	68	47 (69.1)	31	
Unemployed	80	39 (48.8)	52	

Table 4: Prevalence with respect to care giver education

Education	No. tested	Infected (%)	Not infected	p-value
None	167	46 (27.5)	121 (72.5)	0.150
Primary	57	31 (54.4)	26 (45.5)	
Secondary	60	15 (25.0)	45 (75.0)	
Tertiary	24	16 (66.7)	8 (33.3)	

Table 5: Prevalence with respect to awareness of schistosomiasis

Aware	1 (0.3%)
Not aware	307 (99.7%)

Table 6: Prevalence with respect to history of haematuria

Haematuria	No. tested	No. positive (%)
Never	227	86 (37.9)
Always	81	63 (77.8)

Table 7: Cure rate with respect to age group

Age	No. positive at initial survey	No. positive at follow up	Cure rate (%)	P-Value
5-9	**13**	**2**	**84.6**	**0.05**
01-15	$68^{x}/5^{y}$	15/1	77.9/80	
16 - 19	**63**	**25**	**60.3**	

Legend

^{x} - Male, ^{y} - female

Discussion

The main objective of this study is to describe the pattern of urinary schistosomiasis among the study subjects. We therefore determined the point prevalence by the use of a structured questionnaire. The overall prevalence of 48.4% is an indication that urinary schistosomiasis remains highly endemic in the study area and was quite close to prevalence obtained in a similar study carried out among similar subject group in Borno State (Charan and Bismas, 2013).

Male respondents had higher prevalence (51.6% Vs 17.2%) and the difference between the prevalence among males and females was significant ($p < 0.05$). Males were 3 times more at risk of being infected (O.R 3.48). This may be attributed to the religious background of the respondents who are mostly Muslims and hence females are not allowed to go out and mingle with their male counterparts. The 29 female school children that admitted to going to the stream went for domestic purposes only. There are no females among the "Almajiris" and the latter had a slightly higher prevalence of infection (49.4% Vs 44.0%) with the "Almajiris" being slightly more at risk of contacting the infection (O.R 1.15). The reason for a higher prevalence among the males is not far-fetched because boys especially teenagers defy their Mothers' advice of "stay at home" and go to play in the water body because of the harsh Maiduguri weather (Balla *et al*., 2010). A higher prevalence (53.5%) was recorded among the age group 10-15 years and this coincides with several studies carried out within and outside Nigeria (Balla *et al.,* 2015; Atalabi *et al*., 2013). The disease was significantly associated with water contact activities for domestic, recreation and farming activities ($p<0.05$). Respondents whose source of water was the stream recorded the highest prevalence of 87.8% ($p<0.05$), even though its worthy of note that the reason for visit to water body is mostly for recreational purposes due to the harsh weather of Maiduguri. There was no statistical significance in the prevalence of urinary schistosomiasis based on the care givers occupation and level of education ($p>0.05$).

In the context of this study, knowledge about the cause of haematuria "fitsarin jini" is void with only one student admitted knowing about the disease. To the best of our knowledge, this is the first ever research on urinary schistosomiasis that involved awareness lecture at the point of sampling and treatment of infected individuals. Lectures were given using coloured charts of the parasite's life cycle. Both the schools and "Tsangaya" visited reported never been given any treatment against the disease. This is to say the Mass Drug Administration campaign against Schistosomiasis has not reached this part of the country.

Sixty-three of individuals with visible haematuria turned out to be egg positive for the urine filtration technique (77.8%). One hundred and fourty nine were egg positive at the initial survey and fourty three remained positive after administration of 60mg/kg of Praziquantel® and highest cure rate (84.6%) was observed among age group 5-9 years ($p=0.05$). Reason may be due to the fact that infection intensity may be low among this age group because of their young age hence water contact activities may not be too frequent yet.

Conclusions

An overall prevalence of 48.4% and lack of awareness among the studied population calls for a great concern because these group of the population serve as means of maintaining the infection cycle. This reiterates the assertion that Nigeria is considered as the most endemic country for schistosomiasis in Africa (WHO, 2012). Dearth of knowledge about schistosomiasis, extreme weather condition, lack of potable water supply and poverty remains the reasons behind the continued endemicity of schistosomiasis in the study area.

Competing interests

The authors declare that they have no competing interests.

Ethics approval and consent to participate

Approval for this research was obtained from the Borno State Universal Basic Education Board. Letters were further given to the Headmasters and School Principals by the Education Officer. Mallams of the "Tsangaya" were also informed before the day of sampling.

Authors' contributions

Balla, H.J conceived of the study and designed it, Balla, H.J together with U.M Askira conducted the field work with contributions from Dr Simon Pius. Mark did the Statistical analysis and Dr Simon Pius drafted the manuscript. All authors contributed to the final version of the manuscript, read and approved it.

Acknowledgements
We would like to thank the pupils, staff and parents of the participating Schools, the *Mallams* of the *Tsangaya* Schools and the University of Maiduguri Teaching Hospital. The research was funded by the Tertiary Education Trust Fund (TeTfund) Under the Institution Based Research fund.

Glossary
"Almajiri" – A Koranic School pupil
"Tsangaya"- An institute for Islamic clerics and students

References

Akan, J.C., F.I. Abdulrahman., O.A Sodipo., A.E Ochanya., Y.K Askira. (2010). Heavy metals in sediments from River Ngada, Maiduguri metropolis, Borno State. *Journal of Environmental Chemistry and Ecotoxicology;* **2(9)**:131-140.

Atalabi, T.E., Adoh, S.D., Eze, K.M (2018). The current epidemiological status of urogenital schistosomiasis among primary School pupils in Katsina State, Nigeria: An imperative for a scale up of water and sanitation initiative and mass administration of medicines with Praziquantel. *PLOS Neglected Tropical Diseases*: e0006636. https://doi.org/10.1371/journal.pntd.0006636

Balla, H.J., Zailani, S.B., Askira, M.M., Musa, A.B. and Mursal, A. (2010). Prevalence of Urinary Schistosomiasis amongst "ALMAJIRIS" and primary School Pupils in Gwange Ward of Maiduguri. *Borno Medical Journal;* **7(2)**: 7-10.

Balla, H.J., Babagana, M., Dr Baba S and Ibrahim H (2015). Incidence of Urinary Schistosomiasis amongst Out-of-School Pupils and "Almajiris" in Dikwa, North Eastern Nigeria. *Global Journal of Medical Research;* **15(2)**: 15-21.

Brindicci, G., Santoro, C.R., De Laurentiis., Capolongo, C., Solarino, M.E., Papagni, R *et al* (2017). Prevalence of Urinary Schistosomiasis among Migrants in Apulia, a Region of Southern Italy, in the Years 2006-2016. *Biomed Research International*. https//: doi.org/10.1155/2017/8257310

Charan, J and Bismas, T. (2013). How to calculate Sample size for different Study designs in Medical Research. *Indian Journal of Psychology of Medicine;* **32(2)**: 121-126.

Dejon-Agobe, J.C., Jean, R.E., Yabo, J.H., Jeannot, F.Z., Adegbite, B.R., Ngwese, M.M et al (2019). *Schistosoma haematobium* infection morbidity, Praziquantel effectiveness and Reinfection rate among Children and Young Adult in Gabon. *Parasite and Vectors*; **12**: 577-603.

Koffi, A.J., Doumbia, M., Fokou, G., Keita, M., Kone, B and Abe, N.N. (2018). Community Knowledge, Attitudes and Practices related to Schistosomiasis and Associated Health-seeking Behaviours in Northern Cote d'Ivoire and Southern Mauritania. *Infectious diseases of Poverty;* **7(70)**: 15-22.

Mazigo, D.H., Nuwaha, F., Kinung'hi, S.M., Morona, D., Pinot de Moira, A., Wilson, S et al (2012). Epidemiology and Control of Human schistosomiasis in Tanzania. *Parasite and Vectors;* **274 (5)**: 222-235.

Olabode, K.T., Kayode, A.Y., Hilary, Z.Y., Owonubi, E (2014). Millennium Development Goals (MDGs) in Nigeria: Issues and problems. Global Journal of Human-Social Science: *Sociology and Culture;* **14(15)**: 9-15.

Shehata, M.A., Chama, M.F., Funjika, E. (2018). Prevalence and intensity of *S. haematobium* among School Children in Zambia before and after Mass treatment with a single dose of Praziquantel. *Tropical Parasitology;* **8(1)**:12-17.

World Health Organization (1991). Basic Laboratory Methods in Medical Parasitology. www.who.int.

Zakir, A., Abubakar, U., Lawal, U.S., Imrana, H., Habibu, I. T., Hassan, I and Harande, M. M. (2014). The Practice of Almajiri: Prospect and Socio-medical Challenges in Northern Part of Nigeria. *Journal of African Studies and Development;* **6(7)**:128-131.

Citation: Balla, H.J., Pius, S. and Askira, U.M. Review of Risk Factors Associated with Transmission of Urinary Schistosomiasis amongst Vulnerable Groups: School Pupils and *Almajiris* and Effect of Treatment with Praziquantel in Maiduguri Metropolis, North-Eastern Nigeria. ***Sokoto Journal of Medical Laboratory Science; 6(2): 30 - 36***