Science World Journal Vol. 19(No 1) 2024 https://dx.doi.org/10.4314/swj.v19i1.29
www.scienceworldjournal.org
ISSN: 1597-6343 (Online), ISSN: 2756-391X (Print)
Published by Faculty of Science, Kaduna State University

PREVALENCE OF URINARY SCHISTOSOMIASIS AMONG SCHOOL CHILDREN IN GIWA AND MARKAFI LOCAL GOVERNMENT AREAS, KADUNA STATE, NIGERIA

[1*]Danaladi Austine Markus and [2]Henry Gabriel Bishop

[1]Department of Food Science Technology, School of Science, Plateau State Polytechnic, Barkin Ladi, Plateau State, Nigeria
[2]Department of Microbiology, Faculty of Life Sciences, Ahmadu Bello University, Zaria, Kaduna State, Nigeria

*Corresponding Author Email Address: markaustine8@gmail.com Phone: +2348069200892

ABSTRACT
Urinary schistosomiasis is a neglected tropical disease that is affecting the health of many children, especially in Nigeria. Awareness about schistosomiasis in some communities is low; hence more children undertake activities in unsafe bodies of water. This study determined the prevalence, socio-demography, risk factors and symptoms of urinary schistosomiasis among school children in Giwa and Makarfi LGAs. A total of 200 school children were enrolled in this study and each of them submitted 10 mL urine sample. Each urine sample was concentrated by centrifugation and the sediment was examined using a light compound microscope. Data collected were analyzed using IBM SPSS Version 23 at 95% confidence interval. Overall prevalence of urinary schistosomiasis in this study was 19(9.5%). Spatial prevalence was 10.0% and 9.0% in Giwa and Makarfi LGAs respectively. There was no infection among the females (0.0%), but 13.5% of infection occurred among the males (P=0.003, OR =1.156). School children within the age-group of 18–19 years old had highest infection of 20.0%, followed by 12.1% and 5.6% among those within age-groups of 14-15 and 12-13 years old respectively. The infection was more occurring among children in junior secondary school (10.4%) than among those in senior secondary school (7.7%). Significant risk factors were irrigation farming, swimming, fishing and washing of clothes in rivers (P<0.05, OR >1). Significant symptoms of the disease among them included painful urination and terminal haematuria (P<0.05, OR >1). However, infected individuals mostly encountered frequent urination and abdominal pains (OR>1). Urinary schistosomiasis prevails in the study area. It is important to create widespread awareness and treatment intervention.

Keywords: Urinary schistosomiasis, children, awareness, water bodies, infection.

INTRODUCTION

Schistosomes are blood flukes, which are trematode worms with complex multicellular nature (Edward and Andrew, 2002). Six species of *Schistosoma* have been recognized in human cases of schistosomiasis, which include *Schistosoma haematobium, Schistosoma mansoni, Schistosoma japonicum, Schistosoma intercalatum, Schistosoma mekongi and Schistosoma guineensis* (Jamjoom, 2006; Clerinx and Soentjens, 2017).

There are two forms of schistosomiasis: namely, urinary schistosomiasis and intestinal schistosomiasis, depending on the species of schistosome which infected the host and its predilection site. Any of the forms of the disease is commonly called bilharzia, bilharziasis or snail fever (Jamjoom, 2006; Nour, 2010). Schistosomiasis affects majorly children who indulge in indiscriminate water activities and adults who practice unsafe irrigation farming system (Kanwai *et al.,* 2011; Ibironke *et al.,* 2012; WHO, 2022).

Penetration of intact skin (i.e., dermo-invasion) by cercariae is the only known route of infection by schistosomes (WHO, 2022). When humans carryout activities with or in an infested water, the cercariae become attracted by the warmth of the body and lipids on the skin (Sakanari and Mckerrow, 2010). The life cycle of schistosomes is indirect and complex. These parasites require snails as intermediate hosts and man as definitive host (CDC, 2012).
Schistosomiasis is one of the major public health problems of humanity, which affects economic and social developments (Kanwai *et al.,* 2011). It had been estimated that 200 million *Schistosoma* infections (mainly *Schistosoma haematobium*) occur in Africa, accounting for more than 97% of estimated global cases. The disease is now found in 78 countries (WHO, 2013; Brindley and Hotez, 2013; Mohager *et al.,* 2014). Schistosomiasis is a persistent problem in many developing tropical countries (Hotez and Fenwick, 2009) like Nigeria because of the ecology that permits its transmission (SarkinFada *et al.,* 2009).

It is important to ensure that the health of school children is protected at all times. Their juvenile activities should be constantly checked in order to control their predisposition to diseases. This study provided information on the current status of urinary schistosomiasis among school children in Giwa and Makarfi LGAs, the factors that expose them to the infection and associated symptoms for proper planning and implementation of control measures.

MATERIALS AND METHODS

Study area and population

The study was conducted in two Local Government Areas (LGAs) in Kaduna State, namely Giwa and Makarfi LGAs. Children in the areas often go to swim and fish in rivers and especially during the dry season. Children from selected schools were sensitized about schistosomiasis and the purpose of the study. Two hundred (200) consented school children between the ages of 8-17 years were enrolled. Ethical clearance for this study was obtained from Kaduna State Ministry of Health. Permission to conduct a school-based study was obtained from Kaduna State Ministry of Education, Science and Technology.

Science World Journal Vol. 19(No 1) 2024 https://dx.doi.org/10.4314/swj.v19i1.29
www.scienceworldjournal.org
ISSN: 1597-6343 (Online), ISSN: 2756-391X (Print)
Published by Faculty of Science, Kaduna State University

Collection of urine samples and administration of questionnaires

Data on socio-demography, risk factors and symptoms of urinary schistosomiasis among the school children in the areas were collected using structured questionnaires. Urine samples (of about 10 mL each) were collected from the 200 consented school children in wide screw-capped sample bottles. All the samples were examined at the Parasitology Laboratory in Department of Microbiology, Faculty of Life Sciences, Ahmadu Bello University, Zaria, Nigeria.

Parasitological examination

Each urine sample was transferred unto labeled sterile tube and centrifuged at 3000 revolutions per minute (rpm) for 5 minutes. Supernatant was discarded and the sediment was transferred onto clean glass slide by means of Pasteur pipette. Cover slip was applied and the wet mount was examined for characteristic eggs of *Schistosoma haematobium* with terminal-spines using ×10 and ×40 objectives of the light compound microscope (Cheesbrough, 2009; Bishop *et al.,* 2016).

Statistical analysis

Data obtained from the study subjects and the laboratory findings were subjected to Chi-square (χ^2) and Odds ratio (OR) analyses using IBM SPSS version 23 at 95% confidence interval. Final results were simplified in tables.

RESULTS

Detection of terminal-spined eggs of *Schistosoma haematobium* (Plate I) confirmed the occurrence of urinary schistosomiasis among the school children in the study areas. There was higher occurrence of urinary schistosomiasis of 10.0% among children from Giwa LGA than among those from Makarfi LGA (9.0%) as shown in Table 1.

All the infections were significantly found among the males (13.5%, P=0.003), but absent among the females (Table 2). The oldest school children within the age group of 18-19 years old had the highest infection of 20.0%, followed by 12.1% among those between 14-15 years old. However, the youngest children between 10-11 years old were not infected, but the differences in prevalence of disease based on age was not significant (P>0.05) as shown in Table 2.

Children in junior secondary school had higher infection of 10.4% than others who were in senior secondary school (7.7%), but the difference was not statistically significant as shown in Table 2.

In Table 3, all the infections were recorded among children who were not aware about the disease (9.7%), as those who were aware were not infected. Children that engaged irrigation farming (16.5%, P=0.007), swimming in unsafe rivers (16.9%, P=0.008), fishing (21.3%, P=0.002), and fetch water from rivers or streams (100.0%, P=0.008) were significantly more infected (OR >1) than others who did not expose themselves by not engaging in those activities. Also, children who washed their clothes in rivers had higher infection of 21.4% than others who washed clothes at home (8.6%), but the difference was not statistically significant (P>0.05).

Significant symptoms of urinary schistosomiasis identified among the children in this study included painful urination (25.0%, P=0.003), and terminal haematuria (30.0%, P=0.001). Also, frequent urination (20.0%) and abdominal pain (12.5%) were more likely presented by the infected children (OR>1) as shown in Table 4.

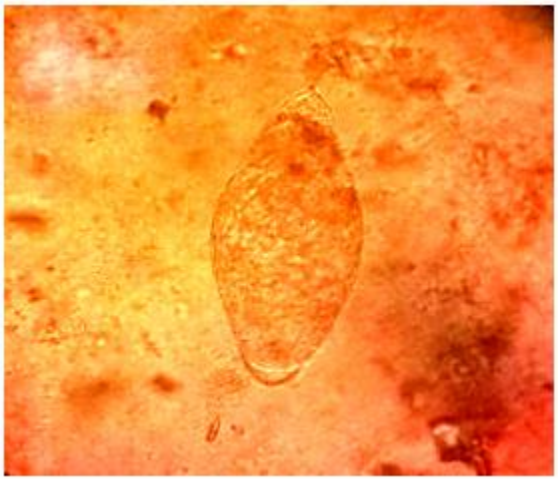

Plate I: Microscopic Appearance of Egg of *Schistosoma haematobium* in Urine Sediment of a School Child from Giwa LGA, Kaduna State, Nigeria.

Table 1: Prevalence of urinary schistosomiasis among school children in Giwa and Makarfi LGAs, Kaduna State

LGA	Number Examined	Number positive (%)	Number negative (%)
Giwa	100	10(10.0)	90(90.0)
Makarfi	100	9(9.0)	91(91.0)
Total	200	19(9.5)	181(90.5)

Table 2: Socio-Demographic Distributions of Urinary Schistosomiasis among School Children in the Study Areas

Socio-demographic factor	Number Examined	Number positive (%)	χ^2	df	p	Odd ratio (OR)
Gender						
Male	141	19(13.5)	8.785	1	0.003	1.156
Female	59	0(0.0)				
Age-group (yr)						
10-11	6	0(0.0)				
11-13	54	3(5.6)				
14-15	66	8(12.1)	7.238	4	0.124	
16-17	44	2(4.5)				
18-19	30	6(20.0)				
School level						
Junior secondary	135	14(10.4)	0.366	1	0.545	0.720
Senior secondary	65	5(7.7)				

Science World Journal Vol. 19(No 1) 2024 https://dx.doi.org/10.4314/swj.v19i1.29
www.scienceworldjournal.org
ISSN: 1597-6343 (Online), ISSN: 2756-391X (Print)
Published by Faculty of Science, Kaduna State University

Table 3: Risk factors of Urinary Schistosomiasis among school children in Giwa and Makarfi LGA, Kaduna State

Risk factor	Number Examined	Number positive (%)	χ^2	df	p	Odd ratio (OR)
Awareness						
No	196	19(9.7)	0.428	1	0.513	0.903
Yes	4	0(0.0)				
Irrigation farming						
No	121	6(5.0)	7.348	1	0.007	3.775
Yes	79	13(16.5)				
Swimming						
No	129	7(5.4)	7.014	1	0.008	3.545
Yes	71	12(16.9)				
Fishing						
No	153	9(5.9)	9.911	1	0.002	4.324
Yes	47	10(21.3)				
Place for washing of clothes						
Home	186	16(8.6)	2.491	1	0.114	2.898
River	14	3(21.4)				
Source of water						
Borehole/tap	9	1(11.1)	9.621	2	0.008	
River/stream	1	1(100.0)				
Hand-dug well	17	17(8.9)				

Table 4: Signs and Symptoms of Urinary Schistosomiasis among school children in Giwa and Makarfi LGAs of Kaduna State

Sign/symptom	Number Examined	Number positive (%)	χ^2	df	p	Odd ratio (OR)
Painful urination						
No	172	12(7.0)	9.098	1	0.003	4.444
Yes	28	7(25.0)				
Frequent urination						
No	195	18(9.2)	0.658	1	0.417	2.458
Yes	5	1(20.0)				
Abdominal pain						
No	184	17(9.2)	0.182	1	0.670	1.403
Yes	16	2(12.5)				
Terminal haematuria						
Absent	180	13(7.2)	10.862	1	0.001	5.505
Present	20	6(30.0)				

DISCUSSION

Detection of terminal-spined egg of *Schistosoma haematobium* in urine sediment was an evidence of urinary schistosomiasis among the school children in Giwa and Makarfi LGAs in Kaduna State, Nigeria. The overall prevalence was of 9.5% in the current study was lower than reported prevalence of 12.3% in Lere LGA (Luka *et al*., 2001), 19.5% in Zaria (Omenesa *et al*., 2015), 12.3% in Jaba LGA (Bishop *et al*., 2016). However, there was more occurrence of the infection among school children from Giwa LGA than Makarfi LGA, indicating more exposure among them.

The infection was significantly found among the male children but absent among the females (P=0.003). The males were more at risk (OR=1.156) of acquiring the infection probably due to increased play habits in water bodies than the females. Female activities after school hours are closely monitored and restricted domestically, especially at puberty. This finding agrees with the some reports of higher occurrence of urinary schistosomiasis among males (Omenesa *et al.*, 2015; Bishop and Ahmadu, 2018; Bishop and Akoh, 2018).
The infection was higher among the older children of 18-19 years. Those in junior secondary school had more infection instead. Predisposition to infested water bodies by these categories of children caused an increase in the infection among them, as Omenesa *et al.* (2015) and Bishop and Ahmadu (2018) reported similar findings.

A very small proportion of the school children had awareness of urinary schistosomiasis, and no infection was recorded among them. Probably, children who were aware about the disease kept away from unsafe water bodies. All the infections in this study were recorded only among those that had no awareness of the disease; hence they exposed themselves to the infested water bodies. Unawareness has been noted as a potential risk factor for the transmission of schistosomiasis (Bishop, 2017).

The transmission of the disease to the children was facilitated by their predisposition to certain risk factors that included participation in irrigation farming, swimming, fishing, washing of clothes in rivers/stream, and fetching of water from rivers/streams. In conducting these water-based activities, the skin is exposed to cercarial penetration. Similar risk factors had been reported by Omenesa *et al.* (2015) and Bishop *et al.* (2023).

Infected school children presented with evidence of painful urination and terminal haematuria (P≤0.05; OR>1), as well as frequent urination and abdominal pains OR>1). These symptoms had also been reported by Cheesbrough (2009), Dawaki *et al.* (2015), Bishop *et al.* (2016) and Bishop *et al.* (2023). However, terminal haematuria that is accompanied by pains as urine is passed out is often considered as classical sign of urinary schistosomiasis, especially in endemic areas (Van der Werf and de Vlas, 2004; WHO, 2016; Bishop *et al.*, 2023).

Conclusion

The current study recorded an overall prevalence of 9.5% of urinary schistosomiasis among school children in the study area, comprised of 10.0% from Giwa and 9.0% from Markarfi LGAs. The male children were significantly more infected and more at risk (P<0.05, OR>1) of urinary schistosomiasis than the females. The infection occurred higher among those in the junior secondary than those in senior secondary school. Age-group of 18-19 years old had the highest occurrence of the infection but absent among the youngest children of 10-11years.
The infection was found only among children who were not aware about the disease. Significant risk factor for urinary schistosomiasis among the study population were irrigation farming, swimming, fishing, washing of clothes in rivers/stream, and fetch of water from rivers/streams (P≤0.05; OR>1).
Significant signs/symptoms of the infection identified among the children were painful urination, terminal haematuria, frequent urination and abdominal pains (P≤0.05; OR>1).

Acknowledgement

We sincerely express our appreciation to the study participants and their parents who granted their consents, as well as the school teachers who assisted in conducting the children during the study. Thank you.

Conflict of Interest

The authors hereby declare that there was no conflict of interest associated with the conduct of their study.

REFERENCES

Bishop, H.G. (2017). Menace of schistosomiasis: its true neglected nature in Nigeria. MOJ *Public Health*, *6*(5), 00186.

Bishop, H.G. and Ahmadu, J.M. (2018). *Schistosoma haematobium* and *Klebsiella pneumoniae* co-infections, antibiotic susceptibility and multiple antibiotic resistance index in school children in Zaria. *Health Research*, *2*, 31-33.

Bishop, H.G. and Akoh, R.I. (2018). Risk factors, symptoms and effects of urinary schistosomiasis on anthropometric indices of school children in Zaria, Kaduna State, Nigeria. *Open Access Journal of Science*, *2*(2), 00045.

Bishop, H.G., Inabo, H.I. and Ella E.E. (2016). Prevalence and intensity of urinary schistosomiasis and their effects on packed cell volume of pupils in Jaba LGA, Nigeria. *Edorium Journal of Microbiology*, *2*, 13-26.

Bishop, H. G., Inabo, H. I., Ella, E. E., Bello, M. (2023). Urinary schistosomiasis: risk factors and symptoms among school adolescents in Kaduna State, Nigeria. *EUREKA: Life Sciences*, 2(44):56–62. doi: https://doi.org/10.21303/2504-5695.2023.002905

Brindley, P.J. and Hotez, P.J. (2013). Break out: urogenital schistosomiasis and *Schistosoma haematobium* infection in the post-genomic era. *PloS Neglected Tropical Diseases*, *7*(3), e1961.

CDC (2012). Parasite-schistosomiasis. Page last updated November 7th 2012. Assessed from: http://www.cdc.gov/parasites/schistosomiasis/biology.html.

Cheesbrough, M. (2009). *District Laboratory Practice in Tropical Countries,* Part I, 2nd ed. updated. Cambridge University Press, Cambridge, UK.

Clerinx, J. and Soentjens, P. (2017). Epidemiology, pathogenesis, and clinical manifestations of schistosomiasis. Assessed from: http://www.uptodate.com/contents/epidemiology-pathogenesis-and-clinical-manifestations-of-schistosomiasis

Edward, J.P. and Andrew, S.W. (2002). Immunology of schistosomiasis. *Nature Reviews Immunology*, **2**:499-511.

Hotez, P.J. and Fenwick, A. (2009). Schistosomiasis in Africa: an emerging tragedy in our new global health decade. *PloS Neglected Tropical Diseases*, **3**(9):e485. doi: 10.1371/journal.pntd.0000485.

Ibironke, O., Koukounari, A., Asaolu, S., Moustaki, I. and Shiff, C. (2012). Validation of a new test for *Schistosoma haematobium* based on detection of Dra 1 DNA fragments in urine: Evaluation through latent class analysis. *PloS Neglected Tropical Diseases*, **6**(1):e1464.

Jamjoom, M.B. (2006). Molecular identification of some *Schistosoma* mansoni isolates in Saudi Arabia. *World Journal of Medical Sciences*, **1**(2):102-107.

Kanwai, S., Ndams, I.S., Kogi, E., Gyem, Z.G. and Hena, J.S. (2011). Urinary schistosomiasis infection in Dumbin Dustse, Igabi Local Government Area, Kaduna State, Nigeria.

Science World Journal, *6*(3), 1-3.

Luka, S.A., Ajogi, I. and Umoh, J.U. (2001). Schistosomiasis among school children in Lere Local Government Area, Kaduna State, Nigeria. *Journal of Tropical Biosciences*, *1*(1), 106-111.

Mohager, M.O., Mohager, S.O. and Kaddam, L.A. (2014). The association between schistosomiasis and enteric fever in a single *Schistosoma* endemic area in Sudan. *International Journal of Pharmaceutical Sciences and Research*, **5**(6):2181-2184.

Nour, N.M. (2010). Schistosomiasis: health effects on women. *Reviews in Obstetrics and Gynecology*, **3**(1):28-32. doi: 10.3909/riog0109.

Omenesa, H.O., Bishop, H.G. and Raji, H.M. (2015). Prevalence of urinary schistosomiasis among pupils attending primary schools in Bomo Village, Zaria-Nigeria. *International Journal of Research in Engineering and Science,* **3**(5):14-19.

Sakanari, J.A. and Mckerrow, J.H. (2010). Medical Parasitology. In: G.F. Brooks, K.C. Carroll, J.S. Butel, S.A. Morse and T.A. Mietzner (eds). *Jawertz, Melnick and Adelberg's Medical Microbiology,* 25th ed. McGraw Hill Companies Inc., US. pp. 665-701.

Sarkinfada, F., Oyebanji, A., Sadiq, I.A. and Ilayasu, Z. (2009). Urinary schistosomiasis in the Danjarima Community in Kano Nigeria. *Journal of Infection Development Series*, **3**(6):452-457.

Van der Werf, M.J. and de Vlas, S.J. (2004). Diagnosis of urinary schistosomiasis: a novel approach to compare bladder pathology measured by ultrasound and three methods for hematuria detection. *American Journal of Tropical Medicine and Hygiene*, **7**(1): 98-106.

WHO (2013). Schistosomiasis. Retrieved 14th February 2023 from: http://www.who.int/mediacentre/factsheets/fs115/en/index.html.

WHO (2016). Schistosomiasis. Fact Sheet Updated February 2016. Assessed on 14th February 2023 from: http://www.who.int/mediacentre/factsheets/fs115/en/

WHO (2022). Schistosomiasis. Retrieved 14th February 2023 from: https://www.who.int/news-room/fact-sheets/detail/schistosomiasis