Prevalence and Risk Factors of Urinary Schistosomiasis among Primary School Pupils in Ndokwa-East Lga of Delta State, Nigeria.

ABSTRACT

Background: Schistosomiasis is a water-borne tropical parasitic disease that is of a major public health problem. It is a neglected tropical disease that has over two-third of its worldwide infection, occurring in Africa. It is a disease that is associated with many complications.

Objective: The aim of the study was to determine the prevalence and risk factors of urinary schistosomiasis among primary school children in Ndokwa East Local Government Area of Delta State, Nigeria.

Methods: This study was a cross sectional descriptive study of primary school children aged 5-16 years in Ndokwa-East Local Government Area (NELGA) of Delta State. Information on the socio-demographic characteristics of the pupils and their caregivers, and water contact activities of the pupils were obtained using questionnaire administered to the pupils. Urine microscopy (centrifugation method) was done for the pupils and the schistosoma eggs were counted and graded according to WHO standards. Relationship between the risk factors of schistosomiasis and the infection prevalence were tested using chi-square analysis and Fisher's exact test where indicated.

Results: A total of 374 pupils were studied. Twenty-eight (7.5%) of them had urinary schistosomiasis; location of primary school (FET, p-value = <0.001), Age (χ^2 = 9.730, df = 3, p-value =0.023), exposure to water body (χ^2 = 7.920, df = 1, p-value = 0.005), frequency of contact with water body (FET, df = 4, p-value = 0.006), time spent inside water bodies (χ^2 = 16.377, df = 3, p-value = 0.001), activities that require long stay inside water bodies (FET, df = 6, p = <0.001) and bush dumping as method of sewage disposal (χ^2 = 6.718, df = 2, p-value = 0.034) were risk factors for the schistosomiasis infection.

Conclusion: The prevalence of urinary schistosomiasis among primary school pupils in NELGA is low. It is highest among the sub-community primary school in an island within the river, and lowest in a primary school in a relatively upland area.

Key Words: Urinary schistosomiasis, prevalence, risk factors

INTRODUCTION

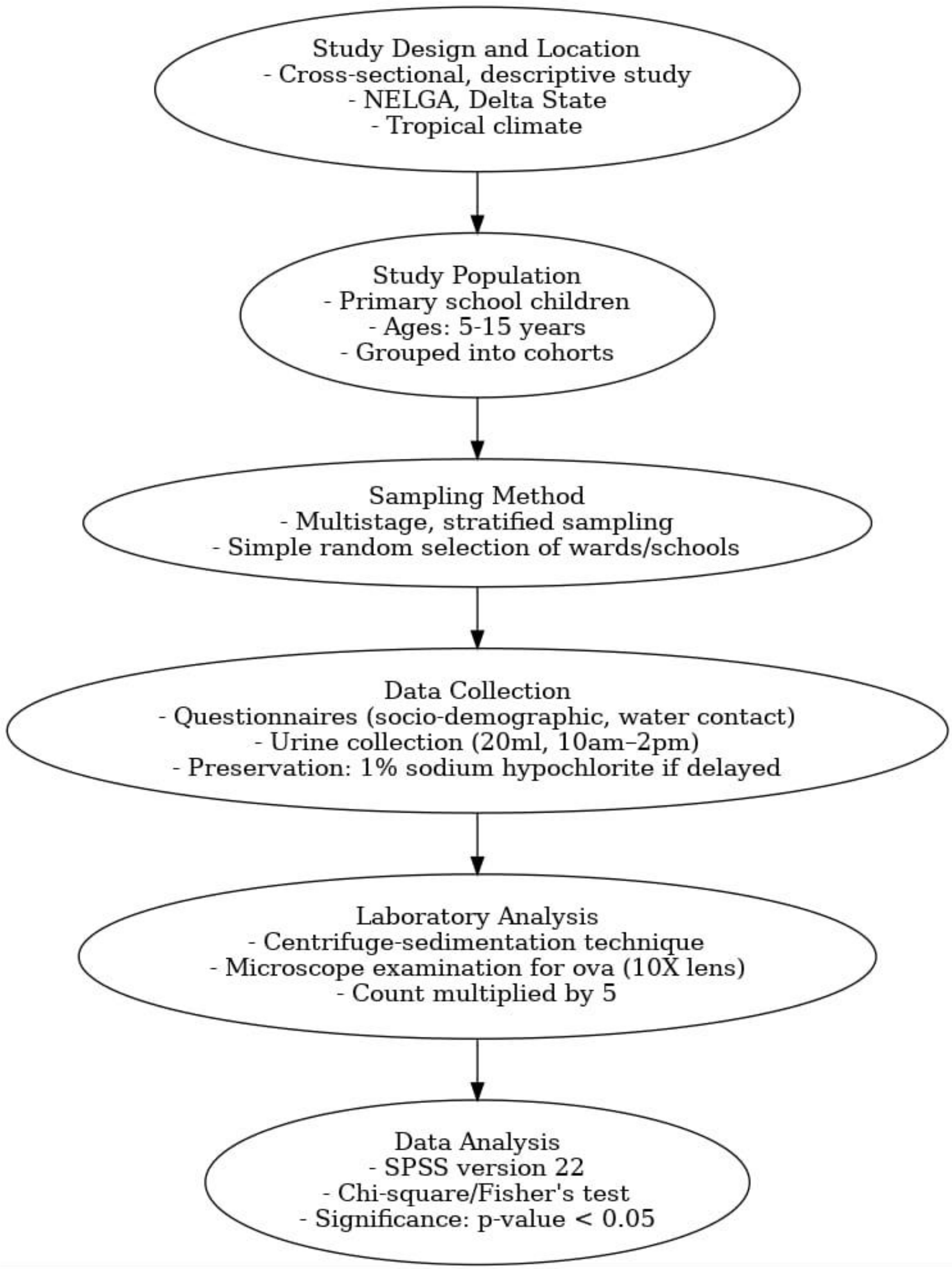
Schistosomiasis is a water-borne tropical parasitic disease caused by one or more species of Schistosoma blood flukes, with S. haematobium being responsible for urogenital schistosomiasis.[1] The World Health Organization (WHO) classifies schistosomiasis as a neglected tropical disease due to limited political commitment and the low socio-economic status of the populations most affected.[2,3] Schistosomiasis remains endemic in parts of Nigeria, including Ndokwa-East Local Government Area (NELGA) of Delta State, where high prevalence rates have been reported in the past.[4,5,6] Although control programs were re-activated in the area following these reports, the infection has persisted. There are several important predisposing factors for persistence of urinary schistosomiasis that need to be evaluated and possibly attended to, in order to eliminate this infection in the LGA.

The aim of the study was to determine the prevalence and risk factors of urinary schistosomiasis among primary school children in Ndokwa East Local Government Area of Delta State, Nigeria.

SUBJECTS AND METHODS

This study was carried out in the selected community primary schools in NELGA of Delta State. The LGA is bounded in the East by River Niger and West by the Ase Creek, in addition to many lakes and streams in the LGA.[7] The climate is tropical; with an average rainfall of about 266.5 mm and an average temperature of about 30°C.[7] The two main seasons in this area include the rainy season (April to October) and the dry season (November to March). Fishing and subsistence farming are the major occupations in the LGA

This was a cross sectional, descriptive study of primary school children aged between 5 and 15 years, drawn from NELGA of Delta State. Subjects were grouped into age cohorts' 5 – 7 years, 8 - 10 years, 11 - 13 years, and 14 – 15 years, as of their last birthday, for easy comparison with previous studies. Subjects' recruitment was by multistage, stratified sampling method. The wards and the primary schools were selected by simple random sampling method. Basic Socio-demographic characteristics of the pupils and other information like history of contact with water bodies, previous history of passage of blood in urine, and administration of praziquantel in the past (within the last two years) were obtained using study questionnaire. Twenty milliliters of clean-catch, midstream/terminal urine samples collected between 10am and 2pm of the day (time of maximum egg excretion)[8] were obtained from the selected pupils and transported to the laboratory at FMC Asaba for analysis. Delay in the transportation of the specimens to the laboratory (more than 2hours in room temperature) was inevitable because of the distance, hence, 1-2 drops of ordinary household bleach (1% sodium hypochlorite) were added to the urine samples to preserve any schistosoma ova present.[9] During the microscopy, eggs were recovered from urine by the standard centrifuge-sedimentation technique.[10] Ten (10) mls of the urine collected from each subject was placed in a test tube with screw top caps, covered tightly, labeled appropriately, and placed in a centrifuge (Model 800-1 Electric Lab Centrifuge Machine [SEGAWE, CHINA]). The urine was spun at a speed of 2000 revolutions per minute for 5 minutes to sediment the residue, after which 9 mls of the supernatant were discarded and the sediment obtained with a pipette. This was to ensure standardized volume of sediments. The residue was then mixed thoroughly by gentle rocking of the pipette to ensure uniform density of ova in the sediment, from which 0.02ml (1/5th of the sediment) was placed on a clean glass microscopic slide. A drop of 1% Lugol's Iodine was dropped on it, and covered with a glass coverslip for microscopic examination. Using the power 10 (10X) objective lens of light binocular microscope (OLYMPUS CH20i), the entire slide under the coverslip was examined for the ova of *S. haematobium*. The number of eggs were counted and multiplied by 5(since it was only 1/5th of the sediment that was placed on the slide). The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 22. Socio-demographic characteristics and water contact activities of the pupils were treated as categorical variables and expressed using frequency tables and charts. Relationship between these categorical variables and infection prevalence were tested using chi-square analysis, and Fisher's exact test when indicated. Level of significance was set at a p-value of less than 0.05.


Study Design and Location
- Cross-sectional, descriptive study
- NELGA, Delta State
- Tropical climate
Study Population
- Primary school children
- Ages: 5-15 years
- Grouped into cohorts
Sampling Method
- Multistage, stratified sampling
- Simple random selection of wards/schools
Data Collection
- Questionnaires (socio-demographic, water contact)
- Urine collection (20ml, 10am–2pm)
- Preservation: 1% sodium hypochlorite if delayed
Laboratory Analysis
- Centrifuge-sedimentation technique
- Microscope examination for ova (10X lens)
- Count multiplied by 5
Data Analysis
- SPSS version 22
- Chi-square/Fisher's test
- Significance: p-value < 0.05

Ethical Consideration

Ethical clearance was obtained from the Ethics Committee, FMC Asaba. Written permissions were obtained from the State Ministry of Basic and Secondary Education, and NELGA. Informed consent was obtained from the caregivers of the study participants and assents were obtained from the participants.

RESULTS

A total of 374 primary school pupils were enrolled into the study. There were 188 males (50.3%) and 186 females (49.7%), giving a ratio of 1:1. The highest number of subjects was selected proportionately from Orewo Primary School (PS) (96 pupils), and the least was from Ise-Onukpor PS (23 pupils). Majority of the subjects were within the age group of 8-10 years (39.8%). The prevalence of urinary schistosomiasis in this study was 7.5%.

Table I shows the distribution of urinary schistosomiasis according to the community primary schools in NELGA. Ise-Onukpor PS pupils had the highest prevalence of infected pupils (14 out of 23 pupils), with a prevalence of 60.9%, while Odo PS recorded no infected case. This is shown in Table I

Table I. Distribution of urinary schistosomiasis according to the community primary schools in NELGA

Primary School	Infection status		
	Infected. N (%)	Not infected. N (%)	Total
Ise-onukpor PS	14 (60.9)	9 (39.1)	23 (100.0)
Ogwezi PS 1	3 (3.3)	87 (96.7)	90 (100.0)
Ogwezi PS 2	5 (19.2)	21 (80.8)	26 (100.0)
Abuator PS	2 (8.7)	21 (91.3)	23 (100.0)
Ashaka PS	2 (2.3)	86 (97.7)	88 (100.0)
Orewo PS	2 (2.1)	94 (97.9)	96 (100.0)
Odo PS	0 (0.0)	28 (100.0)	28 (100.0)

Table II shows the relationship between the socio-demographic characteristics of the pupils and infection status. Males had slightly higher percentage of infected pupils (8.5%) compared with females (6.5%) (χ^2 = 0.572, df = 1, p-value = 0.556). Those between the age ranges of 11-13 years, had the highest prevalence (12.7%), followed by those 14-16 years (11.5%), while the least prevalence was among those between the age group of 8-10 years (2.7%), (χ^2 = 9.730, df = 3, p-value =<0.05). Those that practiced bush dumping as method of sewage disposal, had the highest prevalence (12.0%), compared to those that made use of water cistern (4.3%). (χ^2 = 6.718, df = 2, p-value = <0.05).

TABLE II: Relationship between the sociodemographic characteristics of the pupils and infection status

PARAMETERS		INFECTION STATUS (n = 374)		χ^2	P-value
		Infected N (%)	Not infected N (%)		
Sex	**Male**	16 (8.5)	172 (91.5)	0.572	0.556
	Female	12 (6.5)	174 (93.5)		
Age	**5-7years**	8 (8.2)	89 (91.8)	**9.730**	**<0.05 ***
	8-10years	4 (2.7)	145 (97.3)		
	11-13years	13 (12.7)	89 (87.3)		
	14-16years	3 (11.5)	23 (88.5)		
Walking distance from water body	**<15mins**	23 (9.7)	215 (90.3)	4.671	0.086
	15-30mins	2 (5.3)	36 (94.7)		
	>30mins	3 (3.1)	95 (96.9)		

Sewage disposal method	**Pit latrine**	5 (5.5)	86 (94.5)	**6.718**	**<0.05 ***
	Bush dumping	17 (12.0)	125 (88.0)		
	Water cistern	6 (4.3)	135 (95.7)		

* = Significant p-value

Table III shows the relationship between the level of interaction of the pupils with water bodies, and infection status of the pupils. On water body exposure, those who normally have contact with the surrounding water bodies, had the highest prevalence (10.0%), compared to those who did not have contact with them (1.8%) (χ^2 = 7.920, df = 1, p-value = <0.01). Those that had contact with the water bodies on a daily basis, and those that had contacts with the water bodies 1-4times per week, recorded prevalence of 7.1% and 13.8% respectively, compared to those that visited the water bodies less frequently (Fisher's Exact Test, df = 4, p-value = <0.01). Those that admitted to spending averagely between 10-59 minutes inside water bodies, followed by those that admitted to spending averagely above 59 minutes inside water bodies, recorded the highest prevalence (14.8% and 10.3% respectively), compared to those that answered that they spend averagely less than 10 minutes (4.6%) (χ^2 = 16.377, df = 3, p-value = 0.001). The pupils that mainly go to swim/bath, play and wash clothes, had the highest prevalence compared to those that go to fetch water only (21.1%, 20.0% and 16.7% respectively, compared to 5.8%). (FET, df = 6, p = <0.001).

TABLE III: Relationship between the level of interaction of the pupils with water bodies, and infection status of the pupils.

PARAMETER		INFECTION STATUS(n= 374)		χ^2	P-value
		Infected n (%)	**Not Infected** n (%)		
Visit water body	**Yes**	26 (10.0)	234 (90.0)	**7.780**	**<0.01 ***
	No	2 (1.8)	112 (98.2)		
Frequency of visit	**Daily**	6 (7.1)	79 (92.9)	**FET**	**<0.01 ***
	1-4x/week	19 (13.8)	119 (86.2)		
	1-3x/month	1 (3.3)	29 (96.7)		
	1/ 2-6months	0 (0.0)	7 (100.0)		
	No response	2 (1.8)	112 (98.2)		
Time spent in water body	**<10 mins**	5 (4.6)	104(95.4)	**16.377**	**0.001 ***
	10-59 Mins	18 (14.8)	104 (85.2)		
	>59 mins	3 (10.3)	26 (89.7)		
	No response	2 (1.8)	112 (98.2)		
Major activity in water body	**Swimming/bathing**	16 (21.1)	60 (78.9)	**FET**	**<0.001 ***
	Playing	1 (20.0)	4 (80.0)		
	Washing clothes	1 (16.7)	5 (83.3)		
	Fetching water	8 (6.0)	126 (94.0)		
	Fishing	0 (0.0)	5 (100.0)		

Others	0 (0.0)	34 (100.0)
No response	2 (1.8)	112 (98.2)

* = Significant p-value, FET = Fisher's Exact Test

Table IV shows the Binary Logistic regression analysis of the risk factors of schistosomiasis infection in Primary School Children in NELGA. Binary logistic regression analysis showed that the community PS, frequency of contact with water bodies and time spent inside water bodies were independently significantly associated with urinary schistosomiasis infection in NELGA.

TABLE IV: Binary Logistic regression analysis of the risk factors of schistosomiasis infection in Primary School Children in NELGA

Parameter	Sig	EXP (B)	95% C.I for EXP (B)	
			Lower	Upper
Community Primary School	***<0.001**	**2.928**	**1.868**	**4.590**
Age	0.154	0.679	0.399	1.156
Method of Sewage disposal	0.710	1.137	0.577	2.241
Water body visitation	0.830	0.253	0.000	69779.111
Frequency of visitation	***0.022**	**1.997**	**1.107**	**3.603**
Time spent inside water body	***0.015**	**0.489**	**0.274**	**0.871**
Activity inside water body	0.071	1.065	0.995	1.140

EXP (B) = *Odd Ratio*, C.I = *Confidence Interval, * = Significant p-value, SES = Socioeconomic Status*

DISCUSSION

The prevalence of urinary schistosomiasis among the subjects in this study was 7.5%. This prevalence placed NELGA currently as a low endemic area using the WHO recommended guideline for mass treatment.[11] The low prevalence can be accounted for by the fact that majority of the subjects studied, preferred the use of boreholes to the use of streams/rivers, for domestic activities. It may also be due to the success of the ongoing mass drug administration of praziquantel that was re-commenced in 2008 in the LGA, although it is has not been regular. This finding is in contrast to the two previous studies done by Nwabueze in et al[6] 2005, and Ekwunife et al[12] in 2009 at the same LGA; that reported prevalence rates of 91.4% and 35% respectively, attributable to the success of the control program in NELGA.[13] This reduced prevalence is similar to what was obtained by Adie et al[14] at Cross River state in 2015, who documented a drop in prevalence from 38.5% to 0.2% among school children, after two rounds of MDA done annually.[14] It is also similar to the findings by Ekanem et al[15] in a community at Cross River state in 2017, who documented a drop in the prevalence among school children from 51.0% in pre-portable water era to 14.5%, 8 years after provision of potable water as intervention strategy to the community.[15] Dawaki et al,[16] Nworie et al[17] and Okoli et al[18] recorded prevalence rates of 8.3%, 9.8%, and 11% respectively among school children in similar manner.[17,16,18] However, this finding is at variance with the study by Otuneme et al[19] at Ogun State in 2014, who reported a prevalence rate of 52.7%, despite MDA,[19] may be attributable to the fact that majority of subjects in this present study had access to boreholes/wells and preferred their use to those of rivers/streams, unlike in the latter study.

The observation that Ise-onukpor PS recorded the highest prevalence while Odo PS in Lagos-Iyede community recorded the lowest prevalence can be attributed to the proximity of the communities to the water bodies, as well as absence of pipe-borne water. Ise-onukpor had no boreholes/well, but was only surrounded by river Niger and its rivulets, which are less than 5 minutes' walk from all the houses in the community; while Odo PS in Iyede community had rivers/streams which were more than 30 minutes' walk from their community, and had boreholes/wells. This finding was comparable to the findings in the studies by Ugbomoiko et al[20] in Edo State, Okwelogu et al[21] in Anambra state, and Bello et al[22] in Sokoto State. Mbata et al[23] at Benue state in 2013 reported similar higher prevalence in remote communities that depended mainly on streams than sub-urban settlements that had pipe-borne water supply.[23]

In comparison with the previous studies in the LGA, the prevalence among school children from Orewo PS in Iyede-Ame community reduced from 58.0% reported by Ekwunife et al[12] in 2009 to 2.1% in this study. The prevalence among school children from Odo PS in Lagos-Iyede communinty also reduced from 30.0% reported by Ekwunife et al[12] in 2009 to 0.0%. It reduced at Ogwezi PS, from 91.2% reported by Nwabueze et al[6] in 2005 to 3.3% in this study; 92.1% reported by Nwabueze et al[6] at Abuator PS in 2005 to 8.7% in this index study. The other community primary schools studied in this index study were not studied in the previous studies in the LGA. These marked reductions in the prevalence suggest a success of the ongoing control program in the LGA. Similar findings were reported by some post-interventional studies in Cross Rivers State.[14,15]

Gender had no significant influence on the prevalence of the disease, presumably due to equal exposure of the pupils to the risk factors, as there was no gender bias towards water body restrictions or exposure, among the pupils in the community. Similar findings and deductions were made by other researchers at Anambra State, Delta State, Nasarawa State, Ogun State, and Sokoto state.[12,19,21,23,24] In contrast, Okoli et al,[18] Nworie et al,[17] and Ivoke et al26 reported significantly higher prevalence among male school children than females, accounted for, by the fact that in this present study, there were equal exposures to water bodies among the male and female pupils, unlike in the latter studies.[17,18,26] Nwabueze et al[6] in the same LGA as this index study, 14 years ago, reported significantly higher prevalence among males than female school children.[6] The effect of time (civilization), and reduction in gender discrimination (gender equality) especially at this recent period, may account for no gender bias towards exposures to water bodies in this index study, different from the previous study. Similar to the present study, Ekwunife et al[12] in the same LGA 10 years ago, reported no significant gender-related influence on the prevalence.

The observation that age had a significant influence on the prevalence of the infection in this study could be due to the fact that early adolescent age groups have care-free attitudes towards swimming, bathing and playing in infested water bodies, which encourage infections. This was similar to the findings from the studies by Reuben et al,[27] Okwelogu et al,[21] Sady et al,[28] and Ivoke et al.[26] This can be attributed to the fact that this adolescent age group were actually seen swimming severally without shyness,[21] more adventurous and matured to engage in swimming, fishing and irrigation farming,[26,27,28] making them more exposed to infected water bodies. Contrary to the index study, Nwabueze et al[6] in 2005 and Ekwunife et al[12] in 2009, both at the same LGA with this study, reported peak age of infection to be 5-10 years.[6,12] The reason for this disparity is not so clear but may reflect the effect of change over time that may have affected the pattern of exposure in the LGA. This was because the 11-13 years age group actually had majority of them having contact with the water bodies, different from the previous studies. Availability of boreholes/wells in the LGA during this present study, different from the previous studies, might also have affected the exposure pattern as younger age group may likely go to boreholes/wells to fetch water/wash, whereas the adolescents were still visiting the water bodies for leisure, hence more infection, different from the above studies where everybody had to go to the water bodies for every activity.

The average walking distance from the schools/homes of the subjects to the water bodies affected the prevalence of the infection in this study possibly due to the fact that how close the water bodies are to the schools/home may affect how often that individuals visit them, and frequent contact with infected water bodies increases the risk of infection.[24] Similar finding was documented by Clennon et al,[29] Ugbomoiko et al[30] and Sady et al.[28] In contrast, Kapito-Tembo et al[31] reported no significant influence with the distance of water bodies from homes.31However, it was observed from the latter study[30] that more than 90% of those pupil with their house greater than one kilometer from water sources, were in schools where water sources were less than one kilometer from the schools; hence being exposed equally while in school,[31] unlike in this present study where the schools and homes of majority of study participants studied were close to themselves and had almost the same distance from water bodies.

Exposure to water bodies, the frequency of exposures to the water bodies, and spending long duration inside the water bodies were risk factors for acquiring the infection as depicted by the index study. This is because frequent visitation, and longer duration inside the water bodies, increases the exposure rate to the infective stage of the parasite, and hence more infected people. Bolaji et al[24] reported similar deductions.

The comparatively higher prevalence noted among the subjects that swim/bath/play/wash clothes in the water bodies than those who go to fetch water only, was similar to that of Bolaji et al,[24] who reported higher prevalence among the subjects that wash, play/bath, and do other activities in the water bodies, compared to the individuals that rarely had any activity in the water bodies;[24] and can be explained by the reduced time spent inside water bodies by those that went to fetch water only, compared to others; or the absence of conducive environment for transmission to take place among the subjects that didn't have activity in the water bodies.

Those who practiced bush dumping as method of sewage disposal, had higher prevalence in the index study, compared to those that practiced the use of water closet; similar to the findings by Mohammed et al[32] who reported higher prevalence among those that practiced the use of pit latrine/bush dumping, compared to the water closet method.[32] The explanation for the similarity is that the subjects that practiced water closet method, made use of boreholes/wells, and their urine were sent to a covered pit, hence reducing contamination and exposure to infections/re-infections. Those that practiced indiscriminate urination/defecation (bush dumping) on the other hand do so even beside water bodies, after which the excreta will be carried by flood into the water bodies. Those individuals at the same period made use of the water bodies to wash and carry out other activities, hence more infections. Similar finding was documented by Sady et al.[27] However, Dawaki et al[16] in contrast, reported higher prevalence of infection among those that practiced the use of pour-flush toilet, compared to those that practiced the use of pit latrine.[16] The latter study[16] was done in a rural community that lacked pipe-borne water, and the residents went to the infested streams/ponds to fetch water used in flushing their toilets. This was believed to have resulted in greater exposure to the infection when compared with those who used the pit latrine system which did not require flushing.[16] This may explain the difference from present findings.

CONCLUSION

The findings of this study highlight key risk factors for urinary schistosomiasis among primary school children in NELGA, including frequent contact with water bodies, time spent in them, and specific community hotspots. Public health policies should prioritize targeted interventions such as school-based health education programs to raise awareness about schistosomiasis transmission and prevention. Access to safe water and improved sanitation infrastructure, such as pit latrines and water cisterns, must be expanded, particularly in high-prevalence areas like Ise-Onukpor. Mass drug administration (MDA) with praziquantel should be implemented regularly in affected schools, alongside environmental interventions like water body management to reduce transmission. Lastly, monitoring and surveillance programs should be established to identify high-risk communities early and measure the effectiveness of control measures.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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