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Prevalence and Associated Risk Factors of Urogenital Schistosomiasis among Primary School Children in Agulu, Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors JCO and CAI designed the study, collected samples and carried out the laboratory analyses of the study. Author JCO performed the statistical analysis, wrote and proof-read the manuscript. Authors IN, OPO and CUU managed the literature searches and wrote the protocols. All authors thoroughly proof read and approved the final manuscript.

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ABSTRACT

Aim: Given that comprehensive record of a disease in a town will help in disease prevention and control, the prevalence of urogenital schistosomiasis among school children in Agulu, Anambra State, Nigeria was investigated in this present study.
Method: A total of 150 terminal urine specimens were randomly collected from primary school children and questionnaires were distributed to them. Each pupil was given a clean, wide mouthed specimen container with covers for collecting their urine. Sedimentation method and microscopy was used to demonstrate ova in their urine samples, in addition to reagent strip for hematuria and proteinuria.
Results: Three (3) out of one hundred and fifty (150) pupils tested positive for *Schistosoma haematobium* ova, resulting to an overall prevalence of 2%. The females recorded a higher prevalence rate of 3% while males recorded prevalence of 1%. There was no significant difference in the prevalence of the infection according to sex ($P < 0.05$). The age group between 10 -12 years

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had a prevalence of 4% and 6 - 9 years age group had a prevalence of 3% while the other age groups recorded 0% prevalence. There was no significant difference in the prevalence of the infection according to age groups (P < 0.05). Pupils whose parents are farmers had a prevalence of 4% while whose parents were traders recorded 2% prevalence. There was no significant difference in the prevalence of the infection according to parent's occupation (P < 0.05). The risk factors of this parasite observed included the source of water, frequent use of streams, rivers or lakes.

Conclusion: The result of this study showed that urogenital schistosomiasis infection has reduced considerably in Primary School Children in Agulu, Anambra State, Nigeria. Public health alleviation measures like mass chemotherapy, clean water supply and proper sanitation in addition to health education should be encouraged in Agulu Schools and villages to help eradicate the disease completely.

Keywords: Urogenital; schistosomiasis; sex; age groups; pupils; Agulu; Anambra State.

1. INTRODUCTION

Urogenital schistosomiasis is a neglected tropical disease with an estimated 732 million persons susceptible to its infection globally especially in well-known transmission areas [1]. It is caused by infection with *Schistosoma haematobium* [2]. Most cases reported yearly occur in sub-Saharan Africa which resulted to approximately 150,000 deaths [3]. Nigeria has the highest prevalence of human schistosomiasis with about 29 million infected people within Sub-Saharan Africa [4,5]. It is estimated that at least 236.6 million people need preventive treatment in 2019 [6], approximately 90% of them living in sub-Saharan Africa [7.8]. The parasites that cause schistosomiasis live in some species of freshwater snails. The infectious state of the parasite recognized as cercariae develop from the snail into the water body. Humans can become infected once their skin gets in contact with contaminated freshwater. The control procedures used have not yet totally eliminated the disease since schistosomiasis is a neglected tropical disease [9-12,6]. Adult schistosomes stay in human blood vessels for years, effectively escaping the immune system while expelling hundreds to thousands of eggs every day, which may either leave the body in excreta or turn out to be confined in neighboring tissues [7]. Hematuria is a common sign of infection, other signs comprise dysuria, pollakiuria and proteinuria, while the mortality due to schistosomiasis is very little, subtle and indirect morbidities like fatigue, physical or cognitive damage are well known in kids [13]. The struggle to control schistosomiasis in Nigeria has been increased in the past few years, many nations including few in Sub-Saharan Africa are working to eliminate the disease [14]. The issues accountable for the incessant and insistent transmission of schistosomiasis in Sub-Saharan Africa comprises climatic variations, global warming, nearness to water bodies and poverty [15]. The national policy on schistosomiasis control in Nigeria accepted Praziquantel as the key medication in the control policy meant to reduce morbidity. *Schistosoma haematobium* has long occurred in Agulu lake part of Anambra State, Nigeria and the lake is one geo-referenced Schistosomiasis prevalent part of Nigeria [16,17]. There is a great level of danger of having Schistosomiasis due to low literacy, poverty, poor hygiene and insufficient public amenities for the people of Agulu [18]. This study was conducted to examine the prevalence of urogenital schistosomiasis and the associated risk factors that predispose children to infection in Agulu, Anambra state, Nigeria. It is meant to provide updated information on the status of urinary schistosomiasis in Agulu, Anambra state, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study area for the work is Agulu in Anaocha Local Government Area, home to the Agulu Lake. Agulu is located at geographical coordinates: 6°07′N and 7°04′E. The state is characterized by two distinct seasons which are the rainy and dry seasons. The rainy season spans through April to October while the dry season is from November to March. The state is located within the tropical rain forest of Nigeria characterized by high rainfall intensity with high run off volumes and high relative humidity. The annual rainfall is over 1600mm while the mean daily rainfall is over 150mm. The mean daily maximum and minimum temperatures are $32^{o}C$ and $25^{o}C$ respectively.

2.2 Study Design and Population

This cross sectional study was designed to investigate the prevalence of Urogenital Schistosomiasis among primary school children in Agulu Anaocha Local Government Area of Anambra State Nigeria. A total of 150 pupils aged 6 -18 years were sampled from different schools for the project. Subsequently, the study employed the use of questionnaire to enhance participation and routine parasitological techniques to identify the *Schistosoma haematobium* eggs.

2.3 Exclusion Criteria

Pupils of the school aged 6 -18 years were used for this study, the females in their menstrual period were exempted from the study as the presence of blood in their urine might be mistaken for the presence of the parasite.

2.4 Administration of Questionnaire

A structural questionnaire was administered to the pupils alongside containers for sample collection. The questionnaire was used to seek information on age, sex, occupation of parents, frequency of water contact and rivers in the locality, as well as knowledge, attitudes and practices in the transmission of schistosomiasis. This information was used to determine the risk factors in the transmission of urogenital schistosomiasis.

2.5 Sample Collection

Sterile urine containers were used to collect 20ml of midstream urine specimen from the selected pupils. These specimens were collected around 10am to 2pm during the school's break period. The specimens were properly labeled with identification number given to them and placed in an ice park after collection. The specimens were transported to the laboratory for parasitological examination for the detection of schistosome eggs, proteinuria and haematuria.

2.6 Determination of Biochemical Parameters

Reagent strips were used for rapid determination of urine biochemicals such as Urobilinogen, blood, bilirubin, protein, nitrate, ketones, leukocytes, glucose and pH values. The presence and levels of these substances in urine are often related to parasitic infection including schistosoma. Each strip was dipped in a urine specimen and then matched with the colour chart on the test strip container for detecting the presence and value of these chemicals and graded accordingly [19].

2.7 Parasitological Examination

The physical examination of the urine was carried out which included the colour, the transparency and turbidity. The microscopic examination was done following sedimentation and examined using X10 and X40 objective lens. 10ml of well mixed urine was transferred into a test tube and centrifuged at 1500rpm for 3mins. The supernatant fluid was discarded leaving only the sediment. A drop of the sediment was transferred to 5 labeled slides for each specimen, covered with cover slip and viewed under the microscope using both X10 and X40 objectives [19].

2.8 Data Analysis

Data obtained was analyzed using SPSS version 20 statistical software package. Chi-square, Mann-Whitney Test and Kruskal-Wallis test tool were employed used to compare the differences in prevalence with regards to sex, age groups, occupation etc. The resulting outputs were presented in table and level of significance set at $P < 0.05$.

3. RESULTS

Table 1 indicated that out of the 150 urine specimens examined, 3(2%) were infected while 147(98%) of the samples tested were not infected with any form of *Schistosoma haematobium* which gave an overall prevalence of 3%. The distribution of the parasites according to the demographic characteristics of the selected school children is summarized in Table 2 below. It showed that out of the 150 specimens examined, 65 were females while 85 were males. Also 3% of the females tested positive while 1% of males tested positive. This shows that the highest prevalence base on sex of the children selected was observed in females. There was no significant difference in the prevalence of the infection according to sex ($P < 0.05$).The table also showed that pupils within age group 10 -12 years showed the highest prevalence of 4% followed by pupils within 6 - 9 years who had a prevalence of 3% and age group 13 - 15 years where all were negative to *S. haematobium*

infection with zero prevalence. There was no significant difference in the prevalence of the infection according to age (P < 0.05). Similarly, it showed that for the education level of the parents, those that had no education had the highest prevalence (33%) followed by those that had tertiary education (6%). There is significant difference in the prevalence of the infection according to educational level of the parents (P < 0.05). Furthermore, considering parents occupation, farmers had highest prevalence (4%), followed by traders (2%). There is no significant difference in the prevalence of the infection according to parent's occupation (P < 0.05).

Table 3 showed that the two biochemical parameters were not significant to those infected. From the questionnaire given to assess the risk factors promoting the spread of schistosomiasis, the following risk factors below were observed. A greater percentage of the children indicated that they make use of borehole water (44%), which gave an infection rate of 2% while it was observed that some of them still make use of water from streams (29%) which can be contaminated with the eggs of schistosome and they had a higher infection rate (5%). There is no significant difference in the prevalence of infection according to source of water (P < 0.05). Similarly, 26%, 21% and 12% of the pupils indicated that they frequent the lake, streams and rivers around respectively while those that frequent the river had the highest infection rate of 6%. There is no significant difference in the prevalence of infection according to frequent contact with streams/rivers (P < 0.05). Moreover, 41% of the pupils don't visit any of the water bodies due to awareness of the disease. Furthermore, 48%, 43% and 9% of the children use pit, water system and no toilet system respectively, those that use pit had the highest prevalence of infection of *Schistosoma haematobium* (3%). There is no significant difference in the prevalence of the infection according to toilet facilities used (P < 0.05). It was observed that 95% representing a great percentage of pupils do not urinate in the rivers/streams so this prevents further spread of the disease but among them. Finally, 9% of the primary school children have had previous infection with the disease (Table 4).

Table 1. Overall prevalence of *Schistosoma haematobium* among the selected children

Samples	Number Observed	Percentage
Infected samples	3	2%
Uninfected samples	147	98%
Total samples	150	100%

Table 2. Demographic factors associated to *Schistosoma haematobium* infection

Demographic factors		n (%)	Number infected	Percentage of infection	P -Value
Gender	Female	65(43%)	2	3%	0.412
	Male	85(57%)	1	1%	
Age	6-9 years	52(35%)	1	3%	0.753
	10-12 years	77(51%)	2	4%	
	13-15 years	21(14%)	0	0%	
Parent's Education	Primary	16(11%)	0	0%	0.013
	Secondary	75(50%)	0	0%	
	Tertiary	54(36%)	2	6%	
	None	5(3%)	1	33%	
Parent's occupation	Civil servants	42(28%)	0	0%	0.461
	Farmers	23(15%)	1	4%	
	Traders	85(57%)	2	2%	

Table 3. Biochemical parameters of pupils assessed

Biochemical Parameter	No positive	No infected
Haematuria	3	0
Proteinuria	15	0

Table 4. Some risk factors of Schistosomiasis observed among the selected children

Risk Factors	Observation	Percentage	Number Infected	Percentage Infection	P value
Source of water	Rain: 15	10%	0	0%	0.504
	Pond:26	17%	0	0%	
	Borehole: 65	44%	1	2%	
	Stream: 44	29%	2	5%	
Frequent contact with streams/rivers	Stream: 31	21%	1	3%	0.439
	River: 18	12%	1	6%	
	Lake: 39	26%	1	3%	
	None: 62	41%	0	0%	
Toilet facilities	Pit: 72	48%	2	3%	0.758
	Water system: 65	43%	1	2%	
	None: 13	9%	0	0%	
Frequent urination in stream/river	Yes: 8	5%	0	0%	0.679
	No: 142	95%	3	2%	
Previous infection with the disease	Yes; 13	9%	2	2%	0.000
	No: 137	91%	1	0.7%	

4. DISCUSSION

This present study was conducted to determine the prevalence and associated risk factors of Urogenital Schistosomiasis among primary school children in Agulu, Anambra State. It was observed that among the 150 school children examined, the study revealed 2% overall prevalence, this record revealed a decline in the prevalence of *S. haematobium* in Agulu. The declining trend could be attributed to the fact that the area has become a scene of a number of health surveys including schistosomiasis. This could have created greater consciousness of the presence of parasitic disease among the pupils who have produced urine specimen for urine examination. Because of this level of consciousness, infected pupils most often resort to medical care either through the hospital or by patronizing the patent medicine dealers.

The prevalent rate observed in this study is low compared to other studies reporting schistosomiasis at other places, especially in Ebonyi State where the prevalent rate is up to 49.7% in Ohaukwu Local Government Area of the State. Higher prevalence of schistosomiasis has been reported previously particularly in the study area and Anambra state in general. [20] recorded 38% prevalence rate among school children in Agulu. In a similar vein, [20], in their study on urinary schistosomiasis and health education in Anambra state of eastern Nigeria, reported a prevalence rate of 24%. Previous studies have shown that the prevalence among school children ranges from 20 - 40% [21,22,23], but it can be as high as 50 -70% in areas where environmental changes occur due to constructions of dam and quarries [24,25]. This low prevalence may be as a result of the improvement on socio-economic characteristics of the respondents and improved healthcare available in the study area.

Portable water facilities have also improved in the local government, the people now have boreholes and pipe borne water and this has greatly reduced the water contact activities necessitated by need for water and consequently, the infection rate has reduced. Studies have shown that the longer the distance between a water body and human settlement, the smaller is the chance of transmission [26].

The proportion of the male and female examined showed that the intensity was higher in female than in male. The numerical difference in prevalence rate and intensity of urogenital schistosomiasis between male and female could be attributed to frequency of contact with water. The higher predominance of female than male infection in this study has been reported consistently in various studies across Nigeria [27].

The study showed that children between the ages of 10 -12 years were more infected and less infection occurred in children between the ages of 6 - 9 years. These age groups have been tremendously characterized with boisterous water-related activities such as fishing, washing, swimming and playing that increase the risk of infection in the communities. This probably accounts for higher infection rate among the

groups. [27] reported that the age group 11- 20 years (9.56%) has a slightly higher prevalence than other age groups, but still there was no observed significant difference in infection among the age groups. In a similar view, [28] reported highest prevalence among 6 - 8 years (15.9%) and least among the 12 - 14 years age-group (9.3%). They reported that School children within the 9 - 11years age-group, were infected with a prevalence of 13.9%. The highest infection rate of infection 67.3% was recorded among those in the age group 9 -11 years old. In another study [29], they reported a prevalence of 23% occurring among age groups 11 - 20 years and was closely followed by 10 years age group (12.6%). The least infection prevalence of 1.8% was recorded among 31 - 40 years age groups. [30] reported that the highest prevalence 49.4% were recorded within the 11- 15 years age group. Prevalence based on the occupation of the parents shows a prevalence of 2% among school children whose parents are traders, while that of farmers shows a prevalence of 4%.

The risk factors of this parasite observed included the source of water, frequency to streams or rivers and knowledge of the disease. Prevalence based on source of water, higher prevalence was found for borehole and stream/lake, while no prevalence was found for rain water. This shows that the participants of the study did not depend on water from lakes and streams for their domestic use. This may account for the low prevalence of *S. haematobium* in the study area. [31] reported that the prevalence of infection based on the sources of drinking water was found most prevalent in persons who use rivers (60.0%), followed by users of ponds (50.4%), dams (46.2%), wells (38.1%) and boreholes (19.4%). The least infection 18.8% was recorded in the group termed "others who use tap water and commercially packaged waters. [32] reported that the detrimental nature of schistosomiasis was recognized by 75.0 % of the respondents who agreed that schistosomiasis is a serious disease. Children are generally known to be vulnerable to urinary schistosomiasis, because of their strong tendency to play in water, which predispose them to the infection.

5. CONCLUSION

This study has shown that urogenital schistosomiasis is on a declining trend in Agulu, Anambra state. The study concluded that with more effort, urogenital schistosomiasis will be completely eradicated in the study area. Health education and public sensitization should be promoted by health workers to the community members on the importance of use of safe water for domestic purposes. The government should provide more boreholes in areas closer to rivers, streams and lakes to reduce the school children contact with rivers, streams and lake.

ETHICAL APPROVAL AND CONSENT

The study protocol was approved by the Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. A permission letter was gotten from the Head of Department, Parasitology and Entomology, Nnamdi Azikiwe University, Awka, to carry out this project. A letter of ethical permission was gotten from both the Ministry of Basic Education and the Ministry of Health to carry out this project. The authority to carry out the investigation was obtained from the head of each community while the consent of the school authorities was given before sample collections from the pupils. The clearance was on the promise that pupil privacy must be preserved, good laboratory practices will be followed, and information must be treated with highest confidentiality and for research purposes only [33, 34]. The research study was carried out with utmost observance of ethical standards and procedures for research with humans [35].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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