

Epidemiological Studies on Urinogenital Schistosomiasis in Ebonyi State

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ABSTRACT

This study examined the prevalence and intensity of *Schistosoma haematobium* infection in Ebonyi State, Nigeria. The study was conducted from May 2018 to April 2019. A total of 875 primary school children were randomly selected from three local government areas (LGA). The prevalence and intensity were determined by urine microscopy. Of the 875 school children examined microscopically, 115(13.1%) were found positive with *S. haematobium* egg, 46(5.3%) were positive for macrohaematuria. The overall prevalence was higher in males 67(14.9%) with a mean intensity of 41.15 eggs/10 ml urine than females 48(11.3%) with a mean intensity of 48.25 eggs/10 ml urine though the difference was not statistically significant ($p>0.05$). School children between 6-8 years old had the highest prevalence of the infection (15.9%) with a mean intensity of 41.42 eggs/10 ml urine, followed by those in age group 9-11 years old (13.9%) and mean intensity 41.59 eggs/10 ml urine. Light infection occurred mostly among those in the age group 9-11 years old (67.3%). While heavy infection occurred mostly among those in the age group 12-14 years old (62.5%). Umunneato Primary School pupils were mostly infected (13.7%), mean intensity of 73.4 eggs/10 ml urine, while the least infection rate (5.3%) occurred among pupils from Future Hope Primary School pupils with a mean intensity of 11.5 eggs/10ml urine. Pupils, whose parents/guardians were farmers, had the highest prevalence (23.9%) of the infection, with a mean intensity of 58.29 eggs/10ml urine. Pupils whose parents had no form of formal education had significantly highest prevalence (16.4%) and mean intensity of 76.22eggs/10ml urine. Those who source their water from the river statistically had the highest prevalence of urogenital schistosomiasis 103(23.9%). The highest prevalence of macrohaematuria (7.3%) was recorded at Ikwo LGA. Unique Primary School had the highest prevalence (11.8%) of haematuria. The highest prevalence of haematuria was recorded among males (5.7%). While the age group 6-8 years old had the highest prevalence of haematuria (8.3%). The study revealed that urogenital schistosomiasis is endemic in Ebonyi State. There is need for school-based chemotherapy and health education programme to help reduce the risk of urogenital schistosomiasis in Ebonyi state.

Keywords: Schistosomiasis; *Schistosoma haematobium*; Prevalence; Intensity; Infection

INTRODUCTION

Schistosomiasis also known as bilhaziasis or snail/katayama fever is one of the most wide-spread of all human parasitic diseases, ranking second only to malaria in parasitic disease morbidity and in terms of its socio-economic and public health importance [1]. Schistosomiasis is a chronic and enervating illness caused by digenetic trematode flatworms (flukes) of the genus *Schistosoma* [2]. It is the most prevalent of water-borne diseases, with a very great risk on the health of rural populations [1,3]. In Sub Saharan Africa have over 85% of people are living with schistosomiasis [4]. Two forms of schistosomiasis are recognized in humans; urinogenital schistosomiasis caused by *Schistosoma haematobium* and intestinal schistosomiasis which are caused by

Schistosoma mansoni, *Schistosoma mekongi*, *Schistosoma japonicum* and *Schistosoma intercalatum*. *Schistosoma mansoni* originated in Africa, *S. haematobium* and *S. intercalatum* are confined to Africa while *S. japonicum* and *S. mekongi* are found only in the Far East, in China and the Phillipines [5].

Urogenital schistosomiasis affects many communities especially the school children in Ebonyi State causing illnesses and lethargy that prevent them from attending schools and performing other activities, and at times gives rise to malignancies which are fatal. Besides, many communities lack adequate knowledge on the transmission, prevention and control of this infection. Even with growing awareness of the problem associated with urogenital schistosomiasis in children there is still paucity of documented information on the current prevalence and predisposing factors of

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urogenital schistosomiasis in Ebonyi State. An essential key that will deepen the understanding of basic factors, permissive to the development of the parasite-intermediate host system, is important to target control interventions [6].

Several factors, such as cultural, social, environmental and behavioural, directly influence the prevalence and intensity of urogenital schistosomiasis. It is important that these factors be identified to aid designing control programmes. In Ebonyi State, there is dearth of knowledge on the current prevalence and risk factors associated with schistosomiasis transmission. Environmental conditions are deplorable, indiscriminate defecation and urination is very common, the literacy level is low, and safe/portable water is greatly inadequate with consequent effects on the community health. This makes intervention and control measures more difficult as such information is crucial to identify and implement effective control measures. Therefore, this study was carried out to investigate the extent these factors have contributed to the transmission of urogenital schistosomiasis in Ebonyi State. The aim of this study is to investigate the epidemiological studies of urogenital schistosomiasis in Ebonyi State.

MATERIALS AND METHODS

Study Area

This study was carried out in three local government areas of Ebonyi State, Nigeria. These LGAs are Ikwo, Ohaukwu and Afikpo North (Figures 1-3). Ebonyi State lies between longitude 7.567

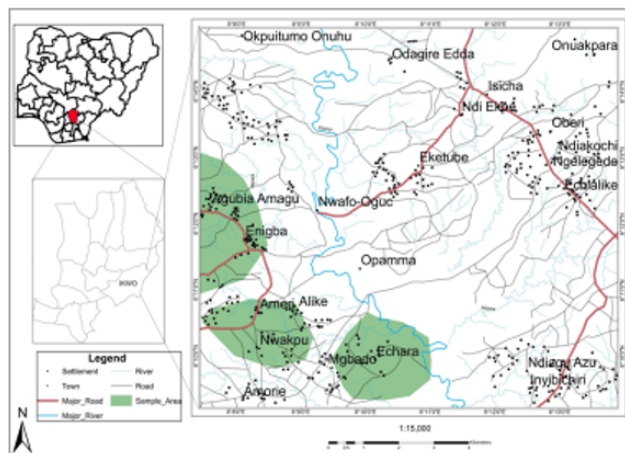


Figure 1: Map of Ikwo L.G.A (Using Geographical Information System).

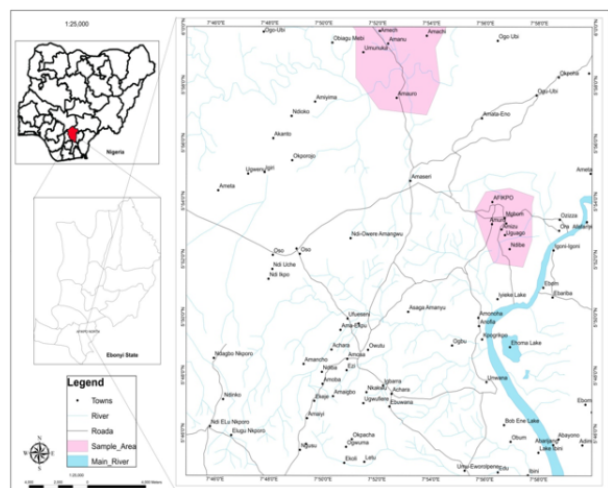


Figure 2: Map of Afikpo North Local Government Area Showing Areas Surveyed (Using Geographical Information System).

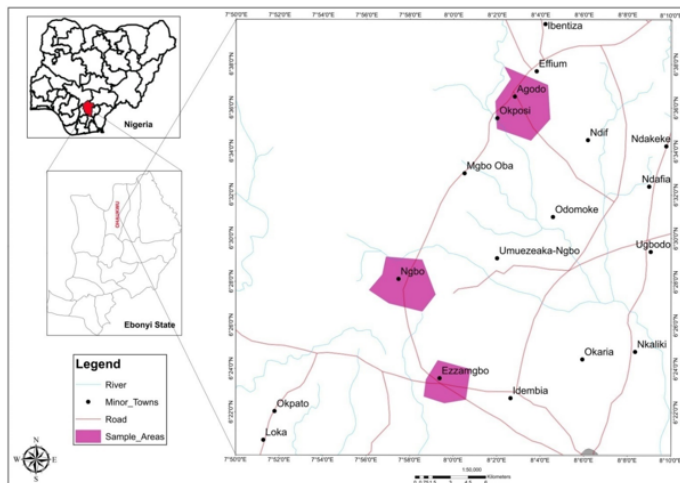


Figure 3: Map of Ohaukwu Local Government Area Showing Sampled Areas (Using Geographical Information System).

and latitude 6.483 with an altitude of 147m. The vegetation is an overlap of savanna and rainforest. Ebonyi state shares a boundary with Kogi state in the north and Enugu state in the south end. In the east it shares a boundary with Abia state while in the west it shares a boundary with Igala Cross River state. It is made up of nine local government areas.

Climate

The mean annual rainfall ranges from 190-203cm, while mean daily temperature ranges from 20-25°C in wet season and between 28-37°C in dry season according to meteorological records obtained from meteorological station.

Occupation

The inhabitants of Ebonyi state are primarily Ibos co-existing with other ethnic groups. The people are predominantly farmers although some were petty traders and bronze-casters. They also practice mixed farming combining animal rearing with crop farming. The major food crops grown in the area are rice, yam, cocoyam, maize, banana, plantain, sweet potatoes and fruits. The cash crops are palm produce, coconut etc. other economic activities include wine tapping, fishing, stone and sand quarrying. The area is rich in mineral resources like lead and salt. One characteristic geographical feature of Ebonyi State is the presence of scattered bodies of water.

Ethical clearance

Approval for the study was given by the Department of Parasitology and Entomology Nnamdi Azikiwe University Awka. Ethical Approval was obtained from the Institutional Based Ethics Committee, Alex Ekwueme Federal University, Ndufu Alike, Ikwo LGA, Ebonyi State (FUNAI/SEN/EBC/17/VOL.1/16) before the commencement of the study. Informed consent was sought from each participant before commencing sample collection. Confidentiality of the data collected was assured by using only code for each participant.

Selection of local government areas

Ebonyi state is made up of three senatorial districts -Ebonyi North, Ebonyi South and Ebonyi Central and thirteen LGAs. In each senatorial district, one LGA was randomly selected. Ebonyi North senatorial district consists of Abailiki LGA, Ebonyi LGA, Izzi LGA

and Ohaukwu LGA. Ohaukwu LGA was selected. Ebonyi South senatorial district consist of Afikpo North LGA Afikpo South LGA, Ohazara LGA, Ivo LGA and Onicha LGA. Afikpo North was selected. Finally from Ebonyi Central which is made up of Ezza North LGA, Ezza South LGA, Ikwo LGA and Isielu LGA, Ikwo LGA was selected. The basis for selection was nearness to body of water.

Advocacy visit

Permission obtainment visits were made to the Chairman of the three LGAs to solicit their support. Similarly, advocacy visits were made to the traditional rulers in which the selected schools were situated during which the purpose of the study was explained to the parents and guardians of the selected pupils for the study. The traditional rulers with their members pledged their support and cooperation of their subjects for the research.

Consent approval

Approval was gotten from the three selected LGAs using a letter of introduction obtained from the Department of Parasitology and Entomology, Nnamdi Azikiwe University, Anambra State. Informed consent was obtained from the parents/guardians of school children one week before sample collection. The consent letters from the volunteers in the study area were collected before the sample collection. The objectives and procedures of the study were explained clearly to them in local dialect where necessary

Study population

There are about 80 primary schools in the three LGAs. These constitute the study population. The population of registered primary school children in the three LGAs was based on the data gotten from the Education zone of the LGAs.

Sample size determination

The sample size was determined using World Health Organization specified guideline for survey of schistosomiasis and Tamil.

$$n = Z^2 pq / L^2$$

n=sample size, z=standard normal distribution at 95%, confidence interval=1.96, p=assumed prevalence rate, L=allowable error of 5%. Using the formula by Tamil (2012) in cross sectional study, the outcome being measured was taken as prevalence of the disease/ risk factor. Therefore sample size was calculated using the formula:

$$N = [Z^2(pq)] \div L^2$$

Z= Normal standard distribution that corresponds to 95.0% confidence interval as 1.96.

$$p = \text{Prevalence of schistosomiasis (20\%)} = 0.20$$

$$q = 1 - p (1 - 0.20) = 0.8$$

$$d = \text{degree of accuracy/precision expected as } 0.05.$$

$$\text{Using } n = z^2 \times p(1-p) / e^2$$

$$\text{Where } z = 1.96; p = 41.9\% = 0.149; e = 5\% = 0.05$$

$$n = (1.96)^2 \times 0.20 \times (1 - 0.20) / 0.05^2$$

$$n = 3.8416 \times 0.20 \times (0.8) / 0.0025$$

$$n = 245.8 = 246$$

The sample size assumed was 246 for each LGA. However, this figure was dependent on the number of pupils that gave consent to the work.

Selection of primary schools

A total of twelve schools out of 87 schools in the selected LGAs were involved in the study. From each LGA, four schools were selected based on their nearness to water bodies and rice farms. From Ikwo LGA, the following schools were selected: Urban Primary School (95), Good Shepherd Primary School (87), Igboji Primary School (73) and Umunneato Primary School (120) giving a total of 375 pupils. In Afikpo LGA, a total of 275 pupils were enrolled from the following schools; Unique Primary School (46), Amaezu Primary School (52), Ukpa Amaechara Primary School (86) and Amauro Primary School (91). From Ohaukwu LGA, the following schools were selected: Future Hope Primary School (51), Ndiagu Primary School (50), Frontline Primary School (67) and Central Primary School (57) giving a total of 225 pupils. Overall, a total of 875 pupils were enrolled for the study. Questionnaires were used to obtain their personal data, source of water, level of literacy, occupation of parent/guardians etc.

Study design

This was a cross-sectional study carried out among school children aged 6-14 years. Pupils were selected from each class using random sampling technique by Nwosu et al. [7]. Age of school children was grouped into three categories: 6-8 years, 9-11 years and 12-14 years. The study was carried out between May 2018 and April, 2019. The participants were school children who make steady contact with water bodies. School children was targeted because schools are easily accessible. Infection prevalence peak is found more in primary school age group. This age group suffers from nutritional deficiencies due to intense physical and mental development. Previous studies have reported that there is generally good compliance from children and parents [8-10].

Collection of urine samples

A total of 875 urine samples was collected from the participants between May 2018 and April 2019. On each day of collection, the urine samples were collected between the hours of 10am and 2pm, in a 20ml well-labelled and clean wide-mouthed sterile universal container [11]. The sample numbers serially were carefully recorded to correspond with their names to avoid mixing up the groups. They were asked to carefully collect the urine samples to prevent faecal contamination and other source of contamination. Also, they were asked to discard the first stream of urine and produce terminal urine for the analysis. To each urine specimen, 10ml (100/0) formalin was added to preserve the normal physiology of the egg/ova of schistosome if present. The essential data of the pupils such as age, sex and name of the school, sample number and time of collection were noted on the containers and then the samples were carefully placed to avoid spillage. All pupils involved were strictly advised to wash their hands before going back to their classrooms. Then, the samples were transported to the Biology Laboratory of Alex Ekwueme Federal University Ndufu-Alike, for analysis not later than two hours [12]. Urine samples were processed within two hours of its collection.

Urine microscopy

The urine samples were gently shook and 10mls of each urine

sample was poured into a clean well labelled test tube. The tubes were placed in the centrifuge buckets and the centrifuge lid was firmly closed. The centrifugation and timing were set to three thousand revolutions per minute (3000 rpm) for five minutes. The tubes were removed from the centrifuge machine and the supernatant fluid was discarded, leaving only the deposits at the bottom of the tubes. The sediment of the urine was remixed by gently tapping the bottom of the tube. A drop of the sediment was placed on a grease-free microscope slide, gently covered with a cover-slip without formation of air bubbles. The entire sediment was examined microscopically for the presence of the ova of *Schistosoma haematobium* with characteristic terminal spine using 10x objective with the condenser iris closed sufficiently to give a good contrast [12]. The number of the eggs in the preparation was counted and reported in number egg/10ml urine to represent the intensity. With counts of <50eggs/10 ml of urine and >50eggs/10 ml of urine indicative of light infection and heavy infection respectively. All the findings were recorded carefully.

Identification of ova

The ova of *Schistosoma haematobium* was identified using Cheesbrough [11]. Under the microscope, it was seen as golden yellowish in colour, elliptical in shape and has a terminal spine (Figure 4).

Socio-demographic and risk factors

At the point of collection of samples, a pre-tested questionnaire was given to all participants to obtain information on their biodata (name, age, sex, and class), religion, and ethnic group, occupation of parents, residential status, toilet facilities, and source of water supply, and other risk-related factors of urogenital schistosomiasis. The questionnaires were numbered to correspond with the universal containers. A school-based questionnaire was administered to each headmistress to collect data on the pupils' population, history of reports of haematuria, and local languages for haematuria.



Figure 4: Eggs of *Schistosoma haematobium* from an infected urine.

RESULTS

Prevalence and intensity of urogenital schistosomiasis in Ebonyi State

Of the eight hundred and seventy-five (875) urine samples examined for urogenital schistosomiasis, 115(13.1%) were found to be infected, with mean and standard error of as shown in Table 1. The highest prevalence of urogenital schistosomiasis (21.5%) was obtained from Ohaukwu LGA followed by Afikpo North LGA (9.8%). The least infection rate of 9.1% was obtained from Ikwo LGA. Fifty-three percent (53.0%) of light infection was obtained while forty-seven percent (47.0%) of heavy infection was obtained. The highest prevalence of light infection of urogenital schistosomiasis was observed in Ohaukwu LGA where a prevalence of 66.1% followed by Afikpo North LGA where a prevalence of 45.5% was obtained. The least prevalence of the infection was recorded in Ikwo LGA with a prevalence of 35.3%. However, the highest prevalence of heavy infection (64.7%) was obtained from Ikwo LGA followed by Afikpo North LGA (54.5%). The least prevalence of heavy infection was recorded in Ohaukwu LGA where a prevalence of 33.9% was obtained. The mean intensity of egg per 10ml of urine obtained was 44.8. In the results obtained, there was significant difference ($X^2=24.322$; $df=2$, $P\text{-value}=0.000$ ($P<0.05$)) for prevalence between *Schistosoma haematobium* infection and the LGAs studied. Also, there was a significant difference ($X^2=8.848$; $df=2$, $P\text{-value}=0.012$) for the intensity of *Schistosoma haematobium* infection in the three LGAs respectively.

Prevalence of urogenital schistosomiasis in relation to school in Ebonyi State

The prevalence of the infection was highest (13.7%) in pupils from Umunneato Primary School followed by those from Urban Primary School (10.9%) and least (5.3%) in children from Future Hope Primary School. The highest prevalence of light infection (100.0%) was recorded in children from both Ukpa Amechara and Amurumgbo Primary School and least (16.7%) in children from Unique Primary School. The highest prevalence of heavy infection (83.3%) was obtained from Unique Primary School. No heavy infection was detected from Ukpa Amechara Primary School and Amurumgbo Primary School. The highest mean intensity (73.4 eggs per 10ml urine) was recorded in Urban Primary School followed by Ndiagu Uno Primary School (55.7 eggs/10ml urine). The least mean intensity (11.5 eggs/10ml urine). There was a significant difference ($X^2=41.994$; $df=11$, $P\text{-value}=0.000$) ($p<0.05$) for prevalence between *Schistosoma haematobium* infection and the schools studied. Also, there was a significant difference ($X^2=27.767$; $df=11$, $p\text{-value}=0.004$ ($P<0.05$)) for the intensity of *Schistosoma haematobium* infection in the school studied (Table 2).

Table 1: Prevalence of urogenital schistosomiasis in relation to LGA in Ebonyi State.

L.G.A	No. Examined (%)	No. Infected (%)	No. with Light infection (<50eggs) (%)	No. with Heavy infection (>50eggs) (%)	Total egg output	Mean intensity (Eggs/10ml of urine).
Ikwo	375(42.9)	34(9.1)	12(35.3)	22(64.7)	1929	53.97
Ohaukwu	275(31.4)	59(21.5)	39(66.1)	20(33.9)	2187	38.37
Afikpo North	225(25.7)	22(9.8)	10(45.5)	12(54.5)	969	42.13
Total	875(100.0)	115(13.1)	61(53.0)	54(47.0)	5085	44.8

Table 2: Prevalence of urogenital schistosomiasis in relation to school in Ebonyi State.

School	No. Examined (%)	No. Infected (%)	No. with Light infection (<50eggs) (%)	No. with Heavy infection (>50eggs) (%)	Total egg output	Mean intensity (Eggs/10 ml of urine)
Urban Pri. Sch.	95(10.9)	8(8.4)	2(25.0)	6(75.0)	514	73.4
Good Shepherd sch.	8(9.9)	5(5.7)	2(40.0)	3(60.0)	266	53.2
Igboji Pri. Sch.	73(8.3)	5(6.8)	4(80.0)	1(20.0)	208	41.6
Umunneato Pri. Sch.	120(13.7)	17(14.2)	5(29.4)	12(70.6)	891	55.3
Future Hope Sch.	46(5.3)	12(26.1)	8(66.7)	4(33.3)	520	43.3
Ndiaguno Pri. Sch.	52(5.9)	14(21.2)	5(45.5)	6(54.5)	613	55.7
Frontline Pri. Sch.	86(9.8)	16(18.6)	9(56.3)	7(43.7)	741	46.3
Central Pri. Sch.	91(10.4)	18(19.8)	15(83.3)	3(16.7)	145	17.3
Unique Pri. Sch.	51(5.8)	12(23.5)	2(16.7)	10(83.3)	661	55.0
Amaezu Pri. Sch.	50(5.7)	5(10.0)	3(60.0)	2(40.0)	219	43.8
UkpaAmaechara Pri. Sch.	67(7.7)	2(3.0)	2(100.0)	0(0.0)	23	11.5
Amurungbo Pr. Sch.	57(6.5)	4(7.0)	4(100.0)	0(0.0)	66	16.5
Total	875(100.0)	115(13.1)	61(53.0)	54(47.0)	5085	44.8

Table 3: Prevalence of urogenital schistosomiasis in relation to gender in Ebonyi State.

Gender	No. Examined (%)	No. Infected (%)	Intensity of infection		Total egg output	Meanintensity (Eggs/10 ml of urine)
			No. with Light infection (<50 eggs) (%)	No. with Heavy infection (>50 eggs) (%)		
Male	449(51.3)	67(14.9)	36(53.7)	31(46.3)	2922	41.15
Female	426(48.7)	48(11.3)	25(52.1)	23(47.9)	2163	48.25
Total	875(100.0)	115(13.1)	61(53.0)	54(47.0)	5085	44.8

Prevalence of urogenital schistosomiasis in relation to gender in Ebonyi State

The prevalence and intensity of *Schistosoma haematobium* infection in four hundred and forty-nine (449) males examined showed that sixty-seven (67) were infected with prevalence of 14.9% and four hundred and twenty-six (426) females examined showed that forty-eight (48) were infected with prevalence of 11.3%. There was no significant difference ($X^2=2.557$; $df=1$, P -value=0.067) ($p>0.05$) for prevalence between *Schistosoma haematobium* infection and the gender studied. Thirty-six (53.7%) of the infected males had light infection while thirty-one (46.3%) had heavy infection. Twenty-five (52.1%) of the infected females had light infection while twenty-three (47.9%) had heavy infection. There was no significant difference ($x^2=0.030$, $df=1$, p -value=0.867 ($P>0.05$)) in intensity by gender. The mean intensity of 41.15 eggs/10ml of urine and mean intensity of 48.25 eggs/10ml of urine were observed in males and females respectively (Table 3).

Prevalence of urinogenital schistosomiasis in relation to age in Ebonyi State

The prevalence of *Schistosoma haematobium* decreased as age increased, highest among 6-8 years (15.9%) and least among the 12-14 years age-group (9.3%). Prevalence and intensity of infection with *Schistosoma haematobium* in relation to age-group indicated that forty-two (42) of the two hundred and sixty-four (264) school-children within the 6-8 years age-group were infected with prevalence of 15.9%. Forty-nine (49) of the three hundred and fifty-two (352) school children within the 9-11 years age-group, were infected with prevalence of 13.9%, twenty-four (24) of two hundred and fifty-nine school children within the 12-14 years age-group, were infected with prevalence of 9.3%. The highest infection rate of light infection (67.3%) was recorded among those

in the age group 9-11 years old. However, the highest prevalence of heavy infection (62.5%) was obtained from those in the age group 12-14 years old. The mean intensity of 41.42 eggs/10ml of urine, 46.59 eggs/10ml of urine, and 46.71 eggs/10ml of urine were recorded for pupils in the age group 6-8 years old, 9-11 years old and 12-14 years old respectively (Table 4). There was no significant difference in prevalence ($X^2=5.367$, $df=2$, p -value=0.068 ($P>0.05$)) in relation to age. However, there was a significant difference in the intensity of infection in relation to age-group ($X^2=7.380$, $df=2$, p -value=0.025 ($P<0.05$)).

DISCUSSION

The present study showed that urinogenital schistosomiasis is present among school children in Ebonyi State, Nigeria. The prevalence and intensity of infection of *Schistosoma haematobium* in the three LGAs studied did not happen by chance, the same causative agent is involved. Any pupil with *Schistosoma haematobium* infection in any of the twelve schools is a potential carrier that can equally transmit it anytime anywhere, all things being equal. However, the occurrence of *S. haematobium* in all the schools in Ebonyi State with overall prevalence of 13.1% showed that Ebonyi State is endemic for urogenital schistosomiasis. Contraction of schistosomiasis infection by school children is highly dependent on the human-water contact patterns as people visit the water bodies for various purposes including domestic, economic, religious and recreational activities. Obviously, these activities have been hitting on in the water bodies present in the study areas giving rise to favorable micro environments that attract aquatic snails. Similarly Okpala et al., stated that various socio-epidemiological factors including distance from transmission site, migration, and emergence of new foci, water supply patterns and level of faecal contamination of the water source are responsible for

Table 4: Prevalence of urogenital schistosomiasis in relation to age in Ebonyi State.

Age (years)	No. Examined (%)	No. Infected (%)	Intensity of infection		Total egg output	Mean intensity (Eggs/10 ml of urine)
			No. with Light infection (<50 eggs) (%)	No. with Heavy infection (>50 eggs) (%)		
6-8	264(30.2)	42(15.9)	19(45.2)	23(54.8)	1450	41.42
9-11	352(40.2)	49(13.9)	33(67.3)	16(32.7)	2564	46.59
12-14	259(29.6)	24(9.3)	9(37.5)	15(62.5)	1071	46.71
Total	875(100.0)	115(13.1)	61(53.0)	54(47.0)	5085	44.8

transmission of the disease and level of infection; hence, focality of transmission [13]. The prevalence (13.1%) recorded in this study was in agreement with the report that in recent years there has been a drop in incidence and prevalence of schistosomiasis in some areas and increase in others [7,14]. This observation corroborates with the findings of Kalu et al. [15] which recorded a prevalence of 14.3% in Lokpanta community in Abia State, 16.9% recorded in two rural communities (Korede and Obada) in the Ijebu East of Ogun State[16], 10.1% and 15.5% in Gashaka and Bali Local Government Areas respectively all in Taraba State. The result of this study was however lower than the 71.8% documented for school children living in settlements near a dam reservoir in Ogun State, Nigeria [17]; 19.8% in Adim, Cross River State, Nigeria [18] and 58.1% in Ilewo Orile, Ogun State, Nigeria [19]. It was also lower than the 68% recorded by Ogunremi and Adewole, (2017) in Aramoko-Ekiti in Ekiti State. The result in this study agreed with the reports of Awogun (1985) in Illorin, Amazigo et al. [20] in Umueze-anam, Anambra, Ekwunife in Anaocha, Bello et al. in Goronyo, Sokoto, Agi and Okafor (2005), Mbata et al, in Ogadibo, Benue state and Abdullahi et al. in Kano that *S. haematobium* is endemic in Nigeria [8,10,21-23].

The highest prevalence of urinogenital schistosomiasis among the pupils from Ohaukwu LGA (21.5%) could be attributed to many water bodies infested with fresh water snail intermediate hosts. Besides, a lot of human activities going on there.

The high prevalence among pupils of Umunneato Primary School (13.7%) could be attributed to the close proximity of their school to the Amovu stream in which the highest population of freshwater snails were collected. Again, they also accompany their parents after school hours and their visit to the stream either after farming or at their leisure for recreational activities like playing and swimming. This finding is similar to the reports of Ekwunife (2004) in Agulu Lake, Aniocha Local Government, Mbata et al. (2009) in the Owukpa and Eha zones in Ogadibo Local Government Area of Benue State [10,22]. The differences in prevalence among school children in these studies could be attributed to the type of water bodies, water-contact practices and poor health education. This is because infection with urogenital schistosomiasis occurs on contact with contaminated water [17,19]. The occurrence of light and heavy intensities in the study might depend on the children's immune system build up or the frequency of their water contact activities with the cercariae infested water bodies [24,25].

CONCLUSION

Since, there is a relatively high prevalence of *S. haematobium* infection among school-children in Ebonyi State; there is need for school-based chemotherapy, health education programmes, vector control, and the provision of safe water and adequate sanitation. Government should intervene through creating more recreational facilities in and outside schools to discourage students from

playing in the infested stream and lake. The research has provided a frame work for complete campaign, control and eradication of schistosomiasis and snail vectors. The State and Federal government has to intensify their campaign strategy to bring a complete end to this infection. Also, integration of the Ebonyi State into the National Schistosomiasis Control Initiatives of the Federal Ministry of Health is imperative.

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AUTHORS' CONTRIBUTIONS

The study was conceived and designed by COA. All authors contributed to make the manuscript a success.

COMPETING INTERESTS

The authors declared that they have no conflict of interests.

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