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Original Research Article

Prevalence of *Schistosoma haematobium* infection among school aged children in Ohaukwu local government area, Ebonyi State, Nigeria

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ABSTRACT

Background: Urinary schistosomiasis caused by *Schistosoma haematobium*, remains a significant health challenge in sub-Saharan Africa particularly Nigeria. The study investigated the prevalence of the infection among school-age children in Ohaukwu Local Government Area of Ebonyi State, Nigeria.
Methods: A total of 570 pupils (308 males, 262 females) from 10 primary schools were examined using microscopy technique. A well-structured questionnaire was administered to collect demographic information, asses the level of knowledge and risk factors of schistosomiasis among the pupils.
Results: The overall prevalence was 15.1% (86/570), with males more infected (17.9%) than females (11.8%). The difference was statistically significant ($p<0.05$). Children in the age 11-15 had the highest infection rate 20.5% (62/302) than other age groups. Chi-square test showed that the differences in prevalence among the age groups were statistically significant ($p=0.001$). Among the component schools, infection was highest in State Primary School Ekwashi Ngbo 36.7% (18/49). The overall mean intensity was 11.35 eggs/10 ml of urine with females having a higher mean intensity (13.26 egg/10 ml of urine) than males (10.27 eggs/10 ml of urine). Most pupils (89.5%) had light infection. Pupils of age group 6-10 years mean egg intensity (17.72 eggs/10 ml of urine) was highest. Mean intensity of *S. haematobium* infection was found to decrease with advancement in age. Knowledge of the infection was poor, with 95.79% of participants having no knowledge.
Conclusions: Extensive campaign on the awareness of the disease and scale-up of mass drug administration of praziquantel to help in the control of the disease is highly recommended.

Keywords: Praziquantel, Prevalence, Schistosomiasis

INTRODUCTION

Schistosoma haematobium is a digenetic trematode responsible for transmission of urinary schistosomiasis. Urinary schistosomiasis is a neglected tropical disease that affects more than 240 million people in 78 countries with approximately 800 million people at risk.[1] People affected include children and young persons in the tropics and subtropics. Schistosomiasis otherwise known as bilharziasis is a major intravascular infection that has serious public health consequences, with significant socio-economic impact in the developing world. The

disease can lead to long-term health consequences and considerable economic burden on disadvantaged populations. *S. haematobium* is found in Middle East, Asia, Oceania and Africa. It afflicts the poor, rural villagers, especially school age children, women and fishermen who lack access to safe water and sanitation and whose daily activities bring them into direct contact with infested water bodies.

The adult organisms are found in the venous plexuses around urinary bladder and their released eggs traverse the wall of the bladder causing haematuria and fibrosis of the bladder. The bladder becomes calcified and there is increased pressure on ureters and kidneys, a condition called hydronephrosis. Urinary schistosomiasis generally can be classified as acute, chronic or advanced schistosomiasis. It causes pain, secondary infection, kidney damage as well as cancer. In most cases, it presents painful or difficult urination (dysuria), blood in urine (haematuria), urethral obstruction, kidney damage due to urine obstruction (this is known as obstructive nephropathy), anuria (no urination). All these are the accompanied signs, symptoms and complications of the disease.[2] The parasite also causes chronic urinary tract bacterial infection. Sometimes the effect of *S. haematobium* on the bladder may produce polyps, ulcers, tubercles, sandy patches, cystitis and leukoplakia which can be visible upon endoscopic examination. It was equally reported that squamous cell carcinoma may develop after infection. Transmission of the disease to humans and other mammalian hosts occur via fresh water snails (*Bulinus spp.*) which serve as intermediate hosts. In Africa, *S. haematobium* is known to be transmitted by the planorbid snail *Bulinus* species which include; *B. globosus, B. africanus, B. nasatus* and *B. trancatus*. *Bulinus forskali* and *B. senegalensis* have also been incriminated as intermediate hosts of *S. haematobium*.[3]

Schistosomiasis is not only endemic in Nigeria but is also known to be prevalent in all countries of Africa. Nigeria is one of the countries known to be highly endemic for urinary schistosomiasis with an estimated report of 101.28 million persons at risk and 25.83 million infected Ajibola et al also reported 29 million infected persons in Nigeria. Several findings on incidence of *S. haematobium* infection and prevalence in some towns and communities in Nigeria have been documented.[5-7]

There have been concerted efforts by government towards the control and possible elimination through integrated intervention measures. Nevertheless, urinary schistosomiasis has remained unabated. Several surveys on the incidence of *Schistosoma haematobium* infection and prevalence in Ohaukwu local government area have been documented Recently, Umoh reported 6.0% while Awopeju reported 30.2% prevalence.[6,7] The reports show that even though there might be reductions in prevalence, urinary schistosomiasis is still endemic and remains a public health problem in the local government area. The health complications due to schistosomiasis such as nephritic syndrome, UTI, cancer have adversely affected children of school age, reducing their school hours and ability to learn. This study therefore, was aimed at assessing the prevalence of *S. haematobium* infection among school aged children in Ohaukwu local government area, Ebonyi State, Nigeria.

METHODS

Study area

The study was carried out in randomly selected primary schools in Ohaukwu Local Government Area of Ebonyi State between the month of April to August 2024. Ohaukwu Local Government Area is one of the 13 Local Government Area of Ebonyi State, Nigeria (Figure 1). The State occupies the area lying between latitude 6º10'40.7028" N and longitude 7º57'33.4296" E. Ohaukwu is located at latitude 6º3'58.3" N and longitude 8º1'22.0" E. The local government area has an area of approximately 707.8 km^2 with estimated population of 291,300.[8]

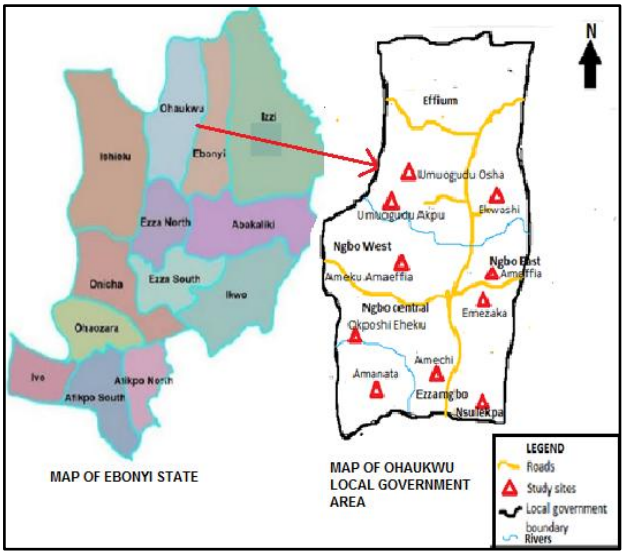

Figure 1: Map of study area showing study sites modified.

Source: http://soluap.com/wp.cont/uploads/2022/11/map -of-Ebonyi State showing the 13 LG Councils-Q320.jpg

The area is typically a settlement. The people settle in thatched huts with few in modern buildings. The inhabitants lack the basic social amenities such as regular electric power supply, pipe borne water and good health centers. They depend mostly on streams, rivers, pond, quarry pit water, borehole water and spring water for domestic use especially among rural dwellers. The climate of the area is tropical with a mean daily temperature of 30°±50°C for most of the year. The annual rainfall is on average of 1300 mm with distinct wet and dry season.[6] The inhabitants especially young ones have contact with snail infested water bodies through rice farming, bathing, swimming, washing of cloths, fetching

of water and fishing. Out of ignorance of the infested water bodies, most inhabitants use them to irrigate their rice farms thereby creating opportunity for *Schistosoma haematobium* cercariae to penetrate into their body. Most users and drivers of motorcycles (cyclists) popularly known locally as Okada stop over the pond sites to wash their motorcycles. Many people mostly believe that haematuria due to the disease is the emergence of maturity in age for the men while others associate it to sexually transmitted diseases.

Study design

The study was cross sectional and it was performed by collecting urine samples by simple random and systematic sampling as well as by administration of close ended questionnaire to the participants.

Study population

The study population consists 570 pupils made up of 308 male and 262 female school children from ages 5-19 years old that were randomly selected from 10 primary schools. The schools include Ibenta Primary School Ezzangbo, Central School Amike Ezzangbo, Amaechi Community Primary School Ezzangbo, Amanamta Community Primary School Ezzangbo, Central School Ngbo, Central School Umuezaka Ngbo, Hilltop primary School Ngbo, Community primary School Ukpeshi Umuogudu Oshia Ngbo, All Saints Methodist Primary School Ukwagba Ngbo and State Primary School Ekwashi Ngbo. The local government was grouped into four zones which include; Ezzangbo, Ngbo East, Ngbo West and Ngbo Central. The schools were randomly picked from each zone with at least two schools per zone. In each of the randomly selected primary schools, fifty and above willing participants were randomly selected from primary 1 to 6 within the age range of the study. The pupils must have been resident in the location for at least one year. The school age children constitute an ideal target group for investigation of urinary schistosomiasis in endemic communities because of their known habits of poor hygiene and frequent water contact activities which enhance the chances of infection with the parasites. They equally represent the true population of the inhabitants of the communities.

Inclusion criteria

Participation in the study was based on pupils who must have lived for at least one year in the study area. Who were willing and interested (consented). Participants were also within the age range for the study.

Exclusion criteria

School children that were unwilling and uninterested to participate. Those outside the age range either below or above those in areas where there was communal crisis and those on anthelminthic medication like praziquantel

Ethical clearance

Participants for the study were enrolled after the approval was granted by the ethical committee of Ebonyi State Ministry of Health, Abakaliki and a letter authorizing the approval of the study in the primary schools within the study area was equally obtained from the secretary of Ohaukwu local government education authority. The headmasters and headmistress of each participating school were equally consulted and explanation on the importance of the study given. Informed consent was obtained from the PTA leadership of each participating School and community leaders. Parents/guardians approval and consent of each participant was sought. Only children whose parents/guardian consented were included.

Specimen collection

Each participant was given a 30 ml sterile dry plastic universal container with a screw lid. The children were given instructions on how to collect a terminal (last-drops) of urine between 10.00 am and 2:00 pm after a minor exercise.[9]

Each container was well labelled with the sex, age, date of collection and serial number of the participant. This corresponded with the serial number on the questionnaire administered to the participants. The collected urine samples were examined macroscopically for the presence of blood (haematuria). Thereafter, 2 drops of 10% formalin was added for preservation of potential ova of the parasite and it was transported to the microbiology/parasitology laboratory in Alex Ekwueme Federal University Teaching Hospital, Abakaliki in an ice pack for further microscopic examinations.

Microscopic examination of urine by centrifugation techniques

Ten (10) ml of urine was centrifuged at 1000 revolution per minute (rpm) for 5 minutes and the supernatant decanted. A drop of the sediment was then transferred onto a clean grease free slide, covered with a coverslip and examined under the microscope using 10x and 40x objectives respectively. Quantitative/intensity of infection was then determined by the number of eggs/10 ml urine.[9]

Quantification of *S. haematobium* eggs

The presence of *S. haematobium* eggs was assessed using the urine filtration technique, the standard for the diagnosis of urogenital schistosomiasis recommended by WHO.[10] Ten (10) ml of the urine sample was filtered through a micro-filter membrane with a pore size of 10-12 µm (MF, Whatman, NJ, USA) using a Luer syringe. The micro-filter membrane was carefully placed on a glass slide, mounted on a microscope and examined using a light microscope's low-power objective (10x). *Schistosoma* eggs were counted and recorded as the

number of eggs/10 ml of urine. Infection intensity was classified as light (<50 eggs/10 ml of urine) or heavy (≥50 eggs/10 ml of urine) as described by Atalabi.[11]

Data analysis

Data was entered into Microsoft excel 2016, cleaned and exported to statistical package for social sciences (SPSS) version 22 for analysis. The mean prevalence and intensity of the infection were calculated based on categorical variables and presented in tables. The association between categorical variables and the prevalence and intensity of infection was assessed using Chi-square test. A p value of ≤0.05 was considered statistically significant for all the analysis.

RESULTS

The results revealed that in a total of 570 pupils who were examined for *Schistosoma haematobium* infection using microscopy technique, 86 (15.1%) subjects were found to be excreting ova of *Schistosoma haematobium* in their urine (Table 1).

The distribution of infection by gender indicates that of 308 and 262 female pupils examined by microscopy for ova of *Schistosoma haematobium*, 55 (17.9%) and 31 (11.8%) had the infection respectively. This indicates that male pupils have a higher prevalence of the infection than the females (Table 1). The difference in gender specific prevalence was statistically significant (p=0.054).

Table 1: Prevalence of *Schistosoma haematobium* infection by gender.

Gender	Number examined	Number (%) positive	χ^2	P value
Male	308	55 (17.9)	3.71	0.054
Female	262	31 (11.8)		
Total	570	86 (15.09)		

Table 2: Prevalence of *Schistosoma haematobium* infection among age groups.

Age group (years)	Number examined	Number (%) positive	χ^2	P value
1-5	13	0 (0)	503.17	0.001
6-10	248	23 (9.3)		
11-15	302	62 (20.5)		
16-19	7	1 (14.3)		
Total	570	86 (15.09)		

Participants were categorized into four age brackets. Participants in the age group of 11-15 years recorded the highest prevalence 20.5% (62/302) followed by those in age group of 16-19 years with prevalence of 14.3% (1/7) while participants in the age bracket of 1-5 had no infection (Table 2). The differences in prevalence of *S. haematobium* infection among the age groups were statistically significant (p value =0.001).

Table 3: Prevalence of *Schistosoma haematobium* infection among the primary schools in Ohaukwu LGA.

Name of School	Number examined by microscopy	Number (%) positive by microscopy	χ^2	P value
Ibenta Primary Sch. Ezzangbo	50	0 (0)	58.21	0.001
Central Sch. Amike Ezzangbo	50	9 (18)		
Amaechi Comm Primary Ezzangbo	50	0 (0)		
Amanamta Comm. Primary Sch. Ezzangbo	57	1 (1.8)		
Central Sch. Ngbo	53	10 (18.9)		
Central Sch. Umuezaka Ngbo.	65	23 (35.4)		
Hill Top Primary Sch. Ngbo	22	3 (13.6)		
Community Primary Sch. Ukpeshi Umuoguduoshia Ngbo	86	10 (11.6)		
All Saint Methodist primary Sch. Ukwagba Ngbo	88	12 (13.6)		
State Primary Sch.Ekwashi Ngbo.	49	18 (36.7)		
Total	570	86 (15.1)		

Table 4: Intensity of *Schistosoma haematobium* infection by gender.

Gender	Number examined	Number infected	Number with light infection	Number with heavy infection	Total number of eggs	Mean intensity (egg/10 ml of urine)
Male	308	55	50	5	565	10.27
Female	262	31	27	4	411	13.26
Total	570	86	77 (89.5%)	9 (10.5%)	976	11.35

Table 5: Intensity of *Schistosoma haematobium* infection by age groups.

Age (years)	Number examined	Number infected	Number with light infection	Number with heavy infection	Total egg count	Mean intensity (egg/10 ml of urine)
1-5	13	0	0	0	0	0
6-10	248	23	18	5	408	17.72
11-15	302	62	58	4	562	9.06
16-19	7	1	1	0	6	6
Total	570	86	77	9	976	11.35

State Primary School Ekwashi Ngbo recorded the highest prevalence 36.7% (18/49). This was followed by Central School Umuezaka Ngbo with prevalence of 35.4% (23/65). The lowest in prevalence was Amanamta Community Primary School with prevalence of 1.8% (1/57). However, Ibenta Primary School and Amaechi Community Primary School had no infection (Table 3). The differences in prevalence among the primary schools were statistically significant (p value =0.001).

The overall mean intensity of the infection was 11.35 eggs/10 ml of urine. In summary, 89.5% (77/86) of the infected participants had light infection while 10.5% (9/86) had heavy infection (Table 4).

From the study, out of the 55 infected male participants 50 had light infection of ova <50 eggs/10 ml of urine while 5 participants had heavy infection ≥50 eggs/10 ml of urine. The mean intensity of male participants was 10.27 while for the female, out of 31 infected participants 27 had light infection <50/10 ml and 4 had heavy infection ≥50 eggs /10 ml. The mean intensity in female participants was higher 13.26 eggs/10 ml of urine than in their male counterparts 10.27 eggs/10 ml of urine.

The study equally revealed that those in the category of age group 6-10 years had the highest mean intensity of 17.72 followed by 11-15 years with 9.06 mean intensity. Those at age group of 1-5 had no infection (Table 5).

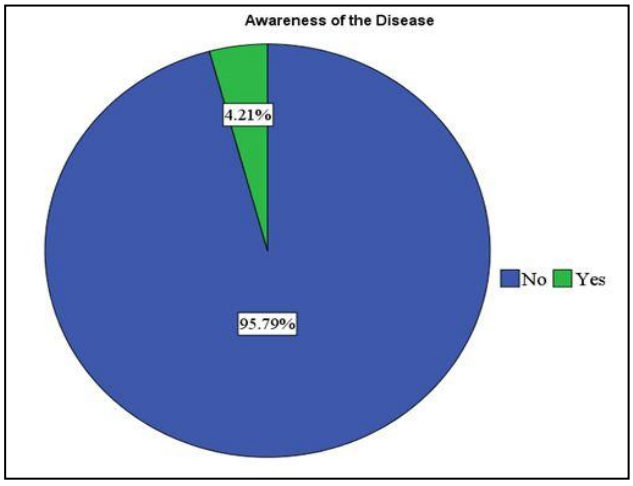

Figure 2: Pie-chart on the awareness of *S. haematobium* infection.

On the awareness of the disease, the result revealed that highest percentage of participants have no knowledge of the disease. The pie-chart presentation shows that 95.79% (546/570) of those examined do not have any knowledge of the infection while only 4.21% (1/24) of them had knowledge of the infection (Figure 2). 98.8% (85/86) of those infected also responded negatively on the awareness to the infection. The difference was statistically significant (p<0.05).

DISCUSSION

In this study, out of 570 participants, from 10 primary schools, 86 were found to be excreting ova of *S. haematobium* representing 15.1% prevalent rate. This prevalence is considered a moderate risk prevalence which falls within the national prevalence range of 2 to 82.5% in Nigeria but higher than the national mean of 13%.[12] This finding revealed that *S. haematobium* infection is still a major public health challenge in Ohaukwu LGA of Ebonyi State, Nigeria especially in school aged children. The overall prevalence of 15.1% was slightly lower than 30.2% reported by Awopeju, 21.5% by Anorue, in their different studies in the state.[7,13] It was equally observed to be lower than the prevalence in some previous studies elsewhere in Ebonyi State and other States of Nigeria (Okpete in Ebonyi LGA recorded prevalence of 68%; Agumah in Ezza north LGA 35.1% prevalence.[14,15] In Ogun State, Uthman reported 25.1% prevalence; Gamde in Silame Sokoto State reported prevalence of 21.3%.[12,16]

The low prevalence rate of the disease in the present study could, firstly, be attributed to the impact of a preventive praziquantel-treatment programme, initiated by the World Health Organization in 2014, for school-aged children and special risk groups in the area which the State Ministry of Health may have implemented. Secondly, it could be as a result of the development of private borehole water facilities which often is used for commercial purposes. This is trending in some villages and communities of this locality and may have reduced the frequency of the inhabitants visiting streams and rivers, thereby reducing the water contact activities that expose them to the infective cercariae stage of the parasite.

Thirdly the low prevalence may as well be attributed to false negative result due to poor sensitivity of the conventional parasitological technique (sedimentation /centrifugation/ microscopy) used to detect the presence of ova of *S. haematobium* on the subjects. Lastly it can also be attributed to the variations in the degree of exposure to the infection, awareness of the infection as well as the variation in the ecological conditions necessary for the breeding of the snail intermediate hosts of the parasites.

The finding of this study showed that the males were more infected than the females. This corroborates the findings of previous researchers such as Onwe, Umoh, Awopeju and Okpete that equally reported higher prevalent rates in males.[5-7,14] This is presumably due to higher water contact activities by male pupils particularly in the swamp-rice farming, where fathers engage male children in their household in the profession. In addition, other regular water contact activities such as swimming and bathing in cercariae infested streams and rivers are usually dominated by the males. Besides, females in the area are usually not free to engage in swimming and bathing in open water like stream/rivers based on religious and socio-cultural grounds unlike their male counterparts who are usually ready to undress openly and swim at will. However, such restriction on the part of the females is gradually being influenced by civilization. On the contrary some other researchers observed that females had higher prevalence than their male counterparts. Uthman and, Sam-Wobo et al reported higher infection rates in females than the males but in the reports of Sam-Wobo.[16,17] the differences were not statistically significant ($p>0.05$).

Age is a very important factor in determining the severity and risk factor of *S. haematobium* infection. It was observed in the present study that those at age group 11-15 years recorded highest prevalence. This is in agreement with some previous studies that recorded highest infection within the age range of 10-20 years viz Onwe, Uthman and Opara.[5,16,18] This may be because members of this age group are the active group that tend to joyfully engage in several water contact activities such as fetching water, swimming, bathing, fishing and playing in schistosome cercariae infested open water bodies that enhance their exposure to the infection.

On the prevalence of *S. haematobium* infection among the ten primary schools in Ohaukwu local government area, State Primary School Ekwashi Ngbo recorded the highest prevalent rate of 36.7%. The high rate of infection at State primary School Ekwashi and Umuezaka can be attributed to the behavioral activities of the children that bring them in contact with the snail infested water bodies where the transmission occurs such as swimming and playing in the water bodies close to their schools after school dismissal. Some children responded in the questionnaire that they regularly engage in swimming in such streams, ponds and rivers such as Ojegburu, Okpukwu, Olonyu, Ogwurube, Nwazulo, and Udah in their different communities which are close to their schools. Other factors that could have contributed to high prevalence of *S haematobium* infection in those schools may include poor environmental sanitation, poverty, low literacy level of their parents and lack of basic amenities. These observations were similar to previous reports made by Onwe; Umoh and Awopeju.[5-7] The variations between the present finding and those of earlier researchers can be attributed to the variations in the degree of exposure to the infection, awareness of the infection as well as the variation in the ecological conditions necessary for the breeding of the snail intermediate hosts of the parasites.

The study revealed an overall mean egg intensity of 11.35 eggs/10 ml of urine. This corroborates to the finding of Bala in Zamfara State who reported a mean egg intensity of 11.45 egg/10 ml of urine.[19] It was equally observed from the study that there was more light infection 89.5% than heavy infection 10.5%. This was in agreement to the finding of Anorue and Amuta on the intensity of *S. haematobium* infection with respect to sex and age of the participants, the study revealed that females had higher mean egg intensity 13.26 eggs/10 ml of urine than their male counterparts 10.27 eggs/10 ml.[13,20] The mean egg intensity decreased as the age advances, hence the age group 6-10 years had highest mean egg intensity of 17.72 eggs/10 ml of urine followed by the age group of 11-15 years which recorded 9.06 eggs/10 ml of urine while 16-19 years recorded 6 eggs/10 ml of urine. This may be attributed to the level of acquired immunity of infected participants and the level of exposure or water contact activities of the participants which may promote their re-infection. Older persons immune system seems to be more developed than the younger ones, therefore the younger tends to harbor more eggs than the older.

The study equally revealed that most participants have no knowledge of urinary schistosomiasis disease in the study area. Over ninety percent (95.79%) of those infected had no knowledge or were not aware of the infection while only 4.21% (1/24) of the respondents were aware of the infection. The difference was statistically significant ($p<0.05$). This is in tandem with the findings of previous researchers who equally reported poor knowledge of the infection.[6,7] Umoh and Awopeju reported poor literacy and low knowledge of the infection as a serious risk factor.[6,7] The low level of knowledge by respondents on urinary schistosomiasis in the study area is therefore a cause for concern as there is a popular saying that “if one is not informed, one is deformed”.

Thus, to avoid frequent transmission of infection, appropriate information through proper education on urinary schistosomiasis and its transmission should constantly be disseminated through the media and educational institutions

Limitations

Apathy from some participants

The fear of urine samples being used for ritual/diabolical purposes prevented some participants from submitting their urine. Some participants were hesitant to provide urine samples despite assurances of community leaders and head teachers' efforts to reassure them.

Funding constraints

There was no sponsorship or funding support from the government or non-governmental agency.

Logistical challenges

Some schools were visited multiple times for permission and data collection. The terrain was very difficult due to bad roads.

Molecular analysis (PCR) may be necessary due to limitations of microscopy but could not be carried out due to funding constraint.

Praziquantel drugs was not administered to infected individuals due to superstitious beliefs and fear generated by local evil activities. Though infected person were directed to Alex Ekwueme University Teaching Hospital Abakaliki. One community Effium was exempted from the study due to communal unrest.

CONCLUSION

Urinary schistosmiasis is still endemic in Ohaukwu local government area especially among school age children considering the current prevalent rate in the present study. Infection rate was highest among males and among pupils of State Primary School Ekwashi Ngbo. Poor knowledge of the infection in the study area demands a very extensive enlightenment programme by the government in the communities and schools.

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