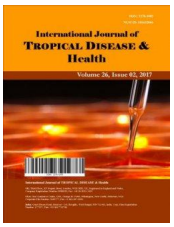

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Socioeconomic and Prevalence of Urinary Schistosomiasis Infection in Riverine Areas of Ondo State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author AAV designed the study, performed the statistical analysis and wrote the protocol. Author AOJ compiles and wrote the first draft of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

The prevalence and socioeconomic status of Urinary Schistosomiasis in the riverine areas of Ilaje Local Government in Ondo State, Nigeria was surveyed. This was done by examining people from five (5) selected villages in the area. A total of 2052 urine samples were collected and examined out of which 994 (representing 48.4% of the total population tested) were infected with *Schistosoma haematobium* parasite. The prevalence of infection was found to be high in Ode – mahin where 237 individuals were infected out of 454 examined; i.e. 52.2%, Ugbo – nla (49.9%), Orioke – Iwamimo (48.9%), Abe – Alala (45.9%), and the least was 44.5% from Maran. The overall prevalence of infection was significantly higher in males (553 infected cases out of 1030 examined. i.e. 53.7%) than in females (441 infected cases out of 1022 examined, representing 43.15%). Across different age groups (4-6; 7-9; and 10-12) the prevalence of infection was 39.2%, 53.8%, and 56.9% in males

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respectively. For the females the highest infection case was found in the age group 10 – 12 (56.9%), the age group 13 – 15 has 50.5% while the least prevalence was found in 4 – 6 (39.2%). There was a significant difference between the male and the female susceptibility to schistosomiasis in the study area. Furthermore, this study also shows the influence of parental occupation on the prevalence of schistosomiasis in the affected areas. Cases of infection were found to be higher amongst the children of fishermen when compared with those of other parental/father's occupations. It is therefore recommended that more awareness program should be embarked upon especially in the rural communities on socioeconomic impact of schistomiasis. Periodic treatment regime should also be conducted in places where there is high prevalence of infection.

Keywords: Schistosomiasis; Schistosoma haematobium; susceptibility; prevalence.

1. INTRODUCTION

There are a number of digenean parasitic trematodes (flatworms) capable of causing disease in man. One of the most important of these helminth infections is schistosomiasis (Bilharzia). This disease is caused by a member of the genus Schistosoma. These parasites are important pathogens estimated to be infecting 200 million people in tropical and subtropical regions. The most important species that infect man are *Schistosoma japonicum*, *S. mansoni* and *S. haematobium* [1,2]. *S. mansoni* is found in parts of South America and Caribbean, Africa and the Middle East; *S. japonicum* in the Far East. *S. mekogi* and *S. intercalatum* are found locally in South East Asia and Central West Africa, and *S. haematobium* in Africa and the Middle East; [3] Urinary schistosomiasis caused by *S. haematobium* places an enormous toll on public health in the affected regions, and this species in particular is an important pathogen, estimated to be infecting between 200 and 600 million people in tropical and sub – tropical region [4]. Over 200 new cases of infections are reported worldwide, 85% of which is concentrated in the sub – Sahara Africa [5]. The prevalence of this helminthic infection is high in children, especially in primary and secondary school pupils. This infection is mostly asymptomatic and does not result in clinical disease; however it can result in or be accompanied by several other illnesses thereby making it more complicated [6].

Urinary schistosomiasis is associated with hematuria (blood in the urine), dysuria (painful urination), lesions of the bladder, and it may also cause retardation of growth in children [5]. Infection may also be associated with decreased physical performance, impaired memory and cognition [7, 8]. The infection occurs through contact with freshwater that contains infective stage of cercaria released from intermediate Snail (*Bulinus* spp and *Biomphalarian* spp) host of aquatic freshwater [9]. Penetration of the human skin occurs when the cercaria comes in contact with the skin. The parasite secretes enzymes that breaks down the skin's protein to enable penetration of the cercarial head through the skin and then transforms into schistosomulum larvae that migrate through the bloodstream to the hepatic portal system to complete the parasite lifecycle [9, 10]. The parasites differentiate and migrate in pair (male and female) into small venules draining the intestine (*Schistosoma haematobium* and *Schistosoma japonicum*) or the bladder (*Schistosoma haematobium*) where they are fully exposed to the host's immune system. The female worm produces 300 to 3000 eggs each day, and the eggs pass into lumen of the intestine or bladder. Schistosomes can live an average of 3 to 10 years in their human hosts, but in rear cases they have been recorded as living as long as 40 years [1].

The prevention of this disease is best accomplished by eliminating the water dwelling snails that serve as a natural reservoir. Acrolein Copper sulfate and niclosamide can be used for this purpose. Studies have suggested that snail populations can be controlled by the introduction or augmentation of existing Crayfish or fresh – water prawn populations [11]. Schistosomiasis is readily prevented and treated using a single oral dose of praziquantel drug annually [12]. It has been reported that this disease is endemic in villages with streams or rivers where the habitat of the primary host is predominate. Thus there is a need to study the prevalence of this parasitic disease in riverine communities in Ondo State namely Ode – mahin, Ugbo – nla, Orioke – iwamimo, Abe – alala, and Maran and determine the usual status of the pathogen with the aim of providing updated information on the infection. Also to give records of socioeconomic factors that contributes to schistosomiasis infection in the study areas.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Ilaje Local Government, a riverine area of Ondo State. The area has many streams, rivers and ponds which constitute the major source of water supply to the communities environ. Their major occupation is fishing. Other activities such as bathing, swimming, washing and drinking are carried out using these water sources.

Five (5) villages were selected and two thousand and fifty two (2052) villagers were examined. The communities selected were Orioke – iwamimo, Ode – mahin, Ugbo – nla, Abe – alala and Maran. These communities were selected due to the close proximity they have to water. Letter of consent was issued by the Zoology Department at Ekiti State University to the community before the commencement of the study. The age group of 4 to 19 was selected for the study, and questionnaire was administered: The questions were translated into their local dialect while the answers were filled in correctly into the questionnaire sheet.

2.2 Sample Collection Techniques and Laboratory Analysis

About 20ml of clean catch, midstream urine was collected in a 50ml sterile urine bottle from each of the volunteers. Two thousand and fifty two (2052) urine samples were collected, and the sampling bottles were well labeled for sex and age. All samples were obtained between 9am and 1pm, fixed with formalin and kept in a cooler packed with ice before they were taken to the laboratory for analysis. Laboratory analysis was carried out following the methods described by Okanla [13] and Cheesbrough's [14]. The urine samples were first examined for Schistosoma eggs using standard parasitological techniques. Ten milliliters (10ml) of each urine sample was dispensed into a centrifuge and spin for 5 mins at 5000 rpm, the supernatant was discarded to leave the sediment as deposit which was released by tapping the bottom of the tube while shaking it. A drop of the deposit was placed on a sterile glass slide and covered with a cover slip before being examined under a microscope using the 10x and 40x objectives of the light microscope.

Macroscopic analysis of the urine samples was done by visual examination of colour and possible haematuria. A combi 9 strip was used to detect blood in the urine (haematuria). Each reagent strip was carefully dipped into a dark sterile bottle containing the urine sample for 5seconds. The resulting change in colour of the strip was compared with the manufacturer's colour chart to estimate the amount of blood in the urine.

2.3 Statistical Analysis

The data was analyzed using SPSS version 22.0 with Microsoft Excel 2007. One way ANOVA was used to compare the rate of infection in the study areas and across the age cohorts at the 95% confidence level (C. I = 95%) with frequency distribution tables showing the percentage prevalence of urinary schistosomiasis. The Chi-square test (X2) was used to compare the differences in prevalence of infection between genders and ages. A socio – economic study associating risk factors with infection prevalence was carried out.

3. RESULTS

The current status of urinary schistosomiasis in riverine areas of Ondo State in the Ilaje local government area was studied. A total of two thousand and fifty two (2052) villagers were examined out of which one thousand and thirty (1030) were males and one thousand and twenty two (1022) were females. Table 1 shows the prevalence of urinary schistosomiasis within age groups in the villages studied. The highest prevalence was found in the age cohort 10 – 12 years with 56.9% prevalence and mean standard deviation (Mean ± S.D) of 50.6 ± 4.05, followed by the cohort 7 – 9 years (53.8%). Thus, school children in the age group 7 – 9 and 10 – 12 years were found to be the most susceptible in the villages studied. The lowest infection rate was recorded in the age group 4 – 6 years with a 39.2% rate. There were no significant differences in the infection rate between the age group 4 – 6 (39.2%) and the group 19 and above (41.6%). Age groups 7 – 9 (53.8%), 10 – 12 (56.9%) and 13 – 15 (50.5%) had no significant differences in rates of infection. The difference in mean infection prevalence has shown in figure 1 was clearly discernible with the highest and the lowest mean seen in the age groups 10 – 12 (50.6d ± 4.04) and 4 – 6 (14.8a ± 0.80) respectively (p – value = 0.000).

Table 1. Prevalence (%) of Urinary Schistosomiasis within different age groups in Ilaje Local Government with means standard deviation (Mean ± S.D)

Age group	Number examined	Number infected (%)	Mean ± S.D
4 – 6	189	74(39.2)	14.8a± 0.80
7 – 9	373	201(53.8)	40.2cd± 14.15
10 – 12	444	253(56.9)	50.6d± 4.04
13 – 15	386	195(50.5)	39.0cd± 8.86
16 – 18	398	162(40.7)	32.4b ± 8.20
19 and above	262	109(41.6)	21.8ab ± 4.66
Total	2052	994(48.4)	33.1 ±13.24

(p – value = 0.000, p < 0.05, C.I = 95%)

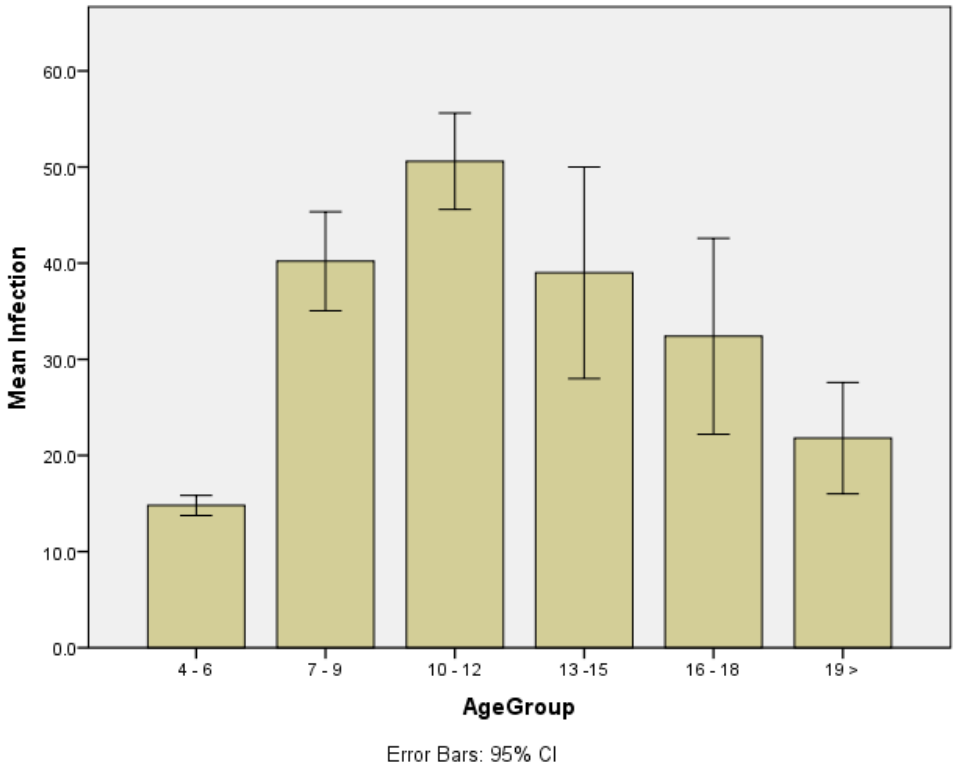

Fig. 1. Mean infection of urinary schistosomiasis (*Schistosoma haematobium*) with respect to the age groups in the study villages

Table 2 represents the overall percentage prevalence of urinary schistosomiasis between males and females examined in the study area. Out of one thousand and thirty (1030) males examined, five hundred and fifty three (553) were infected with *Schistosoma haematobium* which represented 53.7% of the total males examined. One thousand and twenty two (1022) females were also examined for the same pathogen (*Schistosoma haematobium*), four hundred and forty one (441) (43.15%) were infected. This showed that the males are more exposed and susceptible to the infection (p – value = 0.364).

Table 3 shows an outline of the prevalence of the disease (Urinary schsitosomiasis) in five (5) selected communities in the study area. The rate at which the infection occurs is not significantly different in all the five (5) selected study communities. However, Ode – mahin has the highest prevalence with 237 (52.2%) followed by Ugbo – nla with 217(49.9%). The least was recorded from Maran with 169 (44.5%) and Abe alala with 177 (45.9%), while 194 (48.9 %) was recorded from Orioke – Iwamimo (p > 0.05). Table 4 summaries the outcomes from the groups examined (Primary, Secondary and Post

Table 2. Overall percentage prevalence of urinary schistosomiasis among the genders with the means standard deviation (Mean ± S.D)

Gender	Number Examined	Number Infected (%)	Mean ± S.D
Male	1030	553 (53.7)	92.2 ± 45.6
Female	1022	441(43.15)	73.5 ± 23.2
Total	2052	994(48.44)	82.8 ± 35.87

(X^2 = 12.0, p – value = 0.364, p > 0.05)

Table 3. Prevalence (%) of urinary schistosomiasis within the study communities with means standard deviation (Mean ± S.D) of the infection

Community	Number examined	Number infected (%)	Mean ± S.D
Ori – Oke	397	194 (48.9)	32.3a ± 19.3
Ode – Mahin	454	237 (52.2)	39.5a ± 16.0
Ugbo – nla	435	217 (49.9)	36.2a ± 12.9
Abe – alala	386	177 (45.9)	29.5a ± 12.4
Maran	380	169 (44.5)	28.2a ± 11.8
Total	2052	994 (48.4)	33.13 ± 13.23

(p – value = 0.48, C. I = 95%, p > 0.05)

Table 4. Infection rate and mean standard deviation (Mean ± S.D) between primary school and secondary school pupils in study communities

School	Number examined	Number Infected (%)	Mean ± S.D
Primary School	562	275 (48.9)	27.5 ±14.8
Secondary School	1069	545 (50.9)	44.8 ± 8.9
Post – secondary school	421	174 (41.1)	27.1 ± 8.4
Total	2052	994 (48.4)	33.1±13.2

(p – value = 0.324, p>0.05)

Table 5. Socio – economic factors and prevalence (%) of urinary schsitosomiasis infection in study communities

Factor	Number Examined	Number Infected (%)	*p* - value
Source of water			
Rain	164	32 (19.5)	0.220
Stream	678	462 (68.1)	
Well	328	109 (3.22)	
River	534	337(63.1)	
Tap	348	54 (15.5)	
Total	2052	994 (48.4)	
Water contact			
Swimming	534	323 (60.5)	0.224
Fishing	287	162 (56.5)	
Bathing	308	149 (48.4)	
Farming	349	134 (38.7)	
Washing	471	224 (47.5)	
No contact	103	2 (1.9)	
Total	2052	994 (48.8)	
Parents – Fathers Occupation			
Teacher	164	29 (17.7)	0.220
Fisherman	923	646 (69.9)	
Health worker	103	9 (8.7)	
Farmer	513	208 (40.6)	
Others	349	102(29.2)	
Total	2052	994(48.8)	

– secondary school children) in the study area. Out of 562 primary school pupils examined, 275 were found to be infected with urinary schstosomiasis, this represented a 48.9% infection rate within the primary school children in this area. Among 1069 secondary school children examined for urinary schistosomiasis, 545 (50.9%) were infected. The lowest rate was found amongst the post – secondary, where 421 were examined, and 174 (41.1%) were infected.

4. DISCUSSION

This study revealed a very high prevalence of urinary schistosomiasis in the study area. The high prevalence may be due to lack of proper sewage disposal facilities, poverty and or ignorance. The results from this study showed that the mean prevalence rate of urinary shistosomiasis was 48.4% in the study area. Other workers have also reported various degrees of prevalence of the infection in different parts of the country. Recent study carried out in Ikepshi, a rural community in Edo State, Nigeria recorded 65.0% prevalence [15]; 83.3% was reported from Agi and Okafor in 2005 [16]. Similarly, Oniya and Olofintoye in 2009 [17] reported 61.4% in other parts of Ondo State.

The prevalence of the infection across the age groups during the study showed that the age group 7-9, 10-12 and 13-15 has the highest susceptibility. This may be due to the fact that the children between these age brackets [7-15] spent more contact time with water through swimming, fishing, washing etc. Ngele and Oyeukwu [18] have also reported from Ebonyi State in Nigeria that children were more susceptible to urinary schistosomiasis than adults. This study's result on higher infection in males as compared to the females may be due to inquisitiveness and adventure of the male children into the rivers, streams and ponds. This was contrary to the report and opinion of Etim [19], who stated that, females were more vulnerable due to the domestic activities that involved the use of water for domestic purposes.

Parental occupations also contributed to the prevalence of this infection; children of fishermen were found to be the most infected. This may be as a result of constant contact with contaminated water bodies as well as their recreation activities. This report is also consistent with that of Okanla [13] from Ilorin in Kwara State, Nigeria. Edunbgola [20] had also reported the relationship between occupation and schistosomiasis.

5. CONCLUSIONS AND RECOMMENDATIONS

The result from this research showed that urinary schistosomiasis infection was prevalent in the study area, and the infection rate was mainly influenced by parental i.e. Father's occupation plus lack of basic knowledge about the disease. It is therefore recommended that health care workers and community leaders in such local government areas should embark on awareness programs in order to educate the community on the impact and prevention of urinary schistosomiasis. Also, appropriate drugs should be administered to the infected people in the area.

CONSENT

As per university standard guideline participant consent has been collected and preserved by the authors.

ETHICAL APPROVAL

Before this research work was carried out, the authors got ethical approval for the study from the Ministry of Health located in the State of the study. All the samples were collected from the volunteers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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