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Prevalence and Distribution of *Schistosoma haematobium* Infection among Residents of Aye-Oba and Aye-Amodo Rural Communities of Osun State, Nigeria

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ABSTRACT*:* Urinary schistosomiasis, caused by *Schistosoma haematobium*, is an insidious disease of public health concern worldwide, particularly in African countries where Nigeria carries the highest burden of infection. Hence, this study was carried out to determine the prevalence and distribution of *Schistosoma haematobium* infection among residents of Aye-Oba and Aye-Amodo rural communities of Osun State, Nigeria, using appropriate standard parasitological methods including a total of 427 volunteer individuals. The result showed that out the total 427 participants, 139 (32.6%) had urinary schistosomiasis though no significant difference ($p>0.05$). Males significantly had higher prevalence of 38.8% compared to females with 25.6% ($p<0.05$). The age pattern of infection revealed that the highest prevalence of infection (53.1%) was observed among age group 11-20 years while no prevalence was observed among age group 51-60 years. The findings of this study showed that urinary schistosomiasis is prevalent in the two communities, and as such concerted efforts are needed to curb the menace of this neglected tropical disease.

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Schistosomiasis is an acute and chronic water borne parasitic disease caused by trematode blood flukes of the genus *Schistosoma* and family Schistosomatidae (Sturrock, 2001; *Ishii et al.*, 2003). It is a major disease of public health importance worldwide, especially in Nigeria. It is caused by parasite of the genus *Schistosoma*. Some of the common species of *Schistosoma* include *Schistosoma mansoni*, *S. intercalatum*, *S. japonicum* and *S. mekongi* which are all responsible for intestinal schistosomiasis and Schistosoma haematobium which is responsible for urinary schistosomiasis (Mbabazi *et al.*, 2011; Badr, 1981). It is estimated to affect over 250 million people around the world, with 200 million deaths occurring annually and another 779 million people are at the risk of being infected with the disease (Chitsulo *et al.*, 2000). It is endemic and widespread in poor rural communities of the world especially in the Sub-Saharan Africa, Asia and South America, with 9 out of every 10 infected persons found in the Sub-Saharan

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Africa (WHO, 2020). It is a neglected disease of the tropical region and second to malaria in prevalence (Colley *et al.,* 2014; WHO, 2012). Nigeria, a country in West Africa has the highest prevalence of 23% (Dawaki *et al.,* 2015). Nigeria was stratified into four levels of endemicity namely; hyper endemicity, moderately endemicity, low endemicity and zero endemicity (Ezeh *et al.,* 2019). Osun state, South West, Nigeria has been classified as hyper endemic zone (Ezeh *et al.,* 2019; Alade *et al.,* 2023). Urinary schistosomiasis has a complex life cycle and it is transmitted to its final host (man) through a snail intermediate host of the genus *Bulinus* (CDC, 2012). The disease, rather than eliminate its' victims, debilitates them, by weaken the host immune system (Steinmann, 2006). This imparts negatively on the liver thereby leading to various complications that impedes the functionality of the liver (Van der Werf *et al.,* 2003). Clinical manifestations of urinary schitosomiasis include, blood in urine (haematuria), painful urination (dysuria), frequent urination, excess water in the kidney (hydronephrosis) and bladder cancer (WHO, 2020; CDC, 2012). Other effects of urinary schistosomiasis on its victims include, malnutrition, anaemia, impaired learning ability, reduced physical capability and low productivity (WHO, 2020; CDC, 2012; Clerinx, and Soentjens, 2015; Leder, and Weller, 2011). Urinary schistosomiasis has been associated with poverty and it is prevalence where the people have no access to good source of water for drinking and other domestic chores (Grimes *et al.,* 2014). Human skin coming in contact with river/stream that is contaminated with the cercaria is a major risk factor of transmission (Jordan, and Webbe, 1993). The groups mostly at risk of infection are the school age children, pre-school aged and women (Verjee, 2019; WHO, 2020). Hence, this study was carried out to determine the prevalence and distribution of *Schistosoma haematobium* infection among residents of Aye-Oba and Aye-Amodo rural communities of Osun State, Nigeria

MATERIALS AND METHODS

Study Area: This cross-sectional research survey was carried out in two rural communities namely Aye-Oba and Aye-Amodo both in Ifetedo South Local Government Area of Osun State, Nigeria. Osun State lies between longitude 04° 00'E and 05°S and latitude 05°55 N and 08°07W (NBS, 2015). The vegetation is that of a tropical rain forest, with wet and dry season. The maximum temperature is 29°C, while the lowest temperature is 24°C. Annual rainfall is about 1800mm. The people are predominantly farmers, traders and artisans. The people are noted for the cultivation of food crops such as rice, plantain, and cash crops such as cocoa, cashew and palm oil. Both villages have a public health centre, but no other social amenities. Additionally, Aye-Amodo has solar light and borehole that were recently constructed. They share a common river called Aye River that is used for all domestic purposes, including agricultural purposes.

Study design: This study was a cross-sectional and community-based study. The samples were collected between March and July 2024 from volunteer individuals from the two communities of Aye-Oba and Aye-Amodo in Ifetedo South Local Government Area of Osun State, Nigeria. Specimens were prepared and examined for parasitological analysis in the laboratory at the College of Health Sciences, Obafemi Awolowo University, Ile-Ife. Questionnaire administration was done via a face-to-face interview to collect participants' information on the demographic and socio-economic characteristics.

Ethical consideration: Prior to the study, ethical approval was granted by the Osun State Ministry of Health, Health Planning, Research and Statistics Department, Osogbo, Osun State, Nigeria.

Sample size: The sample size was determined using the World Health Organization guidelines for schistosomiasis and other helminthes survey (Lwanga, and Lemeshow, 1991; Ossai *et al.,* 2014). Based on this, a total of four hundred and twenty seven (427) participants, were selected for this study.

Collection of Sample: The participants were instructed on how to void terminal urine into universal bottle to about three-quarter capacity. The urine sample was collected between 10am and 2pm to coincide with the peak period of egg shedding (Weber *et al.,* 1969; Cheesebrough, 2009). The samples were protected from sunlight rays by preserving them in black polythene bag and put in an ice container. At the laboratory, each urine sample was thoroughly agitated to ensure even distribution of content. Approximately 10ml of each urine sample was dispensed into a centrifuge tube that has been well labeled for each sample. The samples were placed in the centrifuge for 5minutes at a speed of 3000 revolution per minute (rpm) (Cheesebrough, 2009). After centrifugation, the supernatant was carefully poured out, leaving the sediment. The sediment was transferred into a glass microscope slide and covered with a cover slip and examined under the microscope using X10 objective lens. The entire slide was examined for the presence of S*chistosoma haematobium* eggs with a characteristic terminal spine (Sturrock, 2001). The slide was also examined using X40 objective lens for confirmation of observation. The presence of a single egg/ova is a confirmation of urinary schistosomiasis

(Weber, 1969; Ojurongbe *et al.*, 2014). The intensity of infection was determined by counting the number of eggs on a slide. The intensity of infection was classified into two, namely light infection and heavy infection based on number of egg count per 10ml of urine sample (WHO, 2020). Light infection has 1-49eggs per 10ml, while heavy infection has 50eggs and above per 10ml (WHO, 2020, Atalabi *et al.*, 2016). A well structure questionnaire was administered to participants who had submitted urine. The questionnaire and each urine sample were paired and given same identification number to avoid mix-up of results.

Data Analysis: Results were presented in tables using frequency and percentage, while chi square was used to test for correlations between variables.

RESULTS AND DISCUSSION

Demographic and Characteristics of Participants: A total of four hundred and twenty seven (427) individuals from Aye-Oba and Aye-Amodo communities in Ife South LGA, Osun State were captured for this cross-sectional study. The sampled population consisted of 224 (52.5%) males and 203 (47.5%) females. They were aged between 1 and 70years old as shown in Table 1. The two communities were predominantly of rural settings, with little or no social amenities. The main source of water is Aye River.

Prevalence of urinary schistosomiasis in relation to sex, age and locations: As shown in Table 2, the result showed that 32.6% (139) were found to be positive for *Schistosoma haematobium* infection, representing one-third of the sampled population. Individuals aged 11-20 years had the highest prevalence of 53.1% which was closely followed by individuals aged 1-10years. The adults aged 21-70 had a prevalence of 6.9%. The result was statistically significant (p<0.05) The findings of this study also posited that prevalence was significantly (p=0.004) higher in males 38.8% (87) than females 25.6% (52). Table 2 also revealed that participants from Aye-Amodo community had a higher prevalence of 33.3% compared with participants from Aye-Oba community with a prevalence of 31.9%.

Prevalence and Water Activities: Skin contact with water contaminated with the cercaria of *Schistosoma* is a major risk factor of infection. This study showed that participants visited the river for all purposes where water is required. Table 3 indicated that participants that visited the river for many purposes had the highest prevalence of 54.5% (97). This result indicated that frequency of contact with water was significantly (p=0.001) associated with acquisition of the infection.

Table 1: Demographic characterization of the sampled population of Aye-Oba and Aye-Amodo communities of Osun State, Nigeria (n=427)

Variables	Frequency	Percentage (%)
Location		
Aye-Oba	238	55.7
Aye-Amodo	189	44.3
Gender		
Male	224	52.5
Female	203	47.5
Age Group (Years)		
1-10	125	29.3
11-20	113	26.5
21-30	29	6.8
31-40	25	5.9
41-50	42	9.8
51-60	26	6.1
61-70	67	15.7

Table 2: Prevalence of *Schistosoma haematobium* infection among the sampled population of Aye-Oba and Aye-Amodo in Osun State, Nigeria based on gender and age (n = 427)

Variables	No. Examined	No. Positive	Prevalence (%)	*P* Value
Gender				
Male	224	87	38.8	0.004
Female	203	52	25.6	
Total	427	139	32.6	
Age Group				
1-10	125	66	52.8	0.001
11-20	113	60	53.1	
21-30	29	2	6.9	
31-40	25	2	8.0	
41-50	42	4	9.5	
51-60	26	0	0.0	
61-70	67	5	7.5	
Total	427	139	32.6	
Location				
Aye-Oba	238	76	31.9	0.759
Aye-Amodo	189	63	33.3	
Total	427	139	32.6	

Table 3: Distribution of *Schistosoma haematobium* infection among the sampled population of Aye-Oba and Aye-Amodo in Osun State, Nigeria based on frequency and reasons for contact with water

Reason(s) for contact with water	No Examined	No Positive	Prevalence (%)
Bathing	31	3	9.7
Swimming	6	0	0.0
Washing	41	3	7.3
Fishing	2	0	0.0
Bathing & Washing	80	29	36.3
Bathing &Swimming	7	0	0.0
Bathing & Fishing	28	3	10.7
Bathing, Washing & Swimming	178	97	54.5
Others	54	4	7.4
Total	427	139	32.6

Chi-square ($\chi 2$): 87.682, Degree of freedom (df): 8, p value: 0.000

This research work was a random sampling involving males and females living in Aye-Oba and Aye-Amodo communities of Osun State. The residents were examined for the presence of *Schistosoma haematobium* eggs in their urine using microscopy which is the gold standard for confirmation of infection (Cheesebrough, 2009). The overall prevalence rate obtained from this study was 32.6%. This falls within the prevalence rates of 2% and 82.5% across the various states in Nigeria as earlier reported by (Awosolu *et al.,* 2018; Akindele *et al.,* 2020).

The result of this present study is however higher than the overall prevalence rate of 9.5% reported by Federal Ministry of Health (Bishop *et al.,* 2017). It is also higher as reported by (Dawaki *et al.,* 2015; Alade *et al.,* 2023; Atalabi *et al.,* 2016; Akinwale *et al.,* 2010; Ajakaye *et al.,* 2017: Kone *et al.,* 2022) in Kano, Osun, Katsina, Ogun, Ondo and Ondo States respectively of Nigeria. This finding suggests that schistosomiasis is endemic and remains unabated in the study areas of Aye-Oba and Aye-Amodo of Osun State. The prevalence rate of 32.6% from this finding seems to be in close range with the 31.3% and 34.1% reported in South East Nigeria by (Chiamah *et al.,* 2019; Ossai *et al.,* 2014) respectively. Other studies have shown close range of 30.5% and 34.8% as reported in Ondo State, South West, Nigeria. Previous studies reported higher prevalence rates of 69%, 60.8%,73% and 48% in the Northern parts of Nigeria (Balogun *et al.,* 2022; Singh, and Muddasiru, 2014; Umar *et al.,* 2016; Mohammed *et al.,* 2019; Akinneye *et al.,* 2018), while (Awosolu *et al.,* 2018) also reported a higher prevalence of 55.8% in three villages in the South-West of Nigeria. This high prevalence could be attributed to lack of knowledge regarding the mode of transmission, poor hygiene and exposure to water bodies contaminated with *Schistosoma haematobium* cercaria (Grimes *et al.,* 2014; Jordan, and Webbe, 1993).

The findings of this study revealed that there is a significant difference ($p<0.05$) in the prevalence of schistosomiasis between gender of the sampled population, with the males having a prevalence rate of 38.8% while the females have 25.6%. This result is in tune with most previous results (Dawaki *et al.,* 2015; Ossai *et al.,* 2014; Awosolu *et al.,* 2018; Kone *et al.,* 2022; Ayabina *et al.,* 2021). This could be attributed to cultural or moral restriction which limited the females from bathing and swimming freely in the river as opposed to their male counterpart that freely and playfully engaged in such activities almost naked. This inherently exposes the males to higher risk of infection of urinary schistosomiasis. However, higher prevalence rates among females were reported by (Bishop *et al.,* 2017; Olerimi *et al.,* 2023). The result of this study indicated a significant difference ($p<0.05$) in the prevalence of urinary schistosomiasis between the age groups. The result showed an increase in prevalence rate from age 1 to 20. This is consistent with most previous studies conducted among school aged children (Dawaki *et al.,* 2015; Awosolu et al., 2018; Singh, and Muddasiru 2014; Akinneye *et al.,* 2018; Oladejo *et al.,* 2006). However, a sharp decline was observed in the prevalence rates among the older age groups of the sampled population as observed among age group 21 to 70 years. Similarly, this result also showed that there was no significant difference ($p>0.05$) in the prevalence of urinary schistosomiasis between the two sampled communities of Aye-Oba and Aye-Amodo of Osun State. This could be due to the fact that the two communities depend on the same river called Aye River which runs through both communities, and it is the main source of water for the two communities. Human contact with water body contaminated with cercaria of *Schistosoma spp* is a major risk factor for infection. Result from this study revealed that prevalence rate increased with the rate and frequency at which the sampled population came in contact with infested water body. This result showed that individuals that visited the river for multiple reasons had the highest prevalence. Thus, there was a linear relationship between prevalence of infection and frequency of contact with infested water body. This finding is consistent with the reports of Bishop *et al.,* (2017) that reported a high prevalence of 21.7% among occupational farmers that visited the river on daily basis and another higher prevalence of 14.7% among people that wash in the river compared with 10.8% that washed at home. Ajakaye *et al.,* (2018) reported a prevalence of 65.7% among people that visited the river for multiple purposes, while Akinneye *et al.,* (2018) also noted a higher prevalence of 33.3% among students that were in close proximity to the source of natural water bodies. Furthermore, Aribodor *et al.,* (2024) reported 43.8% prevalence rate among individuals that visited the river on daily basis for occupational reason and also a higher prevalence among people that visit the river regularly for domestic purposes.

Conclusion: Conclusively, the results of this study showed that urinary schistosomiasis is prevalent and endemic in Aye-Oba and Aye-Amodo in Ife South Local Government (LGA) OF Osun State, Nigeria. This has placed Osun State as a hyper-endemic zone for schistosomiasis. In the light of the above, government participation and efforts at controlling this disease should be on top gear. The Mass Drug Administration should be supported with provision of potable water coupled with sensitization of the populace on the mode of transmission of the disease.

Declaration of Conflict of Interest: The authors declare no conflict of interest

Data Availability Statement: Data are available upon request from the corresponding author

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