

PREVALENCE AND RISK FACTORS FOR SCHISTOSOMIASIS IN BURUTU LOCAL GOVERNMENT AREA, DELTA STATE, NIGERIA

ABSTRACT

The study was carried out to determine the status and prevalence of schistosomiasis among school aged children within some communities in Burutu Local Government Areas of Delta State, Nigeria. The study population was three hundred and eighty (380) school-aged children from six community primary and secondary schools. Parasitological examination using the Kato-Katz egg counting technique was adopted for the study. The results showed that from the examination of 206 urine samples, 22(10.68%) children were infected with *Schistosomiasis haematobium*. Generally, males were same infected as the female, but with different distribution among the communities study and this was statistically significant when compared the number infected ($p < 0.0082$). Also, examination of 164 stool samples from the study population showed that 10(25%) children were infected with *Schistosomia mansoni*. The study indicates that 80% of the children tested positive are males were more infected than the female and this was statistically significant when compared the number infected ($p < 0.0082$). Based on communities, Ogbogbagbene community had the highest overall infection rate of 7(17.5%) of all communities samples followed by Turugbene community with a prevalence of 3(7.5%) infected among the burutu communities investigated in the study. Risk factor analysis showed that there was inverse relationship between prevalence of infection and distance from the river. Also reduce knowledge of duration of last deworming was observe with 87.60% are yet to be deworming for the last five (5) months and 94.36% of the pupils have not be immunized in the last one year. 46.24% of the pupils were observed to use more of pit toilet as the choice of toilet, while 24.06% uses the river as the choice of toilet and 19.55% use bush as the choice of toilet. Though, the prevalence of the infection was relatively low, there is still need for coordinated public enlightenment on schistosomiasis in the areas. Government also needs to provide more social amenities to reduce the infection in the study area.

Key words: Schistosomiasis, school age children, risk factors, Burutu, Delta State.

INTRODUCTION

Schistosomiasis continues to be a health problem in the tropics and subtropics despite advances and research in health care delivery over the past few decades (Utzinger *et al.*, 2015). According to the World Health Organization, schistosomiasis ranked second after malaria in terms of public health and financial implications in the tropics (WHO, 2016). Not undermining the implications of helminthiasis and filariasis (Orhewere *et al.*, 2023). Though, there has been a decrease in the age-standardized rate prevalence of schistosomiasis globally. However, using the socio-

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demographic index (SDI), areas with high SDI has shown increasing burden of schistosomiasis with several countries across Africa bearing high burden of schistosomiasis which requires a high level of preventive and control approach (Zhang and Ming, 2023). Sub-Saharan Africa account for about 90% of reported cases of schistosomiasis with annual estimated death rate of 280,000 (Aula *et al.*, 2021).

In Africa, Nigeria has been reported to be the highest in terms of schistosomiasis reported cases with 25 million people recorded to be infected in 1997 (World Bank, 1997), and even higher rate of 29 million cases recorded in 2015 (Adenowo *et al.*, 2015). With significant reduction in prevalence, Nigeria still bears a significantly higher burden of schistosomiasis with an estimate of over 20 million infected cases. Studies have reported varying prevalence by regions across Nigeria with Osun State, Western Nigeria with 32.6% prevalence (Aniaguya *et al.*, 2024), Katsina State, Northern Nigeria with 32.2% prevalence (Bello *et al.*, 2024), Cross River State, Southern Nigeria with 9.7% prevalence (Imalele, 2024) and Imo State, Eastern Nigeria with 30.2% prevalence (Azoro *et al.*, 2022).

Schistosomiasis is a disease associated with poor hygienic conditions and generally endemic in low income regions and rural communities mainly in the tropical region which are constrained with access to portable water sources, proper sanitation and adequate health facilities (Aula *et al.*, 2021). Hence, schistosomiasis is linked to deprivation, substandard housing, poor water supply, inadequate sanitation, and uncontrolled water resource development. There are two basic causes for this. Due to a lack of education, people unwittingly damage their environment. Another factor is a lack of hygiene-related care (WHO, 2020). According to Anosike *et al.* (2001). Water that has been directly contaminated by an infected person urinating in it is how schistosomiasis is transmitted.

The disease is a snail-borne, neglected tropical disease, caused by the presence of freshwater snail of the general Planorbidae, with species such as the *Biomphalaria pfeifferi* infected with the *Schistosoma mansoni*, which is responsible for intestinal schistosomiasis in human, *Bulinus* *Bulinus truncatus* snail which are natural hosts to the *S. hematobium* which is responsible for the urinary schistosomiasis (Hotez *et al.*, 2014; WHO, 2019). Other snail species are the

Biomphalaria glabrata, *Planorbium metidjensis*, *B. glabrata* as well as *Onchomelasma* species (Huot *et al.*, 2020).

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Lack of information, a negative attitude or view of the disease, and poor behavior all help to keep schistosomiasis at a high incidence. The second most prevalent urologic malignancy (bladder cancer), as well as a wide range of illnesses that increase morbidity and death, are all risk factors for urinary schistosomiasis, (Vennervald *et al.*, 2015). In addition, schistosomiasis infestations harm the physical and psychological growth of school-aged children and adolescents (Mbah *et al.*, 2013). According to USAID (2016), 30 million Nigerians need to be treated for the illness each year. Children between the ages of 5 and 15 have the greatest infection rates in the majority of endemic locations (Ezeh *et al.*, 2019). It is estimated that every year, infections from *S. haematobium* cause 70 million people to experience haematuria, 32 million to have trouble peeing (dysuria), 18 million to have bladder-wall pathology, and 10 million to have significant hydronephrosis.

Burutu is an area bordering on the estuaries of the Rivers Benue, Escravos and Forcados represents the home of the Ijaws of Delta state. Due to recurrent floods, droughts, storms, and a wide range of endemic, epidemic and epizootic diseases constitute important health threats in the riverian areas. The global burden of schistosomiasis has been estimated in large millions disability-adjusted life years lost per annum, but new research suggests that this estimate is a considerable underestimation of the true burden of schistosomiasis. With the National Schistosomiasis Control Program, the lack of information on schistosomiasis prevalence has hindered the accomplishment of a management strategy. This study therefore provides current epidemiological data with regards to evaluation of the status and prevalence of Schistosomiasis in Burutu Local Government Area of Delta State.

~~MATERIALS AND METHODS~~

Study Area

Burutu LGA, Delta State (5030’N; 6000’E) is located in the south geopolitical and oil rich zone of Nigeria. It is circumscribed by the River Niger and Focardos River which is marginally brackish at Burutu due to influence of tide, occasioned by the convergence of freshwater from land and marine saline from the sea. The physiographic landforms of mangrove and freshwater swamps characteristics of the Niger Delta are also common in the area and it is generally low lying with wide coastal belt interlaced with rivulets and streams which form the Niger Delta and which make good habitat for many water borne and water related diseases. The major occupations are farming and trading in addition to civil servants, teachers and traders.

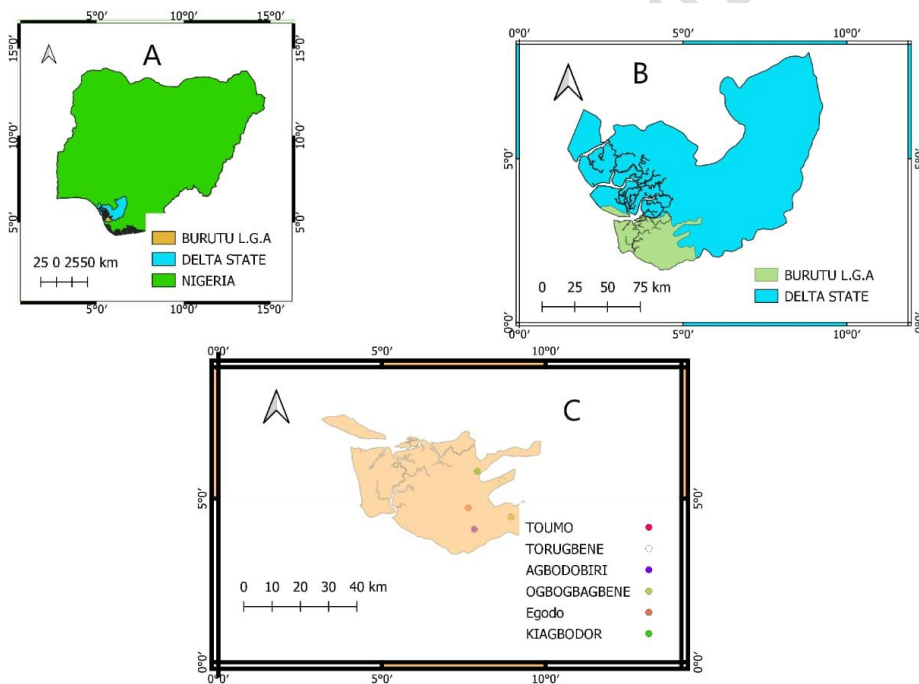


Figure 1: Map of Nigeria and Delta State showing the study area

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Study Population and Sample Size Determination

The study population consisted of pupils aged 5-16 years across primary and secondary school in Burutu LGA, Delta State. The population of the study comprised of school-aged children in public and private schools from different communities namely: Kiagbodor Eghodo, Agbodobiri, Ogbogbagbene, Toumo and Torugbene Communities. Stratified random sampling technique was used to select 380 consented primary and secondary school pupils within the different primary and secondary schools selected for the study using the Cochran formula for sample size determination adopted from Ede *et al.* (2025) as shown below:

$$n = \frac{p(1-p)z^2}{e^2}$$

Where:

n = sample size

p = proportion of the population ($p = 0.1$)

e = acceptable error ($e = 0.05$)

From the sample size determination of 380 participants, 370 consented to the study and samples were obtained from the consented participant and was used for result accordingly.

Ethical Consideration:

This study was approved by the Research ethics committee of Ministry of Health Asaba, and Ethical Committee of Primary Health Care Agency, Asaba both of Delta State was obtained. Written and Verbal informed consent was also obtained from the children's parent or guardian and the various communities Head/Chairman. All information obtained from the participants were treated with confidentiality, only willing pupils was allowed to participate, and were given the right to withdraw from the study at any time.

Inclusion and Exclusion Criteria

Inclusion criteria into the study was based on school-aged ≥ 5 years old who had lived in the community for at least 5 years with no deworming treatment in the last 6 months. Children who were on antihelminthic drug or treated within 1 month prior to data collection were excluded for the baseline study.

Data Collection and Drug Administration

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A semi-structured questionnaire was used to gather information on socio-demographic and other factors related to Schistosomiasis infections. The questionnaire were initially prepared in English and then translated to Ijaw by a fluent speaker of both languages to ensure its consistency. Then, data collectors interviewed the children's parents/guardians. Data collection and drug administration was done by health extension workers who can speak both English and the local language (Ijaw). For children who were not at school at the time of the survey visit, the next students in the sampling frame were considered

Collection of Samples

Labeled clean plastic universal container for Stool and urine, Cellophane-glove, newspaper, and plastic coverings was distributed for fecal sample collection. Instructions on how the fecal material was collected were properly given and discussed with the parents and guardians. On submission of the fecal specimen, were immediately analysed the Laboratory.

Parasitological Examination:

The collected stool and urine samples were processed and examined using Kato-Katz egg counting technique (Katz *et al.*, 1972). The sediments were examined by placing one drop each on the center of the slide covered with cover slip and they were examined, parasites were then identified. The entire preparations were examined under the microscope to identify the eggs present, the number of eggs of each species were recorded and converted into the number of eggs per gram (EPG) of feces in order to analyze intensity of infection as classified by the WHO guideline (WHO, 1998; Aribodor *et al.*, 2021).

Data Analysis:

Data were re-arrange during and after collection, coded, classified to adjust for any missing information, entered. Descriptive statistics were computed and categorical variables were compared using Chi-square test using SPSS statistical package and Microsoft excel package for all graphical presentation. All statistical tests were considered significant at $p < 0.05$.

RESULTS

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I assume yes, please provide this information and how were the samples managed after analysis (disposal process)?

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What method was used to analyse the urine?
The Kato katz technique is not suitable for urine.....

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Prevalence of Schistosomiasis

Parasitological examination of 206 urine samples from school-aged children in the study area showed that 22(10.68%) children were infected with *Schistosomiasis haematobium* (Table 1). Generally, the infection rate were the same for female and male, though with different distribution among the communities study. This showed statistically significance when compared the number infected ($p<0.0082$). The overall prevalence *S. haematobium* infection by communities in this study are given in Table 1. Ogbogbagbene community had the highest overall infection rate of 16(53.33%) of all communities samples followed by Turugbene community with a prevalence of 9(30%) and followed by Kiagbodor with 3(10%) infected and the least were Eghodo community with 2(6.67%) among the burutu communities investigated in the study. Although Agbodobiri and Tuomo communities was not affected of infected by *S. haematobium* infection among the population studied.

The infected male where from two communities, with Ogbogbagbene having the highest male infection of *S. haematobium* of 6(27.27%) and Turugbene with 5(22.73%) infected male in this study. With infected female, four communities had the infection with Ogbogbagbene having the highest with 5(22.73%), followed by Kiagbodor community with 3(13.64%), followed by Eghodo community with 2(9.09%) and the least was Turugbene community with 1(4.54%) in the study.

Parasitological examination of 164 stool samples from the study population showed that 10(25%) children were infected with *Schistosomia mansoni* (Table .2). The study indicates that 80% of the children tested positive are males were more infected than the female and this was statistically significant when compared the number infected ($p<0.0082$). The overall prevalence *S. mansoni* infection by communities in this study are given in Table.2. Ogbogbagbene community had the highest overall infection rate of 7(17.5%) of all communities samples followed by Turugbene community with a prevalence of 3(7.5%) infected among the burutu communities investigated in the study. Although Agbodobiri, Eghodo, Kiagbodor and Tuomo communities was not affected of infected by *S. mansoni* infection among the population studied. The infected female where from two communities, with Ogbogbagbene having the highest female infection of *S. mansoni* of 5(50%) and Turugbene with 3(30%) infected female in this

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study. No infected case was found in the four communities Agbodobiri, Eghodo, Kiagbodor and Tuomo communities in this study.

Table 1: Summary of the parasitological examinations of urinary *Schistosomias haematobium* study communities in Burutu LGA, Delta State, Nigeria

Community No.	Examined	Infected	% Infected	Male infected	Female infected
Kiagbodor	20	3	15	0(0)	3(13.64)
Eghodo	20	2	10	0(0)	2(9.09)
Ogbogbagbene	44	11	25	6(27.27)	5(22.73)
Agbodobiri	20	0	0	0(0)	0(0)
Torugbene	45	6	13.33	5(22.73)	1(4.54)
Toumo	57	0	0	0(0)	0(0)
Total	206	22	63.33	11(50)	11(50)

Chi²= 15.56, p= 0.0082

Table 2: Summary of the parasitological examinations of *Schistosomia mansoni* at study communities in Burutu LGA, Delta State, Nigeria

Community No.	examined	No. infected	% infected	Male infected	Female infected	Chi ² -value	p-value
Kiagbodor	13	0	0	0(0)	0(0)	15.56	0.0082
Eghodo	12	0	0	0(0)	0(0)		
Ogbogbagbene	40	7	17.5	5(50)	2(20)		
Agbodobiri	19	0	0	0(0)	0(0)		
Torugbene	40	3	7.5	3(30)	0(0)		
Toumo	40	0	0	0(0)	0(0)		
	164	10	25	8(80)	2(20)		

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Risk Factors Analysis

The result showed that there was inverse relationship between prevalence of infection and distance from the river. No pupil have Knowledge about urinary schistosomiasis and had a very close distance to stream, with all pupil have a good swimming habit of about 96.99%, this pupil usually has a close contact to river as its use as a major source of water supply for about 81.58% as water contact activity like washing clothes, fishing, bathing, for about 96.99% of the pupils. Also reduce knowledge of duration of last deworming was observe with 87.60% are yet to be deworming for the last five (5) months and 94.36% of the pupils have not be immunized in the last one year. 46.24% of the pupils were observed to use more of pit toilet as the choice of toilet, while 24.06% uses the river as the choice of toilet and 19.55% use bush as the choice of toilet (Table 3).

Table 3: Risk factors associated with *S. haematobium* infection among school children in Burutu Communities

	Response	%Frequency
Knowledge about urinary schistosomiasis	Yes	0
	No	100
Distance to stream	Near	81.58
	Far	18.42
Swimming habit	Yes	96.99
	No	3.01
Source of water supply	Rain water and Well	11.65
	Stream	55.64
	Tap and Borehole	32.71
	Yes	
Water Contact activity like washing clothes, fishing, bathing etc.		96.99
	No	3.01
Duration of last deworming	1-5 months	87.60
	6-11 months	8.65
	1 year and above	3.76
Duration of last immunized	1-5 months	1.50
	6-11 months	4.14
	1 year and above	94.36
Choice of toilet	Bush	19.55
	River	24.06
	Water system	10.15
	Pit	46.24

DISCUSSION

The results of the present study showed the prevalence of *S. haematobium* (10.68%) and in *S. mansoni* (25%) in Burutu LGA from the six prominent communities study. The results of the study showed that there is a low prevalence of schistosomiasis within the communities of Burutu, Delta State, Southern Nigeria compared to previous studies of Aniaguya *et al.* (2024) who reported 32.6% prevalence of schistosomiasis in Osun State, Western Nigeria. Bello *et al.* (2024) reported 32.2% prevalence of schistosomiasis in Katsina State, Northern Nigeria, Azoro

et al. (2022) reported 30.2% prevalence of schistosomiasis in Imo State, Eastern Nigeria. However, the result of this study was higher compared to the report of Imalele *et al.* (2024) who reported 9.7% prevalence of schistosomiasis in Cross River State, Southern Nigeria. The reduction in the prevalence of the infection in the present study may be due to the availability of alternative sources of water for domestic uses and improved waste disposal system, constant public enlightenments and immunization, (Sam-wobo *et al.*, 2011).

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The degree of prevalence of schistosomiasis has been known to depend largely on frequency of man contact with contaminated water and the environmental sanitation activities (Hassan *et al.*, 2012). On the other hand, the high prevalence of the disease could also be a result of contamination of the streams in the study area since residents also use these waterways for domestic purposes. Though, females infected occur more in the communities than males, statistical analysis showed significant difference in the occurrence of the infection in both sexes. This result is at variance to previous results (Sam-wobo *et al.*, 2011) and the pattern of the results may be due to variation in the number of participating sexes as more males participated than the females. The higher infection among pupils of the 10 to 14 years group could be attributed to degrees of exposure (Mafiana and Beyioku, 1998; Akinwale *et al.*, 2009; Sam-wobo *et al.*, 2011). This result is also in agreement with previous studies that the prevalence of urinary schistosomiasis usually increases with age, reaching a peak at age 15 (Hassan *et al.*, 2012; Sam-wobo *et al.*, 2011). This is because children within the age of 10 to 15 usually engage in many outdoor activities including swimming and fishing due to the youthful exuberance.

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The relatively low prevalence observed for Torugbene community could be a result of other sources of water and enlightenment while Ogbogbagbene and Torugbene are comparatively much closer to it. The higher prevalence of the infection in the older age-groups is consistent with previous reports by Mafiana and Omotayo (1994) and Emejulu and co-workers (1994). The higher infection rates in older age groups might be a reflection of susceptibility to *S. haematobium* and/or of increased contact with infected water through swimming and fishing (Mafiana and Omotayo, 1994). The present study found slightly higher infection rates in males however were statistically significant. The study also showed that some of the participating children were already infected during infancy. Similar observation was previously reported on this age group elsewhere (Ekpo *et al.*, 2010; Sam-wobo *et al.*, 2011).

The prevalence of the infection is especially high and found in riverine area where poor people live specifically in areas susceptible to flood. These areas do not have proper waste disposal in these areas is also lack of sanitation among the infected people. Anthropogenic waste disposal in these areas is also very poor. Personal hygiene is also poor in these areas. Latrine and proper human waste disposal is very poor. These areas are tropical in climate and have high humidity and intestinal helminthiasis are prevalent in these areas. Morbidity due to soil-transmitted helminthes infection and the rate of transmission are related to the number of worms harboured by the host (Sam-Wobo et al., 2011; Egwunyenga, and Ataikiru, 2019).

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Conclusion

The present study showed the current status and prevalence of urinary and intestinal schistosomiasis among school aged children within communities in Burutu Local Government Area of Delta State, Nigeria. The results showed that there were lower prevalence rates for both *S. haematobium* and *S. mansoni* infections among the study participants. The results obtained from this study is the first of *S. haematobium* and *S. mansoni* infection carried out in children in across the communities of Burutu Local Government Area, Delta State. This study also establishes preliminary data-base information on the status and prevalence schistosomiasis in Burutu LGA of Delta State and its communities. Based on the result of the study, there is need to explore options for further reduction of schistosomiasis within the studied communities in Delta State including shifting the focus from morbidity control to transmission control. Also, there is a need for integrated control programs, acting beyond preventive chemotherapy. Hence, steps should be taken to enforce health education and action is needed to improve access to clean water, constructions of drainages and adequate sanitation by making policies aimed to improve the sanitation facilities of the areas (e.g., community-led total sanitation).

REFERENCES

Adenowo, A.F., Oyinloye, B.E., Ogunyinka, B.I. and Kappo, A.P. (2015). Impact of human schistosomiasis in sub-Saharan Africa. *Brazilian Journal of Infectious Diseases* **19**:196–205.

Akinwale, O.P., Ajayi, M.B., Akande, D.O., Adeleke, M.A., Gyang, P.V., Adeneye, A.K. and Dike, A.A. (2009). Prevalence of *Schistosoma haematobium* infection in a neglected

- community, South Western Nigeria. *International Journal of Health Research* **2**(2): 149-155.
- Aniaguya, R.N., Olusi, T.A., Dada, E.O., Awosolu, O.B. and Olaniran, O. (2024). Prevalence and distribution of *Schistosoma haematobium* infection among residents of Aye-Oba and Aye-Amodo rural communities of Osun State, Nigeria. *Journal of Applied Science and Environmental Management*. **28**(10):3391-3397.
- Anosike, J.C., Nwoke, B.E.B. and Njoku, A.J. (2001). The validity of haematuria in the community diagnosis of urinary schistosomiasis infections. *Journal of Helminthology* **75**:223-225.
- Aribodor, O.B., Okaka, C.E., Sam-Wobo, S.O., Okpala, B.C., Aribodor, D.N. and Obikwelu, E.M. (2019). Urinary schistosomiasis and primary evidence of female genital schistosomiasis among pupils in Nsugbe community, Anambra State, Nigeria. *Nigerian Journal of Parasitology* **42**(2):394-402.
- Aula, O.P., McManus, D.P., Jones, M.K. and Gordon, C.A. (2021). Schistosomiasis with a focus on Africa. *Tropical Medicine and Infectious Disease* **22**(3):109.
- Azoro, A.V., Onyeonula, N.I., Egeruo, A.S., Dike, M.N. and Mbagwu, C.B. (2022). Endemicity of urinary schistosomiasis in Ihube Okigwe Imo state. *International Journal of Veterinary Sciences and Animal Husbandry* **7**(1): 23-25.
- Bello, S., Eberemu, E. C., Orpin, J.B. and Ya'u, S. (2024). Prevalence of schistosoma haematobium infection among primary school children in Faskari and Funtua Local Government Areas of Katsina State, Nigeria. *FUDMA Journal of Sciences* **8**(3):311-315.
- Ede, E.L., Orhewere, R.D.A., Owzororo, E. and Dodo, E. (2025). Awareness and utilization of insecticide-treated nets for malaria prevention in Abraka Community, Delta State, Nigeria. *Asian Journal of Advances in Medical Sciences* **7**(1):51-59.
- Egwunyenga, O.A. and Ataikiru, D.P. (2012). Soil-transmitted helminthiasis among school age children in Ethiopie East Local Government Area, Delta State, Nigeria. *African Journal of Soil Science* **7**(1):497-500.
- Ekpo, U.F. and Mafiana, C.F. (2004). Epidemiological studies of urinary schistosomiasis in Ogun-State, Nigeria: Identification of high-risk communities. *Nigerian Journal of Parasitology* **25**:111-119.
- Ekpo, U.F., Akintude, L., Oluwole, A.S., Sam-Wobo, S.O., and Mafiana, C.F (2010). Urinary schistosomiasis among pre-school children in a rural community near Abeokua, Nigeria. *Parasite and Vector* **3**(58):1-6.
- Emejulu, A.C., Alabaronye, F.F., Ezenwaje, H.M.G. and Okafor, F.C. (1994). Investigation into the prevalence of urinary schistosomiasis in the Agulu Lake Area of Anambra State, Nigeria. *Journal of Helminthology* **68**:119-23.
- Ezeh, C.O., Onyekwelu, K.C., Akinwale, O.P., Shan, L. and Wei, H. (2019). Urinary schistosomiasis in Nigeria: a 50 year review of prevalence, distribution and disease burden. *Parasite Paris* **26**:19.
- Hassan, A.O., Amoo, A.O.J., Akinwale, O.P., Deji-Agboola, A.M., Adeleke, M.A., Gyang, P.V. and Oluwadun, A. (2012). Human water activities and urinary schistosomiasis around

- Erinle and Eko-Ende Dams, Southwest Nigeria. *Global Advance Research in Journal of Medicine and Medical Sciences*. **11**(4):077-084.
- Huot, C., Clerissi, C., Gourbal, B., Galinier, R., Duval, D. and Toulza, E. (2020). Schistosomiasis vector snails and their microbiota display a phyllosymbiosis pattern. *Frontiers in Microbiology* **31**:10.
- Imalele, E.E., Braide, E.I., Emanghe, U.E. and Osondu-Anyanwu, C. (2024). The burden of schistosomiasis among school-aged children in Ogoja, Nigeria: current level of infection years after mass drug administration with Praziquantel. *African Health Science* **24**(4):65-76.
- Mafiana, C.F. and Beyioku, Y.O. (1998). *Schistosoma haematobium* infection in Abeokuta. *African Journal of Medical Science* **27**:5-7.
- Mafiana, C.F. and Omotayo, A.B. (1994). Urinary schistosomiasis; an evaluation of microscope egg count and chemical reagent strips in children in southwest Nigeria. *Helminthologia* **35**(1):31-35.
- Mbah, M.L., Poolman, E.M., Atkins, K.E., Orenstein, E.W., Meyers, L.A. and Townsend, J.P. (2013). Potential cost-effectiveness of schistosomiasis treatment for reducing HIV transmission in Africa?the case of Zimbabwean women. *PLoS Neglected Tropical Diseases* **8**:e2346.
- Orhewere, R.D.A., Nmorsi, O.P.G. and Ede, E.L. (2023). Prevalence and Risk Factor of Intestinal Helminthiasis and Lymphatic Filariasis (Elephantiasis) Co-Infections in Idumuje-Unor Community, Delta State, Nigeria. *International Journal of Biosciences* **23**(2):38-46.
- Sam-Wobo, S.O., Idowu, J.M. and Adeleke, M.A. (2011). Urinary schistosomiasis among children and teenagers near Oyan Dam, Abeokuta, Nigeria. *Journal of Rural and Tropical Public Health* **10**:57-60.
- Sam-Wobo, S.O., Ekpo, U.F., Ameh, I.G. and Osileye, O.T. (2009). Continued high endemicity of urinary schistosomiasis in Ogun State Nigeria. *Nigerian Journal of Parasitology* **30**:48-52.
- Utzinger, J., Becker, S.L., van Lieshout, L., van Dam, G.J. and Knopp, S. (2015). New diagnostic tools in schistosomiasis. *Clinical Microbiology Infection* **21**(6):529-542.
- Vennervald, B.J. (2015) Epidemiology and mechanism of carcinogenesis of schistosomiasis. *Tropical Hemato-Oncology* **5**:165-170.
- World Bank (1997). *World Development Report*. World Bank; Washington, DC, USA: 1997.
- World Health Organization, (2016). Schistosomiasis countries X indicators http://www.who.int/neglected_diseases/preventive_chemistry/sch/db/?units=minimal®ion=all&country=all&countries=all&year=all.
- Zhang, Y. and Ming, Y. (2023). Burden of schistosomiasis in global, regional, and national 1990-2019: a systematic analysis for the global burden of disease study 2019. *Travel Medicine and Infectious Diseases* **61**.