Sahel Journal of Life Sciences FUDMA (SAJOLS)
March 2024 Vol. 2(1): 143-149
ISSN: 3027-0456 (Print)
ISSN: 1595-5915(Online)
DOI: *https://doi.org/10.33003/sajols-2024-0201-017*

Research Article

Prevalence of Urinary Schistosomiasis among Primary School Pupils in Riverine Community of Garko Local Government Area, Kano State, Nigeria

***[1]Ahmad, A. G. and [2]Bagwai, M. A.**

[1]Department of Biological Sciences, Federal University Gashua, Yobe State, Nigeria
[2]Department of Life Sciences, School of Technology, Kano State Polytechnic, Kano

***Corresponding Author:** abdullahigarbaahmad@gmail.com; +234-8069742233

Received: 20th February, 2024 **Accepted**: 26th March, 2024 **Published**: 31st March, 2024

ABSTRACT

Schistosomiasis is a neglected tropical disease that has become endemic in the riverine communities, primarily among school-age children, leading to school absenteeism. The study determines the prevalence of urinary Schistosomiasis and predisposition factors. A total of One hundred and fifty urine samples were examined for the presence of *Schistosoma haematobium* ova and detection of haematuria. The result obtained was tested using the Chi-Square test, and the overall prevalence was 53.3%. The infection rate was higher among males (58%) than the females (42%). The infection rate was higher among the ≥15 years age group (69.2%), while the 5-9 years age group had the least infection rate (47.2%). The study observed that the highest prevalence (62.0%) was recorded in Kafinchiri Primary School; this might be due to the influence of the water body in the community. The predisposition factors include gender, as males recorded the higher prevalence, which might be related to the economic activities such as irrigation, fishing, and laundry occurring in the riverine area. Age groups among the pupils had an impact on the prevalence of school absenteeism, and running away before closing hours is partially attributed to recreational activities, including swimming. Maintaining a safe distance between schools and water bodies and limiting frequent visits to the riverine area is crucial. The use of personal protective clothing and prompt treatment of infected persons should be encouraged to curtail the infection.

Keywords: Prevalence, Urinary, Schistosomiasis, Pupils, Riverine, Haematuria

Citation: Ahmad, A. G. and Bagwai, M. A. (2024). Prevalence of Urinary Schistosomiasis among Primary School Pupils in Riverine Community of Garko Local Government Area, Kano State, Nigeria. *Sahel Journal of Life Sciences FUDMA*, 2(1): 143-149. DOI: *https://doi.org/10.33003/sajols-2024-0201-017*

INTRODUCTION

Schistosomiasis is a disease of public health importance in developing countries, especially Sub-Saharan Africa due to poor access to safe drinking water, sanitation, and hygiene (WHO, 2018). In Nigeria, the prevalence of schistosomiasis is very alarming, with 29 million people infected and over 101.3 million at risk of the infection, and it has become endemic among adolescents (Hotez & Kamath, 2009). School-aged children are more susceptible to waterborne illnesses due to frequent exposure to contaminated water and poor sanitation (Babamale *et al*., 2018; Otuneme *et al*., 2019). The establishment and expansion of rivers/dams for occupational opportunities, fishing, and rice and vegetable farming led to schistosomiasis becoming an endemic disease in the riverine area (Okpala *et al*., 2004).

Schistosomiasis is the second most severe parasitic disease after malaria and has a devastating impact on infected individuals. The disease is caused by blood flukes (trematode) of the genus *Schistosoma*. The

human pathogens are caused by *Schistosoma haematobium, Schistosoma mansoni,* and *Schistosoma japonicum* (CDC, 2020). *Schistosoma haematobium and Schistosoma mansoni* are responsible for the schistosomiasis in sub Saharan Africa, the former responsible for urogenital schistosomiasis and the later responsible for intestinal schistosomiasis (Kokaliaris *et al*., 2022). Freshwater snails are the intermediate host of the infection, and the transmission is via an infected individual who excretes the parasitic eggs into the water body, hatches to an infected larva (cercariae) and penetrates the skin of the new host and develops into the adult schistosome in the body (Otuneme *et al*., 2019; CDC, 2020). A clinical manifestation includes haematuria, frequent urination, and dysuria. In severe instances, bladder cancer or fibrosis of the bladder and ureter, infertility as well as kidney impairment may be discovered (WHO, 2002; Jiya *et al*., 2021**).** The disease is responsible for school absenteeism and malnutrition, including anaemia among children of school age (Odhiambo *et al*., 2014). At present, there is no available vaccine against schistosomiasis, so precautionary and preventive measures are necessary. However, effective treatment is through the treatment of vulnerable populations, the provision of safe drinking water, improvement in sanitation facilities and hygiene, and control of the intermediate host (snails) from the water body. World Health Assembly has adopted the road map for New Neglected tropical diseases control 2021-2030 in countries with endemic Schistosomiasis (Stothard *et al*., 2009; CDC, 2020; Kokaliaris *et al*., 2022).

Primary school children are susceptible to contracting urinary schistosomiasis as a result of their frequent exposure to water bodies for daily chores such as fetching water or leisure activities like swimming in contaminated water (Sunday *et al*., 2023). This contact can have a significant impact on their health and academic performance. Chronic infection can lead to school absenteeism, poor concentration, and hindered cognitive potential due to symptoms like abdominal pain, fatigue, and anaemia (Otuneme *et al*., 2019; Jiya *et al*., 2021). Schistosomiasis also has economic implications. Treatment can be expensive, and illness can result in a loss of productive school hours. Thus, it is crucial to evaluate the prevalence of urinary schistosomiasis in primary school children from riverine communities. The study can provide valuable insight into the infection's pattern and assist in creating evidence-based intervention strategies. Such interventions include mass drug campaigns, health education, and the provision of safe water and sanitation infrastructure aimed at reducing transmission and improving health outcomes.

MATERIALS AND METHODS

Study Area

The study was carried out in three riverine communities viz; Kumfada, Garin Ali, and Kafinchiri situated around Kafinchiri Dam (11° 36' 0"N and 8° 52' 0"E), Garko Local Government Area, Kano State. The Local Government has a total land mass of 450 km^2 and a total population of 162,500 as of the 2006 census. The area receives an average annual rainfall of 1000 mm, which typically lasts three to five months, and the average temperature ranges from 26^0C to 33^0C. Kafin-chiri dam serves as the source of water for their daily domestic needs, the resident also engages in farming and fishing as their main occupations (Kabir, 2011).

Ethical Considerations

Ethical approvals were granted from the Kano State Ministry of Health via Primary Health Care Management Board and State Universal Basic Education Board (SUBEB) via Garko Local Government Education Authority. Moreover, prior to the commencement of this work, consent was obtained from both the parents and students for the collection of the urine sample. The parents and students were properly informed and educated about the aim and benefits of the research in the area.

Sampling Methods

A total of 150 students, comprising 90 boys and 60 girls, were randomly selected for the study between the months of March and August 2022. However, 50 students each (30 boys and 20 girls) were randomly sampled from the three selected schools (Kafinchiri, Kumfada, and Garin Ali Primary schools) in the study area and grouped into different age groups. Using structured questionnaires, information was obtained from the pupils on the sex, age, class, water contact activities, source of water for drinking and other domestic activities, knowledge and perception about the disease, and access to healthcare facilities, amongst others. Each student received a sterile, dry, 25 ml plastic specimen container with a cap. They were also instructed to collect a terminal urine sample between 10:00 and 12:00, focusing on the last drop, which is when the ova load is at its highest and

when *S. haematobium* eggs are most likely to be passed in urine (WHO, 2002). Each container was labeled with the sex, age, and identification number of the participant, as provided in the questionnaire form, to ensure a correlation with the results. All the urine samples were returned by the participant as directed.

Detection of Haematuria

Fresh urine samples collected were examined macroscopically for the presence of blood (haematuria) using the reagent strip (Medi-Test Combi-9); the strip was dipped in each urine sample, after which the result was recorded at the point of collection.

Laboratory Analysis of the Urine Samples

The samples were then preserved by adding 5 ml of 10% formalin solution to each 10 mL of urine in order to prevent the eggs of schistosomes from hatching (Safa'a & El-amin, 2017). Then, the preserved urine samples were immediately transported in ice packs to the laboratory (Department of Biological Sciences, Kano University of Science and Technology, Wudil) for processing. The sedimentation method was used for the analysis; in the laboratory, the urine samples were shaken well, and then 10 ml of each urine sample were transferred into a glass test tube and spun at 15,000 rpm for 5 minutes on a centrifuge tube to concentrate the eggs (Cheesbrough, 2005). The supernatant was discarded, after which the sediments were transferred to a clean slide, covered with a coverslip, and examined microscopically for the presence of *Schistosoma haemotobium* ova using an x10 objective lens (Ochei & Kolhakar, 2008).

Data Analysis

The data obtained in this study were analysed using SPSS software version 20. The chi-square test was used to compare the parameters and determine the degree of association between observed variables at a 95% confidence level and level of significance set at $p \leq 0.05$.

RESULTS

A blood sample was examined to detect the presence of *Schistosoma haematobium;* out of the 150 subjects (Table I), the result recorded an overall prevalence of 53.3%; males had a higher infection rate (58%) than females (42%); the difference was not statistically significant ($p > 0.05$) between the sexes. The distribution of the infection by age group (Table 2) observed the highest infection among the pupils aged 15 years and above (69.2%), while the lowest infection rate occurred within the 5-9 years age group (47.2%). However, there were no significant differences between the age group and the infection. With respect to infection due to source of drinking water (Table 3), our result indicated that the infection was higher (75.0%) among pupils that used dam/river as a source of water supply, while pupils using tap/borehole recorded the least infection (28.5%). The differences were statistically significant ($p<0.05$). For the detection of hematuria (Table 4), 150 subjects were examined; the result observed that 31 (20.6%) of total children reported passing blood in their urine, of which 26 (24.8%) were males, in comparison to 05 (11.1%) females. However, the difference was not statistically significant between the sexes. From the primary schools investigated (Table 5), the highest prevalence (62.0%) of the infection was recorded in Kafin-chiri primary school in comparison with Kumfada primary school with the least prevalence (44.0%); the differences were not statistically significant ($p > 0.05$).

Table 1: Prevalence of urinary Schistosomiasis in Relation to the Pupils' gender

Gender	Number Examined	Infected	Prevalence (%)
Male	105	61	58
Female	45	19	42
Total	**150**	**80**	**53.3**

p- Value = 0.314

Table 2: Prevalence of Schistosomiasis in Relation to Age of the Students

Ages (years)	Number Examined	Infected	Prevalence (%)
5-9	36	17	47.2
10-14	49	27	55.10
≥15	52	36	69.2
Total	**150**	**80**	

P-Value = 0.549

Table 3: Prevalence of Schistosomiasis among the pupils with respect to source of water supply

Sources of water	Number Examined	Infected	Positive (%)
Well	46	15	32.6
Dam/River	76	57	75.0
Tab/borehole	28	8	28.5
Total	**150**	**80**	

P-Value = 0.010

Table 4: Distribution of Visible Haematuria in Relation to Gender of the Pupils

Gender	Number examined	Presence of Hematuria (%)	Number infected (%)
Male	105	26 (24.8)	17(65.4)
Female	45	5 (11.1)	2 (40.0)
Total	**150**	**31 (20.6)**	

P-Value = 0.116

Table 5: Prevalence of Schistosomiasis in relation to the schools in the Study Area

Schools	Number examined	Infected	Prevalence (%)
Kafinchiri Primary School	50	31	62.0
Kumfada Primary School	50	22	44.0
Garin Ali Primary School	50	27	54.0
Total	**150**	**80**	

P-Value = 0.605

DISCUSSION

The high incidence of schistosomiasis among school children remains a significant public health concern in tropical regions, particularly in Nigeria. The finding of a 53.3% prevalence rate (Table 1) in this study is consistent with the reports in other parts of Nigeria (Ekpo *et al*., 2010; Amuta & Houmsou, 2014; Okwori *et al*., 2014). However, our findings were higher than those of Elfaki *et al*. (2020), Umoh *et al.* (2020), and Joof *et al*. (2021), who reported a lower prevalence than the present finding. Similarly, Maki *et al.* (2021) reported a higher prevalence (62%) compared to the present report in South Darfur State, Sudan. The infection showed gender disparity (Table 1), being more prevalent in boys (58%) than girls (42%), although there were no significant differences ($p>0.05$) between the sexes. Gender variations in schistosomiasis infection might be attributed to the greater involvement of boys than girls in recreational and other water contact activities such as swimming, bathing, washing clothes, and playing at the water bodies. Moreover, agricultural activities in the area are mostly carried out by males in these communities, which is significantly associated with the risk of infection among males. This finding is consistent with previous studies (Geleta *et al*., 2015; Afifi *et al*., 2016; Hajissa *et al*., 2018; Umoh *et al.,* 2020 & Joof *et al*., 2021), who separately reported a higher prevalence of urinary schistosomiasis in males than female subjects. Males have more exposure to water bodies than their female counterparts due to cultural and religious beliefs that restrict girls' movement (Jiya *et al.,* 2022). However, other studies conducted in the southern part of Nigeria reported girls as more prevalent compared to boys (Otuneme *et al*., 2019); this suggests different cultural roles and variations among the genders in the country. Our study also revealed an increase in prevalence with an increase in age (Table 2); the 15-year and above age group had the highest prevalence (69.2%). The result is consistent with the findings of Gbonhinbor & Abah

(2019) and Amuga *et al*. (2020), and this may be attributed to the contact with the dam by the children in this age group due to engagement in several water-related activities, including swimming and laundry. However, the finding disagrees with Goselle *et al*. (2010) and Muhammad *et al.* (2019), who reported a decrease in prevalence with an increase in age groups. The predisposing factor for schistosomiasis in the riverine community includes direct contact with water bodies due to economic or domestic chores (Couto *et al*., 2014; Zida *et al*., 2016; Umoh *et al*., 2020). Furthermore, with respect to the source of water supply (Table 3), the infection was higher (75%) among those who used Dam/Rivers for their daily needs. Our finding is consistent with the findings of Ameachi (2014)**,** who reported a high infection rate among the inhabitants who depend largely on rivers (80.1 %) and streams (53.8 %) as water sources. Umoh *et al.* (2020) reported the highest rate of infection (25%) amongst students who utilized stream water mainly for domestic purposes. Detection of haematuria holds crucial diagnostic and prognostic significance in schistosomiasis. The presence of blood in urine is caused by granulomatous inflammation resulting from the lodging of *S. haematobium* eggs in the bladder and urogenital system. The presence of blood in urine, known as haematuria, may indicate the possibility of schistosomiasis, but it is not a reliable diagnostic tool for individual patients due to its lack of sensitivity and specificity (CDC, 2020). Haematuria can lead to malnutrition in school-age children due to the complications of anaemia (Colley *et al*., 2014). Joof *et al*. (2021) and Maki *et al*. (2021) both observed lower levels of haematuria compared to the current study. Specifically, they found that only 10 individuals (0.5%) in each study were reactive, whereas the present study found 31 individuals (20.6%) to be reactive. The high prevalence of the disease in the three riverine communities (Kafinchiri, Kumfada & Garin Ali), as presented in Table 6, reflects the dependence of the community on the water source for domestic uses and other water contact activities, including agricultural activities, which provides economic opportunities for their livelihood. Unfortunately, it contributes to the new incidence and high prevalence of the disease in the riverine community. The Kafin-chiri dam surrounding the study area was found to be the main transmission foci in these communities. According to the current study, certain factors contribute to the spread of urinary schistosomiasis among primary school pupils in a particular area. These factors include the gender and age of the pupils, the source of water supply and the location of the schools (Babamale *et al.,* 2018). Authorities should ensure that primary schools are not located in close proximity to water bodies. Parents and teachers need to take measures to prevent pupils from visiting dams frequently and to provide personal protective clothing when necessary. Furthermore, infected pupils should receive prompt treatment; improvements in sanitation infrastructure, such as proper disposal of excreta, should also be considered to reduce the disease prevalence in the area CDC (2020).

CONCLUSION

The high prevalence of *S. haematobium* infection observed in the study areas, indicated that the three communities or the study area are endemic for urinary schistosomiasis, with a high intensity of infection. The natural water bodies particularly Kafinchiri Dam and other rivers surrounding the study area were found to be the main transmission foci in these communities. However, ignorance, poor awareness or lack of proper knowledge of the cause and transmission of the disease are the major factors contributes to the spread of the infection in the study area. Moreover, lack of portable water sources or insufficient safe water supplies such as taps and boreholes might have coerced the communities to depend on these infested water bodies for drinking and domestic purposes which considered as risk factors that could put children at higher risk of infection with urinary schistosomiasis in the study area. Therefore, appropriate intervention, health education or public awareness to the community members especially on the dangers of contact with infected rivers and streams, integrated control and prevention measures of schistosomiasis and its attendant illness need to be implemented in the study area. Treatment program using praziquantel and systematic epidemiological studies should be undertaken in the affected communities.

REFERENCES

Afifi, A., Ahmed, A., Sulieman, Y., Pengsakul, T. (2016). Epidemiology of schistosomiasis among villagers of the New Halfa Agricultural Scheme, Sudan. *Iran J. Parasitology*, 11(1):110.

Ameachi, E.C. (2014). Urinary Schistosomiasis among School Age Children in Some Rural Communities of Abia State, South Eastern Nigeria. *Animal Research International,* 11(2), 1953 – 1957.

Amuga, G. A., Nebe, O. J., Nduka, F. O., Njepuome, N., Dakul, D.A., Isiyaku, S., Ngige, E., Jibrin, S., Jacob, S.M., Nwoye, I.A., Nwankwo, U., Urude, R. Aliyu, S. M., Garba, W., Adamani, C. O., Nwosu, I. A., Anagbogu, R. Dixon, A., and Clark, G. O. (2020). Epidemiological Factors Enhancing Transmission in Nigeria. *Global Research Journal of Public Health and Epidemiology*, 8(7), 023-032

Amuta, E. U., Houmsou, R. S. (2014). Prevalence, intensity of infection and risk factors of urinary schistosomiasis in preschool and school aged children in Guma Local Government Area, Nigeria. *Asian Pacific Journal of Tropical Medicine,* (13)34- 39.

Babamale, O. A, Kolawole, O. H, Abdulganiyu, K., Abdulkareem, O. A., and Ugbomoiko, U. S. (2018). Urogenital schistosomiasis among schoolchildren and the associated risk factors in selected rural communities of Kwara State, Nigeria. *Journal of Tropical Medicine*, 1-6. https://doiorg/101155/2018/6913918

CDC (2020), Parasite, Schistosomiasis. Global Health, Division of Parasitic Diseases and Malaria. https://www.cdc.gov/parasites/schistosomiasis/prevent.html

Cheesbrough, M. (2005). *District Laboratory Practical in Tropical Countries* (2nd Ed.). Cambridge University Press. 218-239

Colley, D.G., Bustinduy, A. L., Secor, W. E., and King, C. H. (2014). Human Schistosomiasis. *Lancet*, 383(9936), 2253–64. https://doi.org/10.1016/S01406736(13)61949-2

Couto, L. D., Tibiriça, S. H., Pinheiro, I. O., Mitterofhe, A., Lima, A. C., Castro, M. F, *et al*. (2014). Neglected tropical diseases: prevalence and risk factors for schistosomiasis and soil-transmitted helminthiasis in a region of Minas Gerais State, Brazil. *Trans R Soc Trop Med Hyg*, 108(6):363–371. https://doi.org/10.1093/trstmh/tru054

Ekpo, U.F., Laja Deile, A., Oluwole, A.S., Sam-Wobo, S.O., Mafiana, C.F. (2010). Urinary Schistosomiasis among Pre-school Children in a Rural Community near Abeokuta, Nigeria. *Parasites Vectors*, 3 (58). https://doi.org/10.1186/1756-3305-3-58

Elfaki, T.M., Hamad, M.N.M., Zarrug, E., Muhammad, H.O.M., Muhammad, S.H., Ahmad, R. A., and Eltaher, T. I. A. (2020). Prevalence of schistosomiasis among school aged children in Altakamol area, Khartoum state, Sudan. *Journal of Microbiology and Experimentation*, *8*(5), 167-169. https://doi.org/ 10.15406/jmen.2020.08.00303

Gbonhinbor, J. and Abah, A. E. (2019). Prevalence of Urogenital Schistosomiasis in Four Communities in Ogbia Local Government Area, Bayelsa State, Nigeria. *Int. J. Trop. Dis. Health, 39* (3), 1-9. https://doi.org/10.9734/ijtdh/2019/v39i330206

Geleta, S., Alemu, A., Getie, S., Mekonnen, Z. and Erko, B. (2015). Prevalence of urinary schistosomiasis and associated risk factors among Abobo Primary School children in Gambella Regional State, southwestern Ethiopia: A cross sectional study. *Parasites Vectors*, *8* (215). https://doi.org/10.1186/s13071-015-0822-5

Goselle, N. O., Anegbe, D., Imandeh, G. N., Dakul, D. A., Onwuliri, A. C. F., Abba, O. J., Udeh, O. E., Abelau, A. M. (2010). *Schistosoma mansoni* Infections amongst School Children in Jos, Nigeria.Science World Journal, 5 (1):42-45.

Hajissa, K., Muhajir, A., Eshag, H.A., Alfadel, A., Nahied, E., Dahab, R., Ali, S.M., Muhammed, M., Gaafar, M., and Muhammed, M. (2018). Prevalence of schistosomiasis and associated risk factors among school children in Um-Asher Area, Khartoum, Sudan. *BMC Res Notes*, *11*(1): 779. https://doi.org/10.1186/s13104-018-3871-y

Hotez. P., and Kamath, A. (2009). Neglected tropical diseases in Sub-Saharan Africa: Review of their prevalence, distribution and disease burden. *PLoS Negl. Tropical Disease;* 3:e412.

Jiya, F.B., Jiya, N.M., Ibitoye, P.K., Mohammed, Y., and Mohammad, A.O. (2020). Chronic Urogenital Schistosomiasis among In-School Adolescents in Sokoto, North-Western Nigeria. *Asian Journal of Medicine and Health,* 20(1): 22-36.

Joof, E., Sanyang, A. M., Camara,Y., Sey, A. P., Baldeh, I., Jah, S. L., Ceesay, S. J., Sambou, S.M., Sanyang, S., Wade, C. M., and Sanneh, B. (2021). Prevalence and risk factors of schistosomiasis among primary school children in four selected regions of the Gambia. *Plos Neglected Tropical Diseases*, 15(5), 1-15. https://doi.org/10.1371/journal.pntd.0009380.

Kabir, A. (2011). The Kano Physical Environment. https://www. Kanoonline. Com

Kokaliaris, C., Garba A, Matuska M, Bronzan R.N, Colley D.G, Darkenoo, A.M., Ekpa, U.W., Fleming, F.M

(2022). Effect of preventive chemotherapy with praziquantel on schistosomiasis among school-aged children in sub-Saharan Africa: a spatiotemporal modeling study. *Lancet Infect Dis.* 22(1):136-149. https://doi.org/10.1016/S1473-3099(21)00090-6.

Maki, A. A., Hajissa, K., and Ali, G. A. (2021). Prevalence and intensity of urinary schistosomiasis among selected people in Tulus area, South Darfur State, Sudan. *International Journal of Community Medicine and Public Health, 8*(9):4221-4224.

Muhammad, I. A., Abdullahi, K., Bala, A.Y., and Shinkafi, S. A. (2019). Prevalence of urinary schistosomiasis among primary school pupils in Wamakko Local Government, Sokoto State, Nigeria. JoBAZ 80, 22 https://doi.org/10.1186/s41936-019-0093-3

Ochei, J., and Kolhatkar, A. (2008). *Medical Laboratory Science theory and practice*. Tata M.cGraw Hill Publishing Company Limited, 975-976

Odhiambo, G. O., Musuva, R. M., Atuncha, V. O., Mutete, E. T., Odiere, M. R., Onyango, R. O., *et al.* (2014). Low levels of awareness despite high prevalence of schistosomiasis among communities in Nyalenda informal settlement, Kisumu City, Western Kenya. *PLOS Neglected Tropical Diseases*, *8*(4), 2784. https://doi.org/10.1371/journal.pntd.0002784

Okpala, H. O, Agwu, E, Agba, M. I, Chimezie, O. R, Nwobu, G. O., and Ohihoin, A. A. (2004). A survey of the prevalence of Schistosomiasis among pupils in Apata and Laranto areas in Jos, Plateau State. *Online J Health Allied Scs.*; 1:1-4.

Okwori, A. E. J., Sidi, M., Ngwai, Y. B., Obiekezie, S. O., Makut, M. D., Chollom, S. C., Okeke, I. O., and Adikwu, T. I. (2014). Prevalence of Schistosomiasis among Primary School Children in Gadabuke District, Toto LGA, North Central Nigeria. *British Microbiology Research Journal,* 4(3): 255-261.

Otuneme, O. G., Obebe, O. O., Sajobi, T. T., Akinleye, W. A., and Faloye, T. G. (2019). Prevalence of Schistosomiasis in a neglected community, Southwestern Nigeria at two points in time, spaced three years apart. *Afri Health Sci.* 19(1): 1338-1345. https://dx.doi.org/10.4314/ahs.v19i1.5.

Safa'a, E. I., and El-amin, A. E. (2017). Evaluation of the performance of preservation methods in the detection of *Schistosoma haematobium* ova in urine samples. *Pyrex Journal of Biomedical Research,* 3(3), 21–24.

Stothard, J. R., French M. D., Simba, K. I., Basa´n˜ez M. G., and Rollinson, D. (2009). The Epidemiology and Control of Urinary schistosomiasis and Soil-Transmitted Helminthiasis in School Children on Unguja Island, Zanzibar. *Trans R Soc Trop Med Hyg.*; 103: 1031–1044

Sunday, J. O., Oso, O. G., Babamale, A. O. and Ugbomoiko, S. U. (2023) Urinary Schistosomiasis Prevalence and Diagnostic Performance of Reagent Strip at Point-of-Care. *Journal of Biosciences and Medicines*, 11, 239-251. https://doi.org/10.4236/jbm.2023.114017

Umoh, N. O., Nwamini, C. F., Inyang, N. J., Anthony, N., Victor, U., Usanga, U., Nworie, A., Michael O., Boniface, E., and Ukwah, N. (2020). Prevalence of urinary schistosomiasis amongst primary school children in Ikwo and Ohaukwu Communities of Ebonyi State, Nigeria. *African Journal of Laboratory Medicine,* 9(1): 812. https://doi.org/10.4102/ajlm.v9i1.812

WHO (2002). Expert Committee, Prevention and Control of Schistosomiasis and Soil-Transmitted Helminthiasis, Technical Report Series N°912

WHO (2018). Schistosomiasis;. https://www.whoint/news-room/factsheets/detail/schistosomiasis

Zida, A., Briegel, J., Kabré, I., Sawadogo, M. P., Sangaré, I., and Bamba, S. (2016). Epidemiological and clinical aspects of urogenital schistosomiasis in women, in Burkina Faso, West Africa. *Infect Dis Poverty,* 5(1): 81. https://doi.org/10.1186/s40249-016-0174-1