The Bioscientist Vol. 10 (2): 213-222, March 2022
Available online at *http://www.bioscientistjournal.com*



OPEN ACCESS

Full Length Research Paper

SCHISTOSOMA HAEMATOBIUM INFECTION AMONG CHILDREN OF ANAM COMMUNITY, SOUTH-EASTERN NIGERIA

[1*]Chikwendu J. I., [1]Elosiuba V. N., [1]Ikeh R.E., [1]Igbokwe, E.A., [1]Ngenebgo U.C., and [1]Onyido A. E.

[1]Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka, Nigeria

Email: ji.chikwendu@unizik.edu.ng
Received: 04 January; Accepted 10 April, 2022.

ABSTRACT

Urogenital schistosomiasis is a major source of morbidity and mortality for developing countries in Africa including Nigeria. A cross sectional study on urogenital schistosomiasis was done at an island community of Anam, Anambra State Nigeria between April and May 2021. Each of the 200 students enrolled for the study was given a 20 ml universal bottle for terminal urine sample collection during break-time between 10 am -11 am. Collected samples were transported within a cooler containing ice packs to the laboratory where 10ml of each sample was centrifuged in a test tube at 3000 rpm for 5 minutes. When decanted, sediments were pipetted unto glass slides, covered with cover slips, and examined microscopically using ×40 objective lens. *Schistosoma haematobium* eggs were identified by their characteristic ovoid shapes with terminal spines. Prevalence of infection was calculated as $\left[\left(\frac{no.\ infected}{no.\ examined}\right) \times 100\right]\%$ while MS Excel Chart Wizard was used to prepare Bar Charts with standard error bars indicating significant differences. Chi-square was used to test homogeneity between gender and among age-groups studied with(p<0.05)considered statistically significant. There was an overall infection prevalence of 20.5%. Highest prevalence of 25.6 % was recorded among age group of 9 – 11 years while age-group of 18 – 20 years had least prevalence of 12.5% (p<0.05). Out of 92 males examined, 14 (15.2%) were positive while out of 108 females, 27 (25.0 %) were positive for *S. haematobium* eggs (p<0.05).Urogenital schistosomiasis is endemic at Anam. Thus, control efforts should be targeted on children and females in line with United Nations sustainable development goals.

Keywords: Schistosomiasis, haematuria, *Schistosoma haematobium* eggs, Anam, Nigeria

INTRODUCTION

Schistosomiasis also known as bilharziasis is an acute and chronic parasitic disease caused by blood flukes of the genus *Schistosoma* (WHO, 2020). People get infected when in contact with fresh water contaminated with cercariae (from infected freshwater snails) which penetrate human skin; a strong positive correlation exists between infection rates in snails and infection rates in humans (Chikwendu *et al*., 2019a). Cercariae lose their tails on penetration of human skin and subsequently develop into adult schistosomes (Ligasova *et al*., 2011). Adults of schistosomes live *in-copulo* in mesenteric veins where the females release eggs, some of which are passed out of the body in urine or in faeces, hatch to miracidia which infect snails to continue the parasite's lifecycle (CDC, 2012).Transmission-success of human schistosomiasis requires contact between susceptible host and infective cercariae, meaning that schistosomiasis cannot be in the absence of snail intermediate host in freshwater bodies (Ikpeze *et al.,* 2020). Some eggs become trapped in body tissues, particularly among females, causing immune reactions and progressive damage to the organs (Masong *et al*., 2021). Schistosomiasis is found in tropical countries in Africa, the Caribbean, eastern South America, Southeast Asia, and the Middle East, especially in poor communities without access to safe water and adequate sanitation (WHO, 2019).

There are two major forms of schistosomiasis namely: intestinal and urogenital schistosomiasis (WHO, 2020). *Schistosoma haematobium* causes urogenital schistosomiasis and is recognized as the world's deadliest schistosome, with a record of infecting 112 million people annually in sub-Saharan Africa alone and is responsible for an estimated 150,000 deaths from kidney failure annually (Pennington *et. al.,* 2014).

Diagnosis of urogenital schistosomiasis is by the identification of parasite eggs in urine specimen (Houmsou *et al*., 2016). Antibodies and/or antigens detected in blood or urine samples are also indications of schistosomiasis infection (Chikwendu *et al*., 2019a). Presently, for urogenital schistosomiasis, a filtration technique using nylon, paper or polycarbonate filters is the standard diagnostic techniques (Houmsou *et al*., 2011). In addition, children with *S. haematobium* almost always have minute amounts of blood in their urine which can be detected by chemical reagent strips; therefore, microhaematuria is indicative of urogenital schistosomiasis in endemic communities (Houmsou *et al*., 2011). The WHO strategy for schistosomiasis control in areas where the disease is prevalent focuses on reducing disease through periodic, targeted treatment with Praziquantel through the large-scale treatment (preventive chemotherapy) of affected populations (WHO, 2018). In addition, a combination of access to safe water, improved sanitation, hygiene education, and snail control are expected to bring about sustained control of schistosomiasis(WHO, 2019).Without proper diagnosis of urogenital schistosomiasis in children, the disease may remain untreated and in women may

result in genital lesions, vaginal bleeding, pain during sexual intercourse, and nodules in the vulva. In men, chronic urogenital schistosomiasis can induce pathology of the seminal vesicles, prostate, and other organs. Other symptoms include fever, fatigue, malaise, and muscle aches (WHO, 2019). This study was therefore done to determine the prevalence of urogenital schistosomiasis among school aged children in Anam, Anambra West LGA of Anambra State.

MATERIALS AND METHODS

Study area: The study was carried out at Anam, Anambra West Local Government Area, of Anambra State, Nigeria. Anam is regarded as a semi-island bounded by River Anambra (Ọmambala), River Niger and River Ezichi (Figure 1). It is a community of eight farming and fishing settlements lying west of the Anambra (Omambala) River. These communities include: Mmiata Anam, Umuoba-Abegbu Anam, Umuenwelum Anam, Umueze Anam, Umudora Anam, Umuikwu Anam, Iyiora Anam and Oroma-Etiti. Annual rainfall of more than 2500mm and the rich soil makes this area one of the food baskets of Nigeria. Farming and fishing activities constitute potential risk factors for water-borne diseases, especially schistosomiasis, in the area.

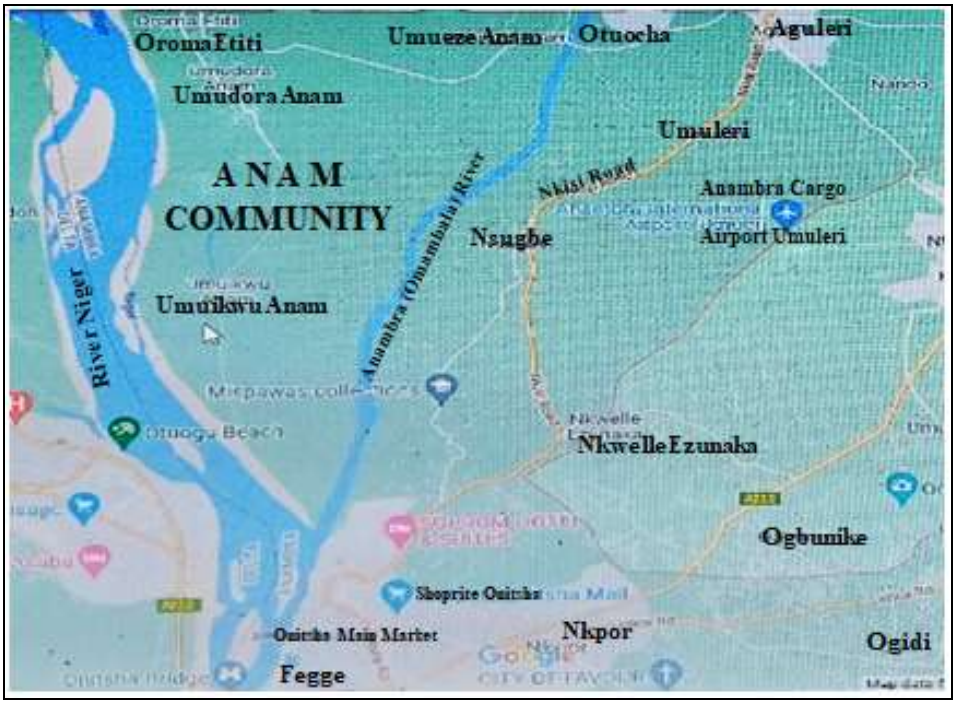


Figure 1: Google map of Anam Community, Anambra West Local Government Area of Anambra State (Adapted from: https://www.google.com/maps/place/...)

Study design: A cross-sectional study was carried out on urogenital schistosomiasis prevalence among the students at Community Secondary School, Anam. Located in Umuikwu Anam. The study was carried out from April – May 2021.

Study Population: Study population comprised all students (N=347) enrolled in Community Secondary School Anam for the 2020/2021 academic year.

Sample size determination: Sample size formula $n = \frac{N}{1+N(e^2)}$ (Rao and Scott, 1992) where n is minimum sample size, N is study population, e is error term, 0.05 at 95% confidence interval, was used to determine the sample size for the study.
Therefore, minimum sample size
$n = \frac{347}{1+(347\ x\ 0.05^2)} = \frac{347}{1+0.8675} = \frac{347}{1.8675} = 186.$
Since a larger sample size will ensure a more accurate and reliable result, therefore 200 students that volunteered to participate in the study were recruited.

Ethical Considerations: A visit was made to the traditional ruler, opinion leaders and the Principal of Community Secondary School Anam, for their permission and cooperation to carry out the study. Oral informed consent was obtained from the students and their parents for participating in the study after a brief health talk was given to them on the impact of schistosomiasis on children.

Urine sample Collection: Students were instructed on how to collect terminal urine. Each student was then given a 20 ml universal bottle labeled with their unique identification number, age, and gender. The urine samples were collected between 10am to 11 am to coincide with the peak egg shedding period (10 am – 2 pm) for *Schistosoma haematobium* (Cheesbrough, 2019). Urine samples were placed in a cooler containing ice cubes and transported to Parasitology and Entomology Laboratory, Nnamdi Azikiwe University Awka, Anambra State.

Urine sample examination for haematuria and proteinuria: Urine samples were tested with paper strips (dipstick). The specific interests in this study were presence of blood in urine (microhaematuria) and proteins in urine (proteinuria) using Medi Test combi 9 (Macherey-Nagel GmbH & Co.KG, Germany) reagent strips for the determination of micro haematuria and proteinuria.

Urine sample examination for parasite eggs: In the laboratory, each specimen bottle containing urine was shaken properly and 10 ml of each urine sample was poured into a test tube and centrifuged at 3,000 rpm for 5 minutes. The supernatant was decanted, leaving the sediment. The centrifuge tube was shaken to obtain a homogenous mixture, then a drop of the sediment was placed on a glass slide and examined microscopically using ×40 objective lens. *Schistosoma haematobium* egg observed was identified by the presence of its ovoid shape and sharp terminal spine (Chessbrough, 2019).

Data Analysis:
Prevalence of urinary schistosomiasis with respect to age and gender were calculated as $\left[\left(\frac{no.\ infected}{no.\ examined}\right) \times 100\right]$ while Chi-square was used to test homogeneity between gender and among age-groups studied with(p<0.05)considered statistically significant. MS Excel Chart Wizard was used to prepare Bar Charts with standard error bars showing significant differences ($p < 0.05$) among variables.

RESULTS
Overall percentage distribution of students examined according to age-groups and gender are shown in Figure 2.revealed that, of the total 200 (100 %) students examined, 92 (42%) were male while 102 (58%) were female. The age group 9-11

years had the highest distribution while the age group 18-20 years had the lowest distribution.

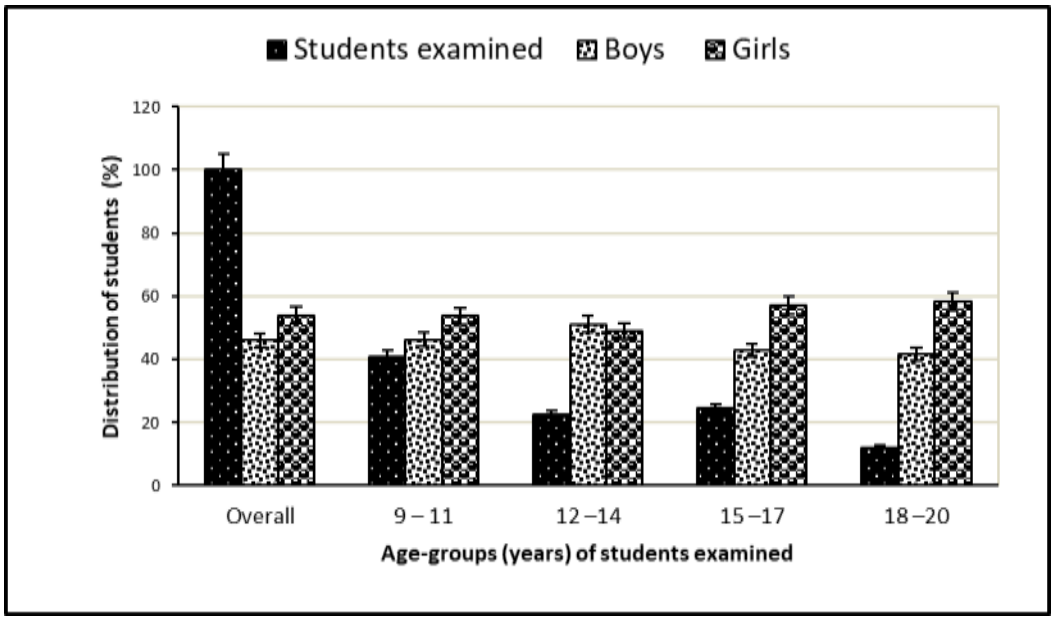


Figure 2: Overall Age distribution of students examined

Ovoid eggs of *Schistosoma haematobium*, with characteristic terminal spines (Plate 1) were observed in urine samples of 41 out of 200 students examined (Overall prevalence = 20.5%).

In addition, microhaematuria was found in sample of the 14 (15.2%) boys that tested positive for the presence of schistosome eggs in urine. Microhaematuria was found in samples of some females 13 (8.5%) that tested positive for the presence of schistosome eggs and in urine samples of some females 5 (2.5%) that tested negative for the presence of schistosome eggs. Proteinuria was found in 68 (34%) of urine samples examined and comprised of 32(16%) males and female36(18%) samples.

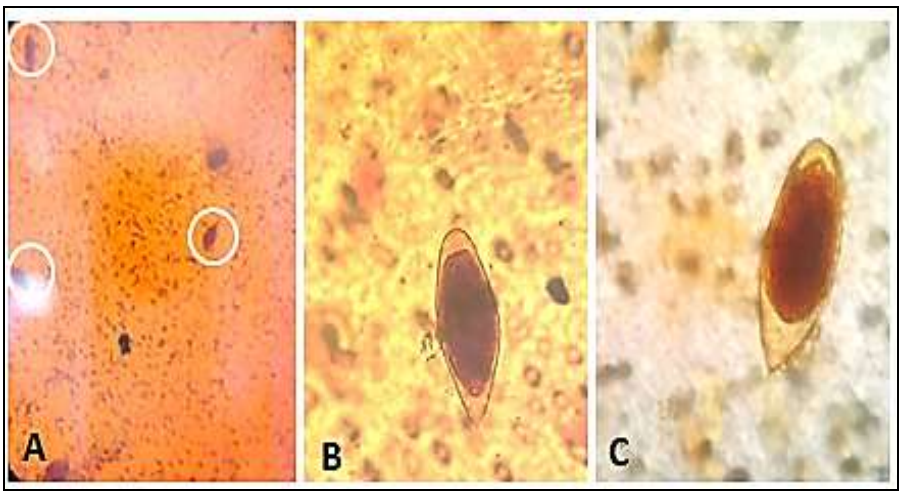


Plate 1: Characteristic ovoid *Schistosoma haematobium* eggs with terminal spines observed in sampled urine. Encircled eggs [A],zoomed eggs [B] and [C]

The overall prevalence of urogenital schistosomiasis according to age-groups and gender of students examined are shown in Figure 3 revealed that, of the total prevalence of 41 (20.5 %) with age group 9-11 years having the highest prevalence of 21(25.6%) and age group 18-20 years having the least prevalence of 3 (12.5%).The prevalence between sexes and age group was statistically significant ($p<0.05$).

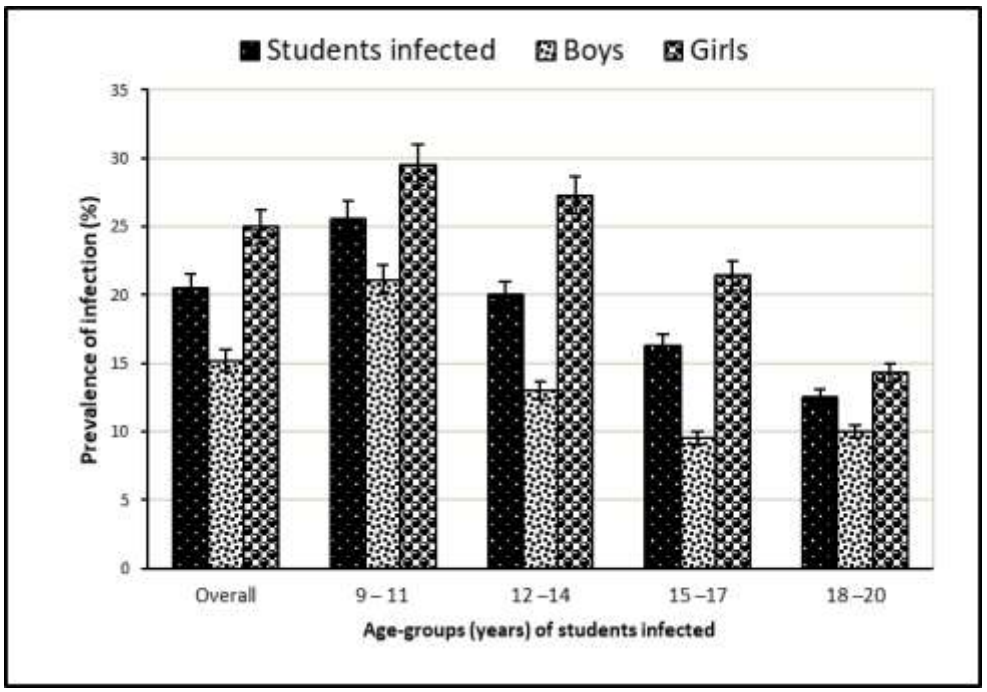


Figure 3: Prevalence of urogenital schistosomiasis in students examined

DISCUSSION

Our present study revealed a high prevalence of urinary schistosomiasis in younger school children and a decreased prevalence as they approached adulthood. Differences in prevalence with age could be due to the fact that young children and adolescents tend to be more adventurous (Dawaki *et al*., 2016) and as a result visit water bodies with their peers to swim or fish thereby making them more susceptible to *S. haematobium* infection.

Contrastingly, in a related study at Omogho, a rice producing community in Anambra State, Iwueze *et al*. (2018) reported an overall *Schistosoma haematobium* infection of 18.1%, with boys having higher prevalence of 11.6% than girls (6.5%). These authors (Iwueze *et al*., 2018) also observed infection rates of 8.2% in 15-19 years age-group, followed 5.6% in 10-15 years age group, and least in 20-24 years age-group with 0.9%. Earlier observations at Okija in Anambra State (Okwelogu *et al*., 2012) also showed that a total of 24% of children (males 14.7%and females 9.3%) aged between 5 and 19 years examined were positive for urinary schistosomiasis, and that 8 to13 year old accounted for 52% of all infections recorded. Chikwendu *et al*. (2019) also reported higher *S.*

haematobium prevalence in males than in females among school aged children in Oju LGA, Benue State, Nigeria.

Findings in this present study were in agreement with Moira *et al*. (2010) who reported that children are more susceptible to schistosomiasis than adults. In this case (Moira *et al*., 2010), after experimental exposure to cercariae, adults were found to be less susceptible leading to the suggestion that adults in endemic communities have acquired a form of resistance to *S. haematobium* infection due to childhood exposure. Ojo *et al*. (2021) also reported age related prevalence among school children in South-west Nigeria, with males having a significantly higher *S. haematobium* prevalence than females. In Mbogwe District Council of Tanzania, no significant difference in prevalence was reported among adult women of reproductive age (Rite *et al*., 2020) though our present study was on school children only.

Unlike in other parts of Nigeria such as Oju (Chikwendu *et al*.,2019b), Omogho (Iwueze *et al*., 2018) and Okija (Okwelogu *et al*., 2012), results from this present study indicated that gender related prevalence of urinary schistosomiasis was significantly higher in females than in males. Higher prevalence in females could be as a result of females regularly visiting natural water bodies to carryout domestic chores like washing clothes and fetching water for cooking and other household activities. Higher prevalence of urinary schistosomiasis infection among females as recorded in this study, coupled with the fact that females after long-term exposure to urinary schistosomiasis could develop female genital schistosomiasis (FGS) which affects their reproductive health (Masong *et al*., 2021), calls for an emphasis in treatment of females against the disease. Similarly, Gyuse *et al*. (2010) reported higher prevalence in females than males among school children in Ikoko-Ijesa and Aye-Oba communities, Osun State, which the authors attributed to higher water contact activities by females than males. However, Hajissa *et al*. (2018) reported no significant difference in schistosomiasis prevalence between male and female primary school children in Sudan where the authors identified proximity from water source as a major risk factor for the schistosomiasis in the area.

Proteinuria and microhaematuria were observed in urine samples of both males and females. Microhaematuria was more specific for the presences of urogenital schistosomiasis in males than in females. This could be because that the presence of blood in urine among young females could not only be due to presence of urogenital schistosomiasis infection but may also be as a result of menstruation. The loss of protein in urine (proteinuria) is a serious morbidity that could lead to protein deficiency anaemia if left untreated for prolonged periods in children. According to Chikwendu *et al*. (2022), proteinuria is one morbidity that may not be completely reversed even after annual chemotherapy with praziquantel for this reason, chronic schistosomiasis infection among children should be avoided at all costs. Houmsou *et al*. (2011) in a study conducted in Buruku and Katsina-Ala LGAs Benue State reported that proteinuria and microhaematuria could be used to estimate both prevalence and intensity of *S. haematobium* infection.

Younger school aged children 5-15 years are the main targets for annual MDA with Praziquantel for the control of schistosomiasis (WHO, 2018). It is however important to note that if schistosomiasis is not treated in children even though egg output may become significantly reduced or even stop completely as they grow older, secondary morbidities due to *S. haematobium* infection may linger for years leading to complications like female genital schistosomiasis (FGS) in women of reproductive age and infertility in males, kidney, and bladder cancers (Masong *et al*., 2021). Morbidities at an older age may not be easily reversed by praziquantel treatment alone

CONCLUSION

Urogenital schistosomiasis remains a public health concern in the study area. In order to ensure good health and promote wellbeing for all genders and all age groups in line with sustainable development goal 3,increased efforts for control of schistosomiasis should be made in Anam community particularly targeting at risk gender (females) and susceptible age groups in the study area and elsewhere in Nigeria.

REFERENCES

Center for Disease Control (2012). Parasites and Health: Schistosomiasis. http://www.dpd.cdc.gov/dpdx/html/schistosomiasis.htm. Accessed December 11, 2021

Cheesbrough, M. (2019).District Laboratory Practice in Tropical Countries.2nd Edition Update.Part1. Cambridge University Press, London.56pp.https://prithvibooks.com/product/district-laboratory-practice-in-tropical-countries-part-1-by-monica-chessbrough/

Chikwendu, J.I., Onekutu, A., Ogbonna, I.O. and Amuta, E.U. (2019a). Association between *Schistosoma Manson* infection rates in humans and in *Biomphalaria pfeifferi* snails in Akwanga, Nasarawa State, Nigeria. South Asian Journal of Research in Microbiology, 5(1): 1-8.https://doi.org/10.9734/sajrm/2019.v5i1-230118

Chikwendu, J.I., Atsuwe, T.S., Obisike, V.U. and Igbor, O.E. (2019b).Prevalence and distribution of urogenital schistosomiasis and trichomoniasis in Oju LGA, Benue State, Nigeria. South Asian Journal of Parasitology,2(4):1-5. Retrieved from: https://journalsajp.com/index.php/SAJP/article/view/30081

Chikwendu, J. I., Ngenegbo, U. C., Obisike, V. U. and Ikpeze, O. O. (2022). Molecular and other diagnostic tools used to compare Schistosoma haematobium infections in pupils before and after praziquantel therapy. *Global Scientific Journals* 10(1): 179-88https://www.globalscientificjournal.com/researchpaper/

Colley, D.G., Bustinduy, A.L., Secor, W.E and King, C.H. (2014).Human schistosomiasis. Lancet, 383(9936):2253-64. http://doi:10.1016/s0140-6736(13)61949-2

Dawaki, S., Al-Mekhlafi, H.M., Ithoi, I., Ibrahim, J., Abdulsalam, A.M., Ahmed, A., Sady, H., Atroosh, W.M., Al-Areeqi, M.A., Elyana, F. N., Nasr, N. A. and Surin, J. (2016).Prevalence and risk factors

of schistosomiasis among Hausa communities in Kano State, Nigeria. Revista do Instituto de Medicina Tropical de Sao Paulo,58:54-62https://doi.org/10.1590/S1678-9946201658054

Gyuse, K.I., Ofoezie, I.E and Ogunniyi, T.A. (2010). The effect of urinary schistosomiasis on the health of children in selected rural communities of Osun State, Nigeria. *Journal of Tropical Medicine and Parasitology*, 33: 7-16.URL:http://www.ptat.thagov.net/contents/

Hajissa, K., Muhajir, A.E., Eshag, H.A., Alfadel, A., Nahied, E., Dahab, R., Ali, S.M., Mohammed, M., Gaafar, M. and Mohamed, Z. (2018). Prevalence of schistosomiasis and associated risk factors among school children in Um-Asher Area, Khartoum, Sudan. BMC Research Notes, 11:779-788. https://doi.org/10.1186/s13104-018-3871-y

Houmsou, R.S., Kela, S,L. and Suleiman, M.M. (2011). Performance of microhaematuria and proteinuria as measured by urine reagent strips in estimating intensity and prevalence of *Schistosoma haematobium* infection in Nigeria. Asian pacific Journal of Tropical Medicine, 4:997-1000https://doi.org/10.1016/S1995-7645(11)60233-2

Houmsou, R.S., Agere, H., Wama, B.E., Bingbeng, J.B., Amuta, E.U. and Kela, S.L. (2016).Urinary schistosomiasis among children in Murbai and Surbai Communities of Ardo-Kola Local Government Area, Taraba State, Nigeria. Journal of Tropical Medicine, Article ID 9831265.https://doi.org/10.1155/2016/9831265

Ikpeze, O.O., Eze, G.C., Ngenegbo, U.C., Obikwelu, M.E., Nri, Mary-Jane and Ubaka, A.U (2020).Some physico-chemical parameters of Atavu River that influence gastropod density at Amagunze Nigeria. *South Asian Journal of Parasitology*,4(4):64-79.www.https.//journalssajp.com/index.php/sajp/article/download/30131/56538/

Iwueze, M.O., Anakenyi, A.M., Ezeagwuna, D.A and Ikpeze, O.O. (2018).Urinary schistosomiasis diagnosed among children of Omogho in Nigeria. The Diagnostics, 2(1):34-39. https://www.thebiomedicaldiagnostics.org

Ligasova, A., Bulantova, J., Sebesta, O., Kasny, M., Koberna, K. and Mikes, L. (2011).Secretory glands in cercaria of the neuropathogenic schistosome Trichobilharzia regent – ultrastructural characterization, 3-D modeling, volume, and pH estimations. Parasites and Vectors,4:162 https://doi.org/10.1186/1756-3305-4-162

Masong, M.C., Wepnje, G.B., Mariene, N.T., Gamba, V., Mengue, M., Kouokam, E., Stothard, J.R. and Ekobo, A.L. (2021). Female genital schistosomiasis (FGS) in Cameroon: A formative epidemiological and socioeconomic investigation in eleven rural fishing communities. PLOS Global Public Health 1(10):e0000007.https://doi.org/10.1371/journal.pgph.0000007

Moira, P.A., Anthony, J.C. Fulford, A.J., Kabatereine, N.B., Ouma, J.H., Booth, M., and Dunne, D.W. (2010). Analysis of complex patterns of human exposure and

immunity to *Schistosoma mansoni*: The influence of age, sex, ethnicity and IgE. PLoS Neglected Tropical Diseases, 4(9):e820.https://doi:10.1371/journal.pntd.0000820

Ojo, J.A., Adedokun, S.A., Akindele, A.A., Olorunfemi, A.B., Otutu, O.A., Ojurongbe, T.A. Thomas, B.N., Velavan, T.P. and Ojurongbe, O. (2021). Prevalence of urogenital and intestinal schistosomiasis among school children in South-west Nigeria. PLoS Neglected Tropical Diseases,15(7):e0009628.https://doi:1371/journal.pntd.0009628

Okwelogu, I.S., Ikpeze, O.O., Ezeagwuna, D.A., Aribodor, D.N., Nwanya, A.V., Egbuche, C.M., Okolo, K.V and Ozumba, N.A (2012).Urinary Schistosomiasis among School Children in Okija, Anambra State, South-Eastern Nigeria. Scholarly Journal of Biological Science, 1(1):1-6. Available online http://www.scholarly-journals.com/SJBS

Ossai, O.P., Dankoli, R., Nwodo, C., Tukur, D., Nsubuga, P., Ogbuabor, D., Ekwueme, O., Abonyi, G., Ezeanolue, E., Nguku1, P., Nwagbo, D., Idris, S. and Eze, G. (2014). Bacteriuria and urinary schistosomiasis in primary school children in rural communities in Enugu State, Nigeria. Pan African Medical Journal, 15:1-5. https://doi:10.11694/pamj.supp.2014.18.1

Pennington, L.F. and Hsieh, M.H. (2014).The immunology of urogenital schistosomiasis. Immunity of Helminthes and Novel Therapeutic Approaches, 2:93-124.https://www.researchgate.net/publication/269464014

Rao JN, Scott AJ. (1992). A simple method for the analysis of clustered binary data, Biometrics, 1992 Jun; 48(2):577-585. PMID: https://www.pubmed.ncbi.nim.nih.gov

Rite, E.E., Kapalata, S.N. and Munisi, D.Z. (2020). Prevalence, intensity, and factors associated with urogenital schistosomiasis among women of reproductive age in Mbogwe District Council, Geita Region, Tanzania. BioMed Research International, Article ID 5923025.https://doi.org/10.1155/2020/5293025

WHO (2019).World Health Organization. Prevention and control of schistosomiasis and soil-transmitted helminthiasis.Geneva.http://apps.who.int/iris/bitsrem/10665/42588/html