UROGENITAL SCHISTOSOMIASIS AND ASSOCIATED RISK FACTORS AMONG WOMEN IN THE THREE(3) SENATORIAL ZONES OF ANAMBRA STATE

.

ABSTRACT

Background
Urogenital Schistosomiasis, a trematode infection (*schistosoma haematobium*) is endemic to Nigeria. The disease results in urogenital consequencies such as cancer and infertility among others.

Aim of the study
This study determined the status of urogenital schistosomiasis among women in the three senatorial zones of Anambra State, Nigeria.

Methodology
This is a cross-sectional study involving 500 women randomly selected in some selected communities of the 3 senatorial zones of Anambra State. The study was conducted between October 2023 and March 2024,in six communities namely Omogho, Oraifite,Agulu, Achalla, Nsugbe and Awkuzu. 500 urine samples were collected from the 500 women who consented, the urine samples were checked for haematuria using combi 9 dipstick,they were centrifuged for 10 minutes at 1500rpm, and the deposit was viewed under x40 microscope objective to detect *S. haematobium* eggs. Data on socio-demographic characteristics and risk factors were obtained through a well-structured questionnaire. Statistical Package for the Social Sciences (SPSS) version 25 was used for analysis, with statistical significance established at p-values less than 0.05.

Results
Urogenital schistosomiasis was found in 56(11.2%) of women in the three senatorial zones. Anambra south senatorial zone had the highest prevalence of 22(12.9%), while Anambra Central had the lowest prevalence 17((9.9%) each. Women of age group 16-20 years had the highest 30(34.5%) urogenital Schistosomiasis infection, and the highest haematuria11(12.6%), the difference in infection rate according to age is statistically significant $p<0.05$, $p=0.000$.women with low educational level had more infection, the difference in infection according to academic level is statistically substantial $p<0.05$. Women who had water contact through swimming or bathing in the infected water bodies had the highest prevalence 50 (12.4%),other risk factors include nearness to streams, use of infested water bodies as main water sources 51(12.8%).

Conclusion
The present study indicated that urogenital Schistosomiasis is endemic in Anambra State, MDA should extend to everybody in endemic communities. Continous health education should be implemented.

Keywords: PHCs, CHEW, Female, genital, Schistosomiasis.

INTRODUCTION

Urogenital schistosomiasis is a significant public health challenge, especially in sub-Saharan Africa caused by *Schistosoma haematobium*. This parasitic disease spreads through contact with fresh water contaminated by snails carrying infective larvae known as cercariae and results in various health problems [2].
Nigeria shoulders a substantial burden of Urogenital Schistosomiasis within sub-Saharan Africa[3]. Around 101 million individuals in Nigeria are at risk due to the endemic spread of the infection across the 36 states [4], mostly school-aged children and adolescents [5][6]

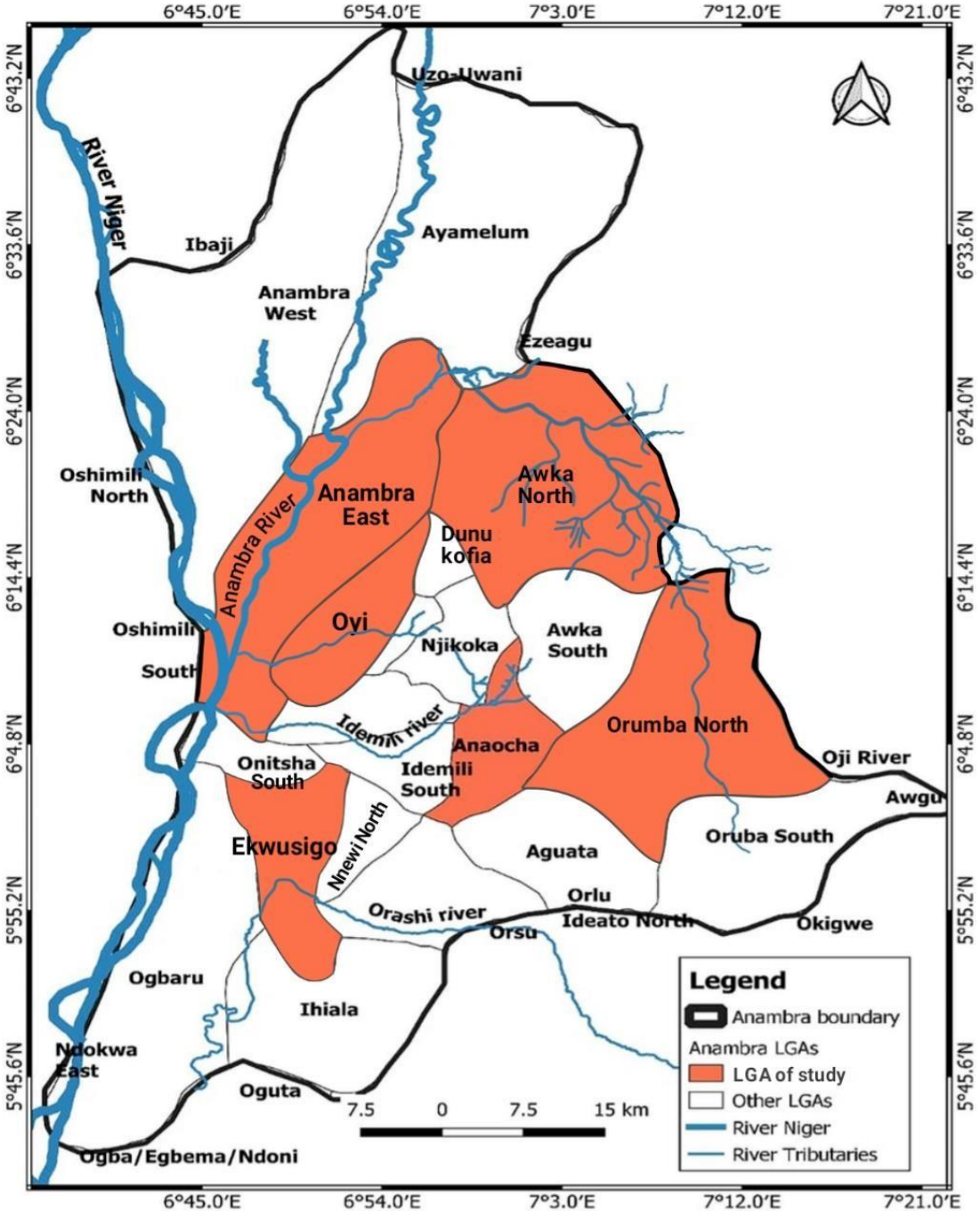
The prevalence of Urogenital Schistosomiasis in Nigeria varies from region to region, with some areas having much higher prevalence [7][8][9][10] than others. One major risk factor for Urogenital Schistosomiasis transmission is engaging in activities which has to do with coming in contact with water bodies where infected snails are present [4].
Sociocultural and behavioural factors such as cultural barriers [11][12], misinformation [13], misconceptions and poor health-seeking behaviours [14] perpetuate transmission. Environmental factors,for urogenital Schistosomiasis epidemiology and distribution include temperature, altitude, rainfall, and land use cover. Whereas rainfall provides temporary snail habitats [15], water level, temperature and height, influence the survival and reproduction of intermediate host snails.
Socio-demographic factors such as age [16][17] and gender may also affect the prevalence of infection. Children and young adults at school have an increased risk of infection because they interact with water frequently [18]. Additionally, the internal migration of those who have been displaced by flooding, unrest, and insurgencies may aid in the disease's spread [7].

Haematuria, or blood in the urine, and chronic inflammation brought on by eggs stuck in the tissues of the pelvic organs—the bladder, lower uterus, cervix, vagina, prostate gland, and seminal vesicles—are among its characteristic symptoms, others include vaginal discharge, pelvic and abdominal pain, postcoital bleeding, and pathologies such as bladder and cervical cancers[19][20][21]. In Anambra State few studies were carried out on urogenital shistosomiasis on women hence this study evaluates the status and risk factors of urogenital schistosomiasis among women in the three senatorial zones of Anambra State.

MATERIAL AND METHODS

2.1 Study area

This study was carried out in Anambra state. Anambra state is located in latitude 6.2758 N and longitude 7.0068E, with a population of 4182,032 according to the 2006 Nigeria census[22]. It has an area of 1774 square meters. Anambra state has a tropical wet and dry or savanna climate with a yearly temperature of 28.99c (84.18F).It has about 212.36mm of rain and 243.38 rainy days annually.(weather and climate. Com),(FIG. 1, Map of Anambra State) showing the study areas. The study areas are bounded by streams and rivers where indigenes do their daily chores like bathing and washing. These freshwater bodies provide suitable habitats to snails which are intermediate hosts of Schistosomes.



Map of Anambra State Showing the Selected Local Government Area for the Study (Source: Geography Information System Laboratory, Department of Estate Survey and Geo informatics, Nnamdi Azikiwe University, 2023)

2.2 Study Design

The study was carried out at the 3 senatorial zones of Anambra State. Two LGAs were selected from each senatorial zone,and one community was selected from each LGA. In Anambra North Senatorial Zone of Anambra State,(Oyi and Anambra East),in Anambra South senatorial zone,(Orumba North and Ekwusigo) while in Anambra central senatorial zone, (Anaocha and Awka North LGAs) were selected. Previous studies implicated these communities as endemic areas for urogenital schistosomiasis [27][41][23]. The study was a cross-sectional study conducted from October 2023 to March 2024.

2.3 **Study population**

The study population consisted of 500 adolescents and women aged between 16 and 50 years who consented and were residents of Agulu-Anaocha; Achalla –Awka North; Oraifite –Ekwusigo; Omogho –Orumba North; Nsugbe- Anambra East and Awkuzu-Oyi.
communities.

2.4 **Inclusion Criteria**

Inclusion criteria, all women who volunteered, all women from ages 16-50year and all women who have lived in the community for at least 10 years.

2.5 Exclusion criteria

Women who are not aged 16- 50 years, women who have not lived in the community for 10years,and women who did not consent

2.6 **Sample Size Estimation**

The sample size for this study was calculated by Yamane's formula [22]. The formula used for the calculation is $n=N/1+N(e^2)$

where n =sample size

N=total population:

From 1991 population census , Number of females in Omogho is 1664:

Number of females in Nsugbe 8,314

Achalla Females 7017

Agulu 25737

Oraifite 13,552

Awkuzu 14431

Total population =70715

e=error term at 95% confidence interval which is 0.05

$n=70715/1 +70715(e^2)$

n= 398 approximately The sample size for the study was 500 individuals

2.7 Sample collection and parasite egg determination

Participants were provided with 20ml sterile containers strictly labelled with specific identification numbers to avoid mix up. Ten ml mid-stream urine samples were collected from each participant between 10 am and 2.00 pm ,a period known for maximum Schistosome egg extraction[42]. Reagent strip (Meditest Combi 9 test strip, manufactured by Macherey-Nagel GmbH and Company, Germany) was immersed in the urine sample within 60 seconds to check for haematuria. The samples were preserved with 10% formaldehyde, chilled on ice packs and transported to the laboratory of Parasitology and Entomology Department of Nnamdi Azikiwe University. The urine samples were centrifuged at 1500rpm for 10 minutes in a model benchtop centrifuge and sediments were examined at x 40 magnification. [23] *S. haematobium* eggs were identified and confirmed by Prof. CA Ekwunife before they were recorded.

2.8 **Associated Risk factors Data collection**

During sample collection, questionnaires were administered too for information on risk factors, participants were given structured questionnaires, the information on their activities was matched with the observed prevalence to determine the factor that predisposes them to higher infection.

2.9 **Data Analysis**

Data from the study was summarized using tables. Chi- square(x) a test was used to compare the prevalence of urogenital Schistosomiasis concerning age, senatorial zones etc, the Statistical Package for the Social Sciences (SPSS) version 25 was used for analysis, with statistical significance established at p-values less than 0.05.

3.0 RESULTS

3.1 Demographic data of the sampled women

Out of 500 women that participated in the study, the highest number 204(40.8%), was from the age range 46-50years while the least number 5(1.0%) represented the age range of 21-25years(Table1).Other factors are seen in Table 1.

Table 1: Demographic data of respondents:

Age group	**No. examined**	**%**
16-20	87	17.4
21-25	5	1.0
26-30	23	4.6
31-35	20	4.0
36-40	38	7.6
41-45	123	24.6
46-50	204	40.8
Total	500	100%
Location by senatorial zones		
Anambra South	170	34.0
Anambra North	158	31.6
Anambra Central	172	34.4
Total	500	100%
Location by study sites		
Omogho	88	17.6
Oraifite	82	16.4
Nsugbe	78	15.6
Awkuzu	80	16.0
Agulu	73	14.6
Achalla	99	19.8
Total	500	100%
Marital status		
Married	401	80.2
Widowed	46	9.2
Single	103	20.6
Total	500	100%
Education status		
Informal	82	16.4
FSLC	193	38.6
WAEC	177	35.4
Higher school	48	9.6
Total	500	100%
Occupation		
Farming/Fishing	313	62.6
Student	85	17.0
Trading	102	20.4
Total	500	100%

3.2 Infection rate of urogenital schistosomiasis by age

Prevalence and intensity of *schistosoma haematobium* by age is shown on table 2.The overall *schistosoma haematobium* prevalence among the studied individuals was 56(11.2%). However the highest *schistosoma haematobium* prevalence is recorded among the age group of 16-20 years which was 30(34.5%),21-25 age range had no prevalence *of S. haematobium* 0(0.0%). the difference in infection rate according to age is statistically significant (p<0.05),p=0.000 as shown on(Table 2).

Table 2 : Infection rate of urogenital Schistosomiasis by age

Age group (yrs)	Total No. examined	S.haema. (%)	Microhaematuria(%)
16-20	87	30 (34.5)	11(12.6
21-25	5	0 (0)	0(0)
26-30	23	3 (13.0)	2 (8.7)
31-35	20	2 (10.0)	0 (0)
36-40	38	5 (13.2)	0(0)
41-45	123	5 (4.1)	5(4.1)
46-50	204	11 (5.4	6(2.9)
Total	500	56	24

3.3 Infection rate of urogenital schistosomiasis by Location by senatorial zones

On prevalence by senatorial zones where Anambra South had the highest prevalence of 22(12.9%) and highest intensity, while Anambra Central had lowest prevalence of17(9.9), Difference due to senatorial zones was not statistically significant.(p<0.05). p=0.65

Table 3a:Infection rate of urogenital Schistosomiasis by Location by senatorial zones

Location	Toatal No examined	S. haem.+ve (%)	Micro haematuria (%)
Anambra South	170	22(12.9)	12(7.1
Anambra North	158	17(10.8)	5(3.2)
Anambra Central	172	17(9.9)	7(4.1)
Total	500	56	24 (14.4)

3.4 Infection rate of urogenital Schistosomiasis by study sites

Prevalence by location by study sites had the highest prevalence of 16(18.2%) at Omogho , while Oraifite had lowest prevalence of 6(7.3%), The Difference due to study sites was not statistically significant.(p<0.05) p=0.178 see table 3b.

Table 3b Infection rate of urogenital Schistosomiasis by study sites

Location by sites	Total No examined	S. haem.(%)	Microhaematuria (%)
Omogho	88	16 (18.2)	10(11.3)
Oraifite	82	6(7.3)	0(0)
Nsugbe	78	11(14.1)	2(2.6)
Awkuzu	80	6(7.5)	5(6.3)
Agulu	73	7(9.6)	5(6.8)
Achalla	99	10(10.1)	2 (2.0)
	500	56	24

3.5: Infection rate of urogenital schistosomiasis by Educational status

Women with Informal education had the highest infection rate 24(29.3) and the highest microhaematuria 10(12.2), while WAEC had the lowest infection rate. The difference in infection rate due to education was statistically significant.($p<0.05$), $p=0.000$. see table 4

Table 4: **Infection rate of urogenital Schistosomiasis by Education status**

Education status	Total No examined	*S. haematobium.* (%)	Microhaematuria (%)
Informal	82	24(29.3)	10(12.2)
FSLC	193	19(9.8	10(5.2)
WAEC	177	9(5.1)	4(2.3
Higher School	48	4(8.3)	0(0)
Total	500	56	24

3.6: Infection rate of urogenital schistosomiasis by Marital Status

Widows had the highest percentage of infection rate 12(26.1%) and haematuria 7(15.2%).While married women had the lowest 30(7.3%) infection rate the difference is statistically significant. $P=0.001$, ($p<0.05$).see table 5

Table 5 Infection rate of urogenital Schistosomiasis by Marital Status

Marital Status	Total No. examined	*S. haematobium.* (%)	Microhaematuria (%)
Married	351	30 (7.3)	3(0.9)
Widowed	46	12 (26.1)	7(15.2)
Single	103	14 (13.6)	14 (13.6)
Total	500	56	24

3.7: Infection rate of urogenital Schistosomiasis by Occupation

Women who engage in Farming and fishing had the highest infection rate 44(14.1%) while traders had the lowest infection rate 4(3.9%), the difference is statistically significant.($p<0.05$),$p=0.016$.see table 6.

Table 6: Infection rate of urogenital Schistosomiasis by Occupation

Occupation	Total No. examined	S.haem. (%)	Microhaematuria (%)
Farming/ Fishing	313	44 (14.1)	15(4.8)
Student	85	8(9.4)	4(4.7)
Trading	102	4(3.9)	5(4.9)
	500	56	24

3.8: Relationship between prevalence and risk factors

The significant risk factors associated with *S. haematobium* infection include frequent contact with infected freshwater bodies (rivers/steams), washing/swimming and fishing. As expected, these results indicate a link between water contact and infection prevalence. Women who use stream/river as water sources had highest infection 12.8% ,Women who swim, bath and wash in these water bodies had highest infection rate 50(12.4%), and those living near water body had a higher infection 12.1%,While those that use rainwater had the lowest infection rate 4.6%.Indiscriminate activities of defecating and urinating into water bodies posed a risk for perpetuating transmission of infection. See Table 7

Table 7: Relationship between prevalence and Risk factors

Source of domestic water source	Yes	No infected	%	NO	No infected	%
River/stream/lake	391	50	12.8	109	6	5.5
Borehole	53	3	5.6	447	53	11.8
Rain water	48	2	4.16	452	54	11.9
Water activity						
Swimming/bath/wash	402	50	12.4	98	6	6.1
paddy farming	447	54	12.1	53	2	3.8
Fishing	471	55	11.7	29	1	3.4
Indiscriminate activity in the water						
Urinating/daefecating	323	54	16.7	177	2	1.1
Water proximity						
Near(<1km)	423	51	12.1	77	5	6.5
Far(>1km)	47	4	8.5	453	52	11.5

Discussion

The overall prevalence of urogenital Schistosomiasis among women studied in Anambra State was 56(11.2%).This prevalence of infection was generally lower as compared to what was reported in the study conducted in the Mwanga district, Kilimanjaro region northern Tanzania among reproductive women where the prevalence was 36% [24] and in Volta basin of Ghana prevalence was 24.8% [25].However, the prevalence reported in this study is more or less similar to what was reported in a study conducted in Sengerema and Misungwi district north-west of Tanzania where the prevalence was 5% [26]. This rate is notably higher compared to recent studies by[27] in Anambra State and indicates the need for revised intervention strategies. This incidence may have been influenced by the omission of adult women from mass drug administrations (MDAs) programs, which primarily target elementary school-aged children. According to earlier research [28], this selective approach impedes control efforts since sick adults act as community reservoirs for the disease. In comparison to other Nigerian regions where MDAs have effectively covered school-aged children (5–14 years), the overall prevalence of Urogenital Schistosomiasis in this study is lower than in the following studies- [29][30][31].

From this study women aged 16–20 years had the highest prevalence, which may be attributed to their increased involvement in water-related activities that bring them in contact with infested water bodies, this observation is in accord with the studies of[32][9][33][23][34]. It is a general characteristic of helminths infections, urogenital schistosomiasis being one of them, that the prevalence of infection varies significantly from one place to another according to variation in exposure pattern even in places close to one another[26]. In this study, it was observed that Anambra South senatorial zone had a relatively higher prevalence of infection as compared to other zones. The observed relatively higher prevalence of infection in the zone is likely due to a higher level of exposure to cercarial infested water bodies as a result of high engagement in activities such as farming and fishing in the rivers, however this difference in infection rate according to location was not statistically significant $p>0.05$, $p=0.172$.

This study showed that urogenital schistosomiasis was more prevalent among women who had no formal education and those with a primary level of education compared to those who had secondary school and higher school level of education.($p<0.05$). This observation is in line with other studies by [35]. It has been suggested that, education may affect attitudes and behaviours with individuals with low educational status being more likely to cross a stream or river barefoot than their more educated counterparts,[36] made similar observation. From this study it was observed that self-awareness of the disease may account for the relatively lower risk of the disease among women with secondary and higher school level of education as was observed by [37]. This mandates the need for health education in endemic communities to lower the overall risk of acquiring the disease by raising the community's level of awareness about the disease.

From this study high prevalence 50(12.4%) was observed among women with the habit of swimming in rivers, streams and lakes. This indicates that long duration of hours of water contact was considered as an important risk factor for exposure to urogenital Schistosomiasis rather than frequency of water contact, this is in line with study of [23] in Anambra State and [38].This study, showed that Schistosoma infection was found in a large proportion of women 50(12.8%) whose source of water for domestic use was stream/river/lake. This could be explained on the premises that majority of rural areas from which the women came from, had no access to protected water sources. They therefore stand the huge risk of Schistosoma infection from their exposure to cercariae infected streams and rivers when accessing these sources to obtain water for domestic use, this was also observed by [38]. Similar findings were made by [39] who observed that 58.9% of respondents whose source of water for washing was streams and 42.1% whose source of water for bathing was river had high prevalence of urogenital Schistosomiasis. [40] also made same observation. It was also observed in this study that defecating and urinating into water bodies enhance transmission of the infection by infesting the waters with the ova of *Schistosoma haematobium* and *S. mansoni*, these are then ingested by the intermediate snail hosts to perpetuate infection. This is in line with the studies of [23] and [34] in Anambra State Nigeria.

This study has some limitations that need to be considered for a comprehensive understanding of its findings. Firstly, the study's geographical scope was limited to only six communities of Anambra State although these represent the three senatorial zones of the state, they may not fully represent the urogenital schistosomiasis situation in other regions of

Anambra State, due to the focal nature of the disease. Secondly, the exclusion of males in the study could have resulted in underestimating the prevalence of urogenital schistosomiasis in these communities. To accomplish total eradication, a more thorough, all-encompassing MDA program to all sectors of the endemic community, including all males and females, is advised. This holistic approach will stop the problem of reinfection and transmission of urogenital Schistosomiasis and assist policymakers and healthcare providers in making decisions about resource allocation.

Conclusion

The study demonstrates that, despite a notable rise in the praziquantel treatment coverage index, schistosomiasis remains endemic in Anambra State.

This presents a significant health hazard, as the infected women who are not included in the MDAs could play a leading role in the spread of the disease. However, when compared to findings from earlier research, the observed decline in the disease's prevalence in the majority of the study locations indicates that recent efforts to combat the illness have been successful.

Declaration of Competing Interest

No conflict of interest.

AUTHORS' CONTRIBUTIONS

Author **OAO**' designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. 'Author **ECA**', **OCE**, **OAI** and 'Author **OIS**' managed the analyses of the study. 'Author **UCA** and Author **OEP**' managed the literature searches. All authors read and approved the final manuscript."

Ethical Approval and Consent to participate

Ethical approval was obtained from Nnamdi Azikiwe University Research and Ethics Committee. (NAUTH/CS/66/VOL.16/VER.3/231/2022/138).Permission for access to communities was obtained from directors of health departments of local government areas of the different towns, with introductory letter from the head of department of Parasitology and Entomology Nnamdi Azikiwe University. key stakeholders including traditional rulers and town union leaders were sensitized during advocacy visits to the community. Informed consent of participants enrolled in the study was duly obtained and confidentiality was maintained. Participation was voluntary and participants were free to withdraw from the study at any time without obligations

Acknowledgments

I am grateful to the community heads and women leaders that mobilized the women for this exercise. I am thankful to the "Primary Health Centres" (PHC) health workers for their assistance. I remain indebted to my amiable supervisor Prof CA Ekwunife for her mentorship

REFERENCES

1. Klohe K, Koudou BG, Fenwick A, Fleming F, Garba A, Gouvras A, (2021). A systematic literature review of schistosomiasis in urban and peri-urban settings. PLoS Neglected Tropical Diseases. 15(2):e0008995.

2. Peletu BJ, Ofoezie IE, Ikwuka AO. Attitude, knowledge, perception, behavioural, cultural and religious practices influencing transmission of urogenital schistosomiasis in Owena, Kajola and Baiken communities bordering Owena Reservoir/Dam, Ondo East Local Government Area, Ondo State, Nigeria. European Journal Med Health Sci. 2023;5(1):23–30.

3. Sibanda T, Makwikwi T.(2023).The prevalence and burden of urogenital schistosomiasis: a case study of Mount Darwin and Makoni districts in Zimbabwe. All Life.16(1):1–12

4. Ezeh CO, Onyekwelu KC, Akinwale OP, Shan L, Wei H. (2019).Urinary schistosomiasis in Nigeria: a 50-year review of prevalence, distribution and disease burden. Parasite. 26:19.

5. Ekwunife C, Nwaorgu O, Ukonze C, Ukaga C, Ezeunala M.(2014). Urinary schistosomiasis and health education in Anambra state of eastern Nigeria. International journal of Infectious Diseases.21:89.

6. Balogun JB, Adewale B, Balogun SU, Lawan A, Haladu IS, Dogara MM,(2022) Prevalence and associated risk factors of urinary schistosomiasis among primary school pupils in the Jidawa and Zobiya communities of Jigawa State, Nigeria. Annual Global Health. 88(1):71.

7. Enabulele EE, Platt RN, Adeyemi E, Agbosua E, Aisien MSO, Ajakaye OG.(2021). Urogenital schistosomiasis in Nigeria post receipt of the largest single praziquantel donation in Africa. Acta Tropics. 219:105916.

8. Njoku JC, Ajayi JA, Pitman SL, Dakul D, Njoku OM. (2014).Urogenital schistosomiasis in females from some suburban communities of Jos, north-central Nigeria. IOSR Journal of Pharmaceutical Biology Science. 9(33):69–79.

9. Abubakar B, Abubakar A, Moi I, Gagman H, Aminu MU, Katagum Y.(2022). Urinary schistosomiasis and associated risk factors among primary school students in the Zaki Local Government Area, Bauchi State, Nigeria. Dr Sulaiman Al Habib Medical Journal. 4:196–204.

10. Opara KN, Akomalafe RT, Udoidung NI, Afia UU, Yaro CA, Bassey BE.(2022). Urogenital schistosomiasis among primary school children in rural communities in Obudu, Southern Nigeria. International Journal of Maternal Child Health AIDS. 10(1):70–80.

11. Nwoke BEB, Dozie INS, Nwoke EA, Anosike JC.(2004). Human schistosomiasis and Nigerian environment and climate change. Journal Biology Resourse of Biotechnology. 2(1):1–11.

12. Bolaji OS, Adeyeba OA, Ojurongbe O, Odewale G, Ukaga CN. (2014).Water contact activities and socio-cultural factors on urinary schistosomiasis in rural area of Osun State, Nigeria. International Journal Res Applied Natural Social Sciences. 2(4):101–6.

13. Antwi S, Aboah KE, Sarpong CK.(2014). The unacknowledged impact of urinary schistosomiasis in children: 5 cases from Kumasi, Ghana. Ghana Medical Journal. 48(4):228–33.

14. Sacolo H, Chimabari M, Kalinda C.(2018). Knowledge, attitude and practices on schistosomiasis in sub-saharan Africa: a systematic review. BMC Infect Dis. 18:46.

15. Banhela N, Taylor M, Zulu S, Strabo L, Kjetland E, Gundersen S.(2017). Environmental factors influencing the distribution and prevalence of Schistosoma haematobium in school attenders of iLembe and uThungulu health districts, KwaZulu Natal Province, South Africa. South African Journal of Infectous Disease. 32(4):132–7.

16. Onyekwere AM, Rey O, Nwanchor MC, Alo M, Angora EK, Allienne JF.(2022). Prevalence and risk factors associated with urogenital schistosomiasis among primary school pupils in Nigeria. Parasite Epidemiology Control. 2022;18:e00255.

17. Sumbele IUN, Tabi DB, Teh RN, Njunda AL.(2021). Urogenital schistosomiasis burden in school-aged children in Tiko, Cameroon: a cross-sectional study on prevalence, intensity, knowledge and risk factors. Tropical Medical Health. 49(1):75.

18. Ayabina DV, Clark J, Bayley H, Lamberton PL, Toor J, Hollingsworth TD. (2021).Gender-related differences in prevalence, intensity and associated risk factors of Schistosoma infections in Africa: a systematic review and meta-analysis. PLoS Neglected Tropical Disease.15(11):e0009083.

19. Ekwunife, C.A., Okafor, F.C. and Nwaorgu, O.C. (2009). Ultrasonographic screening of urinary Schistosomiasis infected patients in Agulu community, Anambra state, southeast Nigeria. International Archives of Medicine, 2, 34.

20. Mazigo HD, Samson A, Lambert VJ, Kosia AL, Ngoma DD, Murphy R, et al. Female genital schistosomiasis is a sexually transmitted disease: gaps in healthcare workers' knowledge about female genital schistosomiasis in Tanzania. PLoS Global Public Health. 2022;2(3):e0000059.

21. Masong MC, Wepnje GB, Marlene NT, Gamba V, Mengue MT, Kouokam E.(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

22. . National Population Commission. Population of Anambra State. www.npc.org.ng2006. Accessed 13 December 2022.

23. Ekwunife CA,and Okafor F C (2004)Schistosomiasis infection in primary schools in Agulu town of Anambra state,Nigeria.Animal Research International vol.1(3)pp.203-204.

24. Poggensee G, Kiwelu I, Weger V.(2000). Female genital schistosomiasis of the lower genital tract: prevalence and disease-associated morbidity in Northern Tanzania. Journal of Infectious Diseases 181:1210–3. [PubMed] [Google Scholar

25. Hotez PJ, Harrison W, Fenwick A, Bustinduy AL, Ducker C, Mbabazi PS (2019). Female genital schistosomiasis and HIV/AIDS: reversing the neglect of girls and women. PLoS Neglected Tropical Diseases. 13(4):e0007025.

26. Aribodor OB, Okaka CE, Sam-Wobo SO, Okpala BC, Aribodor DN, Obikwelu EM.(2021) 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.

27. Ozougwu JC, Imakwu CA, Nwachukwu I, Okeke OP, Uzochukwu CU, Asian. Journal of Parasitology 6(3):29–36.

28. Inobaya MT, Olveda RM, Chau TN, Olveda DU, Ross AG. (2014).Prevention and control of schistosomiasis: a current perspective. Res Rep Tropical Medicine. 5:65–75.

29. World Health Organization.(2003). Manual of basic techniques for a health laboratory. World Health Organization: Geneva. Second edition. 223–249.

30. Ojo JA, Adedokun SA, Akindele AA, Olorunfemi AB, Otutu OA, Ojurongbe TA (2021). Prevalence of urogenital and intestinal schistosomiasis among school children in South-West Nigeria. PLoS Neglected Tropical Disease. 15(7):e0009628.

31. Azoro AV, Onyeanula NI, Egeruo AS, Dike MN, Mbagwu CB.(2022). Endemicity of urinary schistosomiasis in Ihube Okigwe Imo state. International Journal of Veterinary Science and Animal Husbandry. 7(1):23–5.

32. Zida A, Briegel J, Kabré I, Sawadogo MP, Sangaré I, Bamba S (2016). Epidemiological and clinical aspects of urogenital schistosomiasis in women, in Burkina Faso, West Africa. Infectious Disease of Poverty. 5(1):1–10.

33. Abdulkareem BO, Habeeb KO, Kazeem A, Adam AO, Samuel UU.(2018). Urogenital schistosomiasis among schoolchildren and the associated risk factors in selected rural communities of Kwara State, Nigeria. Journal of Tropical Medicine.:6913918.

34. Okoye EP, Ekwunife CA,Onyido AE, Obijiofor EC,Nzekwu CI Nnatuanya IO, OkekeUM, Ude EA (2024).Prevalence of urogenital schistosomiasis among school age children in Riverine area of Anambra West LGA, Anambra State. South Asian journal of parasitology vol7 page 98-109 Article no SAJP.114878.

35. Ajibola O, Gulumbe BH, Eze AA, Obishakin E(2018). Tools for detection of schistosomiasis in resource-limited settings. Medical Science. 6(2):39

36. Ugbomoiko U. S., Ofoezie I. E., Okoye I. C., Heukelbach J.(2010).Factors associated with urinary schistosomiasis in two peri-urban communities in South-Western Nigeria. Annals of Tropical Medicine and Parasitology. 104(5):409–419. doi: 10.1179/136485910X12743554760469

37. Wepnje G. B., Anchang-Kimbi J. K., Ndassi V. D., Lehman L. G., Kimbi H. K.(2019). Schistosoma haematobium infection status and its associated risk factors among pregnant women in Munyenge, south west region, Cameroon following scale-up of communal piped water sources from 2014 to 2017: a cross-sectional study. BMC Public Health. 19(1):p. 392. doi: 10.1186/s12889-019-6659-7. [PMC free article

38. Opara KN, Akomalafe RT, Udoidung NI, Afia UU, Yaro CA, Bassey BE.(2022). Urogenital schistosomiasis among primary school children in rural communities in Obudu, Southern Nigeria. International Journal of Maternal Child Health AIDS. 10(1):70–80.

39. Global Network Neglected Tropical Diseases.(2015). Government of Nigeria Releases New Data on the Prevalence of Schistosomiasis and Intestinal Worms. SABIN: Vaccine Institute, United States of America. Available from: Accessed 23 March 2023.

40. Enabulele EE, Platt RN, Adeyemi E, Agbosua E, Aisien MSO, Ajakaye OG.(2021). Urogenital schistosomiasis in Nigeria post receipt of the largest single praziquantel donation in Africa. Acta Tropics. 219:105916.

41. Ndukwe YE, Obiezue RN, Aguzie IO, Anunobi JT, Okafor FC. (2019).Mapping of urinary schistosomiasis in Anambra state, Nigeria. Ann Glob Health.85(1):52

42. Yamane T. Statistics: An Introductory Analysis. 2nd ed New York: Harper and Row; 1967. [Google Scholar.

43. Kloos H, Rodrigues, Rodrigues J,Pereira W. (2006). Combined methods for the study of water contact behavior ina rural schistosomiasis- endemic area in Brazil. Acta tropica 97(1)31-41.