Alexander et al Pan African Journal of Life Sciences (2021): 5(3): 335-341
DOI: 10.36108/pajols/1202.50.0350

Publication of Faculty of Basic Medical Sciences,
Ladoke Akintola University of Technology, Ogbomoso

www.pajols.org
Online ISSN:2672-5924

RESEARCH **Open Access**

Prevalence of Urogenital Schistosomiasis and its Implication on Control Efforts Among School Pupils in Ogun State, Southwest Nigeria

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Received 31st July 2021; Revised 11th October 2021; Accepted 3rd November 2021

Abstract

Background: Schistosomiasis causes anaemia, stunting, and cognitive impairment in children, which impairs school performance. Government coordinated school-based preventive chemotherapy with donated praziquantel has been primarily used for schistosomiasis control in Ogun State, necessitating the need to monitor treatment coverage and its effect on schistosomiasis burden.

Methods: We screened 422 pupils aged 1-14 years old for *Schistosoma haematobium* in June 2018 using the filtration technique. KAP data and socio-demographic characteristics of participants were also recorded.

Results: Out of 422 screened pupils, 59 (14%) tested positive using the filtration method. Peak prevalence (31.6%) occurred in pupils under five years. Heavy infection intensity occurred in 3.4% of the infected population. KAP studies revealed that 55% knew schistosomiasis was linked to urinating blood. Symptoms experienced mainly were diarrhoea (44.6%), stomach ache (29.7 %), and fever (13.5 %). Pipe-borne water (48.2%), well water (28.7%), and stream water (23.1%) were the major sources of water for household chores. Investigations on excreta disposal showed that 70.3% defecated in latrines, 17.3% in the bush, and 12.4% in water closets. About 54.7% had contact with a stream, while 74.2% were dewormed in the last six months.

Conclusion: Children below five years old should be included in the Ogun State's Ministry of Health's treatment efforts. Health education should be intensified in the study areas because the population visiting streams and openly defaecating will continue undermining the Ogun State Ministry of Health's treatment efforts. Our study will serve as an evidence base for refining control measures and effectively utilising already scarce resources.

Keywords: *Schistosoma haematobium*, prevalence, KAP, children, Nigeria, disease intensity

1.0 INTRODUCTION

Schistosomiasis is a devastating Neglected Tropical Disease (NTD), which leads to substantial morbidity and mortality in many low and middle-income countries [1]. It is caused by infectious trematode worms of the genus Schistosoma and ranks second only to malaria in terms of human suffering in affected countries [2]. There are over 240 million people infected and approximately 10,000 schistosomiasis-related deaths annually worldwide [2, 3]. The Global Burden of Disease Study ranked Nigeria as having the highest number of schistosomiasis cases globally [4].

Infection is established through cercariae penetration of the skin during swimming in freshwater bodies containing snail intermediate hosts. Hence, improved sanitation and access to safe water are some of the world health organisation's recommended strategies for eliminating schistosomiasis [5]. Approximately two-thirds of the schistosomiasis cases in sub-Saharan Africa are due to *S. haematobium*, the causative agent of urinary schistosomiasis [6]. Undernutrition and anaemia are some of the resultant morbidity of schistosomiasis [7]. Individuals with *S. haematobium* may also experience haematuria, dysuria, bladder-wall pathology, female genital sores (a high-risk factor for HIV) and hydronephrosis [8, 9].

Prevalence is often combined with the intensity of infection, also referred to as worm burden, commonly measured by the number of eggs per 10 ml of urine and used as a measure to assess the epidemiological situation for a helminth infection [10]. Microscopic examination of eggs after urine filtration remains the standard urogenital schistosomiasis detection technique [5].

Praziquantel (PZQ 40 mg/kg) is the only drug available for treatment [2, 11]. It has been shown to be effective in decreasing worm burden, egg excretion, and accompanying symptoms of infection [12]. The wide-scale availability of PZQ is believed to reverse morbidity in schoolchildren, preventing as many as 70 million cases of haematuria, 8·5 million cases of splenomegaly, and 280,000 deaths annually [13]. Schistosomiasis deworming programs are typically school-based, with school teachers or community health workers distributing medicines to vulnerable children between 5-15 years of age. A height-based dose pole is used to determine the number of PZQ tablets to administer to children [5, 1].

In conjunction with the Ogun State Universal Basic Education Board (SUBEB), southwestern Nigeria, the Ogun State Ministry of Health has been carrying out mass treatment of pupils with PZQ, at least once a year, depending on the availability of donated drugs, since 2017. The objective of this study was to assess the impact of the Ogun State Ministry of health's annual school-based schistosomiasis treatment efforts on the prevalence, morbidity, and level of awareness of schistosomiasis in the study areas. Findings from the study will assist the Ogun state Ministry of Health on effective and targeted use of praziquantel and health education strategies.

2.0 METHODOLOGY

2.1 Study Population

This study was conducted at Ogun State, one of the 36 states of the Federal Republic of Nigeria. It is located in the southwestern part of the country within longitude 2° 45′ E and 3°55ꞌE and latitude 7°01′ N and 7°18′ N. Ogun state is divided into 20 administrative areas known as local government areas (LGAs) and is one of the few states with a formal control programme for schistosomiasis in Nigeria. Furthermore, there are 1,314 public primary schools with an average of 100 pupils enrolled in each school. Obafemi Owode, Sagamu, and Ijebu-East LGAs were selected for the study because they are among the LGAs where the pilot formal control programme was conducted. Using the cluster sampling technique, four public primary schools were selected, with at least one in each LGA and 100 pupils per school. All consented pupils participated in the study. Public schools in rural areas were selected because of their remoteness and proximity to freshwater habitats.

2.2 Study Design

The study design was cross-sectional and school-based. Pupils aged 1-14 years with parental consent were recruited into the study. Of the available 485 pupils, only 422 participated in the study. Each pupil was given a sterile 200 ml specimen bottle with a unique code corresponding to demographic data, including name, surname, LGA, school name, age, sex, weight, and height. Heights and weights were determined using a metre rule and weighing scale respectively. Pupils were advised to collect midstream urine. Caregivers assisted younger children in collecting urine specimens. Urine samples were collected between 10 a.m and 2 p.m for three days. Four drops of formol saline were mixed into each urine sample before being transported to the Nigerian Institute of Medical Research Lagos and stored at -20°C until processing. Data were collected from 364 willing pupils in the study areas using a structured questionnaire. The questions were related to age, gender, educational level and occupation of parents, knowledge of infection, water contact activities and personal hygiene of respondents. Respondents were interviewed in English, Yoruba, and Pidgin English.

2.3 Ethics Statement

Ethical clearance and approval were obtained from the Institutional Review Board of the Nigerian Institute of Medical Research Lagos (IRB/17/007), Ogun State Ministry of Health, Ogun State Universal Basic Education Board (SUBEB), and the Local Government Education Authority (LGEAs) in the study areas. Informed consent was obtained from parents or guardians of the school pupils with the help of the headteachers and officers of the LGEAs. Children with no parental consent were excluded.

2.4 Sample Preparation

The filtration technique was used to detect *S. haematobium* ova in urine [14]. A drop of Eosin stain was gently mixed with 10 ml of each urine sample to enhance staining. About 10 ml of urine sample was flushed with a sterile syringe through a polycarbonate filter membrane, followed by staining with 20 ml of Lugol's iodine solution. A drop of Ninhydrin solution was added to each filter membrane to fix the schistosome ova [15]. The filter membranes were air-dried and examined under the light microscope using ×10 and ×40 objectives, and the number of eggs per filter was recorded as light infection if <50 eggs and heavy if ≥50 eggs [5].

2.5 Statistical Analysis

The data were analysed using Statistical Package for Social Sciences (Windows version 16.0; SPSS Inc, Chicago, IL, US) and Microsoft Excel (2013) with the application of a chi-square test. Descriptive analysis was used to express gender occurrence and mean age, while the prevalence of infection was expressed in percentage. The difference in the prevalence of infection between the variables was determined using a chi-square test at a 95% confidence interval. P-values less than 0.05 were considered statistically significant

3.0 RESULTS

Of the 422 participants, 59(14%) were positive for *S. haematobium* (Table 1). There were more male participants (56%) than females (44%). While more females (16.1%) were infected, the difference was not statistically significant (p= 0.259). Obafemi-owode was the most infected local government area (15.9%), followed by Sagamu (13.9%). Ijebu-East had the least number of infected pupils (13.0%). There was no significant difference in prevalence across Local Government Areas (p = 0.781). The mean age was 8.12. *S. haematobium* infection was most prevalent in pupils under five years of age (31.6%). The difference in prevalence among age groups was statistically significant (p = 0.049).

Table 1. Prevalence of Urogenital Schistosomiasis by Gender, LGA and Age

Gender	Number examined	Number positive for S. haematobium ova	χ^2
Male	236(55.9%)	29(12.3%)	χ^2 =1.276^a p > 0.05
Female	186(44.1%)	30(16.1%)	(p value=0.259)
Total	422	59	
LGA			
Sagamu	122(28.9%)	17(13.9%)	χ^2 =0.493^a p > 0.05
Ijebu-East	193(45.7%)	25(13.0%)	(p value=0.781)
Obafemi-Owode	107(25.4%)	17(15.9%)	
Total	422	59	
Age group (Year)			
0-4	19(4.5)	6 (31.6%)	χ^2 =6.018^a p < 0.05
5-9	136(32.2)	21(15.4%)	(p value= 0.049)
10-14	267(63.3%)	32(12.0%)	

Heavy intensity classified as ≥50 *S. haematobium* ova per 10ml of urine infection was detected in only 2 pupils (3.4% of the infected population); one from Ijebu-East and the other from Obafemi-Owode (Table 2). The only two pupils with heavy infection was a male in the 5-9 age group and a female in the 10-14 age group (Table 3).

Only 364 (86.3%) out of the 422 pupils in the study population took part in the questionnaire survey (Table 4). About 54% of respondents were male, while 46% were female. The majority of the respondents (61.3%) were between 10-14 years old, Christians (82%), had between one to four siblings (50%), and had parents with some

Table 2. Intensity of Urogenital Schistosomiasis Stratified by LGA

LGA	Light	Heavy	Total (No.)
Sagamu	17	0	17
Ijebu-East	23	1	24
Obafemi-Owode	17	1	18
Total	57	2	59

Table 3. Intensity of infection by age and sex

Age group (Years)	Male			Female		
	No.	Light	Heavy	No.	Light	Heavy
0-4	2	2	0	4	4	0
5-9	8	7	1	13	13	0
10-14	19	20	0	13	12	1

form of formal education (99.5%). Disease awareness showed that 54% of respondents know what schistosomiasis is (urinating blood). Symptoms experienced mainly were diarrhea (44.6%), stomachache (29.7%), and fever (13.5%). Concerning water use, 48.2% fetch water for household chores from taps, 28.7% from wells, and 23.1% from rivers/streams. Furthermore, 70.3% defecate in latrines, 17.3% in the bush, while 12.4% use water closets. Over 50% of the responders had contact with water bodies in the last six months, and about 74.2% were dewormed of *S. haematobium* within the last six months. About 25 students out of the 63 children that defaecated in the open were positive for *S. haematobium*. Of the 270 dewormed children, 5 (2%) were positive, while 21 out of the 209 children who had contact with a water body were positive for *S. haematobium* as well (Table 4).

4.0 DISCUSSION

In this study, urine filtration and microscopy were used to detect *S. haematobium* ova in 422 school-age children attending state-owned schools, namely: Wesley primary school Gbara, and St Mark Primary School Iwelepe (Sagamu); St Joseph Primary school Ogbere (Ijebu-East) and lastly St John Anglican school situated at Obafemi-Owode LGA. We recorded an overall prevalence of 14%

Table 4. Knowledge Attitude and Practice (KAP) Survey

Variables	N	%	No. Positive
Gender			
Males	197	54	14
Females	167	46	19
Total	364	100	
Age groups (years)			
0 - 4	9	2.5	2
5 - 9	120	33.1	10
10 - 14	222	61.3	19
Total	362	100	31
Religion			
Christianity	301	82	29
Islam	61	17	4
Traditional	2	1	0
Total	364		33
Educational level of parents			
Educated (at least primary education)	344	95	23
Non educated (no formal education)	19	5	9
Total	363		32
Number of siblings			
1-4	180	50	19
5-8	162	45	10
9-12	18	5	1
Total	360		
Do you know schistosomiasis is a disease			
Yes	54	72	5
No	21	28	7
Total	75		12
Symptoms experienced			
Fever	10	13.5	0
Stomach ache	22	29.7	1
Diarrhea	33	44.6	5
Blood in urine	5	6.8	3
Blood in stool	4	5.4	0
Total	74		9
Where do you fetch water for household chores?			
River/Stream	84	23.1	19
Well	104	28.7	2
Tap	175	48.2	12
Total	363		33
Where do you defecate?			
Bush	63	17.3	25
Latrine	256	70.3	5
Water closet	45	12.4	2
Total	364		33
Any contact with a water body in the last 6 months?			
Yes	209	57.4	21
No	155	42.6	12
Total	364		33
Have you taken worm medicine in the last 6 months			
Yes	270	74.2	5
No	94	25.8	28
Total	364		33

(14 % in Sagamu, 13% in Ijebu-East, and 16% at Obafemi-Owode). This is higher than the previous prevalence of 0% Oluwole *et al.,* [16] reported in Sagamu (zero prevalence), 8.5% in Ijebu-East, and 6.3% in Obafemi-Owode. However, Oluwole *et al.,* [16] admitted that schistosomiasis prevalence in their study might have been underestimated because areas close to water bodies were skipped. Furthermore, the prevalence in this study is moderate by WHO standards [1], but this is also significant because helminth parasite distributions are highly aggregated, with most worms harboured by few in a population. These few persons continue to serve as reservoirs for the perpetuation of infection in the community [17]. The State Ministry of Health may need to consistently monitor drug coverage and individual compliance during successive treatment rounds.

Regarding gender, although more than half of the participants were males, peak prevalence surprisingly occurred in females, in contrast with studies by Hajiss *et al.,* [18] but agreed with studies by Kayuni *et al.,* [19]. In our study, gender did not significantly influence the rate of infection.

Peak prevalence observed in the 0-4 age group is in line with a study by Ndassi *et al*., [20] but contrasts with Abdulkareem *et al.,* [21]. High prevalence may be attributed to the limited number of participants in the age group or the fact that treatment is administered only to pupils between ages 5-14 years, due to the non-availability of pediatric praziquantel for preschool children [1]. The prevalence between age groups in this study was statistically significant ($P>0.05$). Agnew-Blais *et al*., [22] made a similar observation in Zambia, but this was in contrast with what was observed by Kayuni *et al*., [19] in Malawi.

The intensity of *S. haematobium* in this study described the parasite burden and was measured by the number of eggs excreted per 10ml of urine. The overall rate of light intensity infections was higher than heavy intensity infections indicating that only a few children were carriers of heavy parasite load. This is in agreement with the findings that helminth infections have an aggregated distribution in endemic communities, such that a small proportion of hosts are heavily infected [23,24]. Infected individuals are likely to re-introduce infectious material into the environment, perpetuate transmission, and increase incidence among those successfully treated.

Knowledge, Attitude, and Practice (KAP) of a population regarding infection are essential in planning, implementing, and evaluating interventions [25]. A KAP survey can identify knowledge gaps, cultural beliefs, or behavioural patterns, which help identify needs, problems, and barriers in programme delivery and solutions for improving the quality and accessibility of services. Our findings revealed that the children know that schistosomiasis (urinating blood) is a disease with fewer children fetching water from streams/rivers (23%) and more children utilising latrines (70%) rather than defaecating in the bush. This may be linked to the health education administered by the Ogun State Ministry of Health officials during treatment campaigns. However, children who defaecate in the bush or regularly have contact with water bodies will be a source of infection to the other children.

In conclusion, our study revealed that urogenital schistosomiasis is still endemic in the study areas. Health education needs to be intensified to close the knowledge gaps and promote zero contact with freshwater bodies. We also advocate for the provision and maintenance of potable water and toilet facilities, especially in remote areas, and close monitoring of drug distribution to ensure every child has access to treatment.

Funding

This research work did not receive funding from any organization.

Acknowledgments

We thank the staff of the Public Health Unit of the Ogun State Ministry of Health and the Ogun State Universal Basic Education for providing treatment data and advisory support during our study.

Conflicts of Interest

The authors declare no competing interests.

Authors' Contributions

SIA conceived and designed the study, contributed to data collection, data analysis tools, analysis of data and manuscript writing. **TSN** contributed to data collection and analysis of data. **PVG** contributed to data collection, data analysis tools and analysis of data. **ETI** contributed to study design, data analysis tools, supervised the study and proof-read manuscript. **OPA** contributed to study design, data analysis tools and manuscript writing. All authors approved the final copy of the manuscript

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