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EC MICROBIOLOGY
Research Article

Persistency of Schistosomiasis Infection among School Age Children in Ipogun Area of Ondo State, Nigeria

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Received: May 30, 2018; **Published:** June 27, 2018

Abstract

Objective: The study assessed the status of both urinary and intestinal schistosomiasis among primary school children of Ipogun village, given the ongoing annual school based mass administration of the drug, praziquantel in the state, which is in line with the national and global effort at eliminating schistosomiasis as a public health problem by the target year 2020.

Results: Over half of the 202 children screened, 117 (57.9%), were positive for microhaematuria while 91 (45.0%) had ova of *Schistosoma haematobium* in their urine. Eggs of *Schistosoma mansoni* was however not detected in any of the stool samples collected. Sancta Trinitas Nursery and Primary school had the highest prevalence of 66.6%, while St. Paul CAC and St. Jude Nursery and Primary school had equal prevalence (50.0%). There was no statistical significant difference ($P > 0.05$) in the prevalence rates obtained between females (45.1%) and males (45.0%).

Conclusion: The present study has demonstrated a moderately persistent schistosomiasis infection in this current study area despite annual treatment with praziquantel. Hence, there is need to review the frequency and or dose of praziquantel administration, extend treatment coverage to include adults, particularly those at risk of the infection, such as fishermen and farmers in line with WHO algorithm. Furthermore, the state government urgently needs to make additional effort to provide safe water, improve sanitation, information, education and communications (IEC) materials coupled with health education that would effects behavioral change as well as implement focal mollusciciding, where feasible, to interrupt transmission.

Keywords: *Schistosomiasis Prevalence; Primary School-Aged Children; Praziquantel; Annual Treatment*

Introduction

Schistosomiasis is caused by infection with trematodes of the genus *Schistosoma* whose intermediate host is the snail. In the African region, *Schistosoma (S.) haematobium* causes urinary schistosomiasis, while intestinal schistosomiasis is caused by *S. mansoni* and *S. intercalatum*. Schistosomiasis has focal distribution within affected countries and hence mapping of the disease distribution is critical for programme success [1]. Schistosomiasis is one of the most prevalent neglected tropical diseases (NTDs) [2].

The disease affects 200 million people, most of whom are children. Sub-Saharan Africa accounts for 85% of the global disease burden. In Africa, Nigeria carries the highest burden of the disease with 116 million infected people out of the estimated 555 million infected Africans. Schistosomiasis is a disease of significant and growing importance in Nigeria due to poor water supply and waste management and intensified water development [3].

In Ondo, one of the 36 states in Nigeria, schistosomiasis is of public health importance as prevalence rates reported for the disease in all 18 Local Government Areas were between 41 - 95.7%, with Ifedore Local Government having 47.3% [3]. In Ifedore Local Government Area, urinary schistosomiasis is endemic in Ipogun village. The village first came to national focus in 2001 when 'Newsline', a national television documentary program, reported the village as one where "men menstruate", referring to the symptom of the disease- haematuria (presence of blood in the urine). Since then, it has remained endemic with prevalence rates ranging from 59% in 2003 [4] to 53.1% in 2006 [5]. Oniya and Olofintoye also reported a prevalence rate of about 18.22% among school pupils in the Local Government area in 2008 [6]. A prevalence rate of 18% was reported in five of the primary schools of the village area in 2013 [7].

Diagnosis of schistosomiasis is traditionally done by microscopic detection of eggs in the stool or urine of infected individuals. However, due to the development of immunity in adult individuals and/or the persistency of chronic infection, eggs passage in any of these medium (stool or urine) becomes extremely reduced, thus affecting diagnostic performance [8]. Needless to mention the lack of resources, electricity and trained personnels to carry out such technique in under-resourced communities. Thus against that background of those logistics, coupled with the need to produced rapid result which are used in mass drug administration (MDA), the rapid diagnostic techniques (RDT) has evolved and been employed in various studies [9-11]. This RDTs comes in various forms such as dipstick, cassette or paper strips such as the haemastix.

Preventive chemotherapy (PC) is the main strategy for controlling morbidity caused by this disease using single dose drug, praziquantel at a dose of 40 - 60 mg/kg body weight administered annually to the infected population with special emphasis on school based treatment to cover the most heavily infected segment of the population (school-aged children) due to their close contact with infected body of water [12-14]. Needless to mention here that, the residents' habitats is in proximity with the body of water that acts as the source of infection- "Aponmu river". Although, significant progress has been made in the control of schistosomiasis over the past few decades, the present thrust is that of elimination of morbidity due to the disease as a public health problem by year 2020 [15]. The Nigerian national schistosomiasis control programme was initiated in 1988 with the strategy of delivering praziquantel annually to at least 75% of school aged children in endemic areas, in line with the World Health Organization's (WHO) roadmap to eliminate NTDs [16]. The London Declaration on NTDs of 2011 [17], providing immense global support and commitment by pharmaceutical companies, government and health organizations for the implementation of this roadmap, gave a new impetus to the control of the NTDs, of which schistosomiasis is one. The Ministers of Health of Member States in the WHO African region also expressed their commitment to scaling up proven interventions against the major NTDs, of which schistosomiasis is one, at the Regional level [18]. Ondo state had been administering praziquantel to school aged children, since the free donation of the drug began [7]. The present study therefore assessed the current status of both urinary and intestinal schistosomiasis among primary school age children of Ipogun village, given the ongoing annual effort of mass administration of praziquantel to school children through the state ministry of health NTD programme. It is hoped that the findings would inform policy on required approaches to achieving the elimination of schistosomiasis as a public health problem by year 2020.

Materials and Methods

Study Design

School-aged children attending primary schools in Ipogun village of Ifedore LGA, aged 9 to 12 years old who gave their assent were recruited into the study, following informed parental consent through the school authority. Other criteria for inclusion in the study included having received at least two doses of praziquantel within the past five years, not having received anthelminthic treatment in the last 6 months, and having no severe medical condition at the time of the survey. These children were requested to provide their urine samples which were screened for haematuria using the reagent strip (Haemastix). Those found positive were further requested to provide both stool and urine samples in clearly labelled containers (serially numbered to tally with their names) for easy identification. All diarrhoeal specimens were not processed and the children who produced such specimen were excluded from the study. The remaining specimens were processed using parasitological (see below) methods and the names of those found positive were submitted to the LGA Primary Health Care centre in the village for treatment, in line with the annual treatment program.

Study Area

The study was carried out in Ipogun, a village located at 7º19'N; 5º05'E, in Ifedore LGA of Ondo state, south-western Nigeria. The two distinct seasons in the area are the wet and dry seasons. The wet season lasts from April to October and is characterized by heavy rains with occasional flooding of river banks. The dry season lasts from November to March, characterized by increased temperature. The primary source of water for agricultural activities and most domestic activities is the 'Aponmu' river, flowing through the village; it is this river that serves as the contact site [7] for infection of the disease. Though there are a few boreholes dug by the state government, most of them however were non-functional as at the time the study was carried out, making the people to rely heavily on the river. Furthermore, the inhabitants being mainly farmers depend on and use water from the river in carrying out their daily and recreational activities including bathing and washing.

Study Population

School-aged children (both male and female) aged 9 - 12 years in the seven primary schools in Ipogun village were screened for schistosomiasis. The primary schools included in the study are Muslim primary school, Morohunkeji Nursery and Primary school, St. Jude primary school, Evangel nursery and primary school, Sancta Trinitas Nursery and primary school, St. Paul CAC primary school and Aseyori International Group of Schools.

It is important to state here that, the selection of this age group (9-12 years) was done in accordance with a recent recommendations based on findings from various studies [19-21] that suggested continuous monitoring of parasite prevalence and evaluation of drug potency in communities where MDA is an ongoing programme.

Exclusion criteria

Primary school children excluded from the study included those that fall under the following conditions; children with severe medical condition, children who produced diarrhoeal specimen, children who had received two or more combination treatments and, children who had received praziquantel or anthelmintics within less than 6 months of the study.

Study approach

Advocacy visit was paid to the State Ministry of Health to explain the objectives of the study and permission to conduct the study was obtained. Preliminary visit was also paid to the village head and school authority in Ipogun community for advocacy and approval to conduct the study. Through the school authority parental consent for the inclusion of the children/wards in the study was obtained while assent of each child included in the study was also obtained.

Sample Collection and Evaluation

Urine

Urine samples were collected from each primary school child in a universal container during 10:00 to 14:00 hours between October and November 2014. In each container, 2 drops of eosin was added before the specimen were transferred to the State's Primary Health Care Laboratory at Oke Eda in Akure, the state capital. Urine specimen voided by the children during the pre-screening for the selection, were rapidly tested with haemastix chemical reagent strips. Each strip was read for colour change as per the calibration on the Haemastix container. Further, Filtration technique [22] was employed in the processing of each specimen. Each sample was flushed through a 10 ml syringe over a filter paper placed in a Swinnex filter holder (Fisher Scientific) held over a sink. Twenty (20) ml of lugol's iodine was then flushed through each sample, thereafter each filter paper was taken out of the holder with the aid of a forceps and placed over two drops of ninhydrin stain. The filter papers were allowed to air-dry for about 10 minutes and examined with a binocular microscope at ×40 magnification.

Stool sample

The stool samples were collected at the same time as were the urine samples and analyzed using the Kato-Katz procedure. Briefly, a small amount of the stool specimen voided in a small container by each child was scooped out with the aid of a spatula, and placed on a newspaper, on top of which a piece of nylon screen was pressed so that small amount of faeces accumulated on the screen. The faeces was then collected with the spatula and placed in the hole of the Kato-Katz template already on the microscope slide. Excess faeces was removed from the edge of the template before removing the template. In order to spread the faecal sample evenly, the specimen on the slide was covered with a pre-soaked cellophane strip and pressed against another slide. The second slide which was used as a spreader was carefully removed and the sample was then allowed to air-dry at room temperature before examination [23]. All children found positive were treated by the LGA Primary Health Care Centre with the dose normally administered, 40 mg/kg of praziquantel using the WHO dose pole for dose determination.

Statistical Analysis

The prevalence rate, which is the number of children identified as positive at baseline as against the total number of children whose samples were examined, is given below by the formula:

$$\frac{\text{Number of children identified as positive}}{\text{Total Number of children who provide specimen}} \times 100/1$$

Ethical Consideration

Ethical clearance for this study was received from the Institutional Review Board of the Nigerian Institute of Medical Research with Project number IRB/13/232. Approval was also received from Ondo State Ministry of Health as well as parental consent and pupils assent.

Result

Over half 117 (57.9%) of the 202 children screened were positive for microhaematuria while 91 (45.0%) had ova of Schistosoma haematobium in their urine. Schistosoma mansoni eggs was however not detected in the stool samples collected. The highest prevalence (66.7%) obtained for Schistosoma haematobium ova was in Sancta Trinitas, while St. Paul and St. Jude had same level of prevalence (50.0%) and the least prevalence (12.5%) was recorded in Aseyori International Group of Schools. Consequently, the order of prevalence by haematuria shows Sancta Trinitas, Aseyori and Morohunkeji to have the highest prevalence (Table 1).

Schools	Number of samples		
	Examined	Positive (%) for haematuria	Positive (%) for S. haematobium eggs
Sancta Trinitas	12	9 (75.0)	8 (66.7)
Aseyori	8	6 (75.0)	1 (12.5)
Morohunkeji	52	33 (63.5)	22 (42.3)
Evangelist	23	14 (60.9)	8 (34.8)
St. Paul CAC	16	9 (56.3)	8 (50.0)
Muslim	41	22 (53.7)	19 (46.3)
St. Jude	50	24 (48.0)	25 (50)
Total	202	117 (57.9)	91 (45.0)

Table 1: *Prevalence of haematuria and urinary Schistosomiasis for the schools surveyed.*

Stratification of prevalence by gender (detection of ova) did not show any statistical significant difference ($P > 0.05$) between females (45.1%) and males (45.0%). The higher prevalence rates recorded for females at Sancta Trinitas and St. Paul CAC schools may be reflecting the disproportionate representation of the sexes in both schools. On the other hand, St. Jude (58.1%) and Muslim (45.8%) had the highest male prevalence while same level of prevalence (25.0%) was recorded amongst males of both Sancta Trinitas and St. Paul CAC schools (Table 2 and Figure 1).

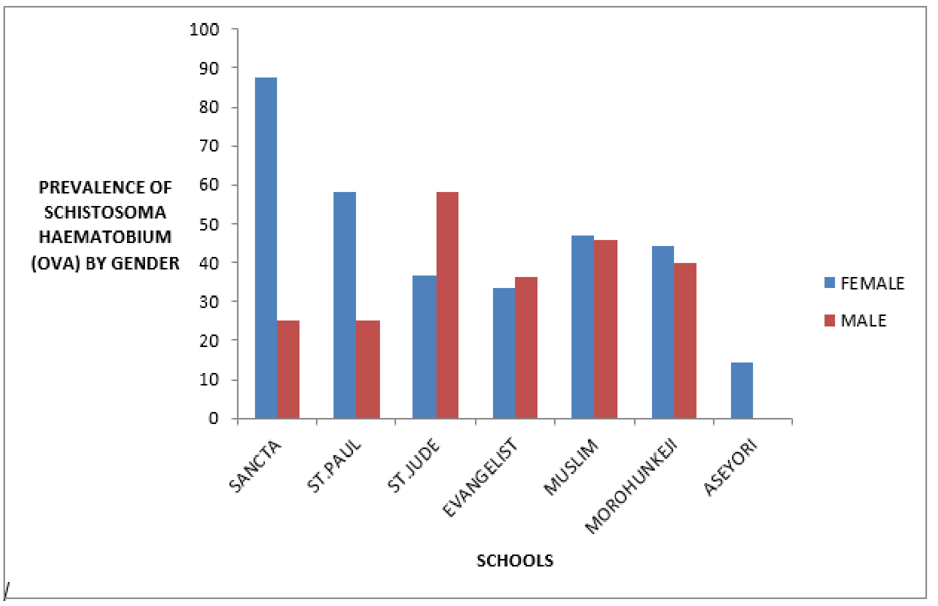

Figure 1: *Prevalence of Schistosoma haematobium ova by gender.*

Schools	Detection of ova in urine by sex			
	Female		Male	
	Examined	Positive (%)	Examined	Positive (%)
Sancta Trinitas	8	7 (87.5)	4	1 (25.0)
St. Paul CAC	12	7 (58.3)	4	1 (25.0)
Muslim	17	8 (47.1)	24	11 (45.8)
Morohunkeji	27	12 (44.4)	25	10 (40.0)
St. Jude	19	7 (36.8)	31	18 (58.1)
Evangelist	12	4 (33.3)	11	4 (36.4)
Aseyori	7	1 (14.3)	1	0
Total	102	46 (45.1)	100	45 (45.0)

Table 2: *Prevalence of urinary schistosomiasis by gender.*

Stratification of haematuria by gender showed females of Morohunkeji to be the most infected while those of Aseyori had the least prevalence (Figure 2). The occurrence of microhaematuria in both sexes in most of the schools is far higher than the detection of S. haematobium ova in the urine samples.

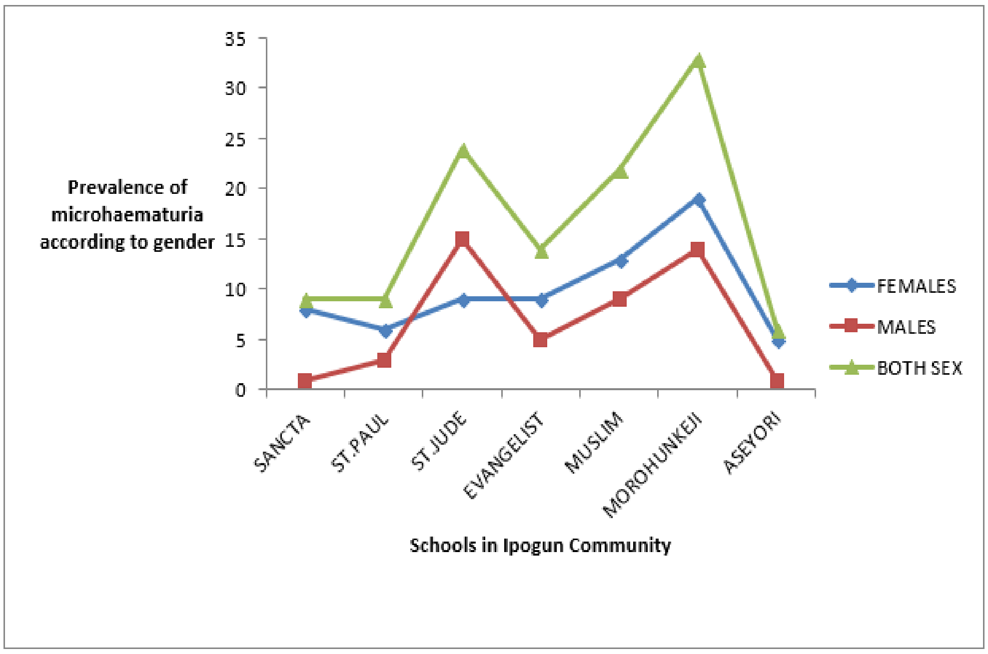

Figure 2: *Prevalence of microhaematuria according to gender.*

Discussion

Schistosomiasis is a serious public health problem for those in underprivileged areas especially children from such areas such as those in this community lacking access to pipe-borne water and are subject to poor sanitation. Despite continuous effort by government to reduce the prevalence of this infection through annual distribution of praziquantel, the prevalence in this study area is still a two-digit figure showing little or no positive impact of control programmes.

The overall prevalence of *S. haematobium* was far higher than that recorded in same Ipogun community the previous year by Oniya and colleagues [7]. Considering the fact that this is an area that receives praziquantel annually, the expectation is a reduced rate of infection, however, the reverse is the case. On the one hand, this high prevalence could be as a result of frequent contact with the "aponmu river" which acts as source of infection since most of the bore holes dug by the state government are no longer functional. While on the other hand, it could be the result of reduced sensitivity of the parasite to drug regimen. The latter however needs further analysis to substantiate such claim.

Furthermore, more females were infected than males in this study which is contrary to previous studies in same community where males had a higher rate of prevalence than the females [7] and in Edo state by Ugbomoiko [24]. This thus shows that it is the frequency of contact/exposure with an infected body of water rather than gender that determines the rate of transmission and consequent prevalence of infection. It is also important to state here that the sex distribution in the various schools in this current study were unequal which could have been responsible for the bias in the prevalence seen.

The occurrence of microhaematuria in both sexes in most of the schools shows a superior value than the detection of eggs in urine. Studies with similar findings include those carried out in rural and some urban areas in the country [8,12,14,25,26]. This could be due to the fact that haematuria could result from other causes other than schistosomiasis, hence the use of microscopy as a "gold standard" for diagnosis. However, the exclusion of other presumed causes of haematuria (such as nephritis, kidney stone sickle cell diseases) were beyond the scope of this study and hence were not considered.

Conclusion

While it was observed that the prevalence of infection was higher in some schools in relation to others was higher, it should however be noted that, the children's resident and the frequency of visit to the source of infection are two important factors that have the most infect in determining disease outcome among the children.

With the global target of eliminating morbidity due to schistosomiasis by year 2020, concerted effort by the state government to interrupt transmission through provision of pipe-borne water or bore holes, mollusciciding and health education to promote individual and community hygiene should be put in place to augment the annual treatment strategy.

The most effective solution to eliminate schistosomiasis and soil transmitted helminthiasis is to improve the environmental condition and encourage change in risk behaviours amongst the populace in endemic areas [16]. Alternatively, the control programme in Ipogun should consider increasing the dosage from 40 to 60 mg/kg for greater impact or increasing the frequency of treatment to twice yearly if logistic permits as carried out by Lamberton., *et al.* [13] where children who were found to be positive after the initial treatment received one or two more subsequent doses.

This study is riffed with some limitations such as the lack of assessment of other host genetic factors (take for instance immunity, drug bio-availability), comparison of parasite genomics pre- and post-treatment to distinguish re-infection from treatment failure, all of which may serve as confounders to drug efficacy

Acknowledgment

The authors acknowledge the effort of the Ondo State Ministry of Health for approval as well as the state primary health care laboratory chief technician for permission to use the laboratory space. Thanks also goes to Mr. Emmanuel Owo for mobilizing the community members and parents as well as the Head teachers, teachers and pupils of the various schools for their cooperation and participation. This work is a baseline project of the central research committee's project of the University of Lagos, Nigeria.

Conflict of Interest

All authors have declared that no conflicting interest exist.

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Volume 14 Issue 7 July 2018