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PREVALENCE AND FACTORS ASSOCIATED WITH URINARY SCHISTOSOMIASIS AMONG INFANTS AND PRESCHOOL-AGED CHILDREN IN SETTLEMENTS AROUND OYAN RESERVOIR IN OGUN STATE, NIGERIA

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ABSTRACT

The need for more information on the risk factors for schistosomiasis among infants and preschool-aged children as become important for the development of health education programme since this age group is currently excluded in preventive chemotherapy programmes. Therefore, the prevalence and intensity of, and risk factors for, infant and preschool-aged children infection with *Schistosoma haematobium* were explored in two endemic settlements around Oyan Reservior in Ogun State, Nigeria. Mothers and caregivers' knowledge of the disease, water contact activities of their preschooler, age at first exposure and control measures were recorded using a structured questionnaire. Of the 86 preschooler screened from the two settlements 46 (53.5%) were infected, with an overall geometric mean intensity of 0.36 eggs/10 ml urine. The prevalence of egg-patent *S. haematobium* infection was 27.8% in Ibaro and 72.0% in Imala-Odo respectively. There were significant differences in prevalence (P=0.0005) and intensity (P=0.0006) of infection between the two communities, however, these did not increase significantly with age in both communities. Interviews revealed that preschoolers were exposed to infected reservoir water as early as after birth, while older preschoolers frequently visited water bodies on their own to play, bath and wash cloth. There was significant reduction in prevalence of schistosomiasis among preschool-aged children in Ibaro community compared to Imala-Odo community; this could be attributed to awareness about the disease, and its mode of transmission. Intensive health education still remains the alternative for reducing transmission in preschoolers in the absence of standardized treatment dosage for them.

Keyword: schistosomiasis, infants, preschooler, risk factors, control, Nigeria

INTRODUCTION

Schistosomiasis is a neglected tropical disease (NTD), with a total of 207 million people being affected with the disease worldwide, and with 97.3% of them resident in Africa (WHO, 2002; Molyneux *et al.* 2005; Steinmann *et al.* 2006; Utzinger *et al.* 2009; Hotez & Kamath 2009). According to the World Health Organization statistics, about 700 million people are at risk of infection in the whole world (WHO 2002; Hotez *et al.* 2007). The disease is highly prevalent in rural and urban communities where unsafe water supply, poor sanitation, ignorance and

poverty is the prevailing circumstances (WHO 1985, 1993, 2002; Gryseels *et al*. 2006; Mathers *et al*. 2007; Hotez & Kamath 2009; Stothard *et al*. 2009).

Schistosomiasis infection in infant and preschoolers (≥ 6 years), have been reported across sub-Saharan African countries with wide implication for control (Mafiana *et al.* 2003; Bosompem *et al.* 2004; Odogwu *et al.* 2006; Opara *et al.* 2007; Sousa-Figueiredo *et al.* 2008; Ekpo *et al.* 2010; Garba *et al.* 2010; Dabo *et al.* 2011; Verani *et al.* 2011; Ekpo *et al.* 2012a). With prevalence over 50%, in many of these reports, the World Health Organization is exploring ways for development of infants' formulation and inclusion of treatment of infants and preschooler in endemic countries (Sousa-Fiqueirodo *et al.* 2010a, 2010b; Sousa-Figueiredo *et al.* 2012).

In a recent review of the current information on the epidemiology of schistosomiasis in infant and preschooler (Ekpo *et al.*, 2012b), some pertinent questions raised were; how early are young children infected with schistosomiasis in endemic communities? What are socio-cultural roles played by mothers and caregivers in the exposure of infants and preschool-aged children to schistosomiasis? Answers to these questions and many others will provide useful guide in developing appropriate health education programme for mothers and caregivers. Here we determined the prevalence of and when preschoolers are exposed to infection, and the roles played by their mothers and caregiver in settlements previously endemic for paediatric schistosomiasis.

MATERIALS AND METHODS

Ethical statement

The study received approval from the Ogun State Ministry of Health and College of Natural Sciences, Federal University of Agriculture, Abeokuta Ethical Review Board. Community leaders, parents, guardians and caregivers of the preschool children, were made to understand the objective of the study. Preschoolers whose guardian and caregivers signed the consent form were enrolled into the study. The research objective was also explained to the older preschool children so as to get their maximum cooperation.

Study area

Paediatric schistosomiasis due to *Schistosoma haematobium* was first described in Abule-Titun, Ibaro Imala-Odo, settlements around Oyan reservoir in Abeokuta North Local Government Area, Ogun, South-western Nigeria (Mafiana *et al*. 2003). There have not been any interventions or preventive chemotherapy, apart from a water borehole drilled in each community. This has not prevented the community members from visiting Oyan reservoir for their domestic activities, such as drinking, washing and recreational purposes. Ibaro and Imala-Odo still lack basic amenities such as sanitation facilities, electric power distribution and proper waste disposal systems, and Abule-Titun, had been depopulated severely and was not included in this follow up study. At the time of our visit, eighty six (86) preschoolers were enumerated in Ibaro and Imala Odo, the two communities, sampling and sample size calculation were not necessary, due to the small number of preschooler living in the two communities.

Parasitological survey

Parents / guardians of the children were given dark (sterile) plastic universal containers with a unique identification label to collect the urine samples of their pre-

schooler between the hours of 10.00 and 14.00 hours (Mafiana *et al.* 2003). Urine samples were test for haematuria using Urino-Combi- 11 reagent test strip (ACON laboratories), dipped in the urine for 5 secs. Subsequently samples were screened in the laboratory for *S. haematobium* infection. In the laboratory, 10ml of each urine sample was centrifuged at 5000 rpm for 5 min. The supernatant was discarded to leave the sediment, which was placed on a clean glass slide and covered with a coverslip. These slides were observed under a light microscope at x40 objective lens for the presence of eggs of *S. haematobium*. The intensity of *S. haematobium* eggs were determined and recorded as eggs/10 ml of urine Only 86 preschool-aged children returned their urine sample which is reported in this study

Questionnaire survey

A questionnaire assessing risks factors for preschooler exposure to reservoir water was administered to participating mothers and caregivers. The questions were interpreted into the local language (Yoruba). Socio-demographic data (e.g. age, sex, occupation, education attainment), age of first exposure of child to dam water, knowledge, attitude and water contact practices, means of prevention were collected.

Data analysis

Data were analysed using SPSS version 17.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The numbers of eggs per 10ml urine were transformed using log10(x+1) to normalize the distribution for statistical analyses. Differences in proportions were tested using the Pearson chi-square test while differences in means were computed using independent samples t-test and one-way ANOVA. A threshold of 5% was used for statistical significance.

RESULTS

Prevalence and intensity of infection

We obtained urine samples from 86 pre-school children: 36 (41.9%) from Ibaro and 50 (58.1%) from Imala Odo. Forty-six (53.5%) of the total participants were male while 40 (46.5%) were female. The ages of the children in this study ranged from 3 months to 6 years with mean year of 3.36 years. Overall, prevalence of schistosomiasis among preschool-aged children in the two communities (n=86) was 53.5%; 54.3% in boys and 52.5% in girls. Prevalence of infection was not significant between sexes (X2, df=1, P=0.864), however, Imala Odo had significant high number (X^2= 16.453, df=1, p=0.0005) of pre-school children infected 72.0%; as against 27.8% in Ibaro. Geometric Intensity of infection within the age group is shown in Table 1. The table also shows that the geometric mean intensity of infection was 0.36 eggs/ 10 ml of urine. There were no significant differences (F=0.864, df=5, P=0.509) in the mean intensity of infection among age groups. Preschool children aged 3-4 years had the highest mean intensity of infection (0.53 eggs/10ml) while the lowest level (0.25 eggs/10 ml) was found in pre-school children aged 1-2 years. Microhaematuria was present in 46 children (54.7%); however, this was not significantly different between the age group (X2=2.285, df=5, P=0.808). There was significant difference in mean intensity of infection between Ibaro and Imala Odo (t=4.811, P=0.00006), but not between sexes (t=-0.825, P=0.412), as shown in table 2.

Table 1. Prevalence and geometric mean intensity of infection (GI) of paediatric schistosomiasis and microhaematuria relative to the age of preschooler

Age (year)	No. examined	Prevalence (%)	GI (eggs/10ml urine)	Microhaematuria (%)
Under 1 year	5	60	0.4352*	40.0
1-2	12	33.3	0.2503*	41.7
2-3	21	52.4	0.3294*	52.4
3-4	15	66.7	0.5328*	66.7
4-5	21	52.4	0.3028*	57.1
5-6	12	58.3	0.4007*	58.3
Total	86	53.5	0.3634	54.7

*ANOVA, F=0.864, df=5, P=0.509

Table 2: Prevalence and geometric mean intensity of infection (GI) of paediatric schistosomiasis by village relative to sex of preschooler

Village	No examined	Prevalence (%)	GI			P value	
			Boys	Girls	Total		
Ibaro	36	27.8	0.1198	0.1737	0.1407		0.536**
Imala-Odo	50	72.0	0.5216	0.5257	0.5238		0.973**
Total/ Mean	86	53.5	0.3294	0.4025	0.3634	0.00006*	0.411**

*Between communities; **between sexes.

Age of first exposure to Oyan reservoir water

Table 3 shows the responses on the question of age of first exposure of preschooler to reservoir water in both communities. 15 (41.7%) of the preschoolers in Ibaro had been exposed to the reservoir water from birth, 4 (11.1%) of them during their 1st year of life while 3 (8.3%) were exposed from 2nd-6th year of life. In Imala-Odo, 22 (44.0%) of preschoolers had been exposed to the infective water source from birth; 6 (12.0%) during their 1st year of life and 2 (4.0%) between 2nd-6th year of life. 14 (28.0%) of the parents had no idea if their children had visited the infected water source while 6 (12.0%) said their children had never visited the infected water source. In total, 37 (43.0%) of the parents and guardians said their preschooler had been exposed to the reservoir water source from birth, 10 (11.6%) from their 1st year, 5 (5.8%) from their 2nd-6th year, 23 (26.7%) had no idea about their child's exposure to the water source while 11 (12.8%) said that their child had not been exposed to the water source before for both communities. There was no significant difference in the exposure rate of the child in both villages ($P>0.05$). The parents and guardian admitted that exposure of their children to reservoir water was necessitated by the need to bath the child.

Table 3: Age of first exposure to Oyan reservoir water in Ibaro and Imala-Odo village

Time of exposure	Ibaro No (%)	Imala-Odo No (%)	Total No (%)
At birth	15(41.7%)	22(44.0%)	37(43.0%)
1st year	4(11.1%)	6(12.0%)	10(11.6%)
2-6 year of life	3(8.3%)	2(4.0%)	5(5.8%)
No idea	9(25.0%)	14(28.0%)	23(26.7%)
None	5(13.9%)	6(12.0%)	11(12.8%)
Total	36(100%)	50(100%)	86(100%)

Frequency of exposure to water Oyan reservoir water source

In Table 4 below, 8 (22.2%) of the 36 children in Ibaro visited the water source every day, 28 (77.8%) do not visit the water source again. 39 (78.0%) of the 50 children in Imala-Odo visited the water source every day, 2 (2.3%) visited once a month while 37 (43.0%) said they do not visit the water source again. There was significant difference in the visit of the children to the water source in the two communities ($P<0.05$).

Table 4: Frequency of exposure to Oyan reservoir water

What is the exposure to stream/river/dam water	Ibaro (%)	Imala-odo (%)	Total (%)
Every day	8(22.2%)	39(78.9%)	47(54.7%)
Once a week	0(0.0%)	2(4.0%)	2(4.0%)
None	28(77.8%)	9(18.0%)	37(43.0%)
Total	36(100%)	50(100%)	86(100%)

Predisposing activities that expose pre-schoolers to schistosomiasis infection

In Table 5, 36 (39.5%) of preschoolers from the two communities visit the water source for bathing, 7 (19.4%) of the children were from Ibaro while 27 (54.0%) were from Imala-Odo. 18 (20.9%) of the children visited the water for bathing, washing and fishing activities; 4 (11.1%) of these children were from Ibaro and 14 (28.0%) from Imala-Odo. A total of 34 (39.5%) of the children did not participate in any activities at the water source, 25 (69.4%) of the respondents from Ibaro and 9 (18.0%) from Imala-Odo. There was significant difference as the ($P < 0.05$) between the two communities in the type of activities engaged in by the preschool children at the water sources.

Table 5: Activities that predispose child to schistosomiasis infection

Village	No interviewed	Predisposing activities to reservoir water			Total
		Bathing of child (%)	Bathing, washing and fishing activities (%)	No activity (%)	
Ibaro	36	7 (19.4%)	4 (11.1%)	25 (69.4%)	36 (100.0%)
Imala-Odo	50	27 (54.0%)	14 (28.0%)	9 (18.0%)	50 (100.0%)
Total	86	34 (39.5%)	18 (20.9%)	34 (39.5%)	86 (100.0%)

Understanding water contact practices among preschoolers

Oyan reservoir water is the major water source in both communities, which is used for bathing, washing, recreation, and cooking. Although there is a functional borehole system in both communities, individual from Imala-Odo still preferred to visit the water source for bathing. The people of Ibaro on the other hand had warned their preschoolers to stay away from the reservoir water, but they still visit a tributary that flows from the reservoir called the Iwofi river. The parents and guardians of preschoolers admit-

ted taking their children aged 0-3 years to the reservoir for bathing, fishing and safe keeping. Preschoolers of 4-6 years old in Imala-Odo admitted going to the water source to bath, wash cloth and utensils and also for fishing activities. In Ibaro community older preschooler still find time to visit the reservoir in spite of the warnings from their parents.

Mothers and caregivers in Ibaro community stated that contact with the Oyan dam reservoir was the causes of urinary schistosomiasis infection. As such, they have prevented their preschooler and other children from going to the water source. Parents and guardians from Imala-Odo on the other hand admitted their ignorant of the mode of transmission and thus cannot restrict their children from the reservoir. Both communities considered schistosomiasis as a major health problem but were handicapped about the treatment. This was a serious concern in Imala-Odo community.

DISCUSSION

The result of this investigation shows that schistosomiasis is still a major health problem in the two communities studied. Comparing the result of this study with that of Mafiana *et al*., (2003); there is a reduction in the overall prevalence for the two communities from 72.8% recorded in 2003 to 53.5%, in the absence of any treatment. This reduction is probably due to the increase in the awareness of the mode of transmission of the disease, which might have promoted mothers and caregivers to reduce reservoir contact with preschoolers. Members of Ibaro community are more aware of the risk of water contact, admitting that their knowledge came from several studies on the disease within their community which had made them aware of the risk factors of the disease (Ofoeze *et al* 1991, 1997; 1998; Mafiana *et al*, 2003). This observation calls for more in-depth studies on the impact of non-intervention prior research on behavioural changes in communities. Although member of Ibaro community were able to associate the disease with contact with reservoir water, however, they are unable to avoid the water due to many reasons, such as it easier to fetch than borehole water, taste, and availability.

Although there have been a few studies on water-contact practices and risk factors for infants and pre-school-aged children. (Ekpo *et al*, 2012b), previous investigations have shown that mothers and caregiver contributed greatly to the exposure of their infants to infected water especially where there is no alternative safer sources (Mafiana *et al*. 2003; Bosompem *et al*. 2004). In this present study, the frequency of exposure of preschool children to the reservoir water source was significantly higher in Imala-Odo than Ibaro. This may be attributed to the knowledge of the parent/caregivers in Ibaro about the relationship between schistosomiasis diseases and water contact of which the parent/caregivers in Imala Odo are ignorant of. The age of first exposure to reservoir water showed that children born in lake shore communities are more likely to come in contact with reservoir water soon after birth. This support the fact that the distances to the water bodies correlated positively with frequency of water contact (Kloss *et al*, 1997; 1998). Whereas Ibaro is farther away from the mouth of the reservoir water, Imala-Odo is sited at the edge of the reservoir water. This allowed the preschooler to have regular contact with reservoir water source. Imala-Odo was closest to the water source therefore their preschool-aged children were not restricted when they go to the water. This is

because the parents and guardians of the children have limited knowledge of the transmission of the infection, and see no reasons in preventing their children from the water body. In Ibaro, parents and guardians of the children have a little knowledge of the mode of transmission of schistosomiasis and thus much restraining of infants is enforced. Most of the children in the community have been forbidden to go to the reservoir water; they therefore go to an alternative river (Iwofi River).

It is now clear from this study that exposure to infection for preschooler is much earlier than previously thought and that this depends on several factors such as type of water sources, distances to water sources, water needs, communal beliefs and knowledge. Early infection with schistosomiasis in childhood could lead to a long term clinical impact and severity of the disease before such children are eligible for treatment (Ekpo et al. 2012b). As safety issues, formulation and pharmacokinetic of Paraziquantel in infants and preschool children < 4 years are yet to be resolved (Sousa-Figueiredo *et al.* 2010a; 2010b; Mutapi *et al.* 2011; Keiser *et al.* 2011; Amin *et al.* 2012), health education targeted particularly to mothers and caregiver would go a long way to reduce exposure of infants and preschool children to infection which has been demonstrated in Ibaro community.

CONCLUSION

This study shows that infant and preschool-aged schistosomiasis is still a major public health problem in Ibaro and Imala-Odo communities. In the absence of approved and standardized Praziquantel dosage for preschoolers, health education to mother and caregivers would help reduced transmission among preschoolers. Health education for mothers and caregivers should become integral part of current preventive chemotherapy for now, until the inclusion of preschooler in treatment campaign is approved.

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