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Urinary schistosomiasis in preschool children in settlements around Oyan Reservoir in Ogun State, Nigeria: implications for control

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Summary We determined the prevalence of urinary schistosomiasis in preschool children below the age of 5 years in three settlements around Oyan Reservoir in Ogun State, Nigeria. Of 209 children screened, 150 (71.8%) had an infection, with no significant difference between males and females; 42.9% of infants were infected. Both prevalence and intensity of infection increased significantly with age ($P < 0.005$). Most (62.7%) infections were light (<50 eggs/10 ml urine). A 17.7 percentage of the children had visible haematuria, which increased with age ($P < 0.005$). Focus group discussions (FGDs) with adult men and women revealed that infection in preschool children was primarily because of exposure occasioned by the mothers' domestic (washing and bathing) and occupational (fishing) activities, while older children could go swimming on their own. Although the participants claimed that using a different water supply may not be effective in combating the disease, as their entire existence was tied to the reservoir, we propose that health education geared towards changing behaviour and attitudes is necessary. As preschool children are a source of both contamination and transmission, control programmes must take them into account.

keywords *Schistosoma haematobium*, preschool children, water contact, water development project, control, focus group discussion, Nigeria

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Introduction

Schistosomiasis is one of the main occupational diseases acquired by man through activities associated with freshwater such as washing, bathing, fishing and recreation (WHO 1985). It has also been recognized as a disease of significant socio-economic and public health importance second only to malaria (WHO 1993). In Nigeria, the disease occurs in all 36 states and the Federal Capital Territory (FCT) Abuja [National Schistosomiasis Control Programme (NSCP) 1996]. WHO (1993) noted that the prevalence and intensity of the disease have increased in areas undergoing water resource development, especially irrigation. After the Sahel drought of 1973, following the Federal Government's policy of large-scale irrigation and water conservation, several reservoirs were built. The public health effects of some of these dams on transmission of schistosomiasis in Nigeria have been described by Pugh and Gilles (1978), Pugh *et al.* (1980), Betterton *et al.* (1988), Udonsi (1990), Ndifon (1991), Ofoezie *et al.* (1991) and Akogun and Akogun (1996).

The Oyan Reservoir, commissioned in 1984, is a large multi-purpose dam for breeding fish, irrigation and water supply, located about 20 km north-west of Abeokuta, the capital of Ogun State (Ofoezie *et al.* 1991). But due to poor use, the reservoir now only functions for water conservation and supply to water treatment plants in metropolitan Abeokuta and Lagos. Irrigation is hardly undertaken as there are no mechanized farms nearby. The creation of the reservoir resulted in displacement of more than 1000 people who were resettled in two villages (Abule-titun and Ibaro) closely to the bank of the reservoir. Within 4 years of building the reservoir, an outbreak of urinary schistosomiasis was reported in the two communities, probably caused by the impoundment (Ofoezie *et al.* 1991). Several follow-up studies have reported on the pattern of infection and transmission of schistosomiasis (Ofoezie *et al.* 1997), dam water level regulation (Ofoezie & Asaolu 1997), water contact patterns (Ofoezie *et al.* 1998), and the distribution of freshwater snail intermediate hosts (Ofoezie 1999).

The control of schistosomiasis has received considerable attention partly because of increasing evidence that treatment can improve the physical and cognitive development of school-aged children and that prevalence in school-aged children can also be used as an index for assessing community prevalence (Guyatt *et al.* 1999). Therefore many prevalence studies, including the development of rapid assessment methods through questionnaires, have focused on school-age children (Mafe *et al.* 2000; Ansell *et al.* 2001; Howard *et al.* 2001; Mafiana *et al.* 2001a; Lengeler *et al.* 2002).

Urinary schistosomiasis is still endemic in Oyan Reservoir communities, as no sustainable control programme has ever been implemented. In a recent investigation of surface water use and its potential for the transmission of parasitic diseases, we observed that preschool children in communities near the reservoir constituted an unexpectedly high proportion of children with water contact (Mafiana *et al.* 2001b). We therefore investigated the extent of infection among this age group.

Materials and methods

Study area

The study was conducted in Abule-titun, Ibaro and Imala-odo, three communities located in close proximity to the bank of the Oyan Reservoir. Abule-titun and Ibaro are resettled communities displaced by the construction of the dam (Ofoezie *et al.* 1991). Imala-odo, however, is a fishing village which derived its name from Imala, a community located 10 km away from the reservoir. Established in 1984, is a multi-ethnic community comprising 80% Idoma (north-central Nigeria), 15% Ilaje (south-west Nigeria) and 5% Hausa (north-west Nigeria) founded for the sole purpose of fishing from the reservoir. In all the three communities, there are no provisions for health care, safe water supply and sanitation facilities. The reservoir is their only source of water supply.

Ethical clearance

Before the study began we briefed the village heads on the objective of the study and obtained their consent. This study forms part of a larger one on community perception and environment receptivity to parasitic infections. The villages were thereafter mobilized to participate in the study.

Parasitological investigation

A house-to-house census was conducted during which all children below 5 years of age in the three communities were listed. Children were registered using an epidemiological field form, which documented their age, sex, the name of the household head and community. We listed 247 children, and tested for *Schistosoma haematobium* infection using the sedimentation of urine by gravity method (Asaolu & Ofoezie 1990). A single urine sample was collected between 10.00 and 14.00 hours from each child; the number of eggs was counted and expressed as eggs/10 ml urine. Eight children <2 years had their urine samples taken between 14.00 and 16.00 hours. For children <3 years, mothers were given dark plastic bowls with the instruction to collect any voided urine between the hours specified. The intensity of infection was expressed as negative (0 egg/10 ml urine), light (<50 eggs/10 ml urine) and heavy (≥50 eggs/10 ml urine). In addition, gross haematuria, i.e. visible blood in urine was scored visually. All children >2 years with positive urine samples were treated with praziquantel tablets (40 mg/kg) as recommended by WHO (1985).

Water contact practices

We also held focus group discussions (FGDs) on perceptions of the disease and possibly infectious water contact practices in the three villages. There were three sessions each with preschool children, adult males and adult females (mostly nursing mothers). The sessions with preschool children were limited to children between 4 and 5 years of age. In addition, in-depth key informant interviews concerning perceptions of urinary schistosomiasis, water contact practices and disease control activities were held with village leaders and opinion leaders.

Statistical analysis

Quantitative data were entered into a computer using Epi Info version 6.04 (CDC, Altanta, GA, USA) and analysed using SPSS version 8.0 for Windows (SPSS Inc, Chicago, IL, USA). Qualitative data from FGDs were recorded, transcribed and analysed accordingly. Differences in proportions were tested by chi-square tests, either for trend or for independence, as appropriate. The mean egg counts were transformed to $\log_{10}(x + 1)$ values, to normalize the distribution of the residuals values for statistical analyses. Variation in mean values between subgroups was then tested using Student's *t*-tests and analysis of variance (one-way ANOVA).

Results

Prevalence and intensity of *S. haematobium*

Of the 247 children under 5 years of age, 135 were from Imala-odo, 75 from Ibaro and 37 from Abule-Titun. We obtained urine samples from 209: 107 (82.9%) from Imala-Odo, 66 (88.0%) from Ibaro and 36 (97.3%) from Abule-Titun; 123 (58.9%) were male and 86 (41.1%) female. Thirty-five children (16.7%) were infants, 32 (15.3%) were 1–2 years old, 46 (22.0%) 2–3 years old, 52 (24.9%) 3–4 years old and 44 (21.1%) 4–5 years old. The overall prevalence of infection was 71.8%; 72.4% in boys and 70.9% in girls. There was no significant difference in prevalence between sexes ($\chi^2 = 0.05$, d.f. = 1, $P = 0.82$) or between communities ($\chi^2 = 3.67$, d.f. = 2, $P = 0.16$). Fifteen (42.9%) infants were infected.

The intensity of infection within the age group is shown in Table 1. The table also shows that nearly two-thirds of the preschool children had light infection (62.7%), while 9.6% had heavy infection. Visible haematuria was present in 37 (17.7%), significantly different between age groups ($\chi^2 = 9.83$, d.f. = 4, $P = 0.043$). In terms of geometric mean egg counts, there were significant differences between age groups ($F = 10.624$, d.f. = 4, $P = 0.0001$) but not between sexes ($F = 0.653$, d.f. = 1, $P = 0.420$) or communities ($F = 1.078$, d.f. = 2, $P = 0.342$), as shown in Table 2.

Understanding water contact practices

The patterns of water use were similar in all the three study communities. These are occupational, bathing, washing, cooking and recreation. FGDs with community members revealed that contact with the reservoir particularly for children <2 years was due to their mothers activities, such as washing and fishing. During fishing, the child (usually <3 months old) is strapped to the boat, which often contains water. Bathing or washing of the child also takes place in the reservoir. A mother in Imala-Odo said: 'I bathe my child in the water (reservoir) as there is no other source of water'.

Older children (4–5 years) admitted that they visit the reservoir everyday for bathing, washing, fetching, swimming and fishing. A preschool boy in Imala-odo stated 'We go to reservoir every day to fish and swim'.

The FGDs also showed that although the villagers have a good perception of urinary schistosomiasis as 'the presence of blood in urine', they did not know the precise mode of transmission. Questions on the causes of schistosomiasis,

Table 1 Prevalence, visible haematuria and intensity of infection with *Schistosoma haematobium* by age

Age group (years)	No. examined	No. infected (%)	Intensity of infection (% of subjects)†			Visible haematuria (%)
			Negative	Light	Heavy	
Under 1	35	15 (42.9)*	57.1	42.9	0.0	2.9
1–2	32	17 (53.1)*	46.9	46.9	6.3	6.3
2–3	46	36 (78.3)*	21.7	78.3	0.0	13.0
3–4	52	45 (86. 5)*	13.5	79.2	17.3	26.9
4–5	44	37 (84.1)*	13.6	65.9	20.5	31.8
Total	209	150 (71.8)	27.2	62.7	9.6	17.7

* One-way ANOVA, F statistics = 10.624, d.f. = 4, $P < 0.0005$.
† Negative, light and heavy infection = 0, <50, and ≥50 eggs/10 ml urine, respectively.

Table 2 Prevalence and mean intensity of transformed egg count with *Schistosoma haematobium* by village by sex

Village	No. examined	No. infected percentage	Mean intensity of transformed mean egg count [$\log_{10}(x + 1)$]		Total	P-value	
			Male	Female		Between villages*	Between sexes*
Abule-titun	36	24 (66.7)	0.8488	0.6779	0.7823		0.412
Ibaro	66	43 (65.2)	1.1029	0.6970	0.9307		0.028
Imala-odo	107	83 (77.6)	0.9244	1.0347	0.9698		0.340
Total/mean	209	150 (71.8)	0.9661	0.8667	0.9252	0.342	0.420

* One-way ANOVA test for differences in means.

revealed the following responses: 'We get it from bathing, drinking and washing clothes with dam water' (adult women, Ibaro); 'We get it from eating sweet things' (preschool children, Imala-odo), 'We feel that contact with the water is the problem' (adult male, Imala-odo).

Overall, the communities did not consider schistosomiasis as a major health problem. In their hierarchy of health problems it ranks after fever in children, rashes, itching and abdominal pain. Preschool children did not consider urinary schistosomiasis a problem either. The communities believed that an alternative water source would not prevent them from using the reservoir as fishing is their main occupation. The village leader in Imala-Odo put it succinctly: 'The reservoir is our only source of income (fishing). We came here purposely to fish, farming is secondary only, when there is no fish to catch'. They preferred that a health centre be built, with adequate provision of drugs.

Discussion

Schistosomiasis in the Oyan Reservoir first received attention after an outbreak of *S. haematobium* in 1988 in two resettlement communities (Ofoezie *et al.* 1991). Further studies there showed that prevalence and intensity of infection, and frequency of haematuria and proteinuria increased markedly from 1991 to 1992, indicating an intensive transmission (Ofoezie *et al.* 1997). These, like many other studies in schistosomiasis, have tended to focus on school-age children and adults, with little or no emphasis on preschool children, and, where preschool children are part of the study, information about them was often subsumed (Akogun & Akogun 1996; Ofoezie *et al.* 1998).

In this investigation, we found a prevalence of 71.8% in under-fives, which is very high compared with Egypt: 14.5% noted by Nour *et al.* (1990), and none in that age group seen by el Katsha and Watts (1997). We speculate that the prevalence of infection in our study could be even higher had we taken more than a single urine sample, given the variability in daily egg output. In addition, the collection of urine samples was extended to 16.00 hours in a few cases because of the difficulty in obtaining samples from these younger age groups. However, Akogun and Akogun (1996) recorded a prevalence of 78% similar to ours in children aged 3–5 years in a settlement near lake Geriyo near Yola in Nigeria. Of particular interest in our results is the proportion of infants (42.9%) who had acquired the infection before the age of 1 year. It would appear therefore that infection is acquired very early in life through water contact in these and other communities that live by lakes or reservoirs, where no other safe source of water supply is available. Infection and transmission in preschool children would occur through early exposure to infected waterbodies, when they accompany their mothers to fishing, bathing and washing.

There was, however, no significant difference in prevalence between males (72.4%) and females (70.9%). This may be an indication that both sexes receive their initial infection at about the same age. Our observations show that at about 3 years of age, exposure to infection is unaided, as most children had acquired the ability to swim, bath and wash on their own. In the three study villages, uninterrupted year-round reservoir use is necessitated by the absence of an alternative water supply for occupational and recreational purposes, which is typical of lakeside communities (Scott *et al.* 1982; Hilali *et al.* 1995; Akogun & Akogun 1996; Useh & Ejezie 1999).

Most villagers are aware of the health risks of reservoir contact, yet they lack the capacity to change their behaviour. The recognition of schistosomiasis as a major health problem is still limited in these communities, as was previously observed by Ofoezie *et al.* (1998). The FGDs showed that a safe water supply may not reduce contact with the reservoir because most water contacts are either recreational or occupational, and a new water supply might at best be used for domestic needs. Any control measure that is to succeed here must involve the communities (el Katsha & Watts 1997), such as developing participatory health education programmes with community members to effect behavioural change by mothers who expose their young children to *S. haematobium* infection. Mothers should wear protective shoes and gloves while in contact with water. The provision of a community crèche where mothers could leave their young children when going fishing or for other water contact activities should be encouraged. Involving the community in providing safe water and sanitation facilities would reduce contamination of the reservoir. Children should be restrained from bathing or swimming in the dams, and communities should be encouraged to heat dam water before using it to bathe. Regular chemotherapy to reduce morbidity should also be applied.

Strategic control of schistosomiasis in Nigeria consists of morbidity control through treatment, supported by health education targeted at schoolchildren and adults to reduce the risk of re-infection (National Schistosomiasis Control Programme 1999). Most studies on schistosomiasis revolve around school-age children and adolescents, while preschool children are excluded. Considering that morbidity in schistosomiasis is a function of intensity and duration (WHO 1993), the exclusion of under-fives from treatment could serve as a veritable source of transmission. In areas where the disease is endemic as a result of water resource projects and where fishing is a major source of income, the schistosomiasis control strategy should be extended to include preschool children.

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