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## **Evaluation of Intensity of Urinary Schistosomiasis in Biase and Yakurr Local Government Areas of Cross River State, Nigeria after Two Years of Integrated Control Measures**

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### **ABSTRACT**

A parasitological mapping of urinary schistosomiasis using filtration method was conducted in Biase and Yakurr LGAs of Cross River State, Nigeria by the Neglected Tropical Diseases Control unit in collaboration with the schistosomiasis/soil transmitted helminths unit of the Federal Ministry of Health, Nigeria in November 2012. The results of the study revealed a mean urinary schistosomiasis prevalence of 49% for the six schools under study in Biase and 30% for the six schools under study in Yakurr LGA. The mean ova load was 0.9 for males and 0.8 for females in the two LGAs. Integrated control measures put in place, included chemotherapy of infected individuals with praziquantel and health education on the predisposing factors responsible for the transmission of urinary schistosomiasis. An evaluation of the interventions was carried out in November 2014, after two rounds of treatment with Praziquantel and intensive education were given. Urine samples were collected from 600 school children, 300 from each of the two LGAs. The evaluation study using the urine filtration technique revealed a mean schistosomiasis prevalence of 0% for the six schools under study in Biase and 0.02% for the six schools under study in Yakurr LGA with mean ova load reduced to 0.3 for males and 0 for females in the two LGAs. Data analysis with SPSS package revealed a 100% participation of all selected school children in 12 schools (6 in each LGA). Statistical analysis showed that there was no significant difference in the prevalence between male and female ( $p > 0.005$ ). A student t-test showed a significant difference between prevalence rates in 2012 and the results in 2014 ( $p > 0.005$ ). The spatial distribution showed that endemic schools were distributed within marshy areas where rice was cultivated in the two LGAs. These results showed that with wide scale integrated control measures, urinary schistosomiasis can be eliminated or reduced to a disease of no public health importance.

**Key words:** Evaluation, intensity, urinary schistosomiasis, integrated control measures

## INTRODUCTION

Schistosomiasis, a parasitic disease that has plagued humanity for centuries is caused by a trematode or fluke of genus *Schistosoma*. The disease has some time ago been misconceived as the male equivalent of menstruation and has therefore been celebrated as the coming of age for young males in rural endemic communities (Amazigo *et al.*, 1997). The widespread, uncontrolled, unmonitored proliferation of water impoundment and irrigation schemes, coupled with the phenomenon of global warming and prevailing ignorance of Schistosomiasis in most endemic areas has elevated the disease to a very serious health problem in sub-Saharan Africa including Nigeria (Abdullahi *et al.*, 2011; WHO., 2012; Useh, 2013).

The disease is also considered as one of the most frequently occurring parasitic infections globally (Okon *et al.*, 2007; WHO., 1985). About 200 million people in 76 countries are affected with schistosomiasis and 600 million people may be at risk of infection (WHO., 1985). In Cross River State, the agrarian population and suitability for the thriving of the snail intermediate host has contributed to the prevalence of *S. haematobium* (Ejezie *et al.*, 1991). A national prevalence survey carried out in 1990/91 among school children aged 5-14 years, reported the presence of schistosomiasis in all 36 states of Nigeria including the Federal Capital Territory, Abuja, with an estimated number of 20 million people infected (Ekpo and Mafiana, 2004; NSCP., 1996). In Biase Local Government Area of Cross River State, Etim *et al.* (1999, 2012) reported 35.95 and 30.5% prevalence of urinary schistosomiasis, respectively while Okon *et al.* (2007, 2009) reported 35 and 45.3% prevalence, respectively from parasitological examination of urine samples from school children. Schistosomiasis can be treated effectively by giving a single oral dose of praziquantel which is effective against all the species of schistosomes. Chemotherapy with health education and provision of safe water sources can reduce transmission. Control of snail intermediate hosts of the disease is however of very limited value (NSCP., 1999). Efforts have been targeted on urinary schistosomiasis (the most common and easily diagnosed) for control (WHO., 1985). Drug administration alone cannot control the spread of schistosomiasis hence the integrated approach used by the Cross River State Neglected Tropical Diseases Control unit in curbing the spread of the disease.

The objective of this study was to evaluate the efficacy of the strategies used in the control of urinary schistosomiasis among school children in Biase and Yakurr Local Government Areas. The results of this study will strengthen planning for large scale control measures.

## MATERIALS AND METHODS

**Study area:** The study was carried out in Cross River State, Nigeria, situated within the tropics, between latitudes 5°32' and 4°27' North and longitude 7°50' and 9°28' East (Fig. 1). All year round rainfall of about 350 mm occurs along the coastal area. Rainfall in the hinterland is between 120 and 200 mm annually with maximum precipitation occurring from July to September. Ambient temperatures remain high throughout the year (22.4-33.2°C). Relative humidity is high (60-93%). The climate is tropical except for Obudu Plateau which has an altitude of 1,575.76 m above sea level and has temperate climate. The State has a 2015 projected population of 3,783,085 people (United Nations Fund for Population Activities (UNFPA)).

**Study procedure:** This study received a country wide ethical clearance from the Ethical Board of the Federal Ministry of Health, Abuja. The Cross River State Health Research and Ethic Committees also provided further clearance for this study. Advocacy visits were made to the Yakurr and Biase LGAs during which the purpose of the study was explained to key opinion leaders. The



Fig. 1: Map of cross river state showing study LGAs and sites

schools were identified and oral consent was obtained after meeting with parents of school children and explaining the study. All participants had the opportunity to opt out if they were not comfortable with participating. This cross-sectional descriptive and analytical study utilized a structured questionnaire for each urine-providing child and this was administered by a trained researcher to capture relevant socio-demographic data. Urine samples were then collected from a total of 600 school children from 12 schools, that is, 300 from each of the two LGAs.

**Collection of urine samples:** A sterile procedure was used to collect urine samples for diagnosis of urinary schistosomiasis. This was to ensure that the samples were not contaminated, hence the samples were collected in sterilin bottles. Pupils were provided with capped sterile bottles. They were instructed to fill the bottle with urine to the 10 mL mark in the middle of a discharge and then cover the bottle with the cap. The period of urine collection for *Schistosoma haematobium* was between 10.00 and 14.00 h.

**Examination of urine samples:** On collection, the urine samples were examined for colour (macrohaematuria) and appearance following the guide indicated in the questionnaire. A reagent strip (hemastix) was inserted in the urine to test for microhaematuria and the observations recorded.

The urine was examined further on the same day for *S. haematobium* eggs, the urine was further treated by fixation, this was done by adding 3 drops of formaldehyde and examining later for *S. haematobium* eggs following the procedure below.

Each of the urine samples was thoroughly mixed and 10 mL of the sample put into a centrifuge tube with a conical tip. The centrifuge was spun for 5 min at 1500 rpm. The supernatant was removed with a pipette leaving about 0.5 mL of the fluid with the sediment at the bottom of the tube undisturbed. The remaining fluid and sediment were mixed using a pipette, then a drop of the mixture was transferred to a microscope slide and covered with a cover slip. The slides were thoroughly examined for *S. haematobium* eggs using the 10X objective. The total number of eggs in all the sediment were expressed per 10 mL of the urine.

**Collection of coordinates:** A hand-held GPS (Garmin 12XL, Garmin Corp, USA) was used to determine the latitude and longitude of the schools. The coordinates were collected in the school compound, the location was marked after allowing the satellite error to come to a distance of 3-5 m.

**Data analysis:** All data were double-entered using SPSS version 17.0 for Windows (SPSS Inc, Chicago, IL, USA). For analysis of infection data, descriptive statistics, including 95% confidence intervals (95% CI), Student t-test analysis was also used to compare differences among variables. ArcView GIS with Spatial Analyst GIS software were used for display of spatial data. The location of each school was linked to the parasitological data using unique schools identifier.

**RESULTS**

The study analyzed urine samples from six hundred pupils (300 males and 300 females) in 12 schools in Biase and Yakurr Local Government Areas. Of the 600 pupils examined before and after the implementation of the integrated control strategies in the two Local Government Areas, 231 (38.5%) and 1 (0.17%) prevalence were reported, respectively (Table 1). In Biase Local Government Area, out of the six schools re-examined after the implementation of integrated control strategies, no infection were found for both sexes while in Yakurr Local Government Area, only 1 (0.67%) prevalence was observed among the male pupils (Table 2 and 3).

Table 1: Age range, percentage prevalence and intensity of urinary schistosomiasis in Biase and Yakurr Local Government Areas, Cross River State, Nigeria before and after the implementation of the integrated control strategies

Age range (years)	No. of pupils examined	Prevalence before implementation of control strategies		Mean Ova/10 mL of urine before implementation of control strategies	Prevalence after implementation of control strategies		Mean Ova/10 mL of urine after implementation of control strategies
		No.	%		No.	%	
5-10	148	68	45.9	50	0	0.00	0
11-15	244	109	44.7	85	1	0.41	12
16-20	208	54	25.9	62	0	0.00	0
Total	600	231	38.5	197	61	0.17	12

Table 2: Prevalence of urinary schistosomiasis among children in 6 selected schools in Yakurr LGA before and after the implementation of the integrated control strategies

Location of school	No. of individuals examined		Prevalence before implementation of integrated control strategies				Prevalence after implementation of integrated control			
			M		F		M		F	
	M	F	No.	%	No.	%	No.	%	No.	%
Lekpanko	25	25	12	48	7	28	1	4.0	0	0
Nko	25	25	4	16	8	32	0	0.0	0	0
Ntam Ekori	25	25	11	44	6	24	0	0.0	0	0
Assiga old town	25	25	6	24	8	32	0	0.0	0	0
Idomi	25	25	14	56	7	28	0	0.0	0	0
Agoi Ekpo	25	25	5	20	2	8	0	0.0	0	0
Total	150	150	52	35	38	25	1	0.6	0	0

Table 3: Prevalence of urinary schistosomiasis among children in six selected schools in Biase LGA before and after the implementation of the integrated control strategies

Location of school	No. of individuals examined		Prevalence before implementation of integrated control strategies				Prevalence after implementation of integrated control			
			M		F		M		F	
	M	F	No.	%	No.	%	No.	%	No.	%
Ugbem	25	25	14	56	9	36	0	0	0	0
Iwuru	25	25	19	76	14	56	0	0	0	0
Agwagwune	25	25	7	28	11	44	0	0	0	0
Abini	25	25	20	80	7	28	0	0	0	0
Adim	25	25	22	88	15	60	0	0	0	0
Akparavuni	25	25	9	36	12	48	0	0	0	0
Total	150	150	52	35	38	25	0	0	0	0

The intensity of urinary schistosomiasis calculated as mean ova load reduced drastically after the implementation of the integrated control strategies from the initial 197 mean ova/10 mL of urine to 12 mean ova/10 mL of urine in the two Local Government Areas (Table 1).

The t-test analysis of the results using the SPSS statistical software indicated a significant difference in the prevalence rates before and after implementation of the integrated control strategies. There was also a significant difference in infection intensity rates amongst the pupils before and after implementation of the integrated control strategies ( $p < 0.05$ ). The only pupil that tested positive in Lekpanko was not treated, since he was absent from school when his class had treatment (Table 1).

## DISCUSSION

Previous studies have established the endemicity of urinary schistosomiasis in parts of Cross River State (Ekanem *et al.*, 1995; Ejezie *et al.*, 1991; Useh and Ejezie, 1996; Etim *et al.*, 1998, 1999, 2012; Okon *et al.*, 2007, 2009) but without deliberate efforts at evaluating available interventions. However, Okon *et al.* (2010) evaluated the status of urinary schistosomiasis in Ogoja Local Government Area, Cross River State, Nigeria, further treated infected persons with artesunate and found 64% cure rate while Inyang-Etoh *et al.* (2008) recorded a cure rate of 88.6% also in their study in Nigeria using artesunate and praziquantel combination.

The present study further re-evaluated the status of urinary schistosomiasis in Biase and Yakurr Local Government Areas of Cross River State with the view of applying integrated control strategies to eradicate the infection. The prevalence rate of infection reported for the two Local Government Areas before the implementation of the control strategies were 231 (38.5%) out of the 600 pupils examined while intensity was 197 mean ova per 10 mL. This result is in consonance with previous reports in these areas as mentioned by earlier investigators.

Two years after the implementation of the integrated control strategies in the two Local Government Areas, the prevalence rate reduced to 1 (0.17%) while the intensity similarly reduced to 12 mean ova per 10 mL. The integrated control strategies utilized included chemotherapy using praziquantel, health education and provision of safe water sources. Chemotherapy with praziquantel currently offers the most feasible means of controlling human schistosomiasis, at least in the short term (WHO., 2002).

Most of the schools in Yakurr and Biase Local Government Areas implemented the UNICEF free open defecation programme, hence there were improved toilet and hand washing facilities in the schools. This encouraged the pupils towards improved sanitary practices which reduced the contamination of available freshwater which were sources of transmission of schistosomiasis. It is very likely that the dramatic reduction in prevalence and intensity of urinary schistosomiasis recorded in these communities is a result of the integrated health interventions introduced two years ago. The benefits of applying mass chemotherapy on a large scale in various endemic populations have been proven scientifically (WHO., 2006; Morris, 2010). Praziquantel is safe and easy to use and it is low cost. The concerns about promoting resistance to Praziquantel by large scale chemotherapy appear to be remote (Utzinger *et al.*, 2009; Webster *et al.*, 2008). Chemotherapy with Praziquantel is the mainstay for the control of the disease in the short term (Useh, 2013). However, there have been recent worries of the emergence of resistance in Senegal following a report of the low cure rates of 18-38% of *S. mansoni* infections (Danso-Appiah and de Vlas, 2002). In the long term, the most cost-effective and sustainable means of controlling endemic infectious disease is through the use of vaccination. From literature, there is great hope in the discovery of schistosome vaccine. This lies in the Sh28GST which has already undergone successful Phase 1 and 2 human trials without adverse side effects (Capron *et al.*, 2002).

Health education and health promotion have also proven to be veritable tools in *Schistosoma* control particularly when combined with mass chemotherapy programmes. The results of this study are in consonance with results of a study done in Poyang Lake area China to examine the short-term effects of health education and health promotion in the control of schistosomiasis and to monitor the long-term impact on re-infection patterns (Hu *et al.*, 2005). In general, the approach of emphasizing health education and health promotion in combination with chemotherapy was highly successful in reducing prevalence and intensity in the two Local Government Areas of Cross River State, Nigeria.

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