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Schistosoma haematobium among Pupils in Yewa North, Southwestern Nigeria: Assessment of Two Consecutive Praziquantel Treatments with 180 Days Interval

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Abstract
Praziquantel is among the drug of choice for the effective treatment of *Schistosoma haematobium* infection for 30 years. Early and regular administration of this drug for optimal control and reduction of long – term consequences of morbidity is currently being advocated. The effect of treatment and retreatment with Praziquantel among pupils in *S. haematobium* endemic communities of Yewa North of Ogun State, Nigeria was evaluated. This cross-sectional study was conducted with 734 pupils (aged 3-17 years) between September 2011 and June 2012. Urine samples were examined microscopically for *S. haematobium* eggs. Infected pupils were treated with single dose praziquantel. Re-examination of pupils was carried out 8 weeks post treatment. Pupils in Government primary school were treated twice with 180 days interval. Data were analysed using Chi-Square and MANOVA for significant variations in prevalence. Pretreatment prevalence was 30.11% while prevalence after treatment was 9.05 % with a reduction rate of 69.90%. Post treatment prevalence of 10.7% in males and 7.3% in females were not significantly different (χ^2 =1.5885, P>0.05). Pretreatment total mean egg count was 102.5±17.4 eggs /10ml of urine, with a 91.24% egg reduction rate and parasitological cure rate of 90.95%. Egg reduction and cure rates of 100% each were observed after the second treatment in Yewa North Local Government Primary School. Repeated treatment with 6 months interval suggests the possibility of elimination of schistosome egg burden.

Key words: Urinary schistosomiasis, consecutive chemotherapy, morbidity, prevalence, Praziquantel.

Introduction

Schistosomiasis remains one of the most prevalent parasitic infections in the world and a highly focal disease particularly where resources are limited [1]. Over 240 million people are infected worldwide and about one million deaths are caused by complications from schistosomiasis [2]. The disease is responsible for the loss of more than 1.7 million Disability Adjusted Life Years (DALYs) per year worldwide, of which 82 % (1.4 million DALYs) are lost in sub-Saharan Africa alone primarily as the result of organ damage, hemorrhage and cancer resulting from the infection [3]. Within sub-Saharan Africa, Nigeria is the country with the most reported cases of human schistosomiasis with about 29 million in 2008 [4]. Certain estimates of DALYs (up to 70 million DALYs per annum) have shown schistosomiasis to be a more debilitating infection than malaria [5]. In Nigeria, urinary schistosomiasis is widespread in both rural and urban communities; with prevalence ranging between 2% and 90% and the vast majority of cases occurring among the poor and marginalized people [6,7,8].

Schistosome transmission requires contamination of water by faeces or urine containing eggs of the parasite, a specific freshwater snail as intermediate host and human contact with water inhabited by infected snail intermediate host. Five species of schistosomes are known to infect man namely: *Schistosoma haematobium, Schistosoma mansoni, S. intercalatum, S. japonicum and S. mekongi* [2]. The pathological effect of *S. haematobium* do not show defined symptoms until about the tenth to twelfth week post infection when eggs begin to appear in urine [9]. Majority of the morbidity associated with schistosomiasis occur when eggs remain trapped in the intestinal or

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bladder wall or in the liver, eliciting the formation of granulomas and fibrosis. Eggs which remain in the tissues cause pathological changes which are serious and could eventually lead to kidney failure if untreated.

Drugs which have been used for treatment of schistosomiasis include: metrifonate, oxamniquine and praziquantel. Praziquantel (PZQ) is the drug of choice for all forms of schistosomiasis and it has become significantly less costly [10]. Good access to PZQ is indeed the strict basis for morbidity control [1]. Urinary schistosomiasis had been reported amongst the people of Yewa North, Ogun State and constitute a long standing health problem [11]. Personal interaction with people in the communities revealed several self attempts to combat the disease which persisted among the people. Growing concern about the high prevalence of schistosomiasis among school children in Yewa area brought about interventions by a Schistosomiasis Research Group and the Ogun State Government in conjunction with the Yewa North Local Government (YNLG) Health Officials. The first treatment intervention was in 2011 followed by a second drug therapy in 2012 with 180 days interval.

This study was therefore designed to evaluate consecutive PZQ treatment of urinary schistosomiasis among Yewa North school children. The main objectives are to determine prevalence and intensity of schistosomiasis in relation to age and gender of pupils and to examine treatment and retreatment with PZQ on the status of schistosomiasis among the pupils.

Materials and Methods

The Study Area

The study was carried out in Yewa North Local Government Area, Ogun State (Fig. 1). The area is located in latitude 7^0 15^0 N and longitude 3^03^1 E in a deciduous – derived Savannah zone of Ogun State, Nigeria with climatic condition favourable for agricultural production throughout the year. Yewa North Local Government Area has a land size of about 200,213-5 square kilometres and the population size is 232,236 according to the 2005 population projection of the state demographic indicator [11]. The inhabitants are mainly yorubas speaking different dialects. A number of nursery, primary and secondary schools and a College of Agriculture are found in this local government. Four primary schools; Yewa Central Anglican (YCA) school Igan Alade, Evangelical Africa Church (EAC) primary school, Ile-Ijoun; Community Primary School(CPS), Eggua and Yewa North Local Government (YNLG) primary school, Oja-Ijoun were selected for this study.

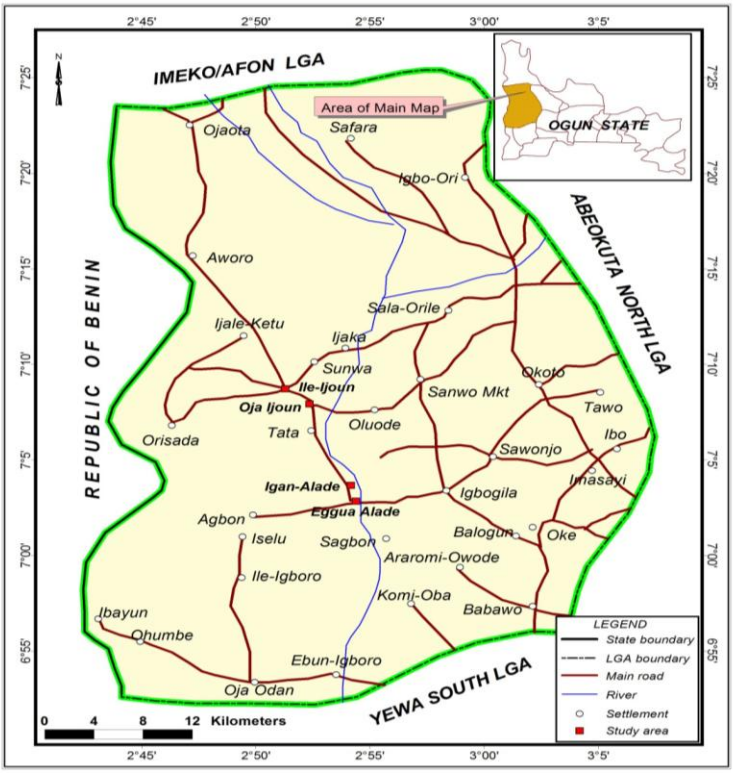

Fig. 1: Map of Yewa North Local Government Area showing study sites.

Ethical Consideration

Ethical approval for the study was granted by the University of Ibadan/University College Hospital Ethics Committee. Permission to carry out the study in selected schools was granted by the State Universal Basic Education Board of Ogun State. Parents/ guardians gave consent for their children/ wards to participate in the study.

Collection of Samples

The cross-sectional survey was conducted between September 2011 and June 2012 among 734 pupils. Using clean and sterile, universal bottles, urine samples were collected between 11:00 and 14:00 GMT from the pupils. Pupils were assisted in the collection of urine samples so as to avoid contamination with faecal matter and other contaminants. Samples were carefully placed in dark clean nylon bags to prevent hatching of eggs, and promptly transported to the laboratory on ice for examination.

Examination of Urine and Egg Counts

Urine samples were examined for terminal spine ova of *S. haematobium* eggs using X 10 and X 40 objective lens of light microscope and egg counts carried out according to procedure outlined by Basompem et al. [12].

Treatment of Pupils

The pupils whose urine contained egg(s) of *S. haematobium* were given a single oral dose of PZQ (40mg/kg body weight) with the help of qualified medical personnel. The treated pupils were screened again 8 weeks post treatment to check for infection status and efficacy of the therapy. Pupils in YNLG primary school Oja-Ijoun received second treatment at the interval of 180days.

Data Analysis

Data collected were entered and analysed using Microsoft Excel 2007 and SPSS version 16 for windows. Significance in prevalence of infection in relation to school,

gender and the different age groups were tested using chi-square. Egg reduction rate (ERR) and parasitological cure rate (CR) were determined using the following formula:

ERR = (mean eggs/10ml of urine before treatment – mean eggs/10ml of urine after treatment)/ mean eggs/10ml of urine before treatment x 100%, CR = (number of children cured/ number of children treated) x 100% [13].

Results

Out of a total of 734 pupils examined, 221(30.11%) were infected with *S. haematobium*. However, CPS Eggua had the highest prevalence rate (70%) while the least prevalence was found in YNLG primary school Oja-Ijoun (23.8%) (Table 1). Overall post-treatment prevalence was 9.05%, 8 weeks after treatment (Table 2). Prevalence in males (10.7%) was higher than in females (7.3%). The difference in variation of prevalence amongst gender was however not significant ($\chi^2 = 1.585$, P> 0.05).

The prevalence of *S. haematobium* infection among the pupils in different age groups (Table 3) showed that the post treatment infection rate was highest in the 13-17 years age group (14.3%), followed by 3-7years age group (12.5%). while the least rate was found in age group 8-12years (7.6%), though the variation in prevalence among the age groups was not significant ($\chi^2 = 6.099$, P> 0.05). However, multivariate analysis of variance showed that prevalence of schistosomiasis reduced significantly after treatment when compared with prevalence recorded before treatment (MANOVA =1110, P <0.05).

S. haematobium infection intensity status, cure rate (CR) and egg reduction rate (ERR) after treatment in the schools are summarized in Table 4. Infection intensity measured as the mean eggs per 10ml of urine had decreased by 91.24% after treatment. The highest egg reduction rate (ERR) was seen at EAC school, Ile-Ijoun (98.25%) with a cure rate (CR) of 89.66% and the least ERR was seen at YNLG primary school, Oja-Ijoun (92.39%) having a CR of 83.53%.

Table 1: Prevalence of *Schistosoma haematobium* Infection

Name of School	No. Examined	No. Infected (%)	Overall Prevalence (%)
EAC Primary School (Ile-Ijoun)	201	65 (32.3)	8.86
YCA School(Igan Alade)	116	29 (25.0)	3.95
CPS(Eggua)	60	42 (70.0)	5.72
YNLG Primary School(Oja-Ijoun)	357	85 (23.8)	11.58
Total	734	221	30.11

Table 2: Prevalence of *Schistosoma haematobium* Infection in Relation to Gender

Gender	No. Infected Pr- t (%)	No. Infected Po-t (%)	Overall Po-t Prevalence
Males	112 (50.7)	12 (10.7)	5.43
Females	109 (49.3)	8 (7.3)	3.62
Total	221	20	9.05

Pr-t = pre-treatment
Po-t = post-treatment

Table 3: Prevalence of *Schistosoma haematobium* Infection in Relation to Age

Age group (yrs)	No. infected Pr-t (%)	No. infected Po-t (%)	Overall Po-t Prevalence
3 – 7	48 (21.7)	6 (12.5)	2.71
8 – 12	159(72.0)	12 (7.6)	5.43
13 – 17	14 (6.3)	2(14.3)	0.91
Total	221	20	9.05

Pr-t = pre-treatment
Po-t = post treatment

Table 4: *S. haematobium* Infection Intensity, Egg Reduction Rate and Cure Rate after Single Treatment

School	Mean egg/10ml urine		ERR (%)	CR (%)
	Pr-t	Po-t		
EAC Primary School (Ile-Ijoun)	97.2 ± 55.3	1.7± 0.7	98.25	89.66
YCA Primary School (Igan Alade)	32.1 ± 7.3	1 ± 0	96.88	98.46
CPS (Eggua)	126.3 ± 53.7	8.5 ± 7.5	93.19	95.24
YNLG Primary School (Oja-Ijoun)	146.3 ± 30.1	11.14 ± 2.1	92.39	83.53
Total	102.5 ± 17.4	8.95 ± 1.8	91.24	90.95

Pr-t = pre- treatment
Po-t = post- treatment

The infection intensity status, CR and ERR in YNLG primary school Oja- Ijoun where a re-treatment was administered to school children are shown in Table 5. The intensity of infection (146.3eggs/10ml of urine) before treatment had decreased by 92.39% after the first treatment with cure rate of 83.53%. However, after repeated treatment the ERR and CR were 100% respectively.

Table 5: Outcome of Treatment and Retreatment of *S. haematobium* in YNLG Primary School Oja-Ijoun

	Pre treatment	Post first treatment	Post second treatment
Prevalence	85	14 (16.5%)	0(0.0%)
Mean egg count	146.3±30.1	11.14±2.1	nil
Egg reduction rate	-	92.39%	100%
Cure rate	-	83.53%	100%

Discussion

The overall prevalence of schistosomiasis post treatment (9.05%) indicated that a single treatment with PZQ demonstrated a high efficacy against schistosome egg production. This prevalence was lower compared with 54.8% observed in the same study area by Hassan et al. [11] and also different from 51% which Ugbomoiko et al. [14], found in Ilobu and Erin-Osun communities of Osun state. However, this prevalence is similar to 10.4% recorded from primary school children in Malawi by Kapito-Tembo et al. [15]. The low prevalence observed in this study may be attributed to the mass drug administration by previous workers in conjunction with the Local Government Health Officials of Yewa North. This study shows clearly that frequent treatment is beneficial to the endemic individuals, particularly school children who may continue to be highly susceptible to re-infection after treatment [16].

Prevalence in relation to gender, showed higher rate of infection in males than females though this was not significant. However, this difference could imply a higher water contact activity amongst the males than the females. This is because boys are more adventurous, and therefore more likely to play in infected water bodies compared to the girls. The higher prevalence in males in this study is in agreement with the findings of Rudge et al. [17], Kapito-Tembo et al. [14] and that of Sousa-figueiredo et al. [18] who reported that urinary schistosomiasis in school children was significantly associated with gender and with boys being twice as likely to be infected as girls. In the various age cohorts, those in age group 13- 17 years had the highest rate of infection. There was no significant difference in prevalence observed between age group after treatment. Thus, confirming absence of infection and further demonstrates the significant impact of PZQ on egg load in all age groups and sustenance of drug effect. The lack of re-infection could be a result of better understanding of the risk of transmission of the disease. Hence, the absence of variation in age related prevalence after treatment.

According to Smith and Christie [19], there is evidence of an association between intensity and morbidity which is caused by egg deposition in and around the urinary tract. The present study revealed a pertinent implication of reduction in egg output which suggests reduction in level of morbidity with regular or more frequent treatment. The overall mean intensity of infection post treatment was 8.95egg/ 10ml urine. This intensity is low compared to 28.23egg/ 10ml reported by Oniya, [20] among primary school children in Ondo state. Also, the total cure rate is in-line with 94.44% observed by Oniya and Jeje [21] among primary school children in Ondo State. This study shows that treating *S. haematobium* infection with PZQ results in high cure rates and egg reduction rates as explained by Nessim and Demerdash, [22]. The present results further demonstrate possible resistance to re-infection among YNLG primary school children after repeat treatment contrary to respective reports [23, 24] of post-treatment re-infection in some children in their first decade of life.

World Health Organisation [25] recommended repeated chemotherapy, which is still the key strategy today particularly in preventive chemotherapy on the road towards elimination of schistosomiasis. This focusses on regular and frequent treatments in schistosomiasis high burden areas to cure and prevent chronic morbidity, by reducing worm burden and indirectly egg burden. Also, to prevent healthy people from becoming infected by reducing the source of infection [1, 26]. Mass therapy for schistosomiasis with PZQ has been employed in YNLG area targeting school children because of repeated exposure to infected water, which is not unexpected in the study locations and increased benefits of reducing infection burden.

Liu et al. [27] reported that multiple dose might improve efficacy of PZQ. The data presented in this study clearly made it tempting to speculate that a two treatment with 180days interval will result in a 100% ERR and parasitological CR. Further studies are still needed for a strong evidence that there is an association with the drug regime used in this setting and 100% ERR and CR.

Conclusion

Drug therapy shows a significant performance in the reduction of urinary schistosomiasis egg burden in this study. A reduction or eventual elimination of transmission could be a long-term outcome of limited continued egg contamination of the endemic environment and justifies treatment based on mass administration which may reduce level of transmission. Thus, diagnosis before treatment becomes important to make treatment cost-effective.

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