PREVALENCE AND INTENSITY OF URINARY SCHISTOSOMIASIS IN SETTLEMENTS AROUND THE GORONYO DAM, NIGERIA.

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ABSTRACT

Background: *Water development projects and irrigation schemes are without doubt very important and sometimes necessary. However, they create distortions in flora and fauna resulting in an increase incidence and prevalence of Schistosomiasis.*

Objective: *This study was conducted to assess the prevalence and intensity of urinary schistosomiasis among school children around the Goronyo dam commissioned in November 2005.*

Methodology: *The study was basically a cross sectional assessment using a pre-tested interviewer administered standardized structured questionnaire to gather baseline information on the bio-data of the pupils. Urine samples were also collected from the pupils and examined for the presence of ova of schistosoma haematobium. A total of 400 pupils were proportionately recruited from schools through a multistage sampling technique and using the list of pupils as the sampling frame.*

Results: *Majority (55.3%) of respondents were 11-12 years old (modal class) with a mean (x) age of 11.5 $\pm$ 2 years and males (89.8%). The prevalence of infection among schools near or around the dam/canals compared to those far away from the dam/canals was found to be between 45% - 52.5% and 7.7% - 17.7% respectively. This was found to be statistically significant ($P<0.001$, RR = 4.963 at 95% CI). The overall prevalence of urinary schistosomiasis among school children in the study area was found to be 32.3% (129/400). The age group 13-14 has the highest age specific prevalence of 39.4% (39/99) and all were males.*

Out of the 129 infected school children, 94 (72.9%) and 34 (27.1%) have light and heavy infection respectively. The later were all males. This might not be unrelated to differences in exposure due to cultural factors among males and females.

Conclusion: *Based on these findings, the prevalence and intensity of urinary schistosomiasis is high largely as a result of weaknesses in planning (including pre-construction phase), lack of social amenities and no control measure currently in place. There is therefore the need for instituting control measures with involvement and proactive participation of the community.*

INTRODUCTION

Water development projects and irrigation schemes are without doubt very important and sometimes necessary. However, they create distortions in flora and fauna resulting in human migration with its attendant risk of introducing the parasite into a previously non-endemic area. Moreover, it increases human water contact as well as new habitat for fresh water snails (*Bulinus spp*), which are the necessary intermediate host for maintaining the transmission of infection. Hence, these projects have been associated with increased incidence, prevalence and intensity of helminthic infections (including Urinary schistosomiasis) as seen in Kainji dam (Nigeria), Aswan (Egypt), Senna (Sudan), Amibara (Ethiopia) and most recently the Senegal River Basin (SRB) [1-5].

The Goronyo dam in Sokoto State was commissioned in November 2005 (construction work commenced in 1983) to boost agricultural activities. At present there is no documentation on the epidemiology of Helminthic infections among the communities living along the dam. There is therefore the need to determine a base line data on the epidemiologic situation of Helminthic infections using urinary schistosomiasis among children as a pointer for the consequence of the dam on the health of the communities along the channels of the dam. This will provide the basis for reasonable comparison in the future and evidence based area specific interventions. School children provide a unique opportunity since schools are widely distributed and school children have been reported to have greater opportunities for group swimming [6, 7]. Moreover, children have been reported to be the major contaminators of surface water, have the highest prevalence and intensity of infection and hence the major reserviour of infection [6-8]. The indirect consequences in children include decrease in school attendance and intellectual development [9-10]. Therefore, treating urinary schistosomiasis during school age is scientifically sound, cost effective and in line with the current global approach for its control [11-13].This

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work will therefore add to the data bank necessary for an evidence based prevention and control measures in endemic areas of the world.

MATERIALS AND METHODS

The Goronyo dam is located in Goronyo LGA of Sokoto state. The dam or its channels cuts across the entire 11 political wards (lowest administrative unit). The dam reserviour covers an area of about 20,000 hectares and irrigates a minimum of 50,000 hectares. It has three major concrete lined canals with several secondary and tertiary unlined canals with an approximate total length of more than 100 km's.

The study was conducted among school children in settlements near the dam or its canals and also from those settlements that are far away from the dam or its canals. The LGA is basically rural and generally the settlements have no potable water and sources of water for domestic use include the dam's canals and tributaries in addition for agricultural uses. The LGA has a total of 17 Primary Health Care facilities.

The Zonal Local Education Authority[14] was contacted for the identification of Primary schools. The LGA has a total of 69 primary schools with a total pupil's enrollment of about 14,600. There are a total of 12 (17.4%) Primary schools that is located in settlements through which the dam or its canals passes. For the selection of the study population, an inclusion criterion was used. Only pupils in classes four, five and six were selected. This is because, the peak prevalence and intensity of infection occur in children aged between 9-14 years as reported in many parts of Nigeria [6,15-17] and elsewhere [18-21] and this age group are mostly in classes four, five and six.

The Headmasters and class Masters for classes four, five and six of all the randomly selected schools were contacted. The aim and objectives of the study was explained to them.

The minimum desired sample size of 385 was estimated using appropriate statistical formula for cross sectional studies.[22] A multistage sampling technique was employed as the sampling strategy. Four (33.3%) out of the 12 identified primary schools that are located along the dam were selected by simple random sampling (balloting). Similarly for each selected school that is located in settlements proximal to the dam and its channels, another school that is far away from the dam or its channels (within the same political ward) was selected by simple random sampling (balloting). The estimated number of pupils (1,600) in classes four, five and six in the eight randomly selected schools served as the sampling frame, from which the study unit was then proportionately selected using a systematic sampling technique after a random selection of the first pupil from the list of all pupils in those classes. A total of 400 (25% of pupil population) pupils were proportionately recruited from classes IV, V and VI in the eight randomly selected schools (200 pupils each respectively from settlements that are far away and those that are proximal to the dam or its canals table I). On the appointed days, pupils were duly informed by the researcher on the aim and objectives of the study in the local (Hausa) language. Information on pupils' bio-data was collected. Each study pupil was also given a universal sterile urine bottle into which he/she voided the terminal portion of his/her urine at least up to three-quarters of the bottle. Urine samples were collected between 10.00 am and 1.00 pm[15,23]. The urine was then processed using the method described in previous studies.[15, 24] A heavy infections was defined according to WHO[8,23] criteria as $\geq$ 50 eggs per 10ml of urine. The pupils whose urine samples were found to have ova of *Schistosoma haematobium* were given appropriate prescription (praziquentel 40 mg/kg as a single dose as recommended by WHO[8]) .The data was analysed using EPI-INFO version 3.3.2 (February 2005) software package. The critical level for statistical significance was set at $P = 0.05$.

RESULTS

The distribution of study sample among classes indicated that the majority (42.5%) of the study unit are in class IV (modal class). (Table I).

TABLE I : DISTRIBUTION OF STUDY POPULATION AMONG SCHOOLS

PRIMARY SCHOOL	TOTAL NO. OF PUPILS IN CLASSES IV,V&VI	STUDY SAMPLE	SAMPLING INTERVAL	DISTRIBUTION AMONG CLASSES		
				IV	V	VI
Falaliya, Rimawa ward	80	20	4	8	6	6
Goronyo, Goronyo ward	482	120	4	56	40	24
Tsohon Garin Dole, Sabon Garin Dole ward	96	24	4	10	8	6
Takakume, Takakume ward	144	36	4	16	12	8
*Rimawa, Rimawa ward	408	102	4	34	41	27
*Balakazo, Goronyo ward	98	25	4	9	9	7
*Dan tasakko, Sabon Garin Dole ward	156	39	4	19	12	8
*Gorau, Takakumea ward	136	34	4	17	11	6
TOTAL	**1600**	**400**	**4**	**169**	**139**	**92**

***Settlements that are far away from dam or its canals.**

TABLE II: SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION

CHARACTERISTIC	FREQUENCY (N=400)	PERCENTAGE (%)
Age:		
9 - 10	67	16.7
11 - 12	221	55.3
13 - 14	99	24.7
15 - 16	13	3.3
TOTAL	**400**	**100**
Sex:		
Male	359	89.8
Female	41	10.2
TOTAL	**400**	**100**

PREVALENCE OF URINARY SCHISTOSOMIASIS

TABLE III- DISTRIBUTION AND PREVALENCE AMONG SCHOOLS

PRIMARY SCHOOL.	TOTAL NO. OF PUPILS EXAMINED	NO. OF CASES WITH POSITIVE OVA IN URINE	% PREVALENCE
Falaliya, Rimawa ward	20	9	45
Goronyo, Goronyo ward	120	63	52.5
Tsohon Garin Dole, Sabon Garin Dole ward	24	11	45.8
Takakume, Takakume ward	36	17	47.2
*Rimawa, Rimawa ward	102	17	16.7
*Balakazo, Goronyo ward	25	3	12
*Dan tasakko, Sabon Garin Dole ward	39	3	7.7
*Gorau, Takakumea ward	34	6	17.7
TOTAL	**400**	**129**	**32. 3**

***Settlements that are far away from dam or its canals.**

TABLE IV: PREVALENCE OF INFECTION BY AGE AND SEX (Urine microscopic analysis for ova of *S.haematobium*)

AGE (YEARS)	MALES (n=359)		FEMALES (n=41)		COMBINED (N=400)	
	No. Examined	No. Positive* n (%)	No. Examined	No. Positive* n (%)	No. Examined	No. Positive* n (%)
9-10	47	15 (3.7)	20	3 (0.8)	67	18 (26.9)
11-12	207	67(16.7)	14	3 (0.8)	221	70 (31.7)
13-14	92	39 (9.8)	7	0 (0.0)	99	39 (39.4)
15-16	13	2 (0.5)	0	0 (0.0)	13	2 (15.3)
ALL AGES (TOTAL)	**359**	**123 (30.7)**	**41**	**6 (1.6)**	**400**	**129 (32.3)**

***Ova of *S.haematobium* present**

df = 3, X^2 (Yates corrected) = 7.881, P=0.0485.

Majority (55.3%) of respondents were 11-12 years old (modal class) with a mean (x) age of 11.5 $\pm$ 2 years and males (89.8%). (Table II).

The prevalence of infection among schools near or around the dam/canals compared to those far away from the dam/canals was found to be between 45% - 52.5% and 7.7% - 17.7% respectively. The overall prevalence of urinary schistosomiasis among school children in the study area was found to be 32.3% (129/400). (Table IIIA).

The age group 13-14 has the highest age specific prevalence of 39.4% (39/99) and all were males. On the other hand, the lowest age specific prevalence of 0% (0/7) was recorded among the 13 - 14 year old Females. (Table IIIB).

Out of the 129 cases, a total of 100 (77.5%) cases were among school children attending schools that are near or around the dam or its canals (df=1,X2= 56.066, P<0.001, Relative risk = 4.963 at 95% confidence interval of 2.396 4.963) (table V).
Out of the 129 infected school children, 94 (72.9%) and 34 (27.1%) have light and heavy infection respectively. The later were all males (table VI).

DISCUSSION

In this study, majority (89.8%) of the respondents were males (table I). This finding is not surprising given the fact that the North Western part of Nigeria (region of the study area) has the highest proportion of females (64.6%) with no education[25]. This indicates that males are more likely than females to be enrolled in school in all age group. Generally this might be related to the deep seated cultural and religious beliefs in the study area that the main role of females is to be house wives and mothers. This pattern is similar to that observed in Zamfara State[26], Edo State of Nigeria[27] and Egypt[28]. About 75% of the respondents were 12-15 years old underscoring the likelihood of late enrollment in school since the current 6-3-3-4 educational policy of Nigeria indicated that by the age 12, one is expected to have completed

TABLE V: FACTORS INFLUENCING THE RISK OF INFECTION

VARIABLE	(URINE MICROSCOPY RESULT) N=400		TOTAL (%) N (%)	P-VALUE*
	OVA PRESENT n (%)	OVA ABSENT n (%)		
Age (years):				
9-10	18 (4.5)	49 (12.3)	67 (16.8)	**df=3**
11-12	70 (17.5)	151 (37.7)	221 (55.2)	**X^2=4.927**
13-14	39 (9.8)	60 (15)	99 (24.8)	**P=0.1772**
15-16	2 (0.5)	11 (2.7)	13 (3.2)	**RR=0.47**
TOTAL	**129 (32.3)**	**271 (67.7)**	**400 (100.0)**	
Sex:				**df=1**
Male	123 (30.8)	236 (59)	359 (87.8)	**X^2 = 2.341**
Female	6 (1.5)	35 (8.7)	41 (10.2)	**P=0.0126**
				RR=9.0
TOTAL	**129 (32.3)**	**271 (67.7)**	**400 (100.0)**	
Class:				**df=2**
IV	70 (17.5)	99 (24.7)	169 (42.3)	**X^2 = 11.283**
V	36 (9)	103 (25.7)	139 (34.8)	**P=0.0035**
VI	23 (5.8)	69 (17.3)	92 (22.9)	**RR=0.47**
TOTAL	**129 (32.3)**	**271 (67.7)**	**400 (100.0)**	
****Location of school**				**df=1**
Around dam/canal	100 (50.0)	100 (50.0)	200 (50.0)	**X^2 = 56.066**
Far from dam/canal	29 (14.5)	171 (85.5)	200 (50.0)	**P=<0.0001**
				RR=1.0
TOTAL	**129 (32.3)**	**271 (67.7)**	**400 (100.0)**	

***(Yates corrected)**

****The overall Relative risk = 4.963; 95% Confidence interval = 2.396 to 4.963 using the approximation of Katz.**

TABLE VI - INTENSITY OF INFECTION BY AGE AND SEX

AGE GROUP (YEARS)	EGG OUTPUT MALES (N=96)			EGG OUTPUT FEMALES*(N=5)			
	Light	Heavy**	Total	Light*	Heavy**	Total	TOTAL
9-10	13	2	15 (3.7)	3	0	3 (0.8)	18 (4.5)
11-12	51	16	67 (16.7)	3	0	3 (0.8)	70 (17.5)
13-14	23	16	39 (9.8)	0	0	0 (0)	39 (9.8)
15-16	2	0	2 (0.5)	0	0	0 (0)	2 (0.5)
TOTAL	**89 (69)**	**34 (26.3)**	**123**	**6 (4.7)**	**0 (0)**	**6**	**129 (32.3)**

***Light infection = 1 49 egg/10ml urine [13]**

****Heavy infection = 50 499 eggs/10ml urine [13]**

primary education. However, this is far higher than the reported studies in Emu (Edo State) [27], Nri, Agulu and Adazi (Anambra State) [29] and Ijiman community (Cross River State) [30] and might be attributable to the differences in socio-cultural beliefs.

The prevalence of urinary schistosomiasis in the study area was found to be 32.3% (table III). This figure is higher when compared with previous studies on school children in Ile-Ife (20.5%) [31] and Akure (21%) [32]. However, it is lower than reports from various health zones of the country where the prevalence ranges between 44% (River state) to 75.5% (Osun state) [24, 26, 33-34]. Plausible reasons for the observed difference include level of community dependence on surface water infested with cercariae, water contact activities and differences in host Immunity. Moreover, the observed high prevalence in the present study might be related to the fact that construction of the dam commenced in early eighties but the lining of the canals with concrete was completed in 2005. Hence population around that dam and its canals may have been coming in contact with the water from the dam for that long. This was further compounded by the lack of available literature on the prevalence of schistosomiasis before the

commencement of the dams' construction. This was further buttressed by the differences among study schools. School specific prevalence rate for pupils attending schools in settlements where either the dam or it canals transverses had higher rates by about five folds (RR = 4.963) when compared to similar schools in settlement that are far away from the dam or its canals. Similar finding in Nigeria was reported after construction of Kainji dam, that villages around the dam had a prevalence of 62% of urinary schistosomiasis which is far higher than those near new Bussa. Moreover, on the Eastern side of lake Kainji, villages adjacent to irrigation canals had a prevalence rate (30%) higher than those away from canals[35-38].

Hence children attending schools in settlements where the dam or its canals transverse are more likely to pay frequent visits either for recreational, domestic or occupational water contact activities particularly since none of the settlements had alternative sources of potable water. Similar dependence of a community on surface water and high prevalence of urinary schistosomiasis have been reported in Igwun river water basin [39] and Malumfashi Kastina State[40].

In the present study, the peak prevalence of infection was found among children aged 13 - 14 years among males and is in agreement with that of several other studies in all parts of Nigeria [12,4,31,32,41,42,] and elsewhere [3, 4, 16, 17] This may be because children less than 15 years are less confined whether for religious or occupational reasons than those who are 15 years old and above. Hence they are more likely to come in contact with water for recreational activities for longer periods than the older age group. Similar finding was reported in South Eastern Nigeria[43].

Sex specific analysis indicated that females have the lowest prevalence rate of 1.6% for all age groups when compared with their male counterparts (30.7%). Furthermore, this difference was recorded even among different age groups for both sexes. This might be related to the cultural beliefs in the study area bordering on the restriction of females to go for swimming even for those far less than 15 years. However the age sex difference, on further statistical analysis of factors that influence the risk of infection among study population were not found to be of statistical significance. This is in keeping with findings among school children around the Bakalori dam[26].

The intensity of infection increases with age and peaked at 11 - 14 years age group with a mean egg count of 37.4±5.8 per 10ml of urine. However, about three quarters of infected cases were of the light infection group and accounted by males . This finding is in line with other previous studies [8,39,44,45].

Finally all the 17 LGA PHC facilities have no laboratory unit and therefore cannot conduct simple microscopy to investigate schistosomiasis. This is contrary to WHO recommendation for areas where water resource development projects are established, that if the infection is not endemic in the area prior to the construction phase, there is the need for surveillance mechanisms to be put in place to serve as an early warning sign of its introduction (i.e. urinary schistosomiasis). Medical examination should be carried out on all employees and their families before they assume duty. Moreover social services such as potable water must also be provided so as to limit or minimise exposure to bodies of surface water infested with cercariae and therefore reduce the risk of the spread of schistosomiasis[12].

CONCLUSION AND RECOMMENDATIONS

From the foregoing, prevalence and intensity of urinary schistosomiasis is high largely as a result of weaknesses in planning (including pre-construction phase), the lack of alternative safe water sources and neither surveillance mechanisms to serve as an early warning sign nor any control measures. There is therefore the need for instituting control measures with involvement and proactive participation of the community to reverse the current trend.

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