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Preliminary studies on the prevalence and distribution of urinary schistosomiasis in Ondo State, Nigeria

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Summary

The prevalence of S. *haematobium* infection in 18 Local Government Area (LGA) in Ondo state was determined by examining pupils from randomly selected schools in the state. A total of 4266 urine samples were examined and 1303 (30.5%) were infected with the parasite. The infection was recorded in both rural and urban communities in each LGA. The overall prevalence was significantly higher in males (33.7%) than in females (26.0%) (P=0.001). The LGA exhibiting the highest overall prevalence of infection was Akure north (86.2%; CI, 0.82-0.9). The infection was most common in subjects between the ages of 11 and 15 years. Seven species of aquatic snails were encountered and B. (P). *globosus* was the most abundant and widespread species. The Owena river/dam in Idanre LGA was richest in molluscan fauna. B. (P). *globosus* and *Biomphalaria pfeifferi* shedding cercariae were recovered from Owena river and dam. The study shows that there were spatial heterogeneities in the prevalence of infections in both human population and the snail intermediate hosts. The implications of the clustering nature of the disease, for a successful control program in the state, were discussed.

Keywords: *Schistosoma haematobium, Ondo state, bulinus globosus, biomphalaria, pfeifferi, Prevalence, haematuria.*

Résumé

Le taux d'infection du *S hematobuim* dans 8 districts dans la province d'Ondo était determiné en examinant d'échantillons d'urine des éleves des écoles choisies au hazard. Un total de 4266 échantillons d'urine étaient analysés et 1303 (30.5% étaient infectes de ce parasite. L'infection était enregistré en communautés rurale et urbaine de chaque district. La prevalence totale était significativement plus élevé chez les males (33.7%) que chez les femeles (26.0%) P=0.001). Le nord d'Akuré était le district ayant la plus grande prevalence de cette infection (82.2%), CI:0.82-0.9). Cette infection était plus commune chez les enfants d'entre 11-15 ans. Sept espéces était distinguées et *B.(P) globosus* était le plus abondant et plus répandu. La rive/lac d'Owena était plus riche en mollusque *B. (P) globosus* et *Biomphalaria pfeifferi* couvrant le *cercavia* trouvé. Cette étude montre que ils y avaient espéces hetérogéne dans la prevalence d'infections dans ces communautés. Les implications de la nature fermée de cette maladie pour un control effectif dans la province ont été discuté.

Introduction

Schistosomiasis is one of the important health problems in Nigeria [1,2,3]. It is primarily rural in distribution, but urban schistosomiasis is also becoming important in Nigeria [4]. The transmission of human schistosomiasis is governed by a range of interacting factors that are determined by local geographical and climatic conditions [5, 6]. These in turn determine the pattern of transmission in terms of its seasonality and pattern of distribution in an endemic area. The epidemiology of schistosomiasis varies greatly within and between regions of Nigeria [2,7,8]. The assessment of the extent and distribution of *Schistosoma* infection in every region in Nigeria is therefore important and required for formulating future intervention strategies in endemic areas. Recently, the Ondo state Ministry of Health sponsored a campaign to increase public awareness of the disease and initiated moves for the control of the disease. These efforts prompted us to determine the current prevalence of *Schistosoma haematobium* infection in Ondo State by using epidemiological and parasitological techniques. There had been few isolated studies [9] in the State but none, to the best of our knowledge, was as extensive and comprehensive as the present study. This will be the first report on the general pattern of the distribution of the disease in Ondo State.

Materials and methods

Ondo State is situated in the heartland of the tropical rainforest belt of western Nigeria (Figure 1). The climate is hot and humid, with small seasonal and daily variations. It lies between latitude 5° 6' N and 8° 2' N and longitude 4° 17' E and 6° 17' E. The average rainfall is concentrated during the months of May to October, with a short break in August and a considerable variation from year to year.

There are 18 Local Government Areas (LGAs) in Ondo state and the study was carried out in all the LGAs.

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Four schools from each LGA were randomly selected to participate in the survey. Teachers and pupils from each school were given health talk by trained officials of the Ministry of Health. This provided the opportunity for Health officers to explain the sample collection procedures to the pupils and to emphasize the importance of compliance.

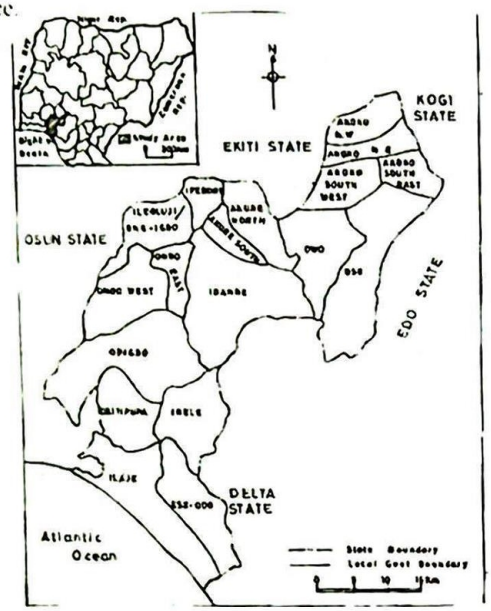

Fig. 1: *Map of Ondo State showing the local government areas surveyed for urinary schistosomiasis.*

Training

Technicians and public health officers from the 18 Local Government Areas were invited to attend a workshop on the control of schistosomiasis. The workshop reviewed the purposes of schistosomiasis survey methods to be used for selecting schools and pupils, urine collection, processing techniques, and data collection. The training gave the participants the opportunity to familiarize themselves with the techniques necessary to perform the survey.

Sample collection.

School children were randomly selected from class registers to participate in the study. About 60 – 80 pupils were selected from each school. Between 300 – 400 urine samples were collected from each LGA between 1000 and 1400hours and 10ml urine was examined for *S. haematobium* eggs using the sedimentation technique [10]; the frequency of visible haematuria (macrohaematuria) was also recorded. Trained technicians at the central laboratory of each LGA and resource persons performed all parasitological examinations. Each student, aided by the teacher, was asked to complete a questionnaire, to obtain information concerning his/her personal biodata, perception of the disease and water contact.

Snail surveys

All water contact sites in the study area were searched for molluscs using the kitchen sieve net method between March and May 2001. Snails found were taken to the laboratory for identification and individual snails were examined for infection by exposure to sunlight.

Ethical considerations

The objectives of the study were explained to the Local Government Area Chairmen and Primary Health Officers of each LGA, the primary school authorities and the parents/ teachers association executives. The information was passed on by teachers/headteachers to pupils' relatives. Children participation in the study was voluntary. Results were made known to teachers/headteachers and all infected children were treated with praziquantel.

Statistical analysis

To evaluate the statistical significance of differences between the frequencies χ^2 with Yate's correction was used. Confidence intervals were calculated according to Kramer (11).

Results

Study population

In the study population, the sex ratio showed an insignificant male predominance (male: female = 1:4). Age ranged between 6 and 15 years and the mean $\pm$ SD age of the study population was 12 ± 5 years. Two thousand four hundred and ninety five (58.5 %) participants were males and 1771 (41.5%) were females. Similar age and sex distribution were noted for all the Local Government Areas.

Prevalence of S. haematobium infection by LGA

The prevalence of *S. haematobium* infection among pupils from the 18 LGA are presented in Table 1. A total of 4266 samples were examined, 1303 (30.5%) were infected with the parasite. The prevalence in individual LGA ranged from 3.3% in Akoko Northwest LGA to 86.2% in Akure North LGA. There was considerable variation in prevalence rates between the LGAs. This study shows that *S. haematobium* is endemic in all the LGAs. The LGA exhibiting the highest overall prevalence of infection were Akure North (86.2%; CI, 0.82 – 0.9), Ileoluji-okeigbo (68.6%; CI, 0.63 – 0.75) and Akure south (54.1%, CI, o.47 – 0.61). The lowest overall prevalences were recorded in Ilaje LGA (3.4%; CI, 0.30 – 0.32), Akoko southeast LGA (3.9%; CI, 0.01 – 0.05) and Akoko northwest LGA (3.3%; CI, 0.01 – 0.05).

Table 2 shows that overall prevalence was significantly higher in males (33.7%) than in females (26.0%) ($\chi^2 = 29.52$, P=0.001). The prevalence in each LGA generally followed the pattern described for the entire state. There are however, variations in the importance of the age groups in each LGA. Table 3 shows that ages 6-10 years and 11 – 15 years are the most commonly infected in each LGA.

Table 1: Prevalence of *Schistosoma haematobium* infection by Local Government Area (LGA) in Ondo State

LGA	No. Examined	No. Infected	Prevalence (%)	C.I. (α=5%)
Idanre	240	113	47.1	0.1 – 1.1
Okitipupa	240	13	5.4	0.03 – 0.08
Akure south	244	132	54.1	0.47 – 0.61
Akure north	312	269	86.2	0.82 – 0.9
Akoko NW	240	8	3.3	0.01 – 0.05
Akoko NE	250	44	17.6	0.13 – 0.23
Akoko SW	248	53	21.3	0.16 – 0.26
Akoko SE	232	9	3.9	0.01 – 0.05
Ese – odo	168	71	42.3	0.35 – 0.49
Irele	228	50	21.9	0.17 – 0.27
Ileoluji – okeigbo	245	168	68.6	0.63 – 0.75
Ifedore	243	115	47.3	0.41 – 0.53
Ilaje	238	8	3.4	0.30 – 0.32
Ose	219	16	7.3	0.04 – 0.1
Ondo west	237	14	5.9	0.01 – 0.11
Ondo east	249	58	23.3	0.18 – 0.28
Owo	168	33	19.6	0.14 – 0.26
Odigbo	265	129	48.6	0.42 – 0.54
Total	4266	1303	30.5	0.30 – 0.32

The prevalence of infection varies considerably between schools in each LGA and in the entire state. Highest prevalences were recorded from Ebenezer CAC primary school, Itaogbolu (95.7%) and St. Andrew's Anglican primary school, Ogbese (95.1%) both in Akure north LGA.

The results of the malacological surveys are summarized in Table 4. Six types of snail habitats were surveyed for schistosomiasis in Ondo state and only four (Stream, rivers, ponds and dams) were rich in snail types. The water quality of these habitats varied from clear to turbid, while the distribution of surface plants varied from none to abundance. Seven species of snails were encountered and *Bulinus (p) globosus* was the most abundant and widespread species in the state. The Owena River/dam in Idanre LGA was richest in molluscan fauna. *B. (p) globosus* and *Biomphalaria pfeifferi* shedding mammalian cercariae were found in Owena River and dam.

Water contact was part of every day life of the subjects and it is centered mostly on the numerous natural freshwater bodies in each LGA. Akoko area had limited numbers of such water bodies and most of the available few water bodies dry up during the dry season. The riverine Ilaje LGA has mostly brackish water that is not suitable for the snail intermediate host of schistosomiasis. Water

Table 2: Prevalence of *Schistosoma haematobium* infection in each Local Government Area (LGA) of Ondo State by sex

LGA	Sex						
	Male			Female			
	No. examined	No. infected	Prevalence (%)	No. examined	No. infected	Prevalence (%)	*P*=0.001
Idanre	149	81	54.3	91	32	35.2	*
Okitipupa	131	10	7.6	109	2	1.8	*
Akure south	133	71	53.4	111	61	54.9	*
Akure north	201	170	84.6	111	99	89.2	*
Akoko NW	126	5	4.0	114	3	2.6	*
Akoko NE	146	32	21.9	104	12	11.5	*
Akoko SW	145	37	25.5	103	16	15.5	*
Akoko SE	131	5	3.8	101	4	4.0	*
Ese – odo	100	42	42	68	29	42.6	*
Irele	137	32	23.4	91	18	19.8	*
Ileoluji–okeigbo	168	116	69.0	77	52	67.5	*
Ifedore	126	64	50.7	117	51	43.6	*
Ilaje	136	4	2.9	102	4	3.9	*
Ose	134	10	7.5	85	6	7.1	*
Ondo west	131	11	8.4	106	3	2.8	*
Ondo east	135	35	25.9	114	23	20.2	*
Owo	89	22	24.7	79	11	13.9	*
Odigbo	117	95	53.7	88	34	38.6	**
Total	2495	842	33.7	1771	460	26.0	**

** = *Significant (P = 0.001)* ; * = *Not significant.*

Both *S. haematobium* and *S. mansoni* eggs were recovered from the urine samples of subjects from Idanre and Irele LGAs.

contact activities in the study area include swimming, fetching of water, washing of clothes, and bathing, cassava

Table 3: Prevalence of *Schistosoma haematobium* infection in each Local Government Area (LGA) of Ondo State by age group

LGA	No. examined by age (yrs)			No. infected by age (Prevalence{%})*			Total no. examined	Total infected	Prevalence (%)
	6-10	11-15	⊕16	6-10	11-15	⊕16			
Idanre	138	95	7	49(35.5)*	60(55.8)	4(63.2)	240	113	47.1
Okitipupa	166	71	3	6(3.6)	7(9.9)	0(0.0)	240	13	5.4
Akure south	128	116	0	55(43.0)	77(66.4)	0(0.0)	244	132	54.1
Akure north	88	190	34	69(78.4)	165(86.5)	33(97.1)	312	269	86.2
Akoko northwest	153	86	1	5(3.3)	3(3.5)	0(0.0)	240	8	3.3
Akoko northeast	82	154	14	4(4.9)	38(24.7)	2(14.3)	250	44	17.6
Akoko southwest	75	138	35	10(13.3)	29(21.0)	14(40.0)	248	53	21.3
Akoko southeast	134	84	14	5(3.7)	14(16.4)	0(0.0)	232	19	3.9
Ese – odo	89	57	22	37(41.6)	24(42.1)	20(90.2)	168	81	48.3
Irele	131	96	1	30(22.9)	20(4.8)	0(0.0)	228	50	21.9
Ileoluji – Okeigbo	129	114	2	58(45.0)	90(78.9)	0(0.0)	245	168	68.6
Ifedore	121	111	11	54(44.6)	56(50.5)	5(45.5)	243	115	47.3
Ilaje	124	110	4	6(4.8)	2(1.8)	0(0.0)	238	8	3.4
Ose	102	98	19	9(8.8)	8(8.2)	1(5.3)	219	16	7.3
Ondo west	94	132	11	2(2.2)	10(7.6)	2(18.2)	237	14	5.9
Ondo east	101	142	6	20(19.8)	38(26.8)	0(0.0)	249	60	23.3
Owo	75	87	6	14(18.6)	18(20.7)	1(16.6)	168	33	19.6
Odigbo	99	161	6	36(36.4)	88(54.7)	5(83.3)	265	129	48.5
Total	2029	2052	196	469(23.1)	750(35.4)	87(44.4)	4266	1285	30.5

Table 4: Water contact sites surveyed for molluscan fauna and water contact activities in Ondo state.

LGA	Site name	Habitat type	Snail species							Water contact activities				
			B. globosus	*B. senegalensis*	*B pfeifferi*	*potadoma sp.*	*Lanistes sp.*	*Melanoides* sp.	*Physa* sp.	*Lybicus* sp.	W	B	S	F	CP
Idanre	Owena	River	↔		↔↔						•	•	•	•	
Okitipupa	Oluwa	River							↔	↔	•	•		•	
Akure south	Ati-awo	Stream	↔		↔						•	•	•	•	
Akure north	-	Stream									•	•			
Akoko NW	-	Stream									•	•			
Akoko NE	Owoloko	Stream	↔								•	•			
Akoko SW	Ose	River					↔	↔			•	•			
Akoko SE	Osami	Pond									•	•	•	•	•
Ese – odo	-										•	•			
Irele	Leja	Stream	↔		↔↔						•	•	•	•	•
Ileoluji – Okeigbo	Erinhosa	Stream	↔								•	•			
Ifedore	Usi	River									•	•		•	
Ilaje	Obinehin	River				↔					•	•		•	
Ose	Olutoye	Dam						↔			•	•		•	
Ondo west	Odo-tosi	Stream				↔		↔			•	•			
Ondo east	Owena	River	↔		↔	↔		↔			•	•		•	
Owo	Arise	River									•	•		•	
Odigbo	Owena	River	↔			↔		↔			•	•		•	

↔ – *represents areas where both infected and uninfected snails were collected.*
W – *clothes washing.*
B – *bathing.*
S – *swimming.*
F – *water fetching.*
CP – *cassava processing.*
• – *represents types of water contact activities observed.*

processing and fishing. Bathing and clothes washing were the most common water contact activities in all the LGAs (Table 4).

Analyses of the questionnaire indicate that there is much greater awareness of the symptoms of urinary schistosomiasis among the subjects. Gross haematuria (Macrohaematuria) was the most commonly known of all the symptoms of the disease.

Discussion

This study reports on the first attempt to broadly assess the prevalence of schistosomiasis in Ondo state, Nigeria. The results show that the disease is a public health problem in the state. The high prevalence (41%–95.7%) in the LGAs indicates that the control of the disease should be given high priority by the State Government. The study shows that there was spatial heterogeneity in the prevalence of infections between LGAs. The focal nature and the ecological diversity of the transmission sites may account for the heterogeneity. Similar observations have been made in most endemic countries [12,13].

This study has recorded high prevalence among children in age groups 6 – 10 years and 11 – 15 years. Similar reports have been made in other parts of the country [4,15,16,17] This is expected as children in this age range have not fully acquired good hygiene habits and they actively sought out and play in rivers, lakes and ponds. It is therefore important that the control efforts in Ondo state should include the development of adequate and continuous educational process for school children and teenagers. The higher prevalence in males than females in the LGAs conforms to the patterns found in other parts of Nigeria [2, 18] and most endemic areas [12,19] and it reflects the greater opportunities of males to exposure.

This study shows that Akoko northeast, Akoko northwest and Ilaje LGAs had the lowest prevalences of infection in the state, probably due to lower exposure. The poor availability of natural freshwater bodies in Akoko area may have accounted for the low exposure while the low endemicity of the disease in Ilaje LGA may be due to the unfavourable aquatic conditions (Brackish water) in the riverine areas of Ilaje. The limited infections reported may therefore be cases of imported infections. Mapping of prevalences may therefore not necessarily indicate the origin of infections [20].

B. (P). globosus is one of the most widely distributed and common freshwater snail in Ondo state. Its wide distribution will enhance the transmission of the disease in the state. Water contact activities in each LGA are remarkably similar and the most common contacts (Clothes washing, bathing and water fetching) are similar (Table 4).

The presence of *S. mansoni* eggs in the urine of subjects from Idanre and Irele LGAs shows that *S. mansoni* is also endemic in some parts of the state. Similar recovery had been reported in other parts of the country (4, 21). The presence of *S. mansoni* eggs in the urine also coincided with the recovery of infected *Biomphalaria pfefferi* in the study area. The distribution of infected snails in this study suggests that focal snail control may be effective in controlling transmission.

In conclusion, transmission of *S. haematobium* in Ondo state is extensive and the prevalences of infection are high to consider schistosomiasis a main public health priority. Considering the clustering nature of the disease, the future success of schistosomiasis control programmes in Ondo state will depend upon broad intervention efforts to target areas of high prevalences and the development of cost effective strategies to identify areas of low prevalences for control efforts. General surveillance activities will also be important as a means of identifying potential increase in the prevalence of *S. haematobium* infection in areas less affected and as a means of monitoring the overall decrease in infection in the state. The use of Praziquantel in the treatment of infected subjects will also be effective against *S. mansoni* in areas where it occurs in the state.

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