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Schistosoma haematobium infection among schoolchildren in the Babana district, Kwara State, Nigeria

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Summary

A study was carried out in the Babana District of Borgu Local Government Areas in Kwara State, Nigeria, to determine the prevalence and intensity of urinary schistosomiasis among schoolchildren. Of 425 pupils found and examined in nine communities, 193 (45.4%) were infected. Infection rates for boys and girls (44.7% and 47.9%, respectively) were not significaptly different ($P > 0.5$). Children between 11 years and 13 years of age had the highest prevalence (59.2%), while those between 5 years and 7 years had the lowest (33.6%). However, the proportion (25.9%) of children excreting at least 1000 eggs/10-ml urine sample during their first decade of life was significantly higher ($P < 0.01$) than for pupils who were older. There was a positive relationship between schistosomal infection and the prevalence of haematuria and proteinuria. Thus, the prevalences of haematuria and proteinuria were significantly higher among the infected than among the non-infected pupils ($P < 0.01$). All the pupils with heavy haematuria ($n = 45$) and those with heavy proteinuria ($n = 14$) had at least 150 eggs/10-ml urine sample and 1000 eggs/10-ml urine sample, respectively.

Résumé

Une étude a été entreprise dans le District de Babana dans la Province du Borgu, Etat du Kwara au Nigeria, afin de déterminer la fréquence et l'intensité de la schistosomiase urinaire chez les élèves. Des 425 élèves rencontrés et examinés dan neuf communautés, 193 (45.4%) étaient infectés. Les taux d'infection chez les garçons et les filles (44.7% et 47.9% respectivement) n'étaient pas notoirement différents ($P > 0.5$). C'est chez les enfants de 11 à 13 ans que la fréquence était la plus forte (59.2%) tandis que chez les enfants de 5 à 7 ans elle était la plus faible (33.6%). Toutefois, le pourcentage (25.9%) des enfants qui excrètent au moins 100 oeufs/10-ml par échantillon d'urine au cours des dix premières années d'existence était sensiblement supérieur ($P < 0.01$) à celui des élèves moins âgés. Il n'y avait aucune relation apparente entre l'occurrence de la crystallurie et celle de la schistosomiase urinaire, mais la corrélation entre la frequénce et l'intensité de l'infection et l'occurence de la proteinurie et de l'haematurie était semblable à celle des sources de documentation.

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Introduction

Cases of *Schistosoma haematobium*, the dominant form of human schistosomiasis in Nigeria, are frequently encountered in schools, hospitals and clinics in various parts of this country. However, the prevalence of the disease, the sites of its transmission and the distribution of the snail intermediate hosts remain unknown [1,2] in most areas. The proliferation of dams and water projects without proper planning and maintenance, the frequency of human water contact and pollution, and the increased population mobility are major factors fostering the propagation and dissemination of schistosomiasis, especially in areas where open irrigation

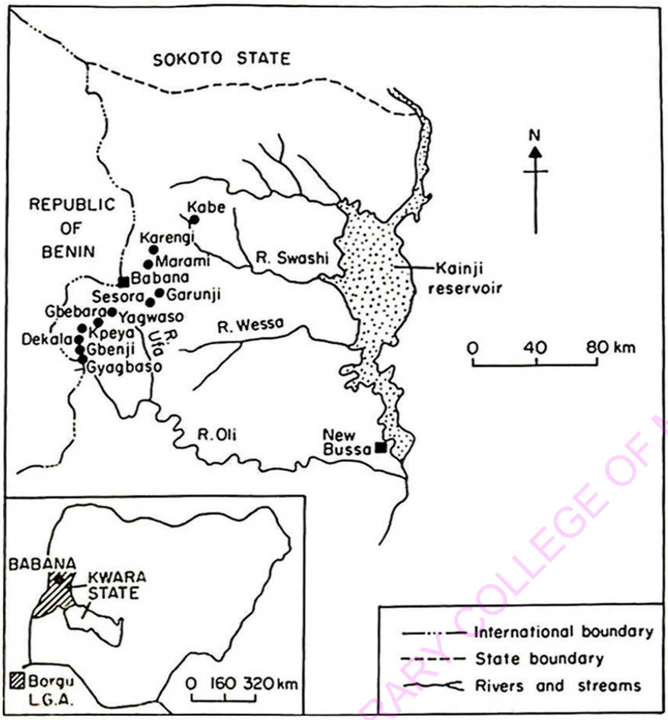

Fig. 1. The map of Babana District showing the villages surveyed. The inset map of Nigeria shows Kwara State and Borgu Local Government Area (shaded).

systems (such as in the River Basin Development Areas) are employed to cultivate large acres for agricultural purposes.

In view of the paucity of information on the distribution of schistosomiasis in most areas, and the general concern that the disease may be increasing in prevalence, distribution and importance, particularly in the remote and poorly accessible rural communities, this study was undertaken to establish the occurrence, prevalence and intensity of *S. haematobium* infection among school children in the Babana District.

The background of this study area (Fig. 1), which has never been surveyed for schistosomiasis, was described by Edungbola *et al.* [3].

Patients and methods

Prior to the collection of urine samples, all the school headmasters were contacted for permission, co-operation and necessary briefing regarding the purpose, relevance and personal involvements of the exercise. Due to ignorance of the aetiology, mode of transmission and public health implications of urinary schistosomiasis, health education meetings were held with the pupils and teachers. Thereafter, with the assistance of each class teacher, questionnaires were used to obtain each pupil's name, age, sex, religion, occupation, home town, previous residence, duration of stay in the present community, sources of water used for bathing and history of terminal haematuria, including its duration, the perceived causes and history of anti-schistosomal therapy.

Urine samples were collected between 11.00 h and 13.00 h. Samples were collected from every pupil present in each school since school enrolment is extremely low throughout the district [3]. In order to collect urine samples, each pupil was led by a male or female member of the survey team to a private place where the pupil was given a clean 1-litre beaker. Only one pupil was allowed in the toilet at a time. The total urine volume voided was measured with a graduated cylinder and observed for any visible evidence of terminal haematuria. Thereafter, the sample

Fig. 2. Children and housewives swimming, playing and washing in a stream that harbours *Bulinus globosus* infected with cercariae of *Schistosoma haematobium* at Marami.

was thoroughly mixed to ensure even distribution of contents. Two 10-ml urine samples were taken with 10-ml disposable syringes. The first 10 ml were examined microscopically for schistosome eggs, red blood cells, urinary casts and crystals. The second sample was used for qualitative urine analysis to ascertain the occurrence of proteinuria and haematuria using commercially prepared reagent strips. Protein estimations of <30 mg/10 ml, ≥30 mg/10 ml and ≥100 mg/ml were regarded as trace, moderate and heavy, respectively.

In order to prevent transfer of eggs and other urine materials from one pupil to another, a beaker was not reused until it had been washed thoroughly and left for at least 30 min in rainwater. Examination of urine for the presence of eggs and sediment was carried out as soon as possible to avoid cloudiness due to prolonged storage. Each sample was filtered under gravity through a superfine wire mesh No. 325, which was conically folded into a glass funnel. Thereafter, the filter was washed into a cross-hatched petri-dish (7.5 cm diameter) and examined for the presence of eggs, red blood cells, urinary casts and crystals. The total number of eggs present in each 10-ml urine sample was determined with a talley hand counter. Repeated centrifugation and examination of urine filtrate showed that no eggs escaped into the filtrates. The manual method using Papanicolaou stain was employed to confirm the identification of representative samples of urine sediments. The results obtained in various communities were analysed and compared by age and sex.

In order to identify the active sites of transmission, community ponds where water-contact activities were very pronounced (Figs 2 and 3), were examined for vector snails by searching among leaves, woods, stones and other objects that could be found. Suspected snails found were washed and tested for cercariae shedding.

Fig. 3. Schoolchildren swimming and playing in River Ufana, the principal site of transmission in Babana.

Table 1. Prevalence of *Schistosoma haematobium* among 425 schoolchildren in different communities in Babana District

	Boys			Girls			Total		
	No. examined	No. infected	% infected	No. examined	No. infected	% infected	No. examined	No. infected	% infected
Babana	129	78	60.5	45	33	73.3	174	111	63.8
Babana (CSS)*	31	12	38.7	6	2	33.3	37	14	37.8
Dekara	44	5	11.4	6	0	0.0	50	5	10.0
Garunji	18	9	50.0	6	1	16.7	24	10	41.7
Gbenji	25	4	16.0	7	0	0.0	32	4	12.5
Kabe	30	0	0.0	10	1	10.0	40	1	2.5
Kerenji	8	3	37.5	4	1	25.0	12	4	33.3
Marami	29	29	100.0	7	7	100.0	36	36	100.0
Yagwaso	17	8	47.1	3	0	0.0	20	8	40.0
Total	331	148	44.7	94	45	47.9	425	193	45.4

*All schools surveyed are primary schools except the Babana Community Secondary School.

Results

Nine community schools were surveyed to determine the occurrence and prevalence of urinary schistosomiasis in the Babana District, Borgu Local Government Area, Kwara State, Nigeria. Of 425 pupils examined, 193 (45.4%) were excreting eggs of *S. haematobium* in their urine. 148 (44.7%) of the 331 boys and 45 (47.9%) of the 94 girls examined were infected. The prevalence of the infection by sex and community is shown in Table 1. Pupils in Marami and Babana (The District Headquarters) had the highest prevalence (100% and 63.8%, respectively) while Kabe had the lowest (2.5%).

As shown in Table 2, children between 11 years and 13 years of age were the most infected (59.2%), while those between 5 years and 7 years were the least infected (33.6%). Infection rates for boys and girls between 8 years and 13 years were similar. However, between 5 years and 7 years of age, girls had higher prevalence rate (53.3%) than boys (26.2%). This pattern is reversed between 14 years and 16 years of age when a significantly higher infection rate (51.8%) was observed among boys than girls (28.6%) ($P < 0.01$).

Of 193 infected pupils seen, 35 (18.1%) were excreting 1000 or more eggs/10-ml urine samples (Table 2). Twenty-nine boys (19.6%) and six infected girls (13.3%) had at least 1000 eggs/10-ml urine samples. In Marami, 14 infected pupils (38.9%) and in Babana, 19 infected pupils (17.1%) also had up to 1000 eggs/10-ml urine sample. The percentage of pupils in their first decade of life who were excreting at least 1000 eggs/10-ml urine sample was significantly higher ($P < 0.01$) than the percentage of those in their second decade of life who had ≥1000 eggs/urine sample.

The overall prevalence of haematuria was 58.5% and this occurred only among infected pupils. Heavy haematuria occurred among 45 (47.8%) of those voiding at least 150 eggs/10-ml urine sample. Pupils in Marami had the highest prevalence of haematuria (77.8%). All pupils in this school were infected and 38.9% had ≥1000 eggs/10-ml urine sample. The only infected girl at Kabe was a new transferee from Marami who had 3434 eggs/10-ml urine sample, with heavy haematuria.

The overall prevalence of proteinuria was significantly higher among infected than non-infected children ($P < 0.01$). Of 193 infected pupils, 118 (61.1%), 61 (31.6%) and 14 (7.2%) had trace, moderate and heavy proteinuria, respectively. Eleven (78.6%) of those with heavy proteinuria were from Marami and Babana, and these were exclusively pupils voiding at least 1000 eggs/10-ml urine sample.

The prevalence of urinary casts was significantly higher ($P < 0.01$) in Marami, where the infection rate was 100%, than in Babana, where it was 63.8%. However, the frequency of occur-

Table 2. Prevalence of *Schistosoma haematobium* and frequency of excretion of 1000 or more eggs/10-ml urine sample by age and sex in Babana District

Age groups (years)	Boys			Girls			Total		
	No. examined	No. and % infected	No. and (%)* with ≥1000 eggs/10-ml urine samples	No. examined	No. and (%) infected	No. and (%) with ≥1000 eggs/10-ml urine samples	No. examined	No. and (%) infected	No. and (%) with ≥1000 eggs/10-ml urine samples
5–7	80	21 (26.2)	5 (23.8)	30	16 (53.3)	3 (18.8)	110	37 (33.6)	8 (21.6)
8–10	125	57 (45.6)	18 (31.6)	42	18 (42.9)	3 (16.7)	167	75 (44.9)	21 (28.0)
11–13	88	52 (59.1)	6 (11.5)	15	9 (60.0)	0 (0.0)	103	61 (59.2)	6 (9.8)
14–16	27	14 (51.8)	0 (0.0)	7	2 (28.6)	0 (0.0)	34	16 (47.1)	0 (0.0)
17–18	11	4 (36.4)	0 (0.0)	0	0 (0.0)	—	11	4 (36.4)	0 (0.0)
Total	331	148 (44.7)	29 (19.6)	94	45 (47.9)	6 (13.3)	425	193 (45.4)	35 (18.1)

*Number with ≥1000 eggs/10-ml urine/number of infected pupils.

rence of crystalluria in the two communities was not statistically different ($P > 0.5$).

The water sites (Figs 2 and 3) where active transmission occurred were confirmed in Babana and Marami, where *Bulinus* specimens infected with cercariae of human schistosome were recovered. This was not possible in other communities because the suspected ponds had dried up at the time of this survey. Apparently, no active transmission occurred at Kabe where the only infected pupil found was a girl who had recently transferred to Kabe from Marami.

There was no awareness of the association between water, schistosomiasis and haematuria in all these schools, and none of the pupils had ever received anti-schistosomal therapy.

Discussion

Urinary schistosomiasis is more common than previously assumed in the Babana District where 45.4% of pupils examined in nine different community schools were infected. This is a relatively high prevalence, considering the prevailing local climatic conditions [3], which appear unfavourable for the transmission and endemicity of schistosomiasis in the area.

Apparently, the disparity in the prevalence and intensity of infection in different communities is related to how long the community streams and ponds could support transmission before drying up. Thus, in Marami and Babana (Figs 2 and 3), where streams last longer and human water contacts are more pronounced, the rate and intensity of infection are significantly higher ($P < 0.01$) than elsewhere in the district. It is conceivable that urinary schistosomiasis spread from these two endemic villages to neighbouring communities, with children, like the case encountered in Kabe, playing an important role in the inter-village dissemination.

Males and females had similar infection rates in all age groups, except between 5 years and 7 years when girls were significantly more infected ($P < 0.001$) than boys. This difference was probably due to variations in the onset of exposure to infection, being earlier for girls who accompany their mothers to streams more often at this age range than their male counterparts. Likewise, the highest infection rate (59.2%) seen among 11–13-year-old pupils, could be related to exposure factors. Children in this age range were stronger, more active and therefore swam more frequently in the infected streams than the younger ones. Also, they were less restrained by social factors than their older counterparts who swim less frequently and probably preferred alternative forms of recreation for leisure.

This study suggests a relationship between the level of schistosomal endemicity and the proportion of pupils with a heavy infection in these communities. Thus, in Marami, where all the pupils examined were infected, 38.9% had ≥1000 eggs/10-ml urine sample, and in Babana, with a prevalence of 63.8%, 17.1% of the infected pupils were excreting at least 1000 eggs/10-ml urine samples. However, in other communities with relatively lower infection rates, correspondingly fewer pupils had ≤1000 eggs/10-ml urine samples. Dalton and Pole [4] have attributed differences in the intensity of *Schistosoma haematobium* in different communities to variations in water-contact activities.

Table 2 shows that 29 (25.9%) children in their first decade of life and six (7.4%) pupils who were older had ≥1000 eggs/10-ml urine sample. Wilkins and Scott [5] made a similar observation in Gambia, and Dalton and Pole [4] attributed such differences to variations in the degree of exposure to infective schistosome cercariae.

Age- and sex-related disparities in the intensity and prevalence of urinary schistosomiasis had been attributed to various factors. These included: differences in water contact, frequencies and duration [4–7]; age-related acquired immunity [8–13]; temporary seasonality in the snail ecology and alternative pattern of local transmission [6,9]; decreases in egg production due to death of adult worms, and reduced egg excretion due to pathological changes elicited in the bladder following calcification.

There was no apparent relationship between prevalence of crystalluria and intensity of schistosomiasis in this study. However, abnormal proteinuria and haematuria occurred with greater frequency and intensity among heavily infected communities and pupils. The diagnostic values and pathological significance of proteinuria and haematuria in urinary schistosomiasis were discussed extensively by Ezzat *et al.* [14] and Wilkins *et al.* [15].

Whereas the prevalence of urinary schistosomiasis among school children is relatively high in this district, it has been reported by Pope *et al.* [16] that the age when radiographic complications of the disease occur is uncertain. In view of the considerable morbidity and public health significance of *Schistosoma haematobium* [16–18], the introduction of a school health programme to control the disease by combining a health education campaign with anti-schistosomal chemotherapy is desirable and recommended.

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