Investigation of the Risk of Infection of Urinary Schistosomiasis at Mahem and Galilea Communities in the Greater Accra Region of Ghana

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Abstract

Urinary schistosomiasis is of great public health importance in developing countries. It has adverse economic and health implications on residents living in endemic areas. Various factors including human behaviour are known to play key role in the transmission of the disease. The knowledge of the levels of risk of infection of urinary schistosomiasis and people's perception will be an important tool in its control. The study determined the prevalence of urinary schistosomiasis and the risk of infection in some communities near the Weija lake in the Ga District. It assessed the knowledge base of the subjects on the disease and its impact on transmission. Data were collected on demographic variables, some behavioural activities in water bodies, knowledge base on the disease and sanitary facilities. Urine samples were analysed using the centrifugation technique. The percentage prevalence for Mahem and Galilea were 58% and 49%, respectively. The difference in prevalence was insignificant; 0.09 (-0.04, 0.21; $P < 0.426$). Bloody urine was associated with high risk of infection; OR of 4.55 (2.82, 7.36); $P < 0.001$. Subjects with primary level of education and invariably below 26 years of age had about two times the risk of infection; OR of 2.12 (1.13, 3.97); $P < 0.02$. The communities had 52% prevalence of urinary schistosomiasis. Frequent contacts and use of the infested lake were associated with infection. Educational intervention alone may not be effective in the control of the disease. The use of an integrated approach should be given favourable consideration.

Introduction

Urinary schistosomiasis is a disease of great public health importance and remains an important cause of morbidity and mortality globally, particularly in the developing world. After malaria, schistosomiasis is the second most prevalent tropical parasitic disease, and is a leading cause of morbidity in endemic areas of Africa, Asia and South America (WHO, 1995). In some parts of Africa the onset of haematuria due to urinary schistosomiasis is so common in adolescent boys that it is seen as normal (Desowitz, 1981). It is estimated that approximately 200–300 million people are suffering from schistosomiasis in the world (Nash *et al.*, 1982; Savioli, 1990).

It is known that *Schistosoma haematobium*, which causes urinary schistosomiasis, is the predominant human schistosome species in Ghana, and it is widely distributed in the country (McCullough & Ali, 1965; Onori *et al*., 1963). In Ghana, recent studies indicate that the disease is of great public health importance. A study by Aryeetey *et al.* (2000) revealed that prevalence of *Schistosoma haematobium* infection in some communities drained by the Densu river ranged between 54.8% and 60.0%.

Various factors, including human behaviour, are known to be important in the transmission of the disease. Human behavioural activities, especially fishing, fetching of water, swimming, washing, and others, play a role in the transmission of the disease (Wagatsuma *et al*., 2003; Useh & Ejezie, 1999). Identifying the levels of risk of infection of urinary schistosomiasis and knowing the general perception of people about the disease will be an important tool in its control.

Materials and methods

Study area

A cross-sectional study was carried out in two communities (Galilea and Mahem) in the Ga District of the Greater Accra Region of Ghana to investigate the problem of urinary schistosomiasis. These communities are in the western part of the District and close to the Weija lake, believed to be infested with schistosome parasites. The inhabitants of these communities rely on the Weija lake for various activities of which fishing and bathing are no exception. Although there are some other sources of water for the communities, water from the lake is put to a variety of uses. Mahem is more rural compared with Galilea. Fig. 1 gives geographical description of the study area and its immediate environment.

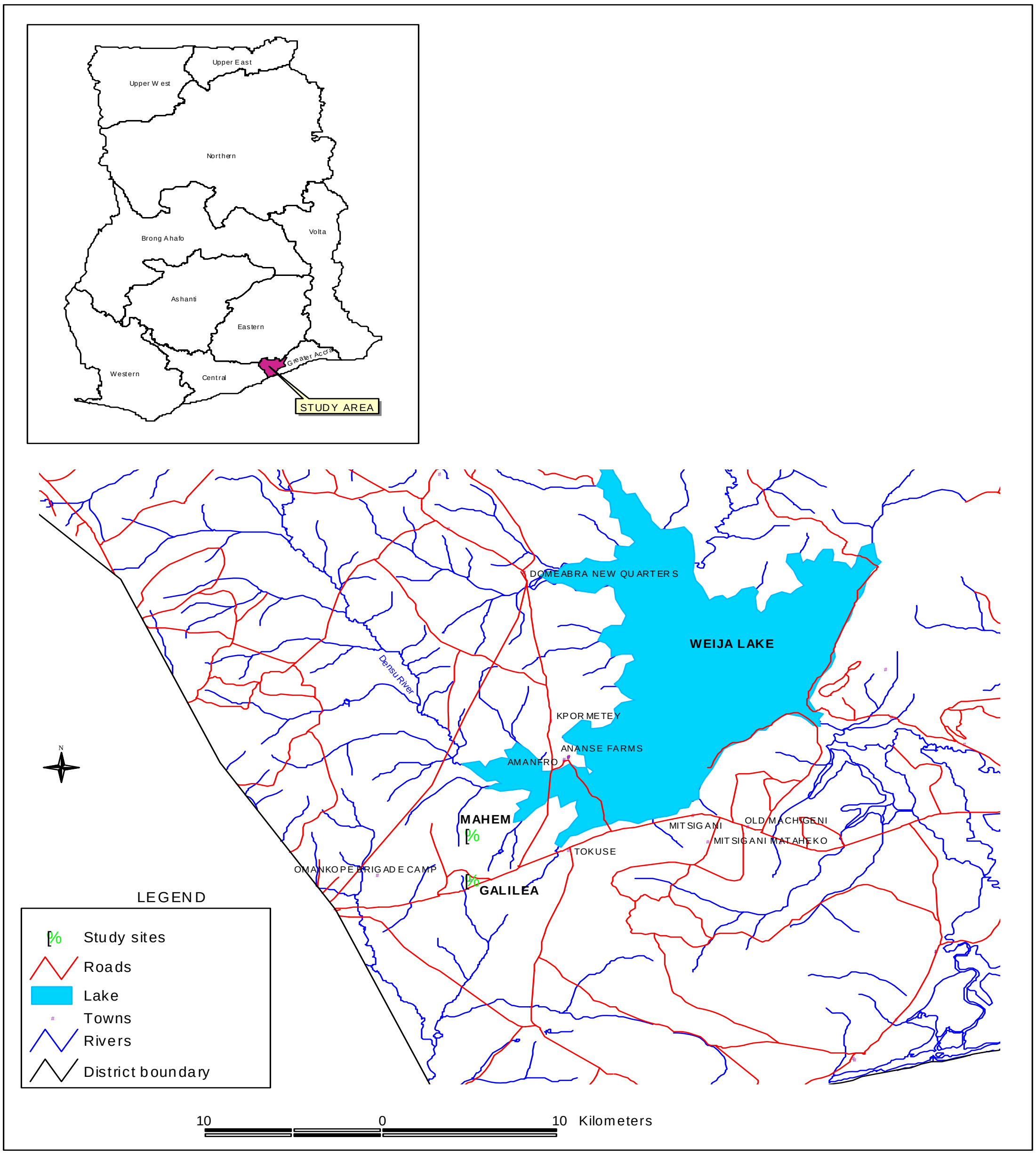

Fig. 1. Geographical description of the study area

Data collection and analysis

The study was carried out between October and April. Questionnaire was designed and used as the data collection tool. It covered common demographic variables, some behavioural activities in water bodies, knowledge base on the disease system and sanitary facilities available in the communities. To reduce selection bias 309 individuals, aged 5 years or more and of both sexes with different educational background and occupation from the communities, were interviewed at random. The questionnaire was structured in a more detailed and specific manner and the content explained in a language best understood by respondents as a way of reducing measurement error. Prior to this, the purpose of the study was explained to them. All those who declined to participate fully or agreed to participate partially were left out of the study.

Parasitological analysis

10-ml urine sample was collected from each subject. All samples were collected between 10 a.m. and 2 p.m. and kept at a temperature of 4–6 ^{0}C till they were sent to the laboratory for analysis. Each fresh urine sample was tested for the presence of blood as soon as possible using CYBOW ™ reagent strips, as hematuria and self-reported blood in urine have been shown to be simple and useful indicators for urinary schistosomiasis (Anosike *et al.*, 2001; Lengeler *et al.*, 2002). Individual urine samples were poured into test tubes and centrifuged at a speed of 1000 r.p.m. for 10 min. The sediment for each sample was prepared on a slide for observation under a microscope. Thorough observation of all prepared slides was done under a micro-scope at × 40 objective lens. The number of schistosome eggs present in each preparation was counted and recorded using the following grading; + [1–5 schistosome eggs per slide (eps)], ++ (1–10 schistosome eps), +++ (1–20 schistosome eps) and ++++ (more than 20 schistosome eps).

The data were analysed using the logistic regression model in Statistical Package for Social Sciences (SPSS) to investigate the association between the risk of urinary schistosomiasis infection and other variables. The Z test was used to compare the prevalence of the disease in both communities and to assess the statistical significance of the observed difference in prevalence.

Results

The infection of *Schistosoma haematobium* was found in the communities studied. In all, 160 (52%) subjects out of 309 were found to have urinary schistosomiasis. The percentage prevalence for Mahem and Galilea were 58% and 49%, respectively. The observed difference in prevalence of the disease in the communities was not significant; 0.09 (-0.04, 0.21; $P < 0.426$). The risk of infection of the disease for demographic variables and blood urine expressed as odds ratio (OR) is shown in Table 1. Subjects with blood urine had high risk of infection of 4.55 (2.82, 7.36); $P < 0.001$ when compared with those without blood in urine. Fishermen had infection risk of 2.05 (0.75, 5.55); $P < 0.160$ when compared with the unemployed.

TABLE 1

Association of the risk of urinary schistosomiasis infection with sex, age, occupation, level of education and bloody urine. Values are numbers (percentages)

Variable	*Infected subjects*	**NSES*	*P value (Wald's)*	*P value (LRT)*	***OR (95%CI)*
Sex					
Male	79 (50.3)	83 (54.6)			1.0
Female	78 (49.7)	69 (45.4)	< 0.451	< 0.451	1.19 (0.76, 1.86)
Age (years)			< 0.515	< 0.486	
> 45	4 (2.5)	9 (5.9)			1.0
5-15	78 (49.7)	70 (46.1)	< 0.140		2.51 (0.74, 8.50)
16-25	50 (31.8)	44 (28.9)	< 0.140		2.56 (0.74, 8.88)
26-35	16 (10.2)	21 (13.8)	< 0.433		1.71 (0.45, 6.58)
36-45	9 (5.7)	8 (5.3)	< 0.230		2.53 (0.56, 11.51)
Occupation			< 0.418	< 0.390	
Unemployed	16 (10.2)	18 (11.8)			1.0
Farmers	5 (3.2)	5 (3.3)	< 0.870		1.13 (0.27, 4.61)
Artisans	6 (3.8)	12 (7.9)	< 0.343		0.56 (0.17, 1.85)
Traders	21 13.4)	24 (15.8)	< 0.972		0.98 (0.40, 2.40)
Students	89 (56.7)	82 (53.9)	< 0.595		1.22 (0.58, 2.55)
Fishermen	20 (12.7)	11 (7.2)	< 0.160		2.05 (0.75, 5.55)
Level of education			< 0.160	< 0.152	
None	20 (12.7)	33 (21.7)			1.0
Primary	100 (63.7)	78 (51.3)	< 0.020		2.12 (1.13, 3.97)
JSS/Middle	27 (17.2)	33 (21.7)	< 0.435		1.35 (0.64, 2.87)
Sec./SSS	9 (5.7)	7 (4.6)	< 0.193		2.12 (0.68, 6.59)
Blood urine			< 0.001	< 0.001	
No	55 (35)	108 (71.1)			1.0
Yes	102 (65)	44 (28.9)	< 0.001		4.55 (2.82, 7.36)

***** No schistosome egg seen in urine sample
****** Odd Ratio (95% confidence interval)

Table 2 gives statistical description of the association between some water contact variables, source of water and knowledge of source of infection on one hand and infection of the disease on the other. Subjects with primary level of education who spend more time in the infested water and invariably below 26 years of age had risk of 2.12 (1.13, 3.97); $P < 0.02$. There was increasing strength of association between frequent contact with the water body and infection. Subjects who had > 4 times contact with the infested water body per week had risk of 1.50 (0.76, 2.95); $P < 0.242$ in comparison with those who had no activity in the water body. The associations of other variables with risk of infection of the disease are given in Table 2.

TABLE 2

Associations of the risk of urinary schistosomiasis infection with some water contact variables, source of water and knowledge of source of infection. Values are numbers (percentages)

Variable	*Infected subjects*	**NSES*	*P value (Wald's)*	*P value*	*OR (95%CI)*
Contact with Infested water body					
No	62 (39.5)	59 (38.8)	< 0.903	< 0.903	1.0
Yes	95 (60.5)	93 (61.2)	< 0.903		0.97 (0.62, 1.54)
Frequency of Contact/week					
No contact	61 (38.9)	56 (36.8)	< 0.231	< 0.222	1.0
Once	51 (33.6)	46 (29.3)	< 0.493		0.83 (0.48, 1.42)
2-4 times	19 (12.1)	26 (17.1)	< 0.260		0.67 (0.34, 1.34)
> 4 times	31 (19.7)	19 (12.5)	< 0.242		1.50 (0.76, 2.95)
Activity in water					
No activity	60 (38.2)	58 (38.2)	< 0.768	< 0.760	1.0
Bathe/swim	15 (9.6)	13 (8.6)	< 0.795		1.12 (0.49, 2.55)
Fetch water	44 (28)	39 (25.7)	< 0.762		1.09(0.62, 1.91)
Wash	10 (6.4)	16 (10.5)	< 0.256		0.60 (0.25, 1.44)
Work/fish	28 (17.8)	26 (17.1)	< 0.903		1.04 (0.55, 1.98)
Frequency of activity					
No activity	62 (39.5)	58 (38.2)	< 0.418	< 0.411	1.0
Once	46 (29.3)	50 (32.9)	< 0.584		0.86 (0.50, 1.47)
2-4 times	20 (12.7)	25 (16.4)	< 0.409		0.75 (0.38, 1.49)
> 4 times	29 (18.5)	19 (12.5)	< 0.305		1.43 (0.72, 2.82)
Source of water					
Other	20 (12.7)	20 (13.2)	< 0.225	< 0.182	1.0
Standpipe only	91 (58.0)	101 (66.4)	< 0.764		0.90 (0.46, 1.78)
River/lake only	7 (4.5)	2 (1.3)	< 0.147		3.48 (0.64, 18.82)
Standpipe/river, Lake	39 (24.8)	29 (19.1)	< 0.459		1.35 (0.61, 2.95)
Knowledge, source of infection					
No idea	16 (10.2)	30 (19.7)	< 0.001	< 0.001	1.0
Food	3 (1.9)	14 (9.2)	< 0.198		0.40 (0.10, 1.61)
Infested water body	138 (87.9)	108 (71.1)	< 0.009		2.40(1.24, 4.62)

As high as 80% (246) of the subjects know that an infested water body is the source of infection of the disease. Equal percentage (33%, 102) of them attributed infestation of water bodies to either urinating or urinating/defaecating into water bodies. Knowledge of infested water body as source of infection had risk of 2.40 (1.24, 4.62); $P < 0.009$.

Discussion

The study reveals that urinary schisto-somiasis is a disease of great public health importance in the Mahem and Galilea communities in Ghana. It is highly endemic in the communities, with overall prevalence of 52%, an indication that the problem needs urgent attention. The prevalence of the disease is 9% higher in Mahem than in Galilea. As revealed by Kloos *et al.* (1997), intensity of infection and water contact decline relatively slowly with distance from infested water body. The difference could, therefore, be due to proximity of Mahem to the infested water body. However, this difference is not significant; 0.09 (-0.04, 0.21); $P < 0.426$, suggesting that the disease is equally important in both communities. Factors such as lack of safe alternative water sources for some residents, water contact behaviour and some types of occupation may cause this high prevalence.

There was highly significant association between blood urine and infection of the disease with blood urine having a risk of 4.55 (2.82, 7.36); $P < 0.001$. Blood urine is a common symptom of urinary schisto-somiasis. In highly endemic areas, blood urine may, therefore, be useful as an indicator of infection of the disease.

The risk of infection of fishermen was two times that of the unemployed, 2.05 (0.75, 5.55); $P < 0.160$, but the *P*-value shows it is not significant. This may be explained by the relatively smaller sample size in that category. However, fishing was found to have stronger association with infection of the disease compared with other occupations and may be due to regular contact with infested water body. It is important to note that 35% (109) of the subjects admitted taking medication to cure the disease (regularly for some of them and < 6 months prior to the study for others) on seeing blood urine. This observation may partly explain the results.

Moreover, frequent contact with infested water body was found to be very important. The risk of infection for more than four times contact with infested water body was found to be higher (43%) than those who do not have contact with the water body. Similar trend was observed with the frequency of activity in infested water body. However, the association was not significant and may be explained by other factors including regular medication.

The results on the relationship between urinary schistosomiasis infection and demographic variables indicate that, overall, there was no significant association between them, although some of the variables were more important than others. Compared to males, females appear to have a risk of 19% more than that of males i.e. 1.19; $P < 0.450$. However, this difference was not significant implying that both males and females are equally vulnerable. All age groups are at risk of infection. The likely reason is contact with infested water bodies.

The young (below 26 years) appear to be at increased risk of infection probably because fetching of water, bathing/swimming in water bodies, among others, which have been identified to be risk factors by some earlier studies (Wagatsuma *et al.*, 2003; Useh & Ejezie, 1999; Enk *et al.*, 2003; Jeans & Schwellnus, 1994), are frequently carried out by them. The overall *P* values for both Wald's test ($P < 0.160$) and likelihood ratio test ($P < 0.152$) indicate that the level of education of subjects has no relationship with infection of the disease. Subjects with primary level of education, who are almost invariably below 26 years of age and spend more time in the infested lake, have about two times risk of infection. This finding may be explained by the fact that children at the primary level of education are attracted to swimming.

The subjects generally have high knowledge of the disease system. This is because earlier interventions have given them the knowledge base. However, there was a strong association between infection of the disease and knowledge of source of infection ($P < 0.001$), suggesting that the subjects do not apply the knowledge or have no alternatives to their water needs. Knowledge of source of infection is, therefore, not protective against urinary schistosomiasis infection; thus, validating the findings of some earlier studies of which those of Wagatsuma *et al.* (2003) and Sama & Ratard (1994) are included. This suggests that educational intervention alone cannot be used to address effectively the problem of schistosomiasis control. The use of an integrated approach in urinary schisto-somiasis control should, therefore, be given favourable consideration.

In conclusion, the communities investigated had 52% prevalence of the disease. Blood urine, frequent contact and use of infested lake water were associated with high risk. Self-medication may have influence on the findings. This is because the drug of choice, Praziquantel, is effective against all schistosome species occurring in man. Metriphonate, a monospecific anti-schistosomal drug, is also effective against *Schistosoma haematobium* (Davis, 1996). Moreover, very large sample size will provide more precise estimate of effect. Further study is recommended in other communities exposed to the risk of infection of the disease.

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