IMPORTANCE OF BULINUS GLOBOSUS SNAILS IN THE TRANSMISSION OF URINARY SCHISTOSOMIASIS IN EIGHT VILLAGES IN SOUTHERN GHANA

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SUMMARY

Snail survey was carried out at water contact sites (WCSs) of 8 villages in southern Ghana to establish fresh water snails responsible for schistosomiasis transmission in the area. *Bulinus globosus,* one of the intermediate host snails of *Schistosoma haematobium* was found at the WCSs in all 8 villages although those infected were identified at sites in 5 of the villages. The snails were confined to the Densu river itself, its tributaries (streams) and ponds. These snails were found during the minor rainy season, at the beginning of and during the dry season. They were found to be focal in distribution. Also found in the Densu river and the ponds were uninfected *Biomphalaria pfeifferi* snails. In addition to those indicated above, non-schistosome-transmitting snails were also found.

Keywords: *Bulinus globosus*, *Schistosoma haematobium*, Densu River, Southern Ghana.

INTRODUCTION

Schistosomiasis, one of the major parasitic diseases affecting about 200-300 million people world-wide is a disease of the tropics and subtropics[1-3]. Judging from the local names given to urinary schistosomiasis - "la shaamo" in Ga, "dwonso mogya" in Akan and "ewudordor" in Ewe - it can be inferred that schistosomiasis has been known in certain areas of Ghana for a long time as reported by Odei[4,5].

There are two types of schistosomiasis in Ghana, the urinary which is the most predominant and the intestinal types[4-6]. The snails responsible for the transmission of urinary schistosomiasis, *Schistosoma haematobium,* in Ghana are *Bulinus truncatus* and *B. globosus*[4,7-10]. *B. globosus* was reported to be the most important and widely distributed in the country before the creation of the Volta Lake[4,5,7,9,11] but rare in the area now occupied by the lake[11]. *B. truncatus* had a less extensive distribution in the pre-lake period and was associated with the Volta watershed and the freshwater lagoons[8,12]. Though the intermediate snail host of intestinal schistosomiasis (*S. mansoni), Biomphalaria pfeifferi* were found in the freshwater lagoons, only *S. haematobium* infection was recorded in the area[9,12]. Comparatively this snail species was far widely distributed than the foci of intestinal schistosomiasis [5, 12,14].

Studies carried out in 1984 in the lower Volta river, below the Akosombo dam[17] and at the Tono irrigation scheme in the Upper East Region[18] indicated that the disease is on the increase. At the root of the problem is often a lack of knowledge of both the epidemiological pattern and of the socio-cultural structures that govern the attitude/perception of the population concerned[19].

The Noguchi Memorial Institute for Medical Research therefore undertook an epidemiological survey to assess the endemicity of urinary schistosomiasis in another geographical area of the country from May, 1992 to July, 1993 to facilitate the formulation of a control strategy. During the study water contact sites (WCSs) in 8 se-lected villages were sampled for the presence of host snails of *Schistosoma spp*. The results of which are presented

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in this paper. Results of the effect of control measures undertaken, socio-cultural findings and water contact behaviour patterns are reported elsewhere.

MATERIALS AND METHODS

The study area covered eight villages in the Ga and Akuapem South Districts of the Greater Accra and Eastern Regions respectively. These villages which are located about 40 to 60km north-west of Accra were grouped into three defined areas on the basis of their natural boundaries. The villages in the Ga District are Ayikai Doblo, Akramaman, Dom Faase and Papase while Ntoaso, Sansami Amanfro, Chento and Gidi Kope are located in the Akuapem South District.

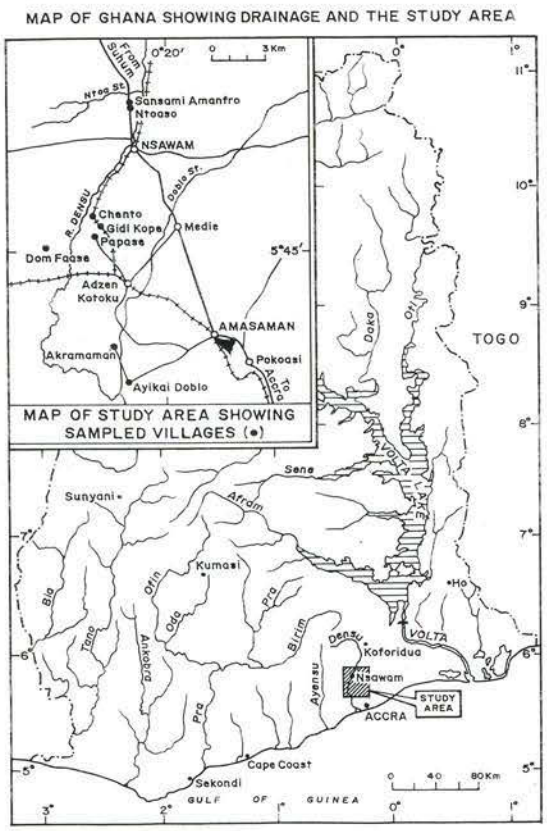

Figure 1. Map of Study Area

The major rainy season in the study area is from April to July and the minor one from September to October. The dry season is from November to March. People living in seven of these villages depend on water from the Densu river and its tributaries while one, Gidi Kope depends on its tributaries and ponds for their daily activities. Fishing is carried out in the Densu river, its tributaries and in the temporary pools created by the overflow of the river during the rainy season. The inhabitants of all 8 villages are mainly peasant farmers who grow maize, cassava and vegetables.

The WCSs for these villages were located on the Densu river itself, its tributaries, permanent and temporary ponds which were partly created by the Densu river overflowing its banks during the rainy season and partly by rainwater. All the identified WCSs were sampled once a month from September 1992 to March 1994 using palm leaf mats[20]. Other methods for snail sampling could not be applied because of the relative low numbers of snails found during preliminary studies. The mats which were made of fresh palm leaves, woven into a palm frond frame of 43x43cm, were left at the WCSs and collected in the mornings of the fourth day. An attempt was made to ensure that the mats were submerged in the water during the exposure period. Snails found attached to the mats were picked into containers and transferred to the laboratory for identification.

The host snails were grouped into young (0-4mm) and adults (4.1mm and above). They were checked for infection the day after collection by exposing them to light between 8.00 hours and 14.00 hours. Snails shedding brevifurcate cercariae were recorded as infected. Non-shedding snails were re-checked for infection once a week and those still not shedding cercariae were crushed at the end of the 4th week for final examination for infection. Infection rate of snails was based on the number of snails shedding brevifurcate cercariae among the number of surviving snails. Non-schistosome host snails collected were also recorded.

RESULTS

General

Figure 1 is the map of Ghana showing the study area while Table 1 summarizes the results on *Bulinus globosus* snails. They were identified in all the 8 villages. Generally, these snails were collected during

the minor rainy season (September and October), the dry season (December and January) and in August and November. At Ntoaso, one of the 8 villages, *Bglobosus* snails were found throughout the year. In all 2,293 *B. globosus* snails were found and 1,913 (83.4%) survived. A total of 3.1% (60/1,913) of the survived snails were infected. These infected snails were found in January, June, September, October, November and December.

Area 1

Ayikai Doblo had 9 WCSs but all the 237 *B. globosus* snails were collected at 4 sites on the Doblo stream. Out of this number, one hundred and sixty one (68.0%) snails survived. The overall infection rate was 23.0% (37/161). Infection rates of 32.7% (36/110) and 14.3% (1/7) were recorded in the adult snails from sites 1 and 2 respectively.

Table 1 *B globosus* snails collected at the water contact sites in 8 villages in southern Ghana

Area	Village	*B. globosus* snails no. collected		*B. globosus* snails no. examined		Infection rate %(no. pos./no.exam.)		
		Young (0-4mm)	Adult (4.1mm+)	Young (0-4mm)	Adult (4.1mm+)	Young (0-4mm)	Adult (4.1mm+)	Overall
1	Ayikai-Doblo	21	216	1	160	0 (0/1)	23.1 (37/160)	23.0 (37/161)
	Akramaman	112	315	88	286	0 (0/88)	0.35 (1/286)	0.3 (1/374)
2	Ntoaso	24	142	16	138	0 (0/16)	2.2 (3/138)	2.0 (3/154)
	Sansami- Amanfro	0	7	0	7	0 (0/0)	0.0 (0/7)	0.0 (0/7)
3	Dom-Faase	0	1	0	1	0 (0/0)	0.0 (0/1)	0.0 (0/1)
	Papase	0	188	0	148	0 (0/0)	2.7 (4/148)	2.7 (4/148)
	Chento	252	995	100	951	1 (0/100)	1.6 (15/951)	1.4 (15 /1051)
	Gidi-Kope	6	14	6	11	0 (0/6)	0 (0/11)	0.0 (0/17)

At **Akramaman** 427 *B. globosus* snails were collected at 4 out of the 11 WCSs; 3 of the sites were located on the Doblo stream while one was on the Densu river. In all 374 (87.6%) snails, (286 adults and 88 young), survived. Only one adult snail, 0.7% (1/145), from site 4 on the Doblo stream was found to be infected giving an overall infection rate of 0.3% (1/374).

Area 2

Ntoaso had 8 WCSs, 7 of which were located on the Ntoa stream while the other one was a fish pond. A total of 166 *B. globosus* snails were collected from 3 sites and 93.0% (154/166) survived. The overall infection rate was 2.0% (3/154). The infected 4.2% (3/71) snails were found at site 5. No schistosome host snail was collected from the fish pond.

The WCSs at **Sansami Amanfro** were made up of 1 site on the Densu river and 7 ponds. None of the seven adult *B. globosus* snails collected at the site on the Densu river was infected. All the 7 snails survived. No schistosome host snail was found in the ponds.

Area 3

Dom Faase: The 20 WCSs at this village were made up of 7 sites on the Densu river, 11 temporary ponds created by the Densu river when it overflows its banks during the rainy season and 2 ponds. Only 1 uninfected *B. globosus* snail which survived was found at site 6 which is a pond.

The 13 WCSs at **Papase** consisted of 6 sites on the Densu river, 6 temporary/permanent ponds and 1 site on a stream, a tributary of the Densu river. A total of 188 adult *B. globosus* snails were collected from 4 ponds and the stream. Out of the 78.7%(148/188) snails which survived, 2.7% (4/148) were infected. Sixty per cent (3/5) of the infected snails were found at site 5 and 4.0% (1/9) at site 6.

Chento: This village had 4 WCSs; 1 on the Densu river, 1 permanent and 2 temporary ponds which were fed by rainwater. A total of 1,247 *B. globosus* snails were found in the permanent pond which did not dry up during the dry season. Only 1.4% (15/1051) out of the 88.6% (1051/1247) surviving snails was infected.

Gidi Kope: All the 11 WCSs at Gidi Kope were ponds. None of the 6 young and 14 adult *B. globosus* snails collected was infected. Eighty five per cent (17/20) of the collected snails survived.

Snails Per Mat

On the average the number of *B. globosus* snails per mat was 8.3.

Other Snails

Also collected were 44 uninfected *Biomphalaria pfeifferi*, snail host of *S. mansoni*, from the ponds and the Densu river in Area 3 during the months of September 1992 and 1993 respectively, April 1993 and May 1993. Other snails found were *Aplexa waterloti, Melanoides spp., B. forskalii, Pila spp.*, and *Lymnaea spp.* (Table 2).

Table 2 Some other snails sampled at the water contact sites in 8 villages in southern Ghana

Area	*B. forskalii*	*Melanoides* spp.	*Pila* spp.	*Aplexa waterloti*	*Lymnaea* spp.	*Biomphalaria pfeifferi*
1	662	446	38	193	0	0
2	29	466	7	1241	6	0
3	721	1019	23	64	166	44

DISCUSSION

Data on the epidemiological studies carried out in 1992/93 in the present study area indicated that urinary schistosomiasis was endemic in all the 8 villages with prevalence ranging between 43.5% at Sansami Amanfro and 65.5% at Ntoaso indicating that transmission of the disease existed in the area (Aryeetey, M. E. et al unpublished observation) and during our survey 3.1% of the surviving 1,913 *B. globosus* snails were infected.

It is known that the relationship between human infection and water bodies which constitute the infection-sites is of importance in the epidemiology of schistosomiasis and that few snails surviving in a water body much frequented by human population are of greater importance in terms of transmission than a large number of snails in a water body not frequented. Furthermore observation made in 1962 indicated that in localities where the prevalence of infection among children was 60% and above, snail host were scarce in the early dry season, the transmission period[8]. In southern Ghana all infections were detected in adult snails and a relationship between the degree of infection in snails and degree of prevalence of human infection, was noted. Lower human infection rates were observed in villages where collected snails shed no cercariae contrary to a high prevalence of infection in communities from which infected snails were collected. The survey revealed the absence of schistosome snails at WCSs which were not much frequented.

The prevalence of *B. globosus* snails at WCSs in all the villages sampled confirmed earlier reports on the wide distribution of this important snail species in Ghana[4,6-8,10,11]. These snails were found in the Densu river, one of the major rivers in Ghana, at Akramaman and Sansami Amanfro, about 50 - 60km from Accra as well as in streams and ponds. *B. globosus* snails are known to thrive in small perennial streams, temporary pools formed in depressions along-side streams and ponds[9, 10, 20]. Its presence in the Densu River noted during the present survey therefore provides further information on the distribution of this important schistosome snail species in Ghana. The focalization of this snail species and the seasonality in its distribution, as being reported here, is a confirmation of earlier findings[20, 21]

The formation of the Volta Lake in 1964 created a vast environment favourable for the invasion of *B. truncatus* in an area, which previously did not favour its survival[11]. The absence of this snail species in our study area could therefore be due to prevailing unfavourable environment for its survival. Ecological changes along the Volta Lake altered the importance of the two snail species responsible for urinary schistosomiasis in Ghana, especially along the lake. With the emergence of *B. truncatus* as an important schistosome transmitter as mentioned above, it was thought that *B. globosus* would loose its importance as schistosomiasis host snail; but the observation of its presence in southern Ghana indicates its continuing epidemiological importance.

The presence of uninfected *Biomphalaria pfeifferi* snails in southern Ghana is worth noting since generally, prevalence of intestinal schistosomiasis is on the increase in Ghana[18]. Infection due to *S. mansoni* was not detected in stool samples examined during an epidemiological study on schistosomiasis in the present survey area (unpubl. data); this could be due to the absence of faeces at the WCSs. In 1974 examination of stool samples of 1,698 boys in north-western Ghana too did not reveal the presence of intestinal schistosomiasis despite the wide distribution of its potential host in the area[20]. The other snails found at the water contact sites are of no known importance with regard to transmission of urinary schistosomiasis in Ghana.

Results of the study demonstrates the relatively "positive" impact of non-interferance of the environment by man on the transmission of urinary schistosomiasis in the study area as compared with the situation along the shores of the man-made Volta Lake.

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