A re-evaluation of the bilharzia risk in and around the Hartbeespoort Dam

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Abstract

Recreational facilities provided by the Hartbeespoort Dam and surrounding pleasure resorts are very popular. In most of these activities close contact with water which, at one time or another in the past had harboured bilharzia snails in certain areas, is unavoidable. The last comprehensive freshwater snail survey was done more than 20 years ago. It is imperative that the general public as well as authorities concerned be kept up to date on the bilharzia risk involved. During November 1991 a systematic search of all possible freshwater snail habitats was conducted. At the same time water samples for selected chemical analyses were taken and notes were made of the aquatic vegetation. No bilharzia snails could be found in either the Hartbeespoort Dam or the Crocodile River. In the case of the former water body this could probably be attributed to the complete absence of marginal and aquatic vegetation and in the case of the latter to a very high mineral content of the water. The Magalies River is considered a potential health risk as it yielded the only bilharzia intermediate host snails during the present investigation.

Introduction

From the results of various earlier snail surveys conducted in the area in question, the presence of *Bulinus africanus* (intermediate host of *Schistosoma haematobium*) in certain places was established. De Meillon et al. (1958) reported this species from the Magalies River and the Crocodile River below the Hartbeespoort Dam wall. Joubert et al. (1983) also collected *B. africanus* from these two localities, but reported this species also from the mouths of two small streams which enter the Hartbeespoort Dam on the eastern side of the mouth of the Magalies River. From all earlier surveys Van Eeden et al. (1964) were the only to record *B. africanus* from the dam proper. However, snail distribution is a dynamic process and considerable changes in both snail abundance and species variety may take place over a short period of time. The last comprehensive survey of this area was conducted nearly two decades ago. Successful efforts in the interim to control the floating water weed *Eichhornia crassipes*, which at one time virtually choked large areas of the open waters of the Hartbeespoort Dam and Crocodile River, altered the suitability of the dam as a potential habitat for freshwater snails considerably. The close association between freshwater snails and aquatic plants is an established fact. Freshwater snails not only utilise aquatic plants as protection from direct sunlight but also as a substrate for depositing their egg masses and to browse on.

The lack of up-to-date information on the occurrence of medically important freshwater snails and the extreme popularity of the recreational facilities of this entire area prompted our survey in November 1991. The fact that most of the visitors to this area indulge in activities such as fishing, diving, swimming and skiing made it all the more urgent to re-evaluate the bilharzia risk in the area concerned.

Method

A team of six experienced collectors equipped with custom-made snail scoops conducted a systematic search of all possible habitats. Special attention was given to all natural and man-made water bodies in the Mt. Amanzi Pleasure Resort situated below the dam wall. In the dam and in the mouth of the Crocodile and Magalies River an inflatable rubber boat was used in the survey.

Water samples were taken and the concentrations of Na, K, Ca and Mg were determined with a Varian atomic absorption spectrophotometer (Model 775). The electrical conductivity and pH of the water were also measured. These parameters could play a decisive role in determining the suitability of a specific habitat for colonisation by freshwater snails (Deschiens, 1956; Malek, 1958; Schutte and Frank, 1964; Williams, 1970; Brown,1980). For the same reason the presence of certain species of aquatic vegetation was carefully recorded.

As the primary aim was to establish the species variety at each locality, no attempt was made to do a quantitative survey. All specimens of bilharzia intermediate host snails were transported live to our laboratory where they were maintained for several weeks and screened for shedding of cercariae at regular intervals.

Results

The freshwater molluscs found are listed in Table 1. Although numerous empty shells of the invader species, *Physa acuta*, were found on the substratum all over the dam, not a single live specimen was found during the entire survey of the dam. During our survey no marginal or aquatic vegetation could be found in the dam proper.

One specimen of *Lymnaea columella* (intermediate host for the liver fluke *Fasciola hepatica*) was the only freshwater snail species of economic importance collected in the Crocodile River. *Physa acuta*, also known as the sewage snail, was the dominant mollusc species in this river.

An outstanding feature of the Crocodile River below the dam wall was the dense growth of aquatic vegetation consisting *inter alia* of the water hyacinth (*E. crassipes*), parrot's feather (*Myriophyllum aquaticum*), curled pondweed (*Potamogeton crispus*), water fern (*Azolla filiculoides*), water hornwort (*Ceratophyllum demersum*) and duckweed (*Lemna gibba*).

The Magalies River was the only locality that yielded a species variety and composition which could be expected from an undisturbed freshwater habitat in that area (Gear et al., 1980).

Results of the chemical analyses of the water samples are given in Table 2.

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Received 12 February 1992; accepted in revised form 27 July 1992.

TABLE 1
SAMPLING LOCALITIES AND IDENTITY OF THE MOLLUSCS COLLECTED (NOV 1991)

Locality	Species
Hartbeespoort Dam	*Physa acuta* (shells) *Aspatharia wahlbergii*
Crocodile River (mouth)	*Physa acuta*
Crocodile River (below dam wall)	*Physa acuta* *Lymnaea columella*
Water bodies at Mt. Amanzi	*Physa acuta*
Magalies River (±1 km from entrance into dam)	*Bulinus africanus* *Lymnaea natalensis* *Lymnaea columella* *Gyraulus costulatus* *Burnupia transvaalensis* *Unio caffer*

TABLE 2
SELECTED CHEMICAL COMPOSITION AND CONDUCTIVITY OF THE WATER (NOV 1991)

Sampling point	Conductivity (µS/cm)	Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)
Hartbeespoort Dam	750	110	25	38,2	0,55
Crocodile River (mouth)	570	130	10	23,3	0,38
Crocodile River (below dam wall)	1 200	270	70	67,2	1,01
Water bodies at Mt. Amanzi	525	40	55	18,8	0,50
Magalies River (± 1 km from entrance into dam)	515	40	205	38,4	0,64

Discussion

Scrutiny of Table 1 shows that the 13 specimens of *B. africanus* from the Magalies River were the only bilharzia intermediate host snails recovered during the present survey. They were maintained in the laboratory and screened for shedding of cercariae at regular intervals for several weeks. None of the snails shed any cercariae during the period of observation, therefore it was assumed that they harboured no patent or prepatent infections at the time of collection. As mentioned earlier, De Meillon et al. (1958), Van Eeden et al. (1964) and Joubert et al. (1983) also reported the presence of *B. africanus* in the Magalies River.

As in the survey of Van Eeden et al. (1964) no bilharzia snails could be found in the Crocodile River anywhere near its entrance into the dam. However, contrary to our results, they reported a large population of *B. africanus* in the Crocodile River below the dam wall. The fact that the Crocodile River at present can support such large and flourishing colonies of aquatic plants, especially below the dam wall, is an indication of a relatively high nutrient content. This is indeed substantiated by the high conductivity level of 1 200 µS/cm which could possibly be attributed to the relatively high concentrations of Na, K and Ca (Table 2). The conductivity levels reported by Schutte and Frank (1964) for natural habitats in the bilharzia endemic areas in the Transvaal Lowveld were rarely higher than 200 µS/cm. It was furthermore experimentally determined by Jennings et al. (1973) that the optimum conductivity level for reproduction of bilharzia intermediate host snails ranged from 300 to 500 µS/cm and that no egg production took place at levels higher than 750 µS/cm. This seems a possible explanation for the absence of bilharzia snails in the Crocodile River and at the same time accounts for the abundance of *P. acuta* which is known to establish itself in polluted water bodies (Brown, 1980).

A perusal of Table 2 gives no obvious explanation for the complete absence of live snails in the Hartbeespoort Dam. Although the conductivity of 750 µS/cm measured in the dam lies at the upper level of the range for egg production of the bilharzia intermediate host snails (Jennings et al., 1973), it is nevertheless much lower than the 1 200 µS/cm recorded for the Crocodile River below the dam wall, a site which did support two species of snails (Table 1). None of the other values recorded for the dam proper, approached levels which could be limiting for colonisation by freshwater snails (Deschiens, 1956; Malek, 1958; Harrison et al., 1970; Williams, 1970; Nduku and Harrison, 1976; Brown, 1980). The only specimen of *B. africanus* on record from Hartbeespoort Dam, was collected by the senior author of this paper in 1964 between the roots of a water hyacinth floating near the mouth of the Magalies River. However, numerous specimens of *Bulinus tropicus* were collected all along the shoreline on the stems and roots of the aquatic plant *Polygonum salicifolium* during that survey (Van Eeden et al., 1964). The evidence at our disposal therefore seems to suggest that the absence of live snails in the dam could be attributed in part to the absence of aquatic and marginal vegetation. Vegetation not only provides the snails with a substratum for laying of egg masses but also supplies shelter against direct sunlight, wave action and predators.

As far as the bilharzia risk is concerned we judge the dam a risk-free area at present. Although the snails from the Magalies River did not shed cercariae it would be advisable to avoid any direct contact with the water in this river and that part of the dam near its mouth.

Acknowledgements

We are indebted to Mr. André du Plessis of Mt. Amanzi Pleasure Resort for providing our team with free accommodation and the SA Medical Research Council and Potchefstroom University for CHE for financial support and permission to publish this paper.

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