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URINARY SCHISTOSOMIASIS CONTROL PROGRAMME: A CASE STUDY OF SOME SELECTED SCHOOL CHILDREN IN THE LOWER VOLTA BASIN

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Abstract

A Schistosomiasis Control Programme was initiated in selected communities in the Lower Volta Basin among school children to assess the disease situation 30 years after the construction of the Akosombo Dam. It combined two tools, chemotherapy and health education. The work was carried out in selected communities in the Lower Volta Basin (Asutsuare, Adidome, Tsetsekpo, Agbeve, Dalive, Mepe, Big Ada and Ada Foah) from October 1997 to October 1998. Prevalence rates were first determined before selective chemotherapy; the gains of chemotherapy were maintained with health education which involved the use of a song and picture booklet. Prevalence rates at baseline of 3.6 - 41.7 per cent were reduced to 0.0-15.6 per cent after chemotherapy, showing a cure rate of 80-84 per cent. The parameters after baseline studies were investigated 3, 6 and 9 months after intervention. A combination of chemotherapy, using praziquantel and health education, has proven to be successful in controlling schistosomiasis in the Lower Volta Basin area.

Résumé

MENSAH, G. T., ANSA, E. D. O & KPIKPI, J. E. K.: *Programme de la lutte contre la schistosomiase urinaire: Une étude de cas de quelques enfants scolaires choisis au hasard du bassin de la basse volta.* Le programme de la lutte contre la schistosomiase était initié en communautés choisies au hasard du bassin de la basse volta parmi les enfants scolaires pour évaluer la situation des maladies après trente ans de la construction du barrage d'Akosombo. Il combinait deux outils: la chimiothérapie et l'hygiène. Les proportions de fréquence étaient d'abord obtenues avant la chimiothérapie sélective, les bénéfices de la chimiothérapie étaient gardés en utilisant l'hygiène qui comprend les chançons et petit livre d'images. Les proportions de fréquence de la base de 3.6 - 41.7 pour cent étaient reduites à 0.0 - 15.6 pour cent après la chimiothérapie montrant une proportions de guérison de 80 - 84 pour cent. Les paramètres après les études de la base étaient enquêtés 3, 6 et 9 mois après l'intervention. Une combinaison de chimiothérapie en utilisant praziquantel et l'hygiène a remporté du succès dans la lutte contre la schistosomiase dans la zone du bassin de la basse volta.

Introduction

Schistosomiasis is one of the most common water-related parasitic diseases in the world. It is known to cause misery to millions of humans and domesticated animals in South-East Asia, The Pacific, South America, Africa, parts of the far East and the Carribean (Rollingson & Southgate, 1987).

Three principal schistosome species known to infect man are *Schistosoma haematobium, S. masoni* and *S. japonicum;* the first being urinary and the last two intestinal (Berquist, 1987). The intermediate host is freshwater snail (Mc Cullough, 1956). In Ghana, the disease is transmitted by *Bulinus rholfsi* and *B. globosus* (Odei, 1995).

The prevalence rates of urinary schistosomiasis in Ghana were 15-20 per cent in 1963 (Furu, 1987), 75 per cent in Pokuase and Mayera in the Ga District, and 30 per cent in Agbogba, Ashongman and Bladjei (Odei, 1995). The area

from the Akosombo Dam down to the South-east of Ghana has become an important endemic area of *S. haematobium* infection (Berquist, 1987; Furu, 1987). *Schistosoma haematobium* transmission was significant around marshes and ponds connected with the River Volta. In 1968, prevalence rate above 75 per cent was reported in certain localities (Paperna, 1968).

From the foregoing, clearly all survey work done is 30 years and above, and recent data on the disease condition is lacking in the country. Though the Volta River Authority (VRA) has been involved in a control programme, no report on that work has been published.

The rationale behind this proposed study is to assess the prevalence rates among school children, and to reduce the rates to the barest minimum as follows:

- reduce the parasite load to the barest level by selective chemotherapy (using praziquantel at 40 mg kg^{-1} body weight)
- maintain prevalence at the reduced percentage by means of health education (using a song and picture booklet).

Experimental

Eight communities were randomly selected from the numerous communities along the Volta Lake for the control of urinary schistosomiasis as part of the environmental impact assessment work of the Volta Basin Research Project. These were Dalive, Agbeve, Adidome, Tsetsekpo, Asutsuare, Mepe, Big Ada and Ada Foah.

The proportionate sampling method was used in selecting children for this study. It involved determining the proportions of the categorized age groups to be selected in the total population, and selecting similar proportions in the sample. The objective was to have equal proportions of children in the categorized age groups rightly represented in the sample. The children were actually selected from the school registers, using systematic random sampling.

Prevalence rates were determined by urinalysis, and praziquantel (40 mg kg^{-1} per body weight) was used for selective chemotherapy. The gains of chemotherapy were sustained by health education, using "a song and picture" booklet. Health education was done in Ada Foah, Big Ada, Dalive, Adidome, Mepe and Tsetsekpo, whilst Agbeve and Asutsuare were the control towns. The picture booklet talks about the parasite, source of infection, and how the parasite is transmitted from person to person. The song is about the life cycle of the parasite and prevention of the disease (Kpikpi & Agudogo, 1997).

Urinalysis (sedimentation technique)

Urine samples were collected from the children between 10.00 a.m. and 2.00 p.m. (Wilkins, 1977), using clean wide-mouthed 0.45-l cylindrical plastic containers. The children were made to run around the school compound before urine was collected (Wilkin, 1977). This is to dislodge the eggs of *S. haematobium* into the urine. Each child was given an identification number which was used to label each corresponding container. Urine samples were transported at ambient temperature to the laboratory for examination by which time the eggs in the urine had settled (transportation time was usually between 60 and 90 min, depending on location of the school (Zuta, 1994).

The supernatant urine was poured off, leaving about 5 ml without disturbing the deposits. The deposit was then swirled gently for about 2 to 3 min (to suspend the sedimented eggs) and poured into a centrifuge tube and centrifuged for 5 min at 6500 rms. The supernatant was then discarded and the deposit transferred onto a microscope slide with a cover slip and examined under a microscope with magnification of × 40 for *Schistosoma* ova.

Urinalysis was done three times after obtaining baseline data; that is, 3rd, 6th and 9th month.

Prevalence determination

Two techniques were considered for assessing the prevalence rate of the disease: oral (using questionnaires) and the actual (determined by urinalysis). The questionnaires were administered to the children during urine collection to estab-

lish the background knowledge of the pupils regarding the schistosomiasis situation to obtain data for oral prevalence (Amankwa *et al.*, 1994).

To allow independent view of each selected pupil, the questionnaires were administered in such a way that each was questioned alone. Language barrier was overcome by involving the school teachers in administering the questionnaire (Chitsulo, Lengeler & Jenkins, 1995).

The results were analysed using Epi Info 6.2 software, and the chi-squared (χ^2) test was used to compare the proportions. Differences in results were significant if P value was < 0.05.

Ada Foah, Big Ada, Dalive and Agbeve were considered as one block of the work; Adidome, Asutsuare, Mepe and Tsetsekpo also formed another block. Analysis was, therefore, according to block and not on pooled sample.

Results and discussion

Comparison of prevalence by questionnaire (oral response) with urinalysis (sedimentation)

For Adidome, Asutsuare, Mepe and Tsetsekpo, oral responses as indicators of prevalence were significantly higher than those given by urinalysis ($P < 0.01$) (Table 3). However, the patterns of infection given by urinalysis and oral responses were familiar.

For Ada Foah, Agbeve, Big Ada and Dalive, the difference in the detected cases when the oral prevalence was compared to that determined by the sedimentation technique in each school was highly significant ($P < 0.001$) at Agbeve and Dalive, but not significant at Ada Foah and Big Ada (Table 2). This confirms the observation that the disease is prevalent among children of ages 15-17 years (Wilkins, 1977).

Gross prevalence and *S. haematobium* infection among the selected school children at baseline studies were 1.5 per cent at Agbeve, 3.6 per cent at Dalive, 41.7 per cent at Ada Foah, and 18.2 per cent at Big Ada. Also 6.0 per cent at Adidome, 20.5 per cent at Asutsuare, 12.9 per cent at Mepe, and 34.2 per cent at Tsetsekpo (Table 1).

The intensity of infection was determined twice after the initial baseline studies: first, 3 months after chemotherapy had been introduced; and second, a follow-up another 3 months later. These involved collection and examination using microscopy. At the end of 6 months, the prevalence rate in the school was also determined.

TABLE 1

The gross prevalence and prevalence by sex of S. haematobium

Town/Community	*Boys*			*Girls*			*Gross (%)*
	No. examined	*Positive cases*	*% prevalence*	*No. examined*	*Positive cases*	*% prevalence*	
Ada Foah	9	4	44.4	15	6	40	41.7
Adidome	24	3	12.5	26	0	0	6.0
Agbeve	38	1	2.6	28	0	0	1.5
Asutsuare	21	2	9.5	18	6	33.3	20.5
Big Ada	168	25	14.9	95	25	24.2	18.2
Dalive	34	0	0	22	2	9.1	3.6
Mepe	70	8	11.8	77	11	14.3	12.9
Tsetsekpo	17	5	29.4	21	8	38.1	34.2

TABLE 2
Comparison of prevalence rates by oral and sedimentation technique at various age groups

Age group	Ada Foah		Agbeve		Big Ada		Dalive	
	Oral (%)	Sedimentation (%)	Oral (%)	Sedimentation (%)	Oral (%)	Sedimentation (%)	Oral (%)	Sedimentation (%)
5 - 9	0	0	83.3	0	50	91.2	33.3	0
10 - 14	20.0	20.0	24.0	0	23.5	23.5	43.9	24.0
15 - 19	42.9	27.1	17.2	3.2	17.9	19.2	66.7	0
20 <	0	0	50.0	0	7.7	69.2	0	0

TABLE 3
Comparison of prevalence rates by oral responses and urinalysis

Settlement	Urinalysis			Oral responses		
	No. examined	No. positive	% prevalence	No. examined	No. positive	% prevalence
Adidome	50	3	6.0	50	22	44.0
Asutsuare	39	8	20.5	39	18	46.2
Mepe	147	19	12.9	147	61	41.5
Tsetsekpo	38	13	34.2	38	21	55.3
Total	274	43	15.7	274	122	44.5

Follow-up exercise

Questionnaires were used to assess the effect of health education on pupil's perception of schistosomiasis. The questionnaire was administered to each of the selected pupils under observation in the study.

The prevalence rates, 3 months after chemotherapy, were as follows: 17.4 per cent at Ada Foah, 8.9 per cent at Agbeve, 14.3 per cent at Dalive, and 7.5 per cent at Big Ada (Table 4a). Others were 2.6 per cent at Adidome, 15.8 per cent at Asutsuare, 2.8 per cent at Mepe, and 10.3 per cent at Tsetsekpo (Table 4b).

The increase in prevalence rates 3 months after chemotherapy (Tables 4a and 4b) may be due to "false negatives" observed during intervention evaluation, and which could manifest as positive cases 3 months later (Gryseels, Nkulikyinka & Engels, 1991; deVlas & Gryseels, 1992). This is because due to financial constraints, selective chemotherapy was done instead of mass chemotherapy.

Six months after chemotherapy, the prevalence rates were as follows: Adidome, 2.6 per cent; Asutsuare, 15.8 per cent; Mepe, 2.8 per cent; and Tsetsekpo, 10.3 per cent. The rest were 0.0 per cent for Ada Foah, Agbeve, and Dalive; and 1.9 per cent for Big Ada (Table 5).

Evaluation of prevalence rates after intervention

The prevalence of urinary schistosomiasis in the first follow-up exercise (i.e., 3 months after intervention) showed a decrease in Ada Foah but an increase in the other three communities. However, 6 months after intervention, gross prevalence was 0.0 per cent in all the communities, except Big Ada which had 1.9 per cent. There

TABLE 4
Prevalence rates of S. haematobium *by sedimentation technique 3 months after intervention*

Community	*No. examined*	*No. positive*	*Males positive*	*Females positive*	*Gross prevalence (%)*
(a)					
Ada Foah	23	4	2	2	17.4
Agbeve	45	4	2	2	8.9
Big Ada	159	12	5	7	7.5
Dalive	28	4	2	2	14.3
(b)					
Adidome	18	1	0	1	2.6
Asutsuare	19	3	1	2	15.8
Mepe	71	2	1	1	2.8
Tsetsekpo	29	3	1	2	10.3

was still a decrease in the gross prevalence in Big Ada from the baseline prevalence of 18.2 per cent. These observations have implications for the control methods used (i.e., chemotherapy and health education). While for chemotherapy re-infection occurs, the effect of health education takes a long time to show up.

Though efforts have been made to control the prevalence of the disease, only one tool was used at a time; therefore, it usually failed to yield the expected results. However, this study clearly establishes the fact that a combination of two or more tools is effective; that is, after selective chemotherapy, the gains were maintained through health education which involved the use of a song and picture booklet.

In one of the control communities (Agbeve), the gains of chemotherapy were still maintained without health education. The reason for this observation is that the teachers did some health education for the pupils after administering praziquantel, the chemotherapeutic agent.

The results also show the efficacy of the therapeutic agent as a drug of choice for controlling

TABLE 5
Prevalence rates of S. haematobium *by sedimentation technique 6 months after intervention*

Community	*No. examined*	*No. positive*	*Males positive*	*Females positive*	*Gross prevalence (%)*
Adidome	18	1	0	1	2.6
Asutsuare	19	3	1	2	15.8
Mepe	71	2	1	1	2.8
Tsetsekpo	29	3	1	2	10.3
Ada Foah	17	0	0	0	0
Agbeve	33	0	0	0	0
Big Ada	120	2	0	2	1.9
Dalive	31	0	0	0	0

the disease, and the dosage is also effective. The effective dosage should be 40 mg kg^{-1} body weight. Though a few pupils expressed fear of side effects, education in the fact that side effects are short-lived, but the disease may lead to death assured them that it was safe, and this contributed to the success of the control effort.

Conclusion

The combination of chemotherapy and health education has emerged as a feasible means of controlling schistosomiasis. Because it helps to change the communities' perception of the disease–they get to know the source of the disease and, therefore, actively get involved in the control effort. For example, at the beginning of the programme, most people in the communities believed it was the VRA that introduced the disease into the river. Because before the VRA's operations, people spent more time in contact with the river harvesting bivalves (oysters), and yet did not have the infection. They claimed that the disease occurred after the VRA constructed the dam at Akosombo. However, during health education, they got to know from the pupils that their water-contact behaviour perpetuated the disease. The results showed that the methods used for health education were effective.

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