ealth Organization, 65 (1): 57-66 (1987)

Water-contact patterns and socioeconomic variables in the epidemiology of schistosomiasis mansoni in an endemic area in Brazil

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A study was carried out in Comercinho in south-east Brazil where information relating to socioeconomic factors and water contacts was obtained from 290 (99% of the total) households and 1208 (82% of the total) inhabitants, respectively. Stool examinations and physical examinations were performed on 90% and 82% of the population, respectively. The rates of Schistosoma mansoni *infection and splenomegaly were higher in families whose heads were manual workers, in individuals living in houses without piped water and of poor construction, and in those who were born in Comercinho. A total of 1017 (84%) individuals reported water contact; 75% of these contacts were for household activities or bathing and 21% for leisure. The faecal egg counts decreased in persons over 15 years of age, while the degree (intensity) of water contact did not. The mean degree of water contact was higher in individuals without than with piped water in the household (96.8 ± 0.6 v. 25.7 ± 0.6). The main risk factors for splenomegaly were no piped water, intense water contact, bathing in streams, and daily contact (odds ratio = 7.3, 5.1, 4.5 and 3.6, respectively). These results indicate that the extension of piped water to houses should decrease the incidence of splenomegaly in this endemic area.*

Although several studies have been carried out on the contacts with water of people living in endemic areas for schistosomiasis (*1–14*),[a] only a few have investigated the reasons for such contacts as a risk factor for *Schistosoma mansoni* infection (*14*),[a] and none has examined the risk factors for the severe clinical form (splenomegaly) of schistosomiasis. Investigations in one endemic area in Brazil showed that the watering of agricultural fields was the highest risk factor for infection in schoolchildren (*14*), while in another area the contact with water during household activities was a risk factor in individuals under 15 years of age.[a] Knowledge about the risk factors for infection by *S. mansoni* and for the development of splenomegaly is essential if the disease is to be controlled.

The socioeconomic situations of infected individuals and those presumably not infected by *S. mansoni* have been studied in various countries (*3*, *9*, *14*, *15*).[a, b] Studies of the relationship between the socioeconomic situation of subjects and the severe form of schistosomiasis are rare; one such study in the north-east of Brazil found that splenomegaly was not related to occupation or the absence of latrines in homes but to the type or quality of the house construction (*2*).

The present survey was carried out in Comercinho, a town in an old schistosomiasis endemic area in Minas Gerais State where both malaria and visceral leishmaniasis are absent (*16*),[c] in order to determine (1) the reasons for and the frequency of water contact

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[a] GUIMARÃES, M. D. C. *A schistosomiasis mansoni clinical-epidemiologic study in a small Brazilian community* (Master's degree thesis, Hebrew University, Jerusalem, 1982).

[b] SOUZA, S. A. L. [*Epidemiological variables in schistosomiasis mansoni.*] (Thesis, Universidade Federal da Bahia, Salvador, 1973) (in Portuguese).

[c] COSTA, M. F. F. L. [*Clinico-epidemiological study of schistosomiasis mansoni in Comercinho, Minas Gerais, 1974/1981.*] (Doctoral thesis, Universidade Federal de Minas Gerais, Belo Horizonte, 1983) (in Portuguese).

by the inhabitants of the town; (2) the relationship, if any, between the degree of contact and the intensity of *S. mansoni* infection in different age groups; (3) the risk factors for the infection and for development of splenomegaly in relation to the water contact and selected socioeconomic variables; and (4) the differences, if any, in the degrees of water contact between the patients who lived in homes with and without a piped water supply.

MATERIALS AND METHODS

Survey area

Comercinho district in Minas Gerais State is about 700 km from the state capital, Belo Horizonte. One third of the population in the district is engaged in agricultural activities; there are no irrigation canals in the area.[d] The main town, Comercinho, where our study was carried out, has no sewage drainage and is surrounded by three small streams which are used by the population for various activities. The intermediate host in transmission of schistosomiasis is *Biomphalaria glabrata* (*17*).[d]

Socioeconomic survey

In May 1981 the occupants in every house in the town were interviewed by one person. Forms were filled in with their names, date and place of birth, sex, occupation, and details about any previous treatment with schistosomicides as well as the type of water supply in the house, the position of the head of the family (see below), and the type of house occupied.

The heads of families were classified as follows: (*a*) large and medium owners; (*b*) small owners; (*c*) skilled workers; (*d*) manual workers; and (*e*) retired persons. Further details are given in Costa et al. (*17*).

The household water supply, whether with or without piped water, was noted; families with no piped water had to use the streams as their source of water. The type or quality of the housing depended on the materials used in their construction and was scored as previously described (*17*).

Water-contact survey

A standard questionnaire was applied to the whole population by a single physician, who had no knowledge of the results of the clinical and faecal examinations. The water contact information was given by each individual, helped by the mother or other responsible person in the case of children under 10 years old. Only those contacts with the streams in Comercinho district (inside and outside the town limits), during the 60 days preceding the interview, were considered.

The following formula was used to determine the *degree* of water contact: $\Sigma(R \times F)$, where R is the score for the reason for the contact and F the score for the frequency of contact. The reasons were given the following scores: 5 (for bathing, swimming, or playing in the streams), 4 (laundering, watering agricultural fields, or sand extraction from streams), 3 (collecting water for the household, dish-washing or car washing), and 2 (fishing or crossing the streams). The frequency of contacts were scored as 28 (daily or at least one contact a day), 4 (weekly or at least one contact a week), 2 (at least two contacts a month), and 1 (less than two a month). Totals of 2–99 were considered as degree I and $\geqslant 100$ as degree II.

Stool examination

The stool examinations were done by the Kato-Katz method (*18*). Two slides of a stool sample from each individual were examined and the arithmetical mean of the number of eggs multiplied by 24 gave the count of *S. mansoni* eggs per gram of faeces. Individuals with *S. mansoni* eggs in the stools were considered as positive.

Physical examination

All the physical examinations were carried out by one physician who had no knowledge of the stool data. The patients were examined while lying on their backs and in the right lateral position; the liver and spleen were considered palpable when detected immediately under the costal margin, with the breath held. Pessoa & Barros' clinical classification (*19*) was used with slight modifications: type I, liver and spleen not palpable, or liver palpable but with normal consistency; type II, hard palpable liver; type III, spleen palpable or splenectomized individuals.

Intradermal test

Intradermal tests were performed in individuals ($\geqslant 2$ years old) who did not have *S. mansoni* eggs in the stools and who had never been treated with schistosomicides. The antigen (extract of adult worms)[e] was given intradermally in the supraclavicular area and the reading was done 15 minutes later (*20*). Individuals with no *S. mansoni* eggs in the stools and a negative intradermal test (papule < 1 cm^2) were classified as negative-1. Individuals with no eggs in the stools but with a history of previous treatment or with a positive intradermal test (papule $\geqslant 1$ cm^2) were classified as negative-2.

[d] See footnote *c* on page 57.

[e] Antigen provided by the "René Rachou" Research Centre, Oswaldo Cruz Foundation, Belo Horizonte.

Statistical analysis

To evaluate the statistical significance of differences between the frequencies, χ^2 with Yates' correction was used; and for the differences between the means, Student's t-test or analysis of variance was used (*21*). Analysis, using the linear regression model, was used to evaluate the relationship between the degree of water contact and faecal egg counts in different age groups; analysis of variance for differences between regression slopes was used (*22*). In the case-control studies, the results were adjusted by age, according to the weighted standard population (direct adjustment with minimum variance method) (*21*). The risks (odds ratio) for infection and for splenomegaly were calculated (Woolf's method with Haldane's correction) whenever the rates among cases with the surveyed characteristic were significantly higher than the rates among the controls (*23*). The minimum level considered significant was 95%.

RESULTS

Surveyed population

Fig. 1 shows the distribution of the population of Comercinho by age, sex, and status with regard to contacts with water and stool examinations.

Stool examinations and water contact surveys were done on 90.2% and 82.0% of the whole population (1474 inhabitants), respectively; 863 individuals with eggs and 301 without *S. mansoni* eggs in the stools (92.2% and 91.2% of the positives and the negatives aged $\geqslant 2$ years, respectively) were examined physically. Patients under 2 years old were not examined because there were no positive cases among them.

Stool and physical examinations

Of the 1329 subjects whose stools were examined, 936 (70.4%) excreted *S. mansoni* eggs. Fifty-seven positive cases (50 were > 15 years old) had previously been treated with schistosomicides; the difference between the geometric means of the number of eggs in the never-treated positives (343.2 ± 4.8) and in all positive cases (333.6 ± 4.4) was not significant ($t = 0.39$).

Types I, II and III clinical forms were found in 67.9%, 25.3% and 6.8% of the positive individuals, respectively; the cases with type II clinical form were excluded from the analysis in Table 3.

Of the individuals with no *S. mansoni* eggs, 145 were classified as negative-2 and 155 as negative-1: of the negative-2 individuals, 75.6%, 17.4% and 7.0% presented clinical forms of types I, II and III, respectively; of the negative-1 individuals, no one had

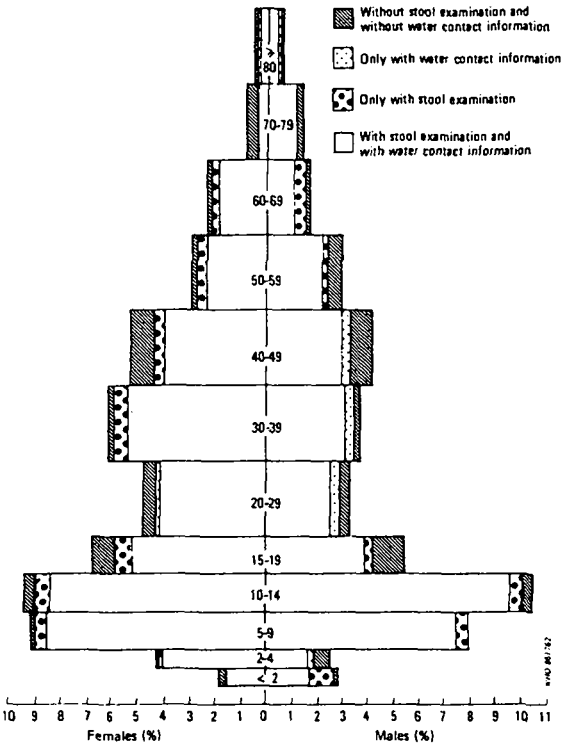

Fig. 1. Percentage distribution of the population of Comercinho in 1981 by age group, sex, and information on water contact and stool examinations.

splenomegaly, 1.3% presented a hard palpable liver, and 98.7% had no palpable liver or spleen or presented a palpable liver with normal consistency. The negative-2 individuals were excluded from the analysis in Table 2.

Water contact in different age groups

Table 1 shows the reasons for and frequency of water contact, according to age group: 84.2% of the 1208 interviewed individuals reported water contact and 52.2% reported at least one daily contact; 75.2% of the contacts were for household activities (laundering, dish-washing and/or collecting water) or for body hygiene (bathing) and 21% were for leisure (swimming or playing). The rate of water contact for leisure was higher in 0–14-year-olds while the rate of contact for laundering was higher in the $\geqslant$15-year-old age group.

Fig. 2 shows the similarity in the curves for the rate of water contact and the rate of infection, according to age group: A comparison of the degree of water

Table 1. Frequency of and the reasons for water contact, according to age group

	No. of persons aged:		
	0–14 years	≥15 years	Total
Frequency of contact:			
Daily	312 (49.1)[c]	319 (55.8)	631 (52.2)
Weekly	145 (22.8)	102 (17.8)	247 (20.5)
Twice a month or less	71 (11.2)	68 (11.9)	139 (11.5)
No contact	108 (17.0)	83 (14.5)	191 (15.8)
Total	636	572	1208
Reasons for contact:	No. of contacts		
Laundry[a]	62 (7.4)	237 (27.5)	279 (17.6)
Collecting water and/or dish-washing	181 (21.7)	256 (29.7)	437 (25.8)
Bathing (body hygiene)	281 (33.7)	261 (30.3)	542 (31.9)
Leisure (swimming or playing)[a]	288 (34.5)	68 (7.9)	356 (21.0)
Other[b]	23 (2.7)	40 (4.6)	63 (3.7)
Total	835	862	1697

[a] Statistically significant differences between 0–14-year and ≥15-year age groups ($P<0.05$).

[b] Sand extraction, car washing, fishing, crossing the streams, and watering agricultural fields.

[c] Figures in parentheses are percentages.

contact and the number of eggs, according to age group, showed that while the geometric mean of the number of eggs decreased among individuals over 15 years of age, the degree of water contact did not (Fig. 3). The regression coefficients, b, between the number of eggs, y, and the degree of contacts, x, in the never-treated positives decreased with increase in age group, as follows: 0.5486, 0.5779, 0.3857, 0.2006, 0.2017 and 0.1046 for age groups 0–4, 5–9, 10–14, 15–19, 20–39 and ≥40 years, respectively (these differences were statistically significant, $F=21.40$). The mean degree of contact was higher in the never-treated positives (81.3 ± 0.6) than in all positive cases (78.0 ± 0.6) ($t=1.66$; $P<0.05$).

Water contact and socioeconomic variables

The socioeconomic questionnaire was applied to 290 out of 293 (99%) households and showed the following distribution of heads of families: large or medium owners (16.6%), small owners (11.4%), skilled workers (6.5%), manual workers (55.9%), retired persons (9%), and no information (1%). Ninety-four houses (32.4%) had piped water; only

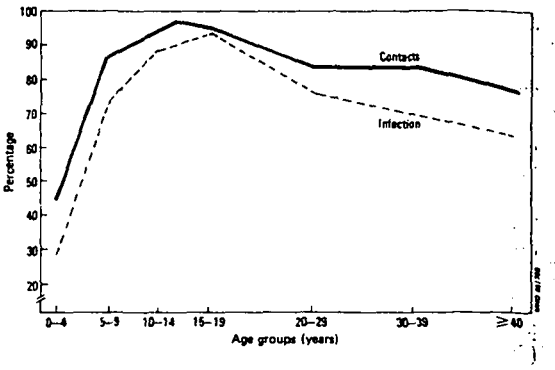

Fig. 2. Percentage distribution of individuals who reported water contact and percentage rate of *S. mansoni* infection, by age group.

11.1% of the manual workers lived in houses with piped water, compared with 86.1% for the large or medium owners and 42.6% for the remaining heads of families ($\chi^2=76.28$; $P<0.05$). Of the 708 children aged 0–14 years, 75.2% were born in Comercinho (inside the town limits), 21.2% in the same district, and 3.5% in another district; the corresponding figures for the 766 individuals over 15 years of age were 30.7%, 59.4% and 9.9%, respectively.

Table 2 shows the distribution of schistosomiasis mansoni infection in individuals over 2 years old, according to selected socioeconomic variables and water contact. The rates of infection were significantly higher in manual workers and in the families whose heads were manual workers, in persons born in Comercinho or living in the poorer type of houses or houses without piped water, in persons who reported

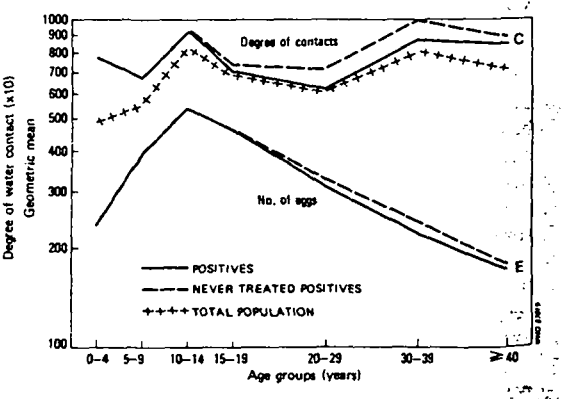

Fig. 3. Degree of water contact ×10 (C) and the geometric mean number of *S. mansoni* eggs (E) by age group.

Table 2. Distribution of schistosomiasis mansoni in individuals ⩾2 years old, according to selected socioeconomic variables and water contact

	No. of persons infected	No. of persons not infected[a]	Odds ratio [95% confidence interval]	
			Persons aged 2–14 years	Persons aged ⩾15 years
Head of family:				
Large and medium owners[b]	124 (10.8)[c]	36 (23.3)		
Small owners	134 (12.4)	24 (15.0)		
Skilled workers[b]	71 (6.4)	20 (12.6)		
Manual workers[b]	555 (65.1)	64 (40.8)	2.1 [1.4–3.2][d]	2.0 [1.1–3.7][d]
Retired persons	52 (5.3)	11 (7.3)		
Occupation:[e]				
Manual construction workers or agricultural labourers[b]	148 (37.0)	10 (22.5)	–	1.5 [0.7–3.1]
House workers and washerwomen	154 (32.5)	12 (27.5)		
Owners, skilled workers, retired or without a job[b]	167 (30.5)	22 (50.0)		
Place of work:[e]				
Chiefly in the country	153 (37.5)	18 (40.5)		
Chiefly in the town	316 (62.5)	26 (59.5)		
Place of birth:				
Comercinho (within town limits)[b]	451 (56.1)	82 (47.8)	0.6 [0.4–1.0]	4.5 [1.8–11.1]
Other places	485 (43.9)	73 (52.2)		
Quality of the house:[f]				
Type III (worst)[b]	292 (35.1)	30 (19.2)	1.8 [1.1–2.9]	1.9 [0.9–4.2]
Types I and II	618 (64.9)	120 (80.8)		
Water supply:[f]				
Not piped[b]	629 (74.0)	78 (50.9)	2.3 [1.5–3.5]	1.6 [0.8–3.0]
Piped	285 (26.0)	72 (49.1)		
Water contact:[f]				
Yes[b]	849 (94.2)	72 (49.9)	55.8 [27.2–114.6]	6.8 [3.5–13.2]
No	155 (15.8)	81 (50.1)		
Reasons for contact:[f]				
Laundry	257 (15.4)[g]	13 (14.3)	240.1 [41.9–1337.4][i]	6.8 [3.1–14.8][i]
Collecting water and/or dish-washing	384 (23.4)	8 (20.1)	151.6 [54.6–420.6][i]	7.5 [3.5–16.4][i]
Bathing (body hygiene)[b]	489 (33.9)	20 (21.4)	184.5 [71.7–475.0][i]	7.8 [3.6–16.9][i]
Leisure (swimming or playing)[b]	288 (24.3)	34 (35.3)	41.5 [19.7–87.6][i]	15.9 [2.9–87.4][i]
Other[b, h]	45 (3.0)	8 (8.9)	2.5 [0.9–6.2][i]	0.7 [0.2–2.9][i]
Frequency of water contact:[f]				
Twice a month or less[b]	92 (11.5)	27 (36.2)	11.5 [5.0–26.4][i]	3.9 [1.4–10.8][i]
Weekly	190 (24.1)	19 (26.5)	52.6 [21.9–126.5][i]	4.6 [1.8–11.5][i]
Daily[b]	567 (64.4)	26 (37.3)	129.0 [55.0–302.3][i]	8.8 [4.1–18.7][i]

[a] Individuals with no *S. mansoni* eggs in the stool and who were negative with the intradermal test (papule < 1 cm²).
[b] Statistically significant differences (minimum variance method) between infected and not infected.
[c] Figures in parentheses are age-standardized percentages.
[d] Reference class: remaining individuals in this section.
[e] Only persons ⩾15 years old.
[f] Cases not surveyed were excluded.
[g] Percentage in relation to the total of the reasons for contacts.
[h] Sand extraction, car washing, fishing, crossing the streams, and watering agricultural fields.
[i] Reference class: individuals who denied water contact.

Table 3. Distribution of cases with splenomegaly and control subjects aged ⩾5 years, according to selected socio-economic variables and water contact

	No. with splenomegaly[a]	No. among controls[a]	Odds ratio [95% confidence interval] 5–14 years	Odds ratio [95% confidence interval] ⩾15 years
Head of family:				
Large and medium owners[b]	1 (1.8)[c]	96 (16.4)		
Small owners	11 (18.6)	81 (15.0)		
Skilled workers	3 (5.1)	52 (8.2)		
Manual workers[b]	43 (72.8)	303 (53.2)	2.6 [1.2–5.9][d]	2.0 [0.0–4.6][d]
Retired persons	1 (1.7)	36 (7.1)		
Occupation:[e]				
Manual construction workers or agricultural labourers	12 (44.1)	91 (34.3)		
House workers and washerwomen	9 (33.3)	94 (27.7)		
Owners, skilled workers, retired or without a job	6 (38.0)	118 (38.0)		
Place of work:[e]				
Chiefly in the country	6 (22.3)	61 (21.8)		
Chiefly in the town	21 (77.7)	242 (78.2)		
Place of birth:				
Comercinho (within town limits)[b]	39 (66.0)	243 (43.3)	3.3 [1.4–7.6]	1.9 [0.9–4.0]
Other places	20 (34.0)	324 (56.7)		
Quality of the house:[f]				
Type III (worst)[b]	26 (43.9)	142 (26.2)	2.9 [1.4–6.2]	1.7 [0.8–3.9]
Types I and II	33 (56.1)	404 (73.8)		
Water supply:[f]				
Not piped[b]	51 (88.0)	337 (64.0)	7.3 [2.0–27.2]	2.4 [0.9–6.4]
Piped	7 (12.0)	201 (36.0)		
Water contact:				
Yes[b]	58 (98.3)	513 (90.4)	2.2 [0.1–39.0]	2.8 [0.5–15.0]
No	1 (1.7)	49 (9.6)		
Frequency of contact:				
Daily[b]	48 (82.6)	316 (63.5)	3.6 [1.3–10.0]	1.8 [0.7–4.6]
Less than daily	10 (17.4)	197 (36.5)		
Reasons for contact:[g]				
Laundry	20 (14.8)	156 (17.4)		
Collecting water and/or dish-washing[b]	22 (16.2)	240 (28.2)		
Bathing (body hygiene)[b]	71 (52.3)	237 (28.9)	4.5 [2.7–7.5][i]	1.3 [0.7–2.3][i]
Leisure (swimming or playing)[b]	17 (12.9)	154 (21.4)		
Other[h]	5 (3.8)	34 (4.1)		
Degree of contact:				
Grade II (intense)[b]	45 (77.4)	236 (42.4)	5.1 [2.0–13.2]	2.7 [1.2–6.2]
Grade I	13 (22.6)	277 (57.6)		

[a] Includes one splenectomized case; splenomegaly was not identified in individuals below 5 years of age.
[b] Statistically significant differences (minimum variance method) between cases and controls.
[c] Figures in parentheses are age-standardized percentages.
[d] Reference class: remaining individuals in this section.
[e] Only persons ⩾15 years old.
[f] Non-surveyed cases were excluded.
[g] Percentage in relation to the total of the reasons for contacts.
[h] Sand extraction, crossing the streams, car washing, fishing and watering agricultural fields.
[i] Reference class: remaining reasons for contacts.
[j] Without palpable liver or spleen or with palpable liver of normal consistency.

water contact for bathing, and in those with daily water contact.

Table 3 shows the distribution of cases with splenomegaly and control subjects for selected socioeconomic variables and according to the water contact. The rates of splenomegaly were higher in families whose heads were manual workers, in persons born in Comercinho or living in the poorer type of houses or houses without piped water, and in persons who reported daily contact with water, contacts for bathing, or an intense (degree II) water contact.

The geometric mean of the degree of water contact was significantly higher in individuals without piped water in the household than in those with piped water: 96.8 ± 0.6 v. 25.7 ± 0.6 for the whole population ($t = 38.59$), and 112.1 ± 0.6 v. 29.0 ± 0.6 for the positive cases ($t = 30.1$); these differences were significant for all the age groups (Fig. 4).

DISCUSSION

There is no standard methodology for case-control studies of *S. mansoni* infections in endemic areas. For example, in the definition of individuals who are presumably not infected, some authors accept as "non-infected" those who have no *S. mansoni* eggs in one (*23–26*) or more[f] stool examinations, while others also take into account the results of immunological tests (*2, 12, 14, 27*). In our investigation we considered as presumably non-infected all persons who had no eggs in a single stool examination, had never been treated with schistosomicides, and presented a negative intradermal test. The clinical classification of schistosomiasis mansoni is also controversial. We adopted Pessoa & Barros' (*19*) classification with slight modifications. These authors define as type I (light form) all patients with a non-palpable liver and spleen; we included in this group also patients with a palpable liver but of normal consistency because we found in Comercinho that the presence of a palpable liver was less strongly associated with *S. mansoni* infection than a hard consistency of the liver (*27*). It is not clear if the egg count given by a single examination by the Kato-Katz method (*18*) is stable. We investigated a random sample of the population of Comercinho and found that the geometric mean of the number of eggs obtained in a single examination was similar to that based on three stool examinations (*28*).

In the same way, water contact surveys have been carried out through questionnaires (*1–3, 7, 9, 13, 14*)[g] or by the observation (*4–6, 8, 10–12*) of people living in endemic areas. In our investigation we used a standard questionnaire that permitted coverage of most of the population in a short time, all interviews being carried out by the same person. The socioeconomic survey considered the position of the heads of families, their place of occupation (town or country), and two indicators of the quality of life (type of housing and availability of piped water in the house). This method permitted the detection of differences in social level among the population living in the town.

The determinants of human water contacts have been studied in several endemic areas; contact in the course of household activities or for body hygiene and leisure pursuits were common in most areas, while professional or religious reasons were important in some places (*1–14*).[g] In Comercinho, where the latter reasons did not exist, 43% of the contacts were for household activities, 32% for body hygiene and 21% for leisure.

With regard to the intensity of *S. mansoni* infection in different age groups, in most areas the stool egg counts increase until 10–14 years (*24–26, 29*) or 15–19 years (*30*)[g] and decrease thereafter. In younger individuals, their chances of infection and the parasite load at first increase, which explains the increasing egg counts until the second decade of life. Two explanations for the decrease in the egg counts in older individuals have been proposed (*31, 32*): first, these persons may decrease their water contact; second, older patients may have developed immunity, which could be associated with the presence of the parasite in the host (*33*), and/or acquired in the course of the infection (*34*), and/or acquired with

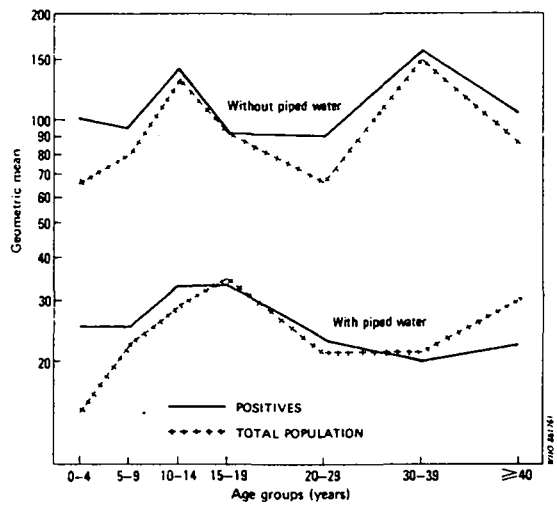

Fig. 4. Degree of water contact among egg-positive individuals and the total population according to presence or absence of piped water in the home.

increasing age (*35*). Our findings support the second explanation. In fact, the geometric mean egg counts decreased after 15 years of age although the mean degree of water contact did not. Also, the regression coefficients between the degree of contact and the egg counts decreased when the ages increased.

The socioeconomic situations of infected patients and those presumably not infected by *S. mansoni* have been studied by several authors. Generally the infection tends to be more frequent in individuals at the lowest socioeconomic level (*9*)[f] or lowest educational level (*3*),[f] in persons living in houses of poor construction (*3, 9, 14*), or without piped water or a latrine (*15*), and in individuals whose occupation requires water contact (*3, 14*).[g]

In a previous paper (*17*) we reported that the rate of *S. mansoni* infection, the geometric mean of egg counts, and the rate of splenomegaly were significantly higher in the environs than in the central area of Comercinho. In the central area the economic situation of the heads of families as well as the quality of their houses and the water supply were better than those observed in the environs of the town. The importance of the socioeconomic factor, including the quality of life, as determinants of schistosomiasis mansoni infection and morbidity was confirmed in the present case-control study. Thus, the rates of infection and of splenomegaly were significantly higher in families whose heads were manual workers and among persons who did not have piped water or lived in houses of poor construction. With regard to splenomegaly, this was identified in only 1/97 (1.0%) among the prosperous families (heads were large or medium owners), compared with 43/346 (12.4%) in the families of manual workers.

Water contact was the greatest risk factor for the infection (odds ratio = 55.8 and 6.8 for individuals aged 2–14 and $\geqslant$ 15 years of age, respectively). The risks increased as the frequency of contacts increased and were greater for persons involved in laundering, water collecting and dish-washing, or during bathing or leisure pursuits in water; other reasons for contact did not pose particular risks of infection.

The risk factors for the severe clinical form clearly point to its relationship with the intensity and/or frequency of water contact in individuals under 15 years of age. In fact, the absence of piped water in the household (the degree of contact was significantly higher among those who did not have piped water), intense (degree II) water contact, baths in the streams (large body areas are thus exposed), and daily water contact were the highest risk factors for splenomegaly in 5–14-year-old subjects (odds ratio = 7.3, 5.1, 4.5 and 3.6, respectively). For older persons the only risk factor was degree-II water contact (odds ratio = 2.7). Generally, the risks were greater for individuals below 15 years of age. This is reflected by the fact that in endemic areas the infection and splenomegaly are acquired early in life (72% of the inhabitants in Comercinho were already infected when 5–9 years old, and 7.0% presented splenomegaly before 15 years of age). Thus, water contacts do not appear to pose risks for individuals with an infection or splenomegaly which they had developed years before.

The results of the present study permit the following conclusions:

—75% of the water contacts were for household activities or body hygiene and 21% during leisure pursuits, these being the activities with implied risks for infection;
—the faecal egg output decreased in patients over 15 years old while the degree of water contact did not decrease, suggesting that there is some resistance or immunity to reinfection in older patients;
—*S. mansoni* infection and splenomegaly were clearly related to the socioeconomic situation and to the patients' quality of life;
—access to public piped water was related to the socioeconomic situation of the heads of family (11% of the manual workers lived in houses with piped water, compared with 86% and 43% for large and medium owners, respectively);
—the highest risk factors for splenomegaly in individuals below 15 years of age were the absence of piped water in the house, degree-II water contact, bathing in streams, and daily water contact;
—the geometric mean of the degree of contact was significantly higher in patients who did not have piped water in the house.

These results strongly suggest that in this endemic area the extension of piped water supplies to homes will reduce the incidence of infection and splenomegaly by reducing the need for intense or frequent contact with potentially infected water.

[f] See footnote *b* on p. 57.
[g] See footnote *a* on p. 57.

ACKNOWLEDGEMENTS

Thanks are due to Maria Aldina Rezende who carried out the socioeconomic interviews, to Gercy de Souza Morais, Pedro Coura and José Ribeiro for technical assistance, and to Professor Laís de Lima e Costa Araújo for reviewing the manuscript. The research work described here was supported by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and by the Financiadora de Estudos e Projetos (FINEP), Brazil.

RÉSUMÉ

EPIDÉMIOLOGIE DE L'INFESTATION À *SCHISTOSOMA MANSONI* DANS UNE ZONE D'ENDÉMIE DU BRÉSIL: TYPES DE CONTACTS HYDRIQUES ET VARIABLES SOCIO-ÉCONOMIQUES

L'étude réalisée à Comercinho (Etat de Minas Gerais), dans le sud-est du Brésil, a porté sur 290 habitations (99% du total) et 1208 habitants (82% du total). Des examens coprologiques et des examens médicaux ont été pratiqués sur 90% et 82% de la population (1474 habitants) respectivement. Les taux d'infestation à *S. mansoni* et de splénomégalie étaient sensiblement plus élevés dans les familles de travailleurs manuels, chez les personnes vivant dans des habitations sans eau courante ou de construction médiocre, et chez ceux qui étaient nés à Comercinho. Quatre-vingt-quatre pour cent de toutes les personnes interrogées ont indiqué qu'elles avaient eu des contacts avec l'eau: 75% pour des travaux ménagers et la toilette et 21% pour la baignade et des activités récréatives. Le nombre des œufs dans les selles diminuait chez les personnes de plus de 15 ans, contrairement à l'intensité des contacts hydriques. L'intensité moyenne des contacts était sensiblement plus élevée chez les individus sans eau courante à leur domicile ($96,8 \pm 0,6$ et $25,7 \pm 0,6$ respectivement). Les principaux facteurs de risque de splénomégalie étaient les suivants: absence d'eau courante, contacts hydriques intensifs, baignades en rivière et contacts quotidiens (risque relatif approximatif = 7,3; 5,1; 4,5 et 3,6 respectivement). Ces résultats montrent que la généralisation de l'approvisionnement en eau courante dans les foyers devrait contribuer à réduire l'incidence de l'infestation et de la splénomégalie dans cette zone d'endémie.

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