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THE EFFECT OF SCHISTOSOMA MANSONI INFECTION ON CHILD MORBIDITY IN THE STATE IN BAHIA, BRAZIL

II — ANALYSIS AT THE INDIVIDUAL LEVEL (*)

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SUMMARY

The present investigation was carried out on a sample of 840 children (5 to 16 years old) from ten small towns of the State of Bahia in northeastern Brazil. The objetive was to study, by using a cross sectional methodology, the evolution of schistosomiasis morbidity (hepatic and splenic enlargement) in children, and the role of the intensity of **S. mansoni** infection in this process. The children were analised in three age groups (5 to 8, to 12 and 13 to 16 years old) and classified as uninfected, mildly infected, moderately infected and heavily infected according to the number of eggs in the stool. In children aged 5 to 8 years, increasing egg counts were not associated with increasing frequencies of hepatic or splenic enlargement. In the 9 to 12 years old group and association was observed with the prevalence of hepatic enlargement, but not with the prevalence of spleen enlargement. In the oldest group, 13 to 16 years old, an association was observed with the prevalence of enlargement of both organs. It was evident that in this population schistosomiasis morbidity develops in the early period of life as a gradual process starting with liver enlargement and followed by spleen enlargement some years later. It was found that the intensity of infection has a fundamental role in this process, although there is a latent period of some years before clinical splenomegaly appears in moderate-heavily infected children. The Authors suggest that the prevalence of splenomegaly in the 13 to 16 years old group is a good measure of the community level of schistosomiasis morbidity and could be used to measure the impact of control programs.

INTRODUCTION

Epidemiological studies on the evolution of morbidity caused by **S. mansoni** infection have demonstrated that the hepatosplenic form of the disease develops in most cases in the age group 10 to 20 years old [12,19]. Pathological [6] and cross sectional studies [2,7,11,15,21] have demonstrated an association between the intensity of infection and the clinical severity of schistosomiasis. The present investigation explored the evolution of hepatic and splenic enlargement in children and the role of the intensity of **Schistosoma mansoni** infection in this process, by using a cross-sectional methodology.

POPULATION AND METHODS

The investigation was carried out in ten small towns of the State of Bahia in northeas-

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tern of Brazil. A sample of 976 children, between 5 and 16 years of age, was selected; the data were completed for 840 (86.3%). The male/female ratio in this sample was 0.95:1.00. The sampling design and the clinical and epidemiological methods were described elsewhere[4]. Each child was provided with a labelled cup for subsequent collection of a fecal specimen. From each sample two thick smears were prepared, using the Kato technique as modified by KATZ et al.[10]. A commercially-available Kit was used (Boehringer-Mannheim Bioquimica S.A., Rio de Janeiro, Brazil).

The children were categorized, according to the number of eggs in the stool, as: uninfected, mildly infected (1-100 eggs/g of stool), moderately infected (101-400 eggs/g of stool) and heavily infected (401 or more eggs/g of stool).

RESULTS

The prevalence of infection increased with age (chi-square for trend = 34.15, $p < 0.001$) as well as the prevalence of splenomegaly (chi-square for trend = 5.12, $p < 0.025$), but not the prevalence of hepatomegaly (chi-square for trend = 0.06, $p > 0.10$) (Table I).

Table II presents the relationship between stool egg excretion and the prevalences of palpable livers and spleens in the 3 age groups. In the 5-8 years old group, increasing egg counts were not associated with increasing frequencies of hepatic and splenic enlargement (chi-square for trend = 0.969, $p > 0.10$ and 0.586, $p > 0.10$, respectively). In the 9-12 years old group an association was observed with the prevalence of hepatic enlargement (chi-square for trend = 21.07, $p < 0.001$) but not with the prevalences of splenic enlargement (chi-square for trend = 0.264, $p > 0.10$). In the oldest group, 13 to 16 years, an association was observed with the prevalences of enlargement for both organs (chi-square for trend = 5.01, $p < 0.025$ and 8.52, $p < 0.01$, respectively). The trend of increasing prevalence of hepatic and splenic enlargement with increasing age within each infection category was significant only for spleen enlargement (chi-square for trend = 7.97, $p < 0.01$) in the moderate-heavy infected category (grouped together due to small numbers).

TABLE I

Prevalence of **S. mansoni** infection, hepatomegaly and splenomegaly in the study sample by age. Bahia, Brazil

Age	No. exam.	Prevalence	% with hepatomegaly	% with splenomegaly
5 — 8	261	25.9	34.5	3.9
9 — 12	365	44.1	39.7	5.0
13 — 16	214	61.0	33.2	8.9
Total	840	42.8	36.4	5.6

TABLE II

Prevalence of hepatomegaly and splenomegaly in the study sample by age and intensity of **S. mansoni** infection. Bahia, Brazil

Schistosome	5 — 8 years			9 — 12 years			13 — 16 years		
EGG/g of stool	No. Exam.	% with hepatom.	% with splenom.	No. Exam.	% with hepatom.	% with splenom.	No. Exam.	% with hepatom.	% with splenom.
0	196	34.7	4.1	205	31.2	4.1	83	25.3	4.8
1-100	47	29.8	4.3	94	44.7	6.4	74	29.7	4.5
101-400	11	36.4	0.0	44	50.0	2.3	39	48.7	17.9
401 +	7	57.1	0.0	22	77.3	9.1	18	50.0	22.2
Total	261	34.5	3.8	365	39.7	4.9	214	33.2	8.9

T A B L E II — cont.

Schistosome EGG/g of stool	5 — 16 years		
	No. Exam.	% with hepatom.	% with splenom.
0	484	31.6	4.3
1 — 100	215	36.3	5.6
101 — 400	94	47.9	8.5
401 +	47	63.8	12.8
Total	840	36.4	5.4

DISCUSSION

There are few longitudinal studies on the evolution of schistosomiasis mansoni morbidity [2,12,13,19] and cross-sectional surveys have not usually focused on this question. Moreover, longitudinal studies have been done with different methodological approaches, thus marking it difficult to compare the results.

Pathological studies of schistosomal splenomegaly emphasize congestive and immunological (reticulo-endothelial hyperplasia) factors in its genesis [1,16,20].

This cross-sectional study supports the evidence of a strong association between the individual **S. mansoni** worm burden as measured by the stool egg count and the prevalence of enlarged livers and spleens in children [7,11,15,21]. Furthermore the present investigation shows the evolution of schistosomiasis mansoni can be explored using this methodology.

The arrangement of Table II makes it possible to examine the results as longitudinal-like data without the confounding influence of age. The unifected group can be considered as a "control group" and the moderate-heavily infected group as an "exposed group". In the "control group", the prevalences of splenomegaly are stable in the 3 age groups. Whereas the "exposed group" demonstrated a substantial and progressive increase in the prevalence of splenomegaly from 5 to 16 years of age. The association of **S. mansoni** egg counts with hepatomegaly began with the 9 to 12 years old group, and with splenomegaly began with the next age group (13 to 16 years old). These finding support the hypothesis of a latent period between the beginning of a moderate-heavy infection and the development of splenic enlargement as proposed by PRATA & BINA [19]. The latent period for liver enlargement was some years shorter than that for spleen enlargement.

The two different latent periods, and the observation that the prevalence of splenomegaly increased with age in the moderate heavily infected group, demonstrated that in this young population clinically detectable splenic enlargement, occurred in most cases after enlargement of the liver. These findings are consistent with earlier observations that the development of schistosomiasis morbidity in children is a gradual phenomenon mediated by the intensity of the infection which can be indirectly measured by the number of eggs in stool [6].

The fact that 13 to 16 years old demonstrated both the highest prevalence of splenomegaly among those infected and an association between the prevalence of splenomegaly and the intensity of infection (Table II) has practical consequences. The prevalences of splenomegaly in this age group should be one of the best indicators of the community level of schistosomiasis morbidity and could be used to evaluate the impact of control programs on the morbidity in a similar way that young children are used to monitor the impact on transmission [23].

The high prevalence of schistosomal disease detected in the study sample indicate the need for morbidity control [13] in the State of Bahia. Although we recognize the critical role of the worm burden in the development of morbidity and the importance of chemotherapy to reduce morbidity [5,18], we are also aware that a dangerously high parasitic burden is more dependent on the social environment than on the internae structure of the body [8,16,22].

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RESUMO

O efeito da infecção pelo Schistosoma mansoni sobre a morbidade de crianças do Estado da Bahia, Brasil. II — Análise ao nível individual

Foi estudada uma amostra de 840 crianças de 5 a 16 anos em 10 pequenas cidades do Estado da Bahia. O objetivo foi, analisar, através de um estudo de prevalência, as características evolutivas da morbidade esquistossomótica em crianças, bem como o papel da intensidade da infecção pelo **S. mansoni** neste processo. As crianças foram agregadas em 3 grupos de idade (5-8, 9-12 e 13-16 anos) e foram classificadas com relação ao número de ovos excretados em: não infectados, infecção leve, infecção moderada e infecção grave. No grupo de 5 a 8 anos o aumento do número de ovos não se associou a uma maior prevalência de hepatomegalia ou esplenomegalia. No grupo de 9 a 12 anos observou-se uma associação com a prevalência de hepatomegalia mas não com a prevalência de esplenomegalia. No grupo de 13 a 16 anos a associação foi observada com as prevalências de hepatomegalia e esplenomegalia. Ficou evidente nesta população que, a morbidade esquistossomótica é um processo gradual, que se inicia em uma etapa precoce da vida e tem como primeiro sinal a hepatomegalia, seguida pela esplenomegalia, após alguns anos. A intensidade da infecção tem um papel fundamental neste processo, porém é necessário um período de latência de alguns anos para ocorrer o desenvolvimento de esplenomegalia clínica no grupo com infecção moderada ou grave.

Os Autores propõem o uso da prevalência de esplenomegalia no grupo de 13 a 16 anos de idade como um bom indicador do nível de morbidade esquistossomótica na comunidade, útil para avaliar o impacto de programas de controle sobre a morbidade.

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