

Assessment of schistosomiasis, through school surveys, in the Forest Zone of Pernambuco, Brazil

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This work had the objective of assessing the present epidemiological situation regarding schistosomiasis through performing Kato-Katz coproscopic tests on representative samples of schoolchildren from each of the 43 municipalities of endemic area of the state of Pernambuco, Brazil. The methodology is recommended by the World Health Organization to conduct sampled surveys among children at elementary school levels, ideal target group for baseline surveys: (i) schools are accessible; (ii) the greatest prevalence of schistosomiasis is found within this group; (iii) the data gathered from this age group can be used for intervention within the community as a whole. The following infection indicators were utilized: positivity (percentage of individuals examined with eggs of Schistosoma mansoni in the feces) and severity (geometric mean number of eggs per gram of feces, epg). These indicators allowed the area in general and the municipalities in particular to be categorized into prevalence and severity classes for S. mansoni. The prevalence classes were: low (<10%), medium (≥ 10 and < 50%), and high (≥ 50%); the severity classes were: low (1-99 epg), moderate (100-399 epg), and severe (≥ 400 epg). For the geohelminthic diseases, the following indicators were used: positivity for each geohelminth (percentage of individuals examined with eggs of geohelminths), and cumulative positivity (percentage of individuals examined with eggs of at least one geohelminth). The municipalities were categorized by means of their cumulative positivity into the following geohelminth prevalence classes (WHO 2002): low (< 50%), medium (≥ 50 and < 70%), and high (≥ 70%). The study covered 271 schools in 179 different localities, thus giving a total of 11,234 examinations performed. The overall positivity for S. mansoni was 14.4% and the egg count for this parasite in the feces gave a geometric mean of 67.9 epg which suggests a low general state of infection. These results allow this mesoregion to be categorized as presenting medium prevalence and low severity of schistosomiasis. The overall positivity rates for the geohelminths, Ascaris lumbricoides, Ancylostomidae, and Trichuris trichiura were, respectively, 30.4, 10.1, and 27.8%; the cumulative positivity was 45.4%. These results allow this mesoregion to be categorized as presenting low prevalence of geohelminthic diseases. The data show some municipalities in Pernambuco with prevalence greater than 20%, while others presented parasite loads greater than 100 epg. These indicators attest to the significant morbidity due to schistosomiasis regarding to the severity of infections established in young populations.

Key words : schistosomiasis control - geohelminths survey - Pernambuco - Brazil

Since the last decade, the coastal and forest zones of the state of Pernambuco have been the target of various field investigations on schistosomiasis. The emphasis has been on the ecology and control of the mollusks that are the intermediate hosts (Barbosa 1992a,b, 1996, Barbosa & Barbosa 1994, 1996, Barbosa et al. 1992, 1993, Bogéa et al. 1996, Dannemann & Pieri 1989, 1991, 1992, 1993a, b, Favre et al. 1995, 1997, Gazin et al. 2000, Pieri 1995, Pieri & Dannemann 1996, Pieri & Thomas 1986, 1987, 1992, Pieri et al. 1995, Randall et al. 2001, Sarquis et al. 1997, Silva et al. 1995), the ecological and epidemiological determinants

of the disease (Barbosa 1992b, 1997, 1998a, b, Barbosa & Coimbra 2000, Barbosa & Gouveia 2000, Barbosa et al. 1996, 1998, 2000, 2001, Coutinho et al. 1997, Gazin et al. 2002, Gonçalves et al. 1992, Moza et al. 1998, Simões-Barbosa et al. 2001), and also the impact of chemotherapy treatment for infected individuals, in relation to the transmission dynamics of the disease (Pieri et al. 1998, Beck et al. 2001, Favre et al. 2002, Zani et al. 2004). The knowledge resulting from these studies has made it possible to adapt the schistosomiasis evaluation and control strategies recommended by central health bodies – WHO at the worldwide level and the Health Surveillance Department of the Ministry of Health at the national level – to the regional characteristics and demands.

A critical assessment of the schistosomiasis control actions implemented in Pernambuco by the national bodies prior to the introduction of the Unified Health System (*Sistema Único de Saúde* – SUS) showed that the situation in the endemic area continued to be of concern, despite the occurrence of an apparent reduction in preva-

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lence in the various municipalities. The results from four cycles of diagnosis and treatment carried out by the Ministry of Health in the Forest Zone, initially through the Special Schistosomiasis Control Program (PECE) and subsequently by the Schistosomiasis Control Program (PCE), showed that there was only a substantial impact on the prevalence of schistosomiasis during the period of the PECE, from 1980 to 1997. Subsequent campaigns had no impact on the prevalence, probably because of the irregularity of the chemotherapy treatment scheme among the target populations (Favre et al. 2001)

In 1999 the Ministry of Health decentralized its endemic disease control actions through the creation of the Integrated Covenanted Program for Epidemiology and Disease Control (PPI/ECD). Thus, the state of Pernambuco and its municipalities started to have their own funds for managing schistosomiasis surveillance and control actions. Today, these resources are transferred directly to the municipal authorities, with the aim of establishing a faster and more constant flow of funds, so as to avoid discontinuities in carrying out such actions.

Since 2001, the certified municipalities have had annual targets prioritized within the Multiyear Plan (PPA). However, with regard to controlling schistosomiasis and other helminthic diseases, the Computerized System for the Schistosomiasis Control Program (SISPCE) recorded a total of only 143,129 coproscopic tests for Pernambuco up to the year 2003 (<http://dtr2001.saude.gov.br/svs/epi/esquis/esquis00.htm>), or in other words less than 48,000 per year.

In view of the fact that the estimated population at risk of contracting schistosomiasis in the 43 municipalities in the Forest Zone of Pernambuco is 1.2 million (<http://www.ibge.gov.br/cidadesat/>), it is unlikely that the covenanted targets will allow the real situation regarding schistosomiasis to be known over the short to medium term. One alternative recommended by WHO (2002) is to conduct sampled surveys among children at elementary school levels (i.e. between 7 and 14 years of age). These children are the ideal target group for baseline surveys for the following reasons: (i) schools are accessible; (ii) the greatest prevalence of schistosomiasis is found within the range of 7-14 years old; (iii) the data gathered from this age group can be used to evaluate the need for intervention within the community as a whole.

In ecologically and epidemiologically homogeneous areas, as is the case of the municipalities in the Forest Zone of Pernambuco, WHO recommends a sample of 200-250 individuals for estimating the prevalence and severity of infection, when the aim is to evaluate the need for control measures (Montresor et al. 1998). In areas where the transmission of schistosomiasis is predominantly rural, the sampling of the classroom groups should reflect this tendency. To obtain comparable data from different schools, the examinations can be concentrated on children in the third and fourth years of elementary education (9-12 years of age), especially if the school population is numerous.

The standard procedure recommended by WHO and the Ministry of Health for diagnosing the presence of

geohelminthic diseases and intestinal schistosomiasis in endemic areas is the Kato-Katz method (Katz et al. 1972), which enables assessment of both the prevalence and the severity of the infection.

The present work had the objective of assessing the present epidemiological situation regarding schistosomiasis in the Forest Zone of Pernambuco through performing Kato-Katz coproscopic tests on representative samples

TABLE I

Results relating to schistosomiasis from parasitological examination of feces (two slides using the Kato-Katz method) carried out among students aged 9-12 years in elementary schools in the 43 municipalities in the Forest Zone of Pernambuco

| Municipality | Schools | Examinations | % SM | GM epg |
|------------------------|---------|--------------|------|--------|
| Água Preta | 6 | 247 | 23.5 | 54.8 |
| Aliança | 8 | 342 | 28.7 | 103.8 |
| Amaraji | 6 | 244 | 8.2 | 58.3 |
| Barreiros | 8 | 277 | 16.6 | 45.2 |
| Belém de Maria | 2 | 263 | 15.2 | 45.2 |
| Buenos Aires | 5 | 295 | 11.5 | 69.2 |
| Camutanga | 4 | 307 | 2.6 | 48.2 |
| Carpina | 10 | 396 | 5.6 | 42 |
| Catende | 7 | 188 | 25.0 | 50.5 |
| Chã de Alegria | 6 | 223 | 23.8 | 64.7 |
| Chã Grande | 4 | 245 | 4.1 | 39.6 |
| Condado | 8 | 268 | 14.6 | 132.4 |
| Cortês | 6 | 220 | 20.9 | 81.8 |
| Escada | 7 | 247 | 38.5 | 121.6 |
| Ferreiros | 4 | 284 | 4.9 | 49.3 |
| Gameleira | 7 | 217 | 28.1 | 70.3 |
| Glória do Goitá | 5 | 240 | 2.9 | 34 |
| Goiana | 8 | 319 | 8.5 | 78.3 |
| Itambé | 9 | 289 | 13.5 | 116.4 |
| Itaquitinga | 5 | 393 | 47.6 | 95.1 |
| Jaqueira | 3 | 207 | 30.9 | 82.2 |
| Joaquim Nabuco | 8 | 243 | 7.0 | 48.9 |
| Lagoa de Itaenga | 8 | 329 | 4.9 | 72.6 |
| Lagoa do Carro | 6 | 202 | 4.0 | 34.8 |
| Macaparana | 5 | 277 | 9.0 | 71.1 |
| Maraial | 6 | 209 | 18.2 | 77.1 |
| Nazaré da Mata | 8 | 335 | 12.5 | 50.6 |
| Palmares | 7 | 189 | 11.1 | 34.9 |
| Paudalho | 8 | 283 | 8.1 | 55.7 |
| Pombos | 5 | 213 | 4.2 | 27.7 |
| Primavera | 3 | 225 | 15.1 | 50.2 |
| Quipapá | 8 | 228 | 10.5 | 66.7 |
| Ribeirão | 7 | 218 | 10.1 | 79.9 |
| Rio Formoso | 5 | 193 | 19.7 | 129.7 |
| S. Benedito do Sul | 6 | 211 | 20.4 | 49.9 |
| S. José Coroa Grande | 8 | 208 | 6.7 | 89.5 |
| Sirinhaém | 6 | 233 | 7.7 | 84.5 |
| Tamararé | 4 | 219 | 6.8 | 77.4 |
| Timbaúba | 8 | 356 | 17.1 | 63.7 |
| Tracunhaém | 6 | 274 | 8.0 | 123.3 |
| Vicência | 6 | 354 | 21.2 | 65.1 |
| Vitória de Santo Antão | 7 | 307 | 6.2 | 23.1 |
| Xexéu | 8 | 217 | 17.5 | 60.5 |

% SM: prevalence of *Schistosoma mansoni* infection; GM epg: geometric mean number of eggs per gram of feces for individuals positive for *S. mansoni*.

of schoolchildren from each municipality in this zone. On the basis of such surveys it would be possible, over the short term, to draw up appropriate intervention and control strategies to be implemented by vulnerable municipalities.

MATERIALS AND METHODS

To examine the school population, authorization was requested from the proper authorities, with explanation of the purpose of the study. The aims of the study were also communicated to the school principals, teachers, and students in the school involved.

Parasitological diagnoses of schistosomiasis were

obtained through the Kato-Katz method, with the preparation of two slides from a single feces sample. Quality control was performed in order to verify the consistency of the readings obtained under the microscope during the survey. Discrepancies of up to 10% in egg counts were considered to be normal.

To obtain representative samples, a list of all elementary schools in existence in 2004 was used, supplied by the State Teaching Department. Eight schools were drawn per municipality, of which six were rural and two were urban. In municipalities with less than eight schools, all of them were considered. Only the classroom groups in the third and fourth years of elementary education were

TABLE II

Results relating to geohelminthic diseases from parasitological examination of feces (two slides using the Kato-Katz method) carried out among students aged 9-12 years in elementary schools in the 43 municipalities in the Forest Zone of Pernambuco

| Municipality | Schools | Examinations | %ASC | %ANC | %TRI | %CUM |
|------------------------|---------|--------------|------|------|------|------|
| Agua Preta | 6 | 247 | 41.3 | 0.4 | 36.8 | 54.1 |
| Aliança | 8 | 342 | 23.4 | 14.3 | 23.7 | 43.7 |
| Amaraji | 6 | 244 | 40.6 | 13.5 | 23.8 | 55.0 |
| Barreiros | 8 | 277 | 38.6 | 1.4 | 46.9 | 60.8 |
| Belém de Maria | 2 | 263 | 23.2 | 3.0 | 19.4 | 37.1 |
| Buenos Aires | 5 | 295 | 10.2 | 5.4 | 7.8 | 17.4 |
| Camutanga | 4 | 307 | 26.4 | 8.1 | 23.8 | 38.7 |
| Carpina | 10 | 396 | 11.7 | 8.0 | 15.4 | 25.7 |
| Catende | 7 | 188 | 40.6 | 4.3 | 35.1 | 55.2 |
| Chã de Alegria | 6 | 223 | 32.7 | 18.8 | 20.2 | 43.3 |
| Chã Grande | 4 | 245 | 26.5 | 11.4 | 11.8 | 37.0 |
| Condado | 8 | 268 | 38.9 | 22.9 | 35.4 | 58.1 |
| Cortês | 6 | 220 | 38.3 | 14.0 | 26.6 | 50.4 |
| Escada | 7 | 247 | 27.1 | 11.3 | 31.6 | 48.6 |
| Ferreiros | 4 | 284 | 16.5 | 13.0 | 10.9 | 31.4 |
| Gameleira | 7 | 217 | 39.4 | 2.8 | 38.4 | 55.1 |
| Glória do Goitá | 5 | 240 | 13.3 | 7.5 | 7.1 | 22.8 |
| Goiana | 8 | 319 | 30.8 | 12.2 | 54.2 | 56.2 |
| Itambé | 9 | 289 | 42.2 | 18.3 | 48.1 | 63.2 |
| Itaquitinga | 5 | 393 | 31.6 | 9.4 | 41.2 | 51.8 |
| Jaqueira | 3 | 207 | 36.6 | 4.7 | 38.7 | 57.7 |
| Joaquim Nabuco | 8 | 243 | 37.9 | 4.9 | 31.3 | 52.8 |
| Lagoa de Itaenga | 8 | 329 | 6.7 | 17.9 | 13.1 | 28.5 |
| Lagoa do Carro | 6 | 202 | 10.7 | 9.3 | 11.6 | 24.1 |
| Macaparana | 5 | 277 | 35.4 | 10.1 | 19.1 | 44.3 |
| Maraial | 6 | 209 | 55.0 | 7.2 | 41.1 | 68.6 |
| Nazaré da Mata | 8 | 335 | 9.0 | 10.8 | 12.7 | 23.9 |
| Palmares | 7 | 189 | 45.0 | 2.1 | 47.1 | 65.0 |
| Paudalho | 8 | 283 | 24.1 | 0.7 | 25.8 | 35.7 |
| Pombos | 5 | 213 | 14.1 | 0.0 | 5.6 | 16.7 |
| Primavera | 3 | 225 | 32.0 | 18.2 | 32.0 | 52.1 |
| Quipapá | 8 | 228 | 52.2 | 3.5 | 35.5 | 63.2 |
| Ribeirão | 7 | 218 | 24.3 | 17.4 | 29.4 | 48.8 |
| Rio Formoso | 5 | 193 | 40.4 | 19.7 | 37.0 | 58.2 |
| S. Benedito do Sul | 6 | 211 | 51.3 | 7.2 | 39.5 | 61.0 |
| S. José Coroa Grande | 8 | 208 | 47.1 | 3.4 | 43.8 | 65.7 |
| Sirinhaém | 6 | 233 | 34.8 | 18.0 | 42.5 | 56.2 |
| Tamandaré | 4 | 219 | 33.8 | 15.1 | 32.9 | 51.4 |
| Timbaúba | 8 | 356 | 13.6 | 2.8 | 8.2 | 19.0 |
| Tracunhaém | 6 | 274 | 18.6 | 8.0 | 21.5 | 33.0 |
| Vicência | 6 | 354 | 22.6 | 7.9 | 13.8 | 32.2 |
| Vitória de Santo Antão | 7 | 307 | 20.3 | 20.6 | 12.0 | 38.5 |
| Xexéu | 8 | 217 | 48.6 | 25.9 | 44.3 | 67.4 |

% ASC: prevalence of *Ascaris lumbricoides* infection; %ANC: prevalence of Ancylostomidae infection; %TRI: prevalence *Trichuris trichiura* infection; %CUM: cumulative prevalence.

chosen from each school, such that a mean of 30 students within the 9-12 year-old age group was examined. For each classroom group, a register was prepared containing the students' names, age, and sex. Each child was given a vial for collecting feces, identified with the name and classroom group. During the distribution, the quantity of fecal material required (approximately 10 g) was indicated, along with the way to put it into the vial using a collecting spoon. The students and teachers were told that the team would return on the next day to collect the vials. Although all the students in the classroom groups chosen were examined, only the data from students who were within the 9-12 yrs

age range were included in the study. After the diagnostic evaluation, the students who were found to be positive for *S. mansoni* were immediately treated using praziquantel, while those who were positive for geohelminthic diseases received mebendazol.

The following infection indicators were utilized: prevalence (percentage of individuals examined with eggs of *S. mansoni* in the feces) and severity (geometric mean number of eggs per gram of feces (epg) among positive individuals). These indicators allowed the area in general and the municipalities in particular to be categorized into prevalence and intensity classes for *S. mansoni* (WHO

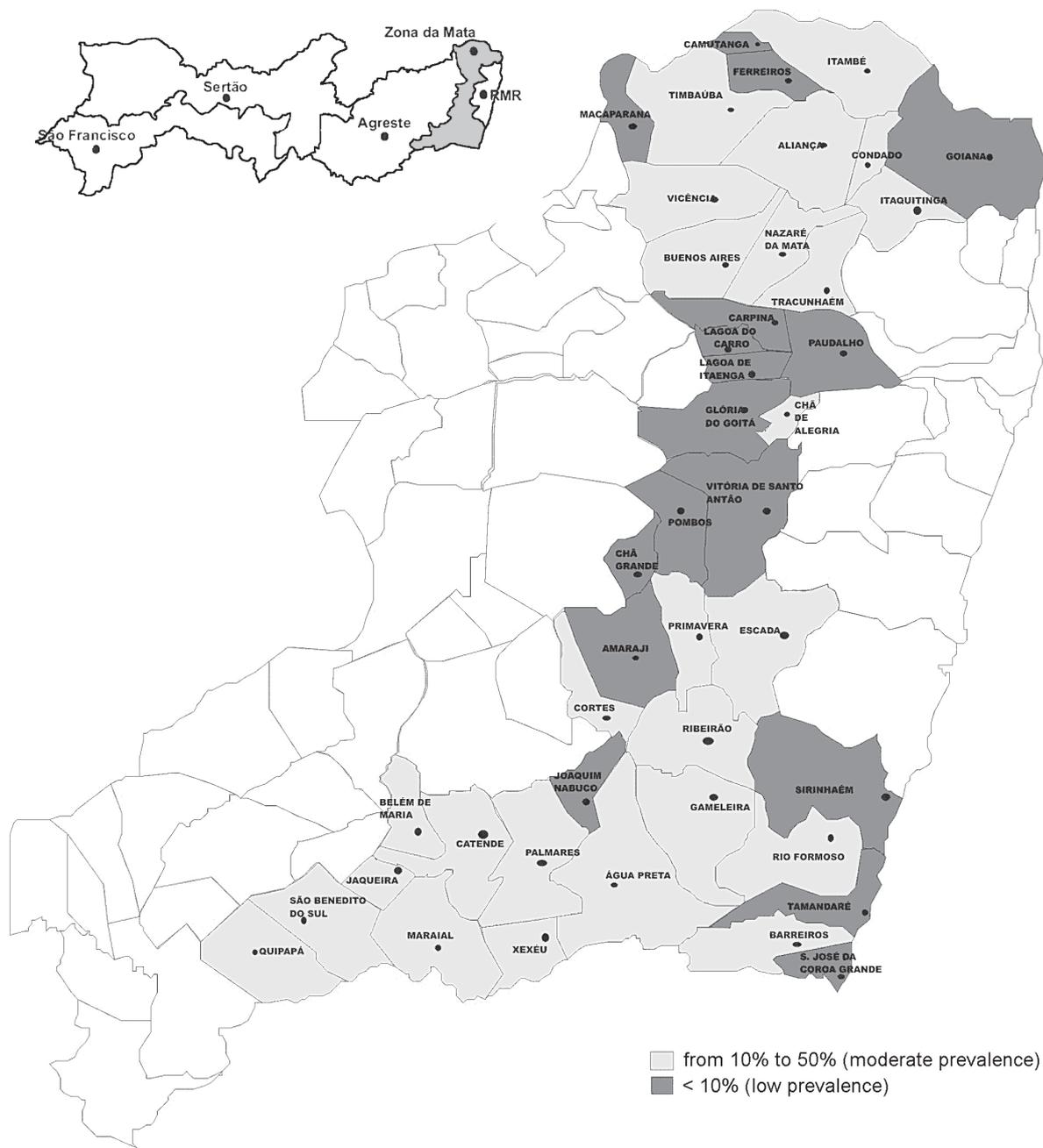


Fig. 1: prevalence classes for schistosomiasis in the municipalities in the Forest Zone of Pernambuco, according to a school survey carried out in 2005.

2002). The prevalence classes were: low < 10%, moderate ≥ 10 and < 50% and high $\geq 50\%$; the intensity classes were: low (1-99 epg), moderate (100-399 epg) and severe (≥ 400 epg). For the geohelminthic diseases, the following indicators were used (Montresor et al. 2002): positivity for each geohelminth (percentage of individuals examined with eggs of *Ascaris lumbricoides*, ancylostomidae or *T. trichiura*), and cumulative positivity (percentage of individuals examined with eggs of at least one geohelminth). The municipalities were categorized by means of their cumulative positivity into the following geohelminth prevalence classes (WHO 2002): low < 50%, moderate $\geq 50\%$

and < 70% and high $\geq 70\%$.

A report containing the results from the survey was handed over to the proper authorities as soon as the data became available. This report contained individual information on all the tests carried out, and also a summary with the numbers of children examined within the target age group, the proportion of positive cases and the mean severity of the infections in all the schools sampled, per municipality. The report also presented an analysis and evaluation of the data collected, with recommendations regarding the preventive and control measures to be adopted.

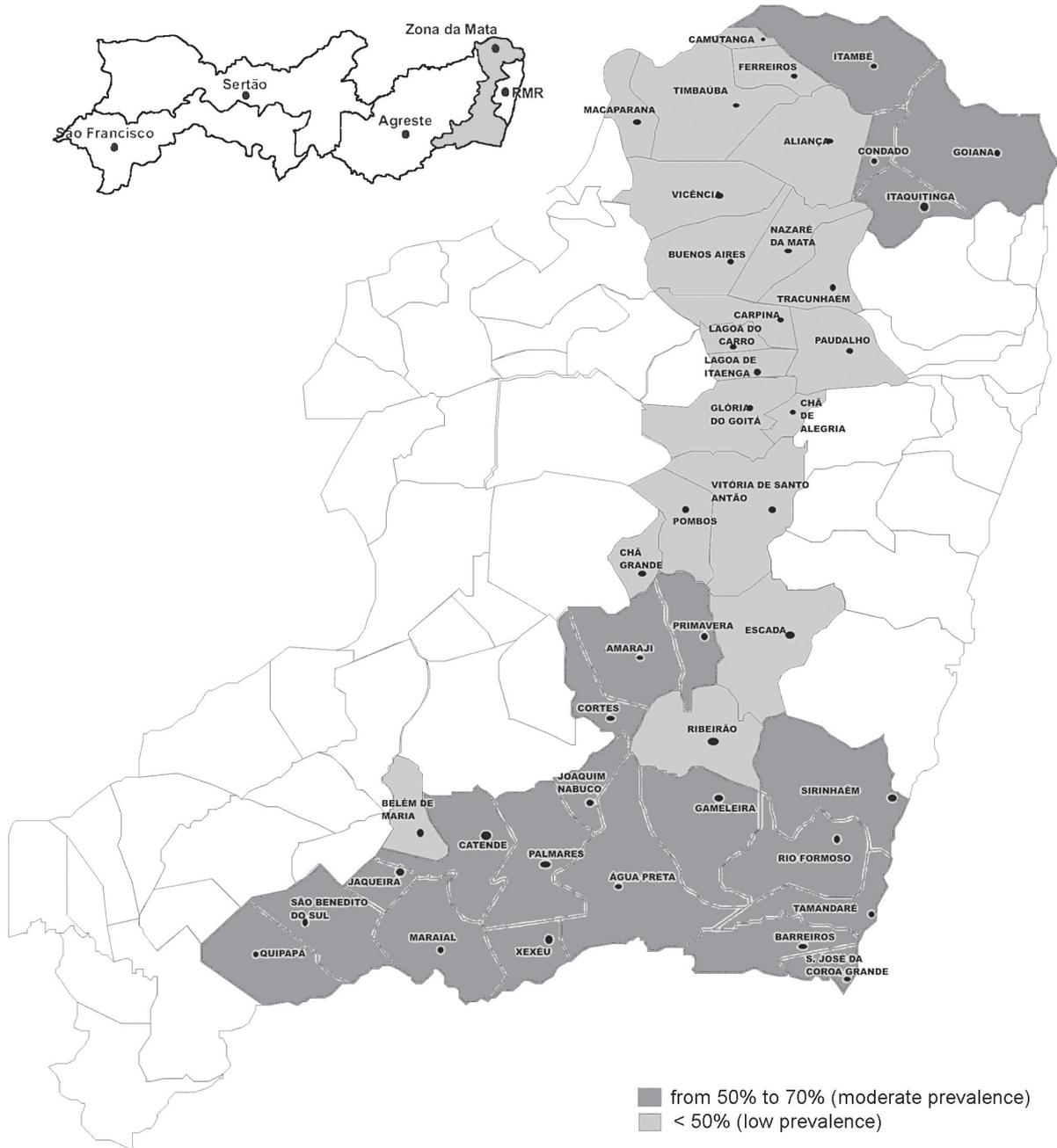


Fig. 2: prevalence classes for geohelminthic diseases in the municipalities in the Forest Zone of Pernambuco, according to a school survey carried out in 2005.

RESULTS

The school survey carried out in the 43 municipalities in the Forest Zone of Pernambuco covered 271 schools (a mean of 6.3 schools per municipality) in 179 different localities, thus giving a total of 15,257 examinations performed, of which 11,234 were within the target age range (students aged 9-12 years). Overall, for all the municipalities, this survey showed 14.4% of *S. mansoni* infection (1625 positive individuals out of the 11,234 within the target age range who were examined). The egg count for this parasite in the feces gave a geometric mean of 67.9 epg among the positive individuals.

These results allow this zone to be categorized as presenting moderate prevalence and low intensity of schistosomiasis infection. For the geohelminths, the overall prevalence rates for *A. lumbricoides*, *ancylostomidae* and *T. trichiura* were, respectively, 30.4, 10.1, and 27.8%; the cumulative prevalence was 45.4%. These results allow this zone to be categorized as presenting low prevalence of geohelminthic infection.

The tables and figures that follow show the results per municipality, with the numbers of schools examined, number of examinations carried out, percentages of cases positive for geohelminthic diseases and for *S. mansoni*, and the geometric mean numbers of epg. The data show that some municipalities in Pernambuco, such as Águia Preta, Aliança, Catende, Chã de Alegria, Cortês, Escada, Gameleira, Itaquitinga, Jaqueira, São Benedito do Sul, and Vicência presented mean prevalence greater than 20%, while others such as Aliança, Condado, Escada, Itambé, Rio Formoso, and Tracunhaém presented parasite loads greater than 100 epg. These indicators attest to the significant morbidity due to schistosomiasis, especially with regard to the severity of infections that have already become established in young populations.

DISCUSSION

The schistosomiasis situation in 26 (60.4%) of the 43 municipalities in the Forest Zone of Pernambuco merits special attention, considering that the levels of prevalence and/or intensity of infection found among the target group of this investigation indicate that there is considerable risk of transmission and morbidity, not only among the children of school age, but also within the population as a whole. There is therefore an urgent need to prioritize schistosomiasis control measures in these municipalities. This should involve chemotherapy treatment for the children of school age (whether or not they are attending school) and other groups at high risk, and also sanitation and environmental management measures. There should also be strategies for information, education and communication within the communities close to these schools with greater prevalence. Such measures are justified not only within the strategy of combining schistosomiasis control and geohelminthic disease control, as recommended by WHO (1999), but also to comply with the target set by Resolution 54.19 from the World Health Assembly, according to which at least 75% of children of school age should be dewormed by 2010 (WHO 2002).

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