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Autochthonous cases of schistosomiasis in children in Recife, Northeastern Brazil

ABSTRACT

OBJECTIVE: Investigate breeding sites with host snails and autochthonous human cases of schistosomiasis.

METHODS: Between July 2010 and September 2012 were performed: (1) malacological survey searching for breeding sites, collection and identification of *Biomphalaria* snails positive for *Schistosoma mansoni* in Recife, PE, Northeastern Brazil; (2) prevalence survey in 2,718 schoolchildren aged from seven to 14 years old to identify cases of schistosomiasis, clinical examination and ultrasound in positive cases of *S. mansoni*. The autochthony of the cases was investigated and the case were clinically evaluated. The cases and breeding sites were georeferenced and spatially described.

RESULTS: The results identified 30 breeding with *B. straminea*, four of which were potential foci of transmission, as molecular testing identified snails with *S. mansoni* DNA. There were 14 children diagnosed with schistosomiasis, of which five were considered to be autochthonous cases of the disease.

CONCLUSIONS: Urgent measures are required in order to avoid schistosomiasis becoming endemic to Recife, as has happened in other coastal areas of the state of Pernambuco.

DESCRIPTORS: *Biomphalaria*, growth & development. *Schistosoma mansoni*. Schistosomiasis, epidemiology. Endemic Diseases, prevention & control.

INTRODUCTION

For decades schistosomiasis *mansoni* in Pernambuco, Northeastern Brazil, was identified as a rural endemic poverty-related disease. Recently, this disease has spread to remote coastal villages of this State where acute human cases and outbreaks of vector snails have been identified. This confirms the introduction and establishment of the disease in previously untouched areas. The disease, in the form of outbreaks or stabilized as endemic, has different epidemiological, clinical, economic and socio-cultural characteristics from those found in rural zones in the state.^{3,4,6,9,12,14}

Unemployed rural workers migrate to the coastal areas of Pernambuco where they find temporary work in resorts, hotels and summer houses. Some of these coastal areas are important tourist centers where there is intense population growth combined with chaotic land occupation in which natural resources are destroyed by invasive and unscrupulous civil construction. On the periphery of these privileged tourist areas, the migrant population agglomerates, awaiting employment opportunities and living in settlements without basic sanitation or infrastructure, without access to health care or services. These living conditions favor contamination of the freshwater aquatic environment. Human waste thrown into the streams and ponds of the coastal areas contaminates the natural breeding sites of the host snails favoring the establishment of disease transmission. Extensive publication of scientific articles has recorded the occurrence of new outbreaks of host snails and acute human cases of schistosomiasis on the coast of Pernambuco and the Metropolitan Region of Recife (MRR) with data on the epidemiology, ecology and spatial distribution of the schistosomiasis. These records support and guide the actions of the health care services in controlling and preventing the disease on the coast of Pernambuco.^{2,5,7,8,10,11,16,18,20}

The first indication of schistosomiasis transmission in Recife, PE, Northeastern Brazil, was in 2008 when a scientific expedition detected the presence of *Biomphalaria straminea* infected with *Schistosoma mansoni* in a pond located in Apipucos Park, in a neighborhood of the city.^a The site is a beautiful, traditional leisure area, including children's playgrounds and areas for playing sport, where some people fish and swim, and in which sewage dumping was found in several locations.

Based on these findings, epidemiological investigations were initiated to find evidence of schistosomiasis transmission in the city of Recife.

The aim of this study was to investigate breeding sites of host snails and autochthonous human cases of schistosomiasis in Recife.

METHODS

A malacological survey was carried out between July 2010 and September 2012, actively searching for host snails in fresh water at selected points in Recife. The snails were collected using scoops and tweezers in an active search of fresh water in epidemiologically important points (close to habitation). They were examined using the molecular Nested PCR technique, specific and efficient for identifying DNA of *S. mansoni* in *Biomphalaria*.^{1,15} This technique allows the rapid identification of aquatic environments contaminated with the parasite. Human cases were identified between August and September 2011 using the *Inquérito Nacional de Prevalência da Esquistossomose e Geohelmintoses* (INPEG – National Survey on Prevalence of Schistosomiasis and Geohelmintoses),^b which sampled 2,718 schoolchildren between seven and 14 years old in 35 schools in Recife. Besides the 35 schools selected for the survey, a purposeful search for schistosomiasis cases was conducted in two schools that were very close to breeding sites with a high concentration of snails. The parasitological diagnosis for parasites in stool samples was performed by the Kato-Katz method using two slides for each sample.¹³ Clinical tests were performed on those children with positive diagnosis for *S. mansoni* to investigate episodes of diarrhea with blood in the stool in the preceding two weeks, episodes of upper gastrointestinal bleeding (UGIB), splenomegaly or UGIB in the family. Ultrasound test was performed to establish the presence of splenomegaly, hepatomegaly and patterns of periportal fibrosis. The World Health Organization (WHO) Niamey classification was used to define periportal fibrosis as pattern A (no fibrosis), B (debatable fibrosis), C (peripheral fibrosis), or D (central fibrosis).²⁰

The autochthony of the cases was carefully investigated with the children's relatives. Those children who reported any kind of exposure outside of Recife were ruled out as autochthonous case.

The locations of schools and households with positive cases of schistosomiasis *mansoni* were geocoded using Google Earth software version 6.1, with the completeness of the data reaching 95%. The breeding sites of snails were georeferenced using a Garmin eTrex GPS device, in the UTM projection system and the SAD69 datum. These data were included and processed in

^a Epi Schisto Risk Modeling. [cited 2012 Sept 14]. Available from: <http://www.epichisto.org/>

^b Ministério da Saúde/Fundação Oswaldo Cruz. Inquérito Nacional de Prevalência da Esquistossomose e Geohelmintoses. Brasília, DF; 2012.

a Geographic Information System in ArcGIS 10.0 (Esri) software, creating a thematic map with spatialized attributes.

This project was approved by the Research Ethics Committee of the *Centro de Pesquisas René Rachou* (Process n° CAAE 0007.1.245.000.10). The research followed the ethical principles contained in Resolution n° 196/96, of the *Conselho Nacional de Saúde*, Ministry of Health. All participants signed an informed consent form. Anonymity was maintained at all stages of the study.

RESULTS

There were 30 breeding sites identified in Recife, from which 2,423 *B. straminea* snails were collected. As this species is not very susceptible to *S. mansoni*, the snails were subjected to the molecular Nested PCR diagnosis technique to search for DNA from the parasite. Four breeding sites with molluscs bearing *S. mansoni* DNA were found in Recife neighborhoods one in Caxangá, two in Apipucos and one in San Martin (Figure).

From the 2,718 schoolchildren investigated by parasitological survey INPEG, 9.05% were infected with *Ascaris lumbricoides*, 8.64% with *Trichuris trichiura*, 1.1% with hookworms and 0.44% with *Schistosoma mansoni*. The search for new cases among 179 children examined in the schools in the Varzea and Apipucos neighborhoods, which were not included in the INPEG sample, allowed two more schistosomiasis cases to be found. A total of 179 children were examined and 14 cases of schoolchildren parasitized by *S. mansoni* were diagnosed with loads between 46 and 816 eggs per gram of feces (EGP). These 14 children were sent to *Centro de Pesquisas Aggeu Magalhães/Fiocruz* – CPqAM/Fiocruz to be clinically examined and undergo ultrasound diagnosis (US). The mothers and children were counseled about the disease and how to prevent becoming infected again. The patients received specific medication for *S. mansoni* and other diagnosed parasitic diseases.

Nine children were excluded from the autochthony investigation as they reported exposure to locations outside of Recife city, even if the exposure had been for a few hours. Only five children could be considered autochthonous cases because their families assured the researchers that they had never left the city of Recife. Of the 14 cases which were positive for *S. mansoni*, it was not possible to carry out a clinical examination on one of them (AS, 11 years old) because the relatives did not give permission, but the autochthony of the case was investigated and confirmed in a home visit. Figure shows the geographic location of the households of the schistosomiasis cases diagnosed and

the locations of snail breeding sites, some carrying *S. mansoni* parasite DNA.

DISCUSSION

This is the first report of children born and residing in the city of Recife parasitized by *S. mansoni*, with proper research to ensure autochthonous cases. There are reports of adult patients with schistosomiasis in peripheral areas of the Metropolitan Region of Recife;¹⁸ however, none of these cases were investigated for autochthony.

The parasitological survey (INPEG), conducted through random sampling, detected 0.44% of schistosomiasis cases while epidemiological search, conducted in schools close to the breeding of vector snails, was able to detect 1.1% of children parasitized by this helminth. Among the nine cases which were not counted as autochthonous, three of them reported one single exposure outside of Recife. The other five children diagnosed as autochthonous cases of schistosomiasis had not left Recife and reported exposure near to their homes in the rainy season, when streams and drainage ditches in the neighborhood overflow and host snails are passively carried into the streets and yards. This seasonal infection, featuring episodic transmission in urban areas, could be avoided by establishing sanitation strategies, such as adequate drainage for rainwater. With respect to the three children who reported one single exposure outside Recife city and were ruled out as autochthonous cases of the disease, the interviews recorded the hypothesis that the contamination may have been in this city since their parents mentioned systematic contact with streams and flooded streets around their residences.

Among the three children who had high parasite loads (one of which was autochthonous), between 458-816 EPG, two of them had specific symptoms and alterations seen in the ultrasound, suggesting numerous and/or intense exposure (Table). One child, (GLSS, eight years old) living in the Boa Viagem neighborhood, had a high parasite load (816 EPG) and reported one single exposure in an endemic area, when swimming in the river for two hours, with no recollection of symptoms (cercarial dermatitis or fever) after this contact. No breeding sites for host snails were found in the Boa Viagem neighborhood, but the child reported systematic and accidental contact when the water of the canal adjacent to his residence overflows.

Among the three children suffering from hepatomegaly, two were autochthonous cases. One of them (LRMSF, eight years old) developed the hepatosplenic clinical form, although the parasitological stool examination detected 48 eggs/gram of feces, suggesting an old infection which had not been specifically treated (Table). The

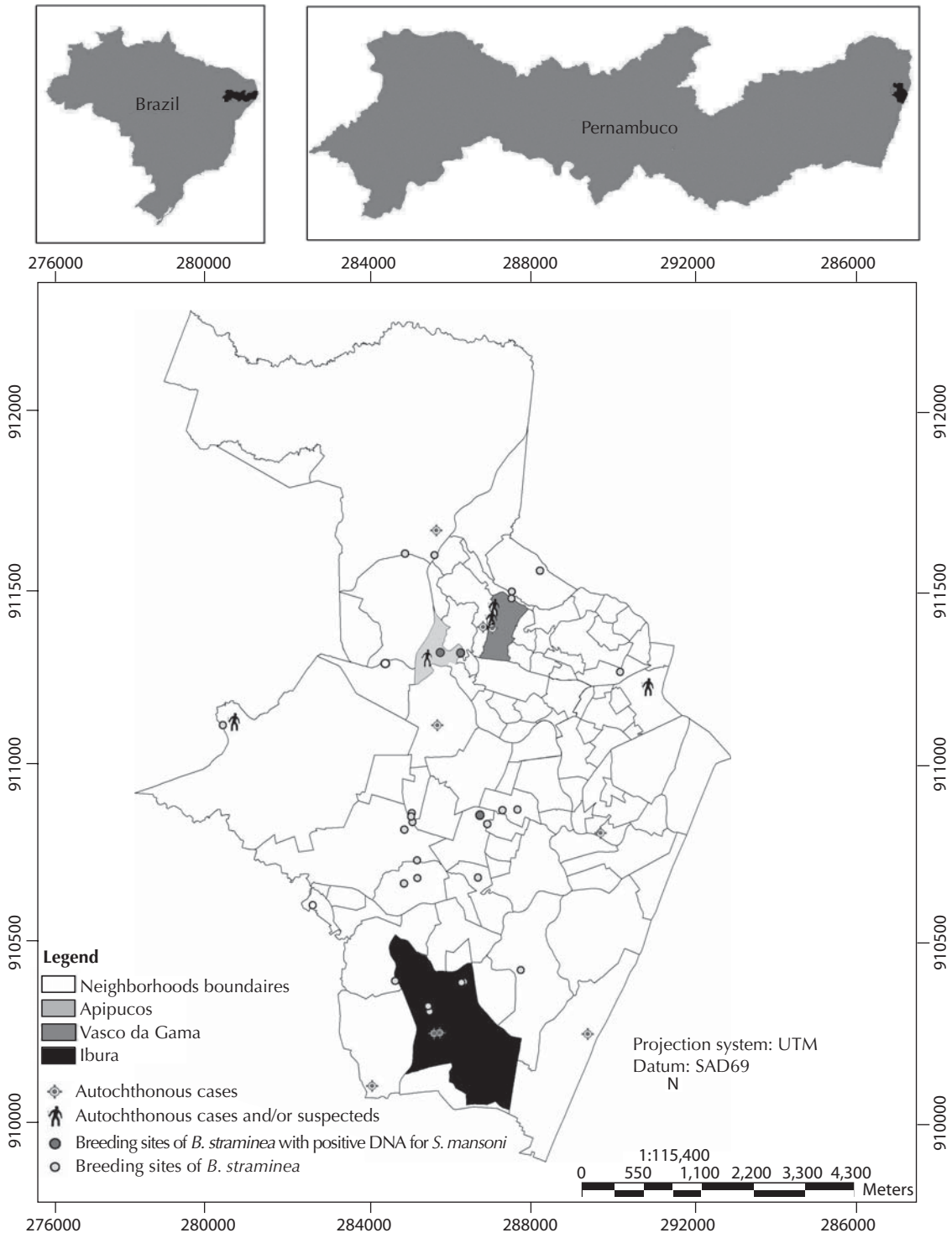


Figure. Geographic distribution of cases of schistosomiasis and *Biomphalaria* breeding sites. Recife, PE, Northeastern Brazil, 2012.

liver damage in the three autochthonous cases, with stage B and C fibrosis, is a sign of the severity of the disease in its chronic course, similar to that observed in patients in endemic areas with recurrent exposure to the etiological agent.

Only one of the autochthonous case of the disease and three breeding sites of *B. straminea* with *S. mansoni* DNA were identified in the Apipucos neighborhood. This was the first child diagnosed with schistosomiasis in Recife. During the autochthony investigations of this

Table. Results of the clinical examinations and ultrasounds of those schoolchildren diagnosed with *Schistosoma mansoni*. Recife, PE, Northeastern Brazil, 2012.

Patient	Age	Symptoms	Eggs per gram of feces	US	Fibrosis patterns ^a	Autochthony
AGCA	9	Yes	72	Hepatomegaly/Fibrosis	Pattern C	No
MTAN	9	No	240	Fibrosis	Pattern C	No
TYOS	9	No	148	Hepatomegaly/Fibrosis	Pattern C	Yes
AGS	12	No	192	No alteration	No Fibrosis	No
SLS	13	No	144	Fibrosis	Pattern C	No
WCLO	9	Yes	458	Hepatomegaly/Fibrosis	Pattern C	Yes
IMFS	9	Yes	46	Fibrosis	Pattern B	No
LRMSF	8	Yes	48	Hepatosplenomegaly/ Fibrosis	Pattern B	Yes
GLSS	8	Yes	816	Fibrosis	Pattern B	No
MMS	13	Yes	140	Fibrosis	Pattern D	No
EAMA	8	No	456	No alteration	No Fibrosis	No
DLLN	10	No	72	No alteration	No Fibrosis	No
LDS	12	No	264	No alteration	No Fibrosis	Yes
AS	11	No	72	–	–	Yes

US: Ultrasound

^aFibrosis patterns: Pattern A: no fibrosis; Pattern B: probable or debatable fibrosis; Pattern C: peripheral fibrosis; Pattern D: central fibrosis.²²

case (AS, 11 years old), the parents confirmed that the child used to swim every day in Apipucos lake. The Ibura neighborhood had four breeding sites of host snails and two children with schistosomiasis, these are biological indicators of risk which merit special attention by environmental and epidemiological monitoring. The Vasco da Gama neighborhood had three cases of schistosomiasis and two of them were autochthonous; investigation with the family, asking about possible contact and exposure, leads to the assumption that these children may have been contaminated in the nearby swamps of Brejo do Beberibe and Apipucos, areas frequented by those children that were breeding sites of host snails.

Figure shows the exact location of the areas where there may be favorable conditions for disease transmission. Further investigations are necessary to identify and map the entire city in search of new areas of transmission, avoiding the spread of schistosomiasis in Recife. In spite of their limitations, the data shown in Figure are essential for guiding monitoring activities searching for new cases and investigating unhealthy environments.

The findings of the present investigation, represented by *Biomphalaria straminea* breeding sites containing

snails carrying *S. mansoni* DNA, and by the autochthonous cases of schistosomiasis in children, indicate that the disease is being transmitted in Recife. These data, linked to the fact that, according to the Brazilian Institute of Geography and Statistics (IBGE) census of (2010),^c around 50% of the municipality of Recife has no sanitation network, takes on significant epidemiological and public health relevance, calling for emergency actions in order to avoid schistosomiasis becoming endemic in the city. In coastal areas of Pernambuco where the disease is already established, the dynamic of transmission has specific epidemiological and clinical characteristics, represented by episodic outbreaks and acute clinical forms.

The results of this research point to the need to identify new cases of the disease and breeding sites in all neighborhoods of the city, perhaps using the technique of mice exposure in the breeding of *Biomphalaria straminea* to detect the presence of the parasite cercariae.

The results of this study are limited to the specific situation of Recife and may be useful for the Schistosomiasis Control Program (PCE) to take emergency actions in order to prevent the disease from spreading in Recife city.

^c Instituto Brasileiro de Geografia e Estatística (IBGE). Censo 2010 [cited 2012 Sept 22]. Available from: http://www.censo2010.ibge.gov.br/primeiros_dados_divulgados/index.php?uf=26

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