ORIGINAL ARTICLE

Strongyloides stercoralis AND OTHER ENTEROPARASITES IN INDIVIDUALS OF RURAL AREA OF UBERLÂNDIA, MINAS GERAIS STATE, BRAZIL

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ABSTRACT

The aim of this study was to verify the occurrence of *Strongyloides stercoralis* and other enteroparasites in the rural area of Uberlândia, Minas Gerais, Brazil, between September 1996 and May 1997, using the Baermann - Moraes and Lutz methods. Out of 180 individuals studied, 92 (51.1%) were infected. Twelve people (6.7%) were infected by *S. stercoralis,* being five in children with ages between zero and 12 years old and 7 cases older than 12 years old. Other enteroparasites diagnosed were *Entamoeba coli* (27.2%), *Giardia lamblia* (10.6%), Hookworm (7.2%), *Endolimax nana* (3.9%), *Ascaris lumbricoides* (3.3%), *Entamoeba hartmanni* (3.3%), *Enterobius vermicularis* (2.2%), *Hymenolepis nana* (1.1%), *Iodamoeba butschlii* (1.1%), *Entamoeba histolytica/ dispar* (0.6%), and *Schistosoma mansoni* (0.6%). Of the 92 positive cases there were 71% with mono-parasitism, 25% with bi-parasitism, and 4% with poly-parasitism. It was concluded that strongyloidiasis is hyperendemic in the rural area of Uberlândia. We highlighted the importance of the multiple parasitological methods performed in three different occasions with fecal samples of each individual, which enhanced the possibilities for detection of an elevated enteroparasite rate (51.1%). We also point out to a serious public health problem in this rural area.

KEY WORDS: *Strongyloides stercoralis.* Enteroparasites. Children/Adults. Rural area. Brazil.

INTRODUCTION

Strongyloidiasis is an infection caused by *Strongyloides stercoralis*. This nematode is prevalent in tropical and subtropical areas, where there is a high population density, favorable climatic condition, extreme poverty, limited sanitary

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education, and absence of basic sanitary conditions. These factors encourage the development and permanence of this etiologic agent in the environment (Mahdi et al., 1993; Hall et al., 1994; el-Shazly et al., 2006).

Research in different regions of Brazil describe a prevalence of enteroparasites ranging between 30.7% to 74% (Mello et al., 1988; Gonçalves et al., 1990; Miranda et al., 1998; Giraldi et al., 2001; Paniagua et al., 2007, Silva et al., 2009). In the Minas Gerais state, the infection rate of people living in the rural area varied from 18.9% to 68.2% as described in Table 1. This variability in the rate of infection is related to the number of fecal samples examined, age, and the specific diagnostic method used for helminthes larvae, eggs and cysts detection.

Table 1. Frequency of enteroparasites by age and parasitological methods found in inhabitants of the rural area of Minas Gerais, Brazil.

Nº of individuals	Age Category (Year)	Nº (%) of infections	Parasitological methods	Authors
294	7 ¬ > 15	103 (35.0)	Lutz	Barbosa et al, 2005.
22	7 ¬ > 15	47 (38.5)	Lutz	Barbosa et al, 2005.
172	0 ¬ > 60	45 (26.2)	Lutz, Willis, Kato-Katz	Bernardes & Marçal Jr, 2001
103	7 ¬ > 15	23 (22.3)	Lutz	Ferreira & Marçal Jr, 1997.
72	5 ¬14	43 (59.7)	Lutz	Ferreira et al, 2003.
1332	0 ¬ > 40	909 (68.2)	Formalin-ether, Sedimentation Technique	Fleming et al, 2006.
188	2 - 95	177 (47.1)	Lutz	Machado et al, 2008a
78	1 – 70	51 (65.4)	BM & Lutz	Oliveira et al, 2003.
360	7 - 14	68 (18.9)	Rugai & Lutz	Ribeiro & Marçal Jr, 2003.

Nº: number; %: percentage.

The occurrence of *S. stercoralis* described in the literature revealed that the epidemiology of *S. stercoralis* worldwide, nationally and in each state scale has not been explored specifically in the rural areas. No studies at the city of Uberlândia have been found within this context. The epidemiological research conducted used routine fecal examination with the stool sample, preserved in formalin, or sodium acetate-acetic acid-formalin (SAF) and without employing specific and sensitive methods in detecting nematode larvae. The present study constitutes the first one carried out in a rural area using specific methods to diagnose helminthes in three consecutive fecal samples, without addition of preservatives. The aim of the study was to verify the rate of occurrence of *S. stercoralis* and other enteroparasites in inhabitants of a rural area of Uberlândia, Minas Gerais State, Brazil, between September 1996 and May 1997.

MATERIAL AND METHODS

Uberlândia city is localized in Triângulo Mineiro region, Minas Gerais State, Brazil. In 1996, this city had 438,986 inhabitants, with 431,744 living in

urban areas and 7,242 in rural areas. Both children and adults living near of three rural school communities located in different geographic positions North, South, and West in district of Uberlândia (Instituto Brasileiro de Geografia e Estatística, 1996) were studied. The sample size was calculated by the formula: $n = Z^2 \times PQ/d^2$, considering (Z) of 95%, (d) of 5% and (P) of 13% (data obtained previously in a study on *S. stercoralis* and enteroparasites in the City of Uberlândia, Machado & Costa-Cruz, 1998), and a non-observed value (Q) of 87%, with the sample size (n) calculated to 174 persons. This sample was amplified and 180 individuals selected at random (60 at each rural area) were analyzed.

Parents, children, relatives of children and school employees participated in this study. All people signed a consent form to participate. Individual questionnaires were administered to all participants in order to collect information pertaining to the demographics (age, sex, and education) and behavior (wearing shoes, food consumption, personal hygiene, health care seeking, and living conditions).

Three fecal samples from each individual were collected in plastic vials without preservatives with intervals of four to six days and analyzed at the Laboratory of Parasitology of the Federal University of Uberlândia using the Baermann methods, as modified by Moraes (BM) and Lutz (Baermann, 1917; Lutz, 1919). Ten slides were prepared, stained with Lugol's iodine and each sample was read by two investigators. Four slides for each sample (540 samples) were examined using the BM method and for the Lutz examination the three fecal samples of each patient were mixture and six slides prepared and diagnosed. A total of 3,240 slides were examined.

All adults and the children's relatives received the results of the parasitological examinations from the laboratory, in addition to medication prescribed by a physician from the Prefeitura Municipal of Uberlândia, Minas Gerais. The only case diagnosed as having *Schistosoma mansoni* was referred to the Secretary of Health of the Prefeitura Municipal of Uberlândia to receive specialized treatment.

The results from the parasitological examinations were analyzed using the Chi-square test (X^2) and odds ratio with 95% confidence intervals (CI), being considered statistically significant with $p < 0.05$ (GraphPad Prism 4).

RESULTS

From the 180 individuals studied 87 were male and 93 were female, ages varying from zero to 12 years of age (n = 92) and more than 12 years of age (n = 88). Twelve patients (6.7%) were infected with *S. stercoralis* larvae in at least one of the three samples, being five in children with age between zero to 12 years (41.6%) and seven cases in individuals older than 12 years old (58.4%). From these cases, three were detected only by BM method (25.0%), one case only by Lutz method (8.3%) and eight cases by both methods (66.7%).

Of the 180 individuals studied, 92 (51.1%) were positive for enteroparasites, including the *S. stercoralis* cases being 46 (50%) male and 46 (50%) female. There were 65 (71%) individuals mono-infected, 23 (25%) bi-infected, and four (4%) poly-infected. The distribution of 92 positive cases in relation to individuals' age and gender did not show significant differences, however, the rate of infections was higher in individuals above 12 years of age. The distribution of enteroparasites is shown in Table 2. From the bi-infected individuals, three had associated infections with *S. stercoralis*: Hookworm either *Ancylostoma duodenale* or *Necator americanus* in one (33.3%) and *Entamoeba coli* in two (66.7%).

Table 2. Distribution of enteroparasites in inhabitants of rural area of Uberlândia, Minas Gerais, Brazil, between September 1996 and May 1997.

Parasites	Nº. of positive infectious cases	%
Entamoeba coli	49	27.2
Giardia lamblia	19	10.6
Hookworm	13	7.2
Strongyloides stercoralis	12	6.7
Endolimax nana	7	3.9
Ascaris lumbricoides	6	3.3
Entamoeba hartmanni	6	3.3
Enterobius vermicularis	4	2.2
Hymenolepis nana	2	1.1
Iodamoeba butschlii	2	1.1
Entamoeba histolytica/dispar	1	0.6
Schistosoma mansoni	1	0.6

Nº: number; %: percentage

The questionnaire applied to the 180 participants regarding personal hygiene and meat handling practices, as well as basic sanitary conditions in their homes and their relation with the presence or not of *S. stercoralis* and other enteroparasites, were analyzed. Of the 92 positive cases of strongyloidiasis or other types of infection, 53 (57.6%) walked barefoot; 71 (77.2%) drunk filtered water; 75 (81.5%) washed their hands before handling meat; 85 (93.4%) washed their hands after using the restroom; 92 (100%) washed fruits and vegetables before eating them; 82 (89.0%) did not have water piped into their home; 84 (91.0%) had indoor bathrooms; 77 (84.0%) residences had a bathroom in their house; and 62 (67.4%) residences had kitchen gardens in their yards. Of the nine questions analyzed, the only one that related significantly to *S. stercoralis* infections was the habit of people drinking unfiltered water or directly from the faucet. Of 12 positive cases of strongyloidiasis, seven (58.3%) individuals drank water directly from the faucet. Regarding running water in their house, only two did not have it. In houses with kitchen gardens there was a positive association with enteroparasites infection ($p = 0.05$).

DISCUSSION

Strongyloidiasis has heterogenic worldwide distribution, with three recognized world regions, according to the predominance of infection by *S. stercoralis*: sporadic (<1%), endemic (1 – 5%) and hyperendemic (> 5%) (Stuerchler 1981 *apud* Pires & Dreyer 1993). By employing three samples per individual and two methods of diagnosis, it was observed that *S. stercoralis* infection was hyperendemic in the rural area studied. The data are in agreement with the literature, with the rate of infections ranging from 5.8% to 30.7% (Gonçalves et al., 1990; Mahdi et al., 1993; Hall et al., 1994; Kobayashi et al., 1995; Machado & Costa-Cruz, 1998, Silva et al., 2009). In all these studies, the authors used two or more parasitological methods sometimes associated with each other and sometimes only one method specific to diagnose the presence of nematode larvae in three fecal samples. Other results described in the literature showed a lower rate of occurrence of strongyloidiasis, however this study used one parasitological method and a non-specific method in the diagnoses of one fecal sample (Costa-Cruz et al., 1995). Due to this fact it is recommended for an effective diagnostic procedure that three feces samples are necessary because 45.5% of the cases in the present research were identified only in the third sample and only 27.3% in all samples. The data diagnosed in the third sample corroborate with the data of the literature that show the necessity of the use of three or more samples of feces to increase the sensitivity of the method, since infected patients with *S. stercoralis* expel larvae in an intermittent form and the diagnosis may be negative in the first and second fecal samples. Additionally, the BM method was able to identify the infection in 3 (25.0%) of the people studied.

Positive cases (6.7%) of *S. stercoralis* were distributed in all age groups, given that in the age range from zero to six years there was one case. The majority of the cases of strongyloidiasis were diagnosed in females who were six years or older, but without significant differences between gender. These findings are consistent with the results described in the literature revealing that cases of *S. stercoralis* affect patients in all age groups and in both genders (Hall et al., 1994; Kobayashi et al., 1995; Schnack et al., 2003).

Results obtained with *Giardia lamblia* (10.6%) corroborate the findings at the regional and national levels (Mahdi et al., 1993; Costa-Cruz et al., 1995; De Sa Cardoso et al. 1995; Kobayashi et al., 1995; Machado & Costa-Cruz, 1998, Machado et al., 2008b, Silva et al., 2009). These data show that giardiasis has a high incidence in Brazil. Of the six species of helminthes identified, hookworm presented the highest rate of infection, probably due to the barefooted walking habit of the rural population (57.6%), which facilitates the active penetration of the infective larvae of this parasite through the skin. The rate of infection found in this study was lower for all helminthes in relation to the percentages of helminthes infection found as described in the literature (Machado & Costa-Cruz, 1998; Carvalho et al., 2002; Gomes et al., 2002; Brooker et al., 2006). The low percentage of parasites diagnosed

probably is due to good hygienic conditions of this population in relation to their body and food. The contamination with these parasites may be due to absence of canalized water in the houses and drinking water contaminated with fecal residuals. The only person diagnosed with *S. mansoni* was not originally from the city of Uberlândia, but emigrated from Salvador, Bahia a region in which schistosomiasis is endemic (de Cássia Ribeiro et al., 2007).

It was concluded that strongyloidiasis is hyperendemic in the rural area of Uberlândia. We highlight the importance of the performance of multiple parasitological methods done in three different fecal samples of each individual, which made it possible to detect an elevated rate of enteroparasites (51.1%) showing a serious public health problem in this area. It is therefore necessary to establish a prophylactic plan of action to control the parasitic infection in this region.

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CONFLICTS OF INTEREST: None declared.

RESUMO

Strongyloides stercoralis e outros enteroparasitos em indivíduos da área rural no município de Uberlândia, estado de Minas Gerais, Brasil

O objetivo deste estudo foi verificar a ocorrência de *Strongyloides stercoralis* e outros enteroparasitos em habitantes da área rural de Uberlândia, Minas Gerais, entre setembro de 1996 e maio de 1997, utilizando os métodos de Baermann-Moraes e de Lutz. Dos 180 indivíduos estudados, 92 (51,1%) estavam infectados. Doze indivíduos (6,7%) estavam infectados por *S. stercoralis,* sendo cinco em crianças com idade de entre zero e 12 anos e sete em indivíduos acima de 12 anos. Outros enteroparasitos diagnosticados foram *Entamoeba coli* (27,2%), *Giardia lamblia* (10,6%), Ancilostomatídeos (7,2%), *Endolimax nana* (3,9%), *Ascaris lumbricoides* (3,3%), *Entamoeba hartmanni* (3,3%), *Enterobius vermicularis* (2,2%), *Hymenolepis nana* (1,1%), *Iodamoeba butschlii* (1,1%), *Entamoeba histolytica/dispar* (0,6%) e *Schistosoma mansoni* (0,6%). Dos 92 casos positivos houve 71,0% de monoparasitismo, 25,0% biparasitismo e 4,0% poliparasitismo. Concluiu-se que a estrongiloidíase é hiperendêmica na área rural de Uberlândia. Destacamos a importância do uso de múltiplos métodos parasitológicos realizados em três diferentes amostras fecais de cada indivíduo que possibilitou

a detecção de elevada taxa de enteroparasitas (51,1%) demonstrando um sério problema de Saúde Pública.

DESCRITORES: *Strongyloides stercoralis*, Enteroparasitos, Crianças/Adultos, Área Rural, Brasil.

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