

# ***Strongyloides stercoralis* and other Enteroparasites in Children at Uberlândia City, State of Minas Gerais, Brazil**

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*To evaluate the rate of infection by Strongyloides stercoralis and other enteroparasites a survey was conducted in the city of Uberlândia, State of Minas Gerais, Brazil. A total of 900 stool samples from 300 children aging from four months to seven years, randomly selected in ten nursery schools from September 1994 to December 1995, were examined, both by the Baermann-Moraes and Lutz methods. Thirty nine children (13%) were found to be infected by S. stercoralis, 64.1% were boys and 35.9% were girls. Taking all the enteroparasites as a whole the results of the survey pointed out that 265 (88.4%) of the 300 children were infected by the following: Giardia lamblia, 78.3%; Ascaris lumbricoides, 15.3%; S. stercoralis, 13%; Hymenolepis nana, 6.7%; hookworms, 6%; Enterobius vermicularis, 4%; Hymenolepis diminuta, 4% and Trichuris trichiura, 0.7%. From 265 infected children 64.5% were mono-infected, 27.2% were infected by two parasites and 8.3% had a poly-specific parasite burden. It was concluded that strongyloidiasis is hyperendemic in this area.*

Key words: *Strongyloides stercoralis* - intestinal parasites - children - Brazil

Strongyloidiasis has heterogenic worldwide distribution, with three world regions, according to the predominance of the infection by *Strongyloides stercoralis* (Bavay, 1876): sporadic (<1%), endemic (1-5%) and hyperendemic (>5%) (Stuerchler 1981 *apud* Pires & Dreyer 1993).

The occurrence of *S. stercoralis* in children aged from 0-14 years in some Brazilian states is summarized in Table I.

This study aimed at surveying the prevalence of *S. stercoralis* and other enteroparasites in nursing school children aging from four months to seven years, in Uberlândia, State of Minas Gerais, Brazil, from September 1994 to December 1995.

## **MATERIALS AND METHODS**

In 1994 Uberlândia had 49 nursery schools, from these ten were taken at random. The size of the sample was calculated according to the formula:  $n = Z^2 \times P \times Q/d^2$  (Rodrigues 1986) considering (Z) of 95%; (d) of 5%; (P) of 10%, obtained in a pilot study in three nursery schools, and a non-observed value (Q) of 90%; with the size of the sample (n) evaluated at 138 persons. This sample was amplified and 300 children were selected at random, 30 at each of the pre-determined school; these children were later identified according to sex and

age following the agreement of their parents or tutors for their participation.

Three fecal samples from each child were collected in plastic vials without preservatives with intervals of four to six days. The samples were stored in boxes with ice and analyzed at the Laboratory of Parasitology of the Universidade Federal de Uberlândia by the methods of Baermann and Moraes (BM) (Baermann 1917, Moraes 1948) and Lutz (Lutz 1919). For more adequate reading of the slides the larvae were fixed using 0.2 ml of a 10% solution of formalin applied to the residue of the first method. Five slides were prepared for the BM analysis and six for the Lutz analysis for each of the 900 samples. The total number of slides examination was thus 9900.

All the families of the children received the results of the laboratory diagnosis. The positive cases were referred to the Pediatric Polyclinic, where they received specific treatment.

The data were processed using the analysis of variance (Anova) and the Students' t according to Malleta (1992).

## **RESULTS**

*S. stercoralis* infection - From the 300 children studied 39 (13%) were infected with larvae of *S. stercoralis* in one of the three periods sampled. Of these cases, 28 cases were detected only by BM method (71.8%), nine of them only by the Lutz' method (23.1%) and two by both methods (5.1%). These differences were statistically significant by Anova, GL 2 and 6. Of these 39 cases nine (23%)

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were diagnosed only in the first sample; one (2.6%) in the first and third; one (2.6%) in all three samples; 14 cases (35.9%) in the second sample and 14 (35.9%) only in the third sample. These variations were not statistically significant by Anova GL 2 and 6. Regarding sex 25 (64.1%) cases of *S. stercoralis* were detected in boys and 14 (35.9%) in girls. Children in all ages were infected, except in those from zero up to one year. Table II has the number of children studied and test results by age category. There was no statistically significant difference in rates of infection by sex or age. Positive cases of *S. stercoralis* varied from 3.3% to 23.3% in the ten nursery schools.

*Other enteroparasites* - Of the 300 children studied 149 (49.7%) were boys and 151, girls (50.3%). Of these 265 (88.4%) were infected: 132 (49.8%) were boys and 133 (50.2%) were girls. The distribution of parasites, (excluding the positive children from the other sample) is represented in Table III. There were 171 (64.5%) children mono-infected; 72 (27.2%) bi-infected and 22 (8.3%) poly-infected. From the bi and poly-infected children there were 32 associated infections of *S. stercoralis*: *Giardia lamblia*, Stiles, 1915, in 17 cases (53.1%); *Ascaris lumbricoides*, Linnaeus, 1758, in four (12.5%); hookworms either *Ancylostoma duodenale* (Dubini, 1843) or *Necator americanus*, Stiles, 1903, in one (3.1%); *Hymenolepis nana* (Siebold, 1852) in one (3.1%); together with *G. lamblia* and *A. lumbricoides* in five (15.6%); *G. lamblia* and hookworms in two (6.2%); *G. lamblia* and *H. nana* in one (3.1%) and *G. lamblia* and *Enterobius vermicularis* (Linnaeus, 1771) in one (3.1%).

TABLE II  
Distribution of the 39 cases of *Strongyloides stercoralis* by age category of the children studied in Uberlândia between September 1994 and December 1995

Age category (year)	No. of children examined (n=300)	No. of positive cases (n=39)	% by positive cases	% by age category
0 - 1	8	0	0	0
1 - 2	55	6	15.4	10.9
2 - 3	61	8	20.5	13.1
3 - 4	48	6	15.4	12.5
4 - 5	55	7	17.9	12.7
5 - 6	42	8	20.5	19.0
6 - 7	31	4	10.3	12.9

TABLE III  
Frequency of enteroparasites among children aged from four months to seven years from ten nursery schools in Uberlândia, from September 1994 to December 1995

Parasites	No. of positive children	%
<i>Giardia lamblia</i>	235	78.3
<i>Ascaris lumbricoides</i>	46	15.3
<i>Strongyloides stercoralis</i>	39	13
<i>Hymenolepis nana</i>	20	6.7
Hookworms	18	6
<i>Enterobius vermicularis</i>	12	4
<i>Hymenolepis diminuta</i>	12	4
<i>Trichuris trichiura</i>	2	0.7

TABLE I  
Occurrence of strongyloidiasis in children in different states of Brazil

State	No. of children	Age category	No. of positive (%)	Parasitological methods	Authors (year)
Minas Gerais	1021	0-14 years old	82 (8)	Direct	Alonso (1967)
Amazonas	240	0-12 years old	4 (1.7)	Faust	Ferraroni et al. (1979)
Pernambuco	4312	0-14 years old	102 (2.4)	Lutz	Alves et al. (1982)
Maranhão	2634	0-14 years old	758 (28.8)	Direct, Rugai, Faust, Lutz	Cutrim-Jr et al. (1985)
Rio Grande do Norte	4441	0-14 years old	159 (2.9)	Lutz, Graham, BM	Cavalcanti-Jr et al. (1987)
Mato Grosso	149	3-72 months	5 (3.3)	Lutz	Latorraca et al. (1988)
Pernambuco	459	0-13 years old	44 (9.6)	Ritchie, Brumpt	Okazaki et al. (1988)
Goiás	1296	3 -23 months	79 (6.1)	Lutz, Faust	Santos et al. (1990)
Rio Grande do Norte	134	1-14 years old	32 (23.9)	Lutz, BM	Albuquerque et al. (1990)
Distrito Federal	298	1-12 years old	9 (3)	Ritchie	Almeida (1992)
Minas Gerais	94	0-12 years old	2 (2.1)	Lutz	Gennari-Cardoso et al. (1996)

BM: Baermann and Moraes.

## DISCUSSION

To the present time the records of children infected with *S. stercoralis* in the city of Uberlândia varied from zero (Berbert-Ferreira & Costa-Cruz 1995) and 2.1% (Gennari-Cardoso et al. 1996). Both of these studies were conducted using only one sample per case and using only the Lutz' method.

Using the procedure of three samples per child and two methods for diagnosis the rate of infection was found to be considerably increased, 13%. It is recommended that for effective diagnosis three samples are necessary: 71.8% of the cases in the present research were identified only in second and third samples. Additionally, the BM method was able to identify the infection in 30 (76.9%) of children studied.

No children of the 0-1 age category were found to be infected with *S. stercoralis* compatible with other research previously published: Marzochi and Carvalheiro (1978), Almeida and Costa-Cruz (1988), Berbert-Ferreira and Costa-Cruz (1995), Guimarães and Sogayar (1995). In the other age categories the rate of positive cases varied from 10.3% to 20.5% for *S. stercoralis* involving, 10.9% to 19% of children, indicating that this parasite is hyperendemic in the city.

In terms of other detected enteroparasites the rate of infection (88.4%) was classified as severe considering the damage that these etiologic entities may inflict on their hosts. This rate of infection is the highest found so far in this city, even when other age categories have been included (Costa-Cruz et al. 1991, Sá & Costa-Cruz 1991, Berbert-Ferreira & Costa-Cruz 1995, Costa-Cruz et al. 1996, Gennari-Cardoso et al. 1996). *G. lamblia* was the only pathogenic protozoan detected (235 cases). Seven species of helminthes were identified, of which *A. lumbricoides* presented the highest rate: 15.3%. The occurrence of 35.5% of children infected by more than one parasite demonstrated that enteroparasites represent a serious problem to the public health of Uberlândia.

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## REFERENCES

- Albuquerque LMM, Cavalcanti-Junior CB, Ribeiro MD 1990. Eosinofilia sangüínea em crianças com helmintíases intestinais. *Rev Anál Clin* 22: 26-30.
- Almeida IS 1992. Prevalência de *Giardia lamblia* em população infantil e condições ambientais no bairro Nossa Senhora de Fátima, Planaltina, D.F. *Bras Méd* 29: 5-10.
- Almeida LP, Costa-Cruz JM 1988. Incidência de enteroparasitas em habitantes do município de Araguari, Minas Gerais. *Rev Cen Ci Bioméd Univ Fed Uberlândia* 4: 9-17.
- Alonso MT 1967. Incidência de protozooses e helmintoses intestinais em crianças no Triângulo Mineiro. *Hospital* 72: 315-320.
- Alves JGB, Ferreira OS, Rocha JA 1982. Parasitoses intestinais em crianças atendidas no Ambulatório do Instituto Materno Infantil de Pernambuco (IMIP). *J Pediatr Rio de Janeiro* 52: 15-16.
- Baermann G 1917. Eine Einfache Methode zur Auffindung von Ankylostomum (Nematoden) Larven in Erdproben. Mededeel mit h. Geneesk. Lab Weltvreden Feestbundel, Batavia, p. 41-47.
- Berbert-Ferreira M, Costa-Cruz JM 1995. Parasitas intestinais em lactentes de 4 a 12 meses, usuários das creches da Universidade Federal de Uberlândia, Minas Gerais. *J Pediatr Rio de Janeiro* 71: 219-222.
- Cavalcanti-Junior GB, Ribeiro MD, Brito TNS, Araujo MCPE, Medeiros MCC 1987. Frequência de parasitoses intestinais numa amostra da população infantil do Rio Grande do Norte. *Rev Bras Anál Clin* 19: 75-76.
- Costa-Cruz JM, Ambrósio MR, Marques DE, Gennari-Cardoso ML, Couto JDV 1991. Inquérito coproparasitológico em escolares de Uberlândia, MG. *Rev Soc Bras Med Trop* 24 (Suppl. II): 141.
- Costa-Cruz JM, Ferreira MS, Rossin IR 1996. Intestinal parasites in AIDS and +HIV patients in Uberlândia, Minas Gerais, Brazil. *Mem Inst Oswaldo Cruz* 91: 685-686.
- Cutrim-Junior RJC, Fonseca PHM, Carneiro SFM 1985. Prevalência de entero-helmintos em pré-escolares e escolares do bairro da Vila Palmeira, São Luís - MA. *Arq Bras Med* 59: 467-468.
- Ferraroni MJR, Montoril-Filho M, Ferraroni JJ 1979. Parasitas intestinais numa população humana da cidade de Nova Olinda do Norte, Amazonas. *Acta Amazônica* 9: 657-659.
- Gennari-Cardoso ML, Costa-Cruz JM, Castro E, Lima LMFS, Prudente DV 1996. *Cryptosporidium* sp. in children suffering from acute diarrhea at Uberlândia city, State of Minas Gerais, Brazil. *Mem Inst Oswaldo Cruz* 91: 551-552.
- Guimarães S, Sogayar MJL 1995. Occurrence of *Giardia lamblia* in children of municipal day-care centers from Botucatu, São Paulo State, Brazil. *Rev Inst Med Trop São Paulo* 37: 501-506.
- Latorraca MQ, Meirelles SMP, Marchini JS 1988. Indicadores das condições nutricionais na região polonoroeste. V: desnutrição proteico-energética e parasitoses intestinais em um grupo de crianças de 3 a 72 meses de idade da cidade de Mirassol d'oeste, Mato Grosso, Brasil. *Rev Inst Med Trop São Paulo* 30: 192-196.
- Lutz AV 1919. *Schistosoma mansoni* e a schistosomose, segundo observações feitas no Brasil. *Mem Inst Oswaldo Cruz* 11: 121-125.
- Maletta CHM 1992. *Bioestatística em Saúde Pública*. 2nd. ed., Coopmed, Belo Horizonte, MG, 301 pp.
- Marzochi MC, Carvalheiro JR 1978. Estudos dos fatores

- envolvidos na disseminação dos enteroparasitas. *Rev Inst Med Trop São Paulo* 20: 31-35.
- Moraes RG 1948. Contribuição para o estudo do *Strongyloides stercoralis* e da estrogiloidíase no Brasil. *Rev Saú Públ* 1: 507-624.
- Okazaki M, Miranda P, Neto J, Diegues V, Alves J, Machado C, Tanabe M, Kobayashi S, Kaneto N, Nagakura K, Kobayashi M, Motta S, Taneto S, Takeuchi T 1988. Parasitological and serological studies on amoebiasis and other intestinal parasitic infections in Recife and its suburban area, Northeast - Brazil. *Rev Inst Med Trop São Paulo* 30: 313-321.
- Pires ML, Dreyer G 1993. Revendo a importância do *Strongyloides stercoralis*. *Rev Hosp Clin Fac Med São Paulo* 48: 175-182.
- Rodrigues PC 1986. *Bioestatística*, Ed. Universitária, Niterói, RJ, 227 pp.
- Sá MAR, Costa-Cruz JM 1991. Incidência de enteroparasitas nos centros de saúde do município de Uberlândia-MG, no ano de 1988. *Rev Soc Bras Med Trop* 24 (Suppl. II): 141.
- Santos MAQ, Paçô JM, Isac E, Alves EL, Vieira MA 1990. Prevalência estimada de parasitas intestinais em escolares de creches e estabelecimentos de ensino em Goiânia - Goiás. *Rev Patol Trop Goiânia* 19: 35-45.