

## INTESTINAL PARASITISM AND SOCIO-ENVIRONMENTAL FACTORS AMONG MBYÁ-GUARANI INDIANS, PORTO ALEGRE, RIO GRANDE DO SUL, BRAZIL

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### SUMMARY

Disturbing data reveal the prevalence of intestinal parasites and their relationship with socio-environmental factors among Mbyá-Guarani Indians. The prevalence was determined by spontaneous sedimentation in water, centrifugation-floatation, and Kato-Katz. A socioeconomic questionnaire was submitted to each family. The overall prevalence of intestinal parasites was 88.7%, and 45.5% were polyparasitized. There was 90.5% prevalence of enteric parasites in children (1-12- year-old), and 85% among 13-65-year-old individuals, indicating that both age groups are extensively parasitized. The parasite load was low to moderate for geohelminths and 75% of the families did not have latrine, thus the practice of defecation occurred outdoors. These findings suggest that the multiple intestinal parasitism in the Mbyá-Guarani community is high to the point of being the rule, and that it relates essentially to the traditional lifestyle and health habits. It is urgently necessary to implement the association of anti-parasitic treatment with sanitation improvement. This should be done simultaneously with health education activities for this population.

**KEYWORDS:** Enteroparasites; Mbyá-Guarani Indians; Polyparasitism; Indigenous health; Socio-environmental factors.

### INTRODUCTION

The permanent and indiscriminate contact of indigenous populations with the national society harms their traditional and millenary cultural habits and calls forth the establishment of an environmental and cultural unbalance in the villages<sup>4</sup>. This fact results in higher susceptibility among native indigenous people to local endemic illnesses such as enteroparasitic infections<sup>13,18</sup>. The indigenous population constitutes a socioeconomically disadvantaged segment in Brazil, and it is therefore vulnerable to infectious and parasitic diseases due to lack of instruction, deficient access to drinking water, feeding, health care, personal hygiene, and basic sanitation<sup>2,3,13,15,16,19,20</sup>. The prevalence of infectious and parasitic diseases is high among Amerindian populations<sup>18</sup>. Since the Indian ethnic groups are inserted in the urban society and no proper water supply exists to enable the adequate indigenous hygiene habits, the major problem is the absence of infrastructure destined for the collection of human and domestic animal waste and the nonexistence of drinking water in the villages. A recent study shows that the Guarani population in Southern and Southeastern Brazil structure is indicative of high birth and death rates, low average age and low life expectancy at birth<sup>3</sup>. The principal causes of death were respiratory (40.6%) and infectious and parasitic diseases (18.8%), suggesting precarious living conditions and deficient health services<sup>3</sup>.

The interest to carry out studies on prevalence of intestinal parasites

in indigenous populations rises from the fact that there are few reports in literature, and the existing ones show high rates of parasitism in these individuals<sup>19</sup>. However, these studies are still insufficient, and epidemiological surveys are imperative to contribute with new data to the knowledge of indigenous health in order to support the development of future health/public policies. Therefore, the aim of this study was to determine intestinal parasitism data and the socio-environmental factors among Mbyá-Guarani Indians from Lomba do Pinheiro, Porto Alegre, Rio Grande do Sul, Brazil.

### MATERIALS AND METHODS

This study was conducted in January 2010 within the Mbyá-Guarani ethnic group, located in the district of Lomba do Pinheiro in Porto Alegre, capital of Rio Grande do Sul (RS), Brazil (30°06'47.62" S and 51°07'37.85" W)<sup>17</sup>. This ethnic group is composed of 20 families, totaling eighty persons, between one and 75 years of age.

This village is called *Tekoá Anhetenguá* (in English, True Village), and it covers an area of 10 hectares, where there are small crops of maize, watermelon, and peanut. The Mbyá-Guarani population produces handicrafts through sculpture as a source of income. This indigenous population is undergoing acculturation and dramatic changes in life-style, and depends on non-indigenous society for earnings. Despite this close contact with society in a large urban center, the Mbyá conserve their

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culture and philosophy. The indigenous population has the possibility to use latrine infra-structure, but the great majority of them choose not to. Members of these communities live in wooden and/or brick and stone constructions with unpaved floors. Defecation occurs outdoors, whereas drinking water is supplied by DMAE (Municipal Department of Water and Sewer). There is a health care center in the village which offers medical, nursing and dental services. The non-indigenous neighborhood possesses the basic infrastructure.

The importance of this study was explained to the tribal leader of the village and, after his agreement, instructions on how to correctly collect the fecal samples were given to the population through a motivational lecture. Subsequently, the Term of Free and Clear Consent (TFCC) was read and explained to each indigenous family and then signed by each individual who accepted to participate in the study.

Three different techniques were used on a single stool sample: the spontaneous sedimentation method - HOFFMAN *et al.*, 1934<sup>9</sup>; LUTZ, 1919<sup>11</sup>, the centrifugation-floatation method - FAUST *et al.*, 1939<sup>6</sup>, and the quantitative method of Kato-Katz, 1972<sup>4,10</sup>. Regarding the Kato-Katz technique, we analyzed samples which presented *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms by the spontaneous sedimentation and centrifugation-floatation methods and excluded diarrheic samples. Based on the results of these tests, the following indicators were determined: prevalence of enteroparasite species according to age groups, prevalence of mono, bi and polyparasitism, most common associations between enteroparasites, and intensity of infection (parasite load) due to geohelminths (*Ascaris lumbricoides*, *Trichuris trichiura* and hookworms). Intensity of infection by geohelminths was classified as eggs per gram of feces (epg). For *A. lumbricoides*, low (1-4,999 epg), moderate (5,000-49,999 epg) and severe ( $\geq 50,000$  epg). For *T. trichiura*, low (1-999 epg), moderate (1,000-9,999 epg) and severe ( $\geq 10,000$  epg). For hookworms, low (1-1,999 epg), moderate (2,000-3,999 epg) and severe ( $\geq 4,000$  epg)<sup>21</sup>.

A questionnaire about housing and sanitation conditions was applied to the head of each indigenous family. The questions were posed in order to specify: number of cohabiting people, housing and floor material, presence of toilet, sharing the latrine or not, presence of drinking water and sewage. These questions were chosen as simple indicators of hygienic conditions, rather than specific risk factors for intestinal parasitic infections.

This study has received approval and authorization by all the following instances: (i) Research Committee, Faculdade de Farmácia, Universidade Federal do Rio Grande do Sul (UFRGS), Brazil, report no. 07/08; (ii) Research Ethics Committee, UFRGS, report no. 2007875; (iii) National Research Ethics Committee, registration no. 15092; (iii) Conselho Nacional de Pesquisa e Desenvolvimento (CNPq/Brazil); and (iv) Indian National Foundation (Fundação Nacional do Índio, (FUNAI), authorization for entering in indigenous territory no. 83/CGEP/09. At the end of the survey, the results were presented to the Chieftain and to the physician responsible for the treatment of the Mbyá-Guarani Indians.

## RESULTS

The parasitological test was submitted to 62 individuals, 44 females and 18 males, aged 1-65 years-old (68% aged between one and 12 years

of age). Fecal material provided by each of the individuals was sufficient to perform the spontaneous sedimentation in water, the centrifugation-floatation, and the Kato-Katz techniques. The parasitological analysis showed that 88.7% of native people were parasitized by enteroparasites. The overall prevalence showed the highest values for *Entamoeba coli* (58.1%), *Ascaris lumbricoides* (32.3%), and *Hymenolepis nana* (30.6%). Table 1 shows the prevalence of parasitic infections in different age groups: 1-12 and 13-65. It can be observed that 90.5% of children are infected with at least one parasite, and *Entamoeba coli* was the most common enteroparasite. In the other age group, the total prevalence observed was 85%, the non-pathogenic protozoa *E. coli* being responsible for 75% of infections. The most significant difference between the groups was the prevalence of *E. histolytica/E. dispar*: among the 1-12-year-old individuals it was 14.3%, and in the other age group it was 40%. Most importantly, the predominant values of *Strongyloides stercoralis* and *Enterobius vermicularis* may have been underestimated, since the techniques used were not the ones most recommended for their diagnosis. The results indicated that 16% of the overall infected individuals presented infection with one parasite species (monoparasitism), 38% presented two parasite species (biparasitism) and 45.5% were infected with more than two parasite species (polyparasitism).

**Table 1**

Prevalence according to enteroparasites species (%) and age groups among Mbyá-Guarani Individuals, Porto Alegre, RS, Brazil, 2010

Enteroparasites	Positive samples			
	1-12 years		13-65 years	
	N (42)	%	N (20)	%
<i>Entamoeba coli</i>	21	50	15	75
<i>Ascaris lumbricoides</i>	16	38	4	20
<i>Hymenolepis nana</i>	14	33.4	5	25
<i>Endolimax nana</i>	12	28.6	4	20
<i>Giardia lamblia</i>	12	28.6	3	15
<i>Entamoeba histolytica/E. dispar</i>	6	14.3	8	40
<i>Trichuris trichiura</i>	5	11.9	1	5
Hookworms	3	7.1	1	5
<i>Strongyloides stercoralis</i>	1	2.4	1	5
<i>Enterobius vermicularis</i>	0	-	1	5
Total	38	90.5	17	85

The most frequent associations of enteroparasites species found in infections in biparasitism and polyparasitism are shown in Table 2. The severe polyparasitism cases comprise two individuals. One of them presented infection with six distinct parasites species, among which are *Endolimax nana*, *Entamoeba coli*, *Giardia lamblia*, *Entamoeba histolytica/E. dispar*, *H. nana*, and hookworm. The other, a child, presented infection with five enteroparasites species: *A. lumbricoides*, *E. nana*, *E. coli*, *H. nana*, *E. histolytica/E. dispar*.

The intensity of the infection due to *A. lumbricoides* was moderate in two cases, in which the quantification revealed values of 32,688 epg and 10,080 epg; and one case of low parasite load was determined with 1,488 epg. For *T. trichiura* and hookworms, low parasite loads were observed with values of 96 epg and 384 epg respectively.

**Table 2**

Most common associations between enteroparasites in biparasitism and polyparasitism among Mbyá-Guarani individuals, Porto Alegre, RS, Brazil, 2010

Association of enteroparasites	Cases
<b>BIPARASITISM</b>	
<i>Ascaris lumbricoides</i> and <i>Entamoeba coli</i>	4
<i>Entamoeba coli</i> and <i>Endolimax nana</i>	3
<i>Endolimax nana</i> and <i>Giardia lamblia</i>	3
<b>TOTAL</b>	21 (38%) <sup>a</sup>
<b>POLYPARASITISM</b>	
<i>Hymenolepis nana</i> , <i>Entamoeba coli</i> and <i>Entamoeba histolytica/E. dispar</i>	2
<i>Hymenolepis nana</i> , <i>Giardia lamblia</i> and <i>Entamoeba coli</i>	2
<i>Endolimax nana</i> , <i>Entamoeba coli</i> and <i>Entamoeba histolytica/E. dispar</i>	2
<i>Giardia lamblia</i> , <i>Entamoeba coli</i> and hookworms	2
<b>TOTAL</b>	25 (45.5%) <sup>b</sup>

<sup>a</sup>38% of the 55 infected individuals presented biparasitism<sup>b</sup>40% of the 55 infected individuals presented polyparasitism.

The questionnaire revealed the socio-environmental conditions and hygiene habits among the families studied (Table 3). Most members of this village lived in constructions made out of wood (75%), and having a wooden (67%), or dirt (soil-made) floor (17%). Only 25% of houses had toilets. Consequently, the vast majority of families (75%) defecated outdoors, on open ground. This practice is performed in the surrounding houses, contributing to soil contamination and therefore increasing the risk of contamination of individuals who walk barefoot. Furthermore, the Mbyá-Guarani ethnic group has the habit of cooking in ground fire and there is no protection of food and utensils used from contact with the contaminated ground.

## DISCUSSION AND CONCLUSIONS

High infection rates due to intestinal parasites as well as the coexistence of different enteroparasitic species have been observed in Brazilian indigenous populations with harmful effects on their health, as reported among the Xavánte population (Central-West Brazil), Parakanã (Northern Brazil), Pankararu (Northeastern Brazil), Terena Indians (Central-West Brazil), Iauareté (Northern Brazil) and Kaingáng community (Southern Brazil)<sup>1,2,7,13,16,18</sup>. Several factors are responsible for the alarming number of parasitism in the Mbyá-Guarani village such as the practice of open defecation in the bushes surrounding the houses and the non-use of footwear, especially among children<sup>13,15,18</sup>. In a personal communication of the Mbyá-Guarani Chieftain José Cirilo

Pires Morinico, “the land for the Guarani culture is more than a place to live. The land is life and it represents our origin, and therefore our habits should not be judged as something that can bring contamination, impurities and facilitate the transmission of diseases”. Hence, the indigenous people do not concern themselves to use footwear and to wash the hands. Furthermore, the Mbyá-Guarani people have the habit of cooking in ground fire and there is no protection of food and utensils used from contact with the contaminated ground. MOURA *et al.* (2010) demonstrated that the high level of soil contamination in the village located in the State of Paraná, southern Brazil, constituted a potential source of parasitic infection<sup>15</sup>.

Despite the high prevalence of intestinal parasites, the parasite load was low to moderate, for that reason this community was classified as World Health Organization (WHO) level II<sup>21</sup>. For this level of enteroparasites infections, it is recommended to have improvements in sanitation, health education and treatment for high risk groups of intestinal parasites (women of reproductive age, preschool and school children). In a previous study the antiparasitic treatment associated with sanitation improvements and educational activities were shown as controlling measures in the short term, and producing direct impact on the prevalence and parasite load<sup>18</sup>.

Our data have become even more worrisome due to the fact that 90.5% of the positive samples were from children aged one to 12 and also that the majority (45.5%) of the population was polyparasitized. Two of them were infected with five or six different intestinal parasites. Although the indicators of undernutrition are multifactorial: parasitic infections such as those caused by *A. lumbricoides*, *T. trichiura* and hookworms can alone undermine growth due to depletion of nutrients<sup>5,20</sup>. Previous studies have shown that *H. nana* infections cause deficiency in vitamin B12 and folate, and high prevalence of undernutrition in patients<sup>14</sup>. MATOS *et al.* (2008) reported that *G. lamblia* infections, even asymptomatic ones, cause a negative impact on children’s growth<sup>12</sup>. Although there is potable water supply, the soil contamination, by open defecation, may be responsible for these rates. *E. coli* and *E. nana* occurred at rates of 58.1% and 25.8% in the overall prevalence. Previously, these amoebae were considered to be non-pathogenic protozoa, but are now accepted as parasites of variable virulence, depending on the environmental and/or individual conditions of the host. Furthermore, it has been shown that the species *E. nana* may be associated with diarrhea among children, if at high prevalence and intensity<sup>8</sup>.

From the standpoint of public health, it was found that the Mbyá-Guarani Indians were exposed to risks of infection due to the lack of sanitation and the maintenance of indigenous traditional health habits, such as the disposal of human and solid waste in the peri-domiciliary areas. The existence of some infrastructure such as local health care, school and electricity supply was also observed. In most cases, solid waste was scattered in the surroundings such as near sources of water or on the

**Table 3**

Socio-environmental data of the Mbyá-Guarani village from Lomba do Pinheiro, Porto Alegre, RS, Brazil (n = 62)

House	Floor	Toilet	Sanitary facilities	Electricity
Clay walls 8%	Soil-made 17%	Latrine 25%	Presence 25%	Presence 83%
Wood/ masonry 75%	Wood/ masonry 67%	No latrine 75%	No presence 75%	No presence 17%
Concrete 17%	Concrete 16%			

ground. Periodic parasitological studies, including the quantification of the parasitic load are necessary for the control of intestinal parasites in the village, as well as the evaluation of policies and measures to combat infections transmissions. Therefore, health education also needs to be implemented together with sanitary policies improving the living, social, and economic conditions of this community. Thus, the presence of human and solid waste in peri-domiciliary areas associated with high prevalence of intestinal polyparasitism, the increasing urbanization and the lack of sanitation has negatively affected the quality of life of the Mbyá-Guarani Indigenous population from Lomba do Pinheiro, Rio Grande do Sul, Brazil.

## RESUMO

### Parasitismo intestinal e fatores socioambientais de indígenas Mbyá-Guarani, Porto Alegre, Rio Grande do Sul, Brasil

Dados preocupantes demonstram a prevalência de parasitos intestinais e sua relação com fatores socioambientais entre indígenas Mbyá-Guarani. A prevalência foi determinada pelas técnicas de sedimentação espontânea em água, centrífugo-flutuação e Kato-Katz. Para cada família, um questionário socioeconômico foi aplicado. A prevalência geral de parasitos intestinais foi de 88,7% e 45,5% estavam poliparasitados. A prevalência em crianças (1-12 anos) foi 90,5% e em indivíduos entre 13-65 anos foi 85%, indicando que ambas as faixas etárias são amplamente parasitadas. A carga parasitária foi baixa a moderada para geohelminthos e 75% das famílias não possuem banheiro, sendo a prática da defecação feita ao ar livre. Estes achados sugerem que o poliparasitismo intestinal na comunidade Mbyá-Guarani é altíssimo, a ponto de ser a regra, e que se refere essencialmente ao estilo de vida tradicional e hábitos de saúde. Há a necessidade de aplicar urgentemente a associação de tratamento antiparasitário às melhorias sanitárias. Isto deve ser feito simultaneamente com atividades de educação em saúde para esta população.

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## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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