

INTESTINAL PARASITOSEs AMONG INDIGENOUS PEOPLE OF XERENTE ETHNIC OF THE SALTO VILLAGE, TOCANTÍNIA CITY, PROVINCE OF TOCANTINS, BRAZIL

Josefa Moreira do Nascimento Rocha¹, Valdir Francisco Odorizzi^{2,3}, Paulo Roberto Blanco Moreira Norberg⁴,
Guilherme Goulart Oliveira², Rayza Karlla Sales Araújo², Antonio Neres Norberg^{*4,5}

¹Uni-Anhanguera Goiás University Center, Goiás, Brazil.

²Presidente Antonio Carlos Institute – ITPAC, Tocantins, Brazil.

³Tocantins Federal University – UFT, Tocantins, Brazil.

⁴São Carlos Metropolitan School – FAMESC, Rio de Janeiro, Brazil.

⁵Unibaue University Center, Rio de Janeiro, Brazil.

*Corresponding Author: Dr. Antonio Neres Norberg

Unibaue University Center, Rio de Janeiro, Brazil.

Article Received on 21/02/2019

Article Revised on 11/03/2019

Article Accepted on 31/03/2019

ABSTRACT

Intestinal parasitism is caused by helminth and protozoan species and, depending on the pathogenicity of the etiological agent, can cause the death of the infected one. High rates of parasitism are often related to the pollution of water, soil and food. This research had the objective to perform a parasitological survey on the Xerente indigenous population of the Salto village in the city of Tocantínia, Province of Tocantins, Brazil. A total of 104 fecal samples were examined from volunteers of both genders and different age groups. For the parasitological diagnosis, the samples were submitted to the techniques of Hoffman, Pons and Janer, Ritchie and Kinyoun. The overall prevalence for parasites was 89.42%. The prevalence by species were: *Ascaris lumbricoides* (63,46%), *Hymenolepis nana* (20,19%), Ancylostomatidae (13,46%), *Strongyloides stercoralis* (7,69%), *Trichuris trichiura* (7,69%), *Entamoeba coli* (31,73%), *Entamoeba histolytica/dispar* (14,42%), *Giardia lamblia* (8,65%), *Endolimax nana* (7,69%) and *Iodamoeba butschlii* (4,81%). This research contributed to know the identity of the parasites incident among the Xerente population and guided the appropriate drug intervention.

KEYWORDS: Enteroparasitoses, Protozoan, Helminths, Indigenous people, Xerente.

INTRODUCTION

The etiological agents of intestinal parasitoses are among the pathogens most commonly found in humans. They are represented by helminths and protozoa and are one of the great problems of world public health.^[1,2]

Parasitic diseases have wide geographic distribution, with variable incidence according to the characteristics of the environment and the involved species of the parasites.^[1,3] The morbidity in endemic areas is closely associated with the intensity and chronicity of the parasitoses, which are generally closely related to sociodemographic and environmental aspects, such as: problems inherent to poor or absent basic sanitation infrastructure; unavailability or difficulty in obtaining potable water; precarious socioeconomic conditions, deficient or unbalanced nutritional status, among others.^[4,5]

Despite many efforts by the world public health authorities to control parasitic diseases, a considerable reduction in morbidity for these diseases was not achieved until now. Parasitic diseases can affect all

members of a family, especially families with low economic conditions. Lack of hygiene and inadequate nutrition are facts which contribute to the spread of these etiological agents. The epidemiology of enteroparasitoses in some groups and regions are not well known, considering that parasitized individuals not always attends to health care services for diagnosis and treatment, mainly because they do not perceive the presence of the parasite since most of the parasitoses are chronic and do not present noticeable symptoms.^[3,6,7]

Enteroparasitoses can remain asymptomatic or induce several clinical manifestations with characteristic symptoms. Parasitic infestations in immunocompromised patients are worrisome. Enteroparasites usually do not cause high lethality, but some isolated or associated infections can contribute to affect the nutritional balance, induce intestinal bleeding and malabsorption of nutrients, compete for the absorption of micronutrients, reduce food intake, cause surgical complications such as rectal prolapse, obstruction and intestinal abscess, acting through several mechanisms, among them spoiler and allergen actions. As a result of the spoiler action, clinical condition of iron deficiency anaemia may occur, which

in adults can interfere with the reproductive capacity.^[8,9,10]

The prevalence of parasitoses in the world population can be evinced by the bulletins published by the World Health Organization, which in 1999 estimated that in the world 250x10⁶ are infested by ascarids; 151x10⁶ by hookworms; 45.5x10⁹ by tricurids; 1.7x10⁶ by onchocerciasis.^[1] From a medical and social point of view, these parasites represent important public health problems which, in addition to constantly threatening for the well-being of a large part of the population, cause considerable economic losses with medical care, lessen work productivity or causing incapacitation for work. The gastroenteritis caused by *Entamoeba histolytica* represented a serious public health problem as reported in 1997, when 47 million cases occurred, causing about 170 thousand deaths among them. Since 1980, with the AIDS epidemic, amebiasis, toxoplasmosis, other protozooses, bacterioses and viruses become more important as diseases and were responsible for most of the death causes in patients with HIV-related diseases.^[1]

In the scientific literature, we did not find epidemiological data on parasitoses among Xerente indigenous people, which makes this manuscript unprecedented, since the rate of intestinal parasitoses in that population group was unknown until now. The present research had the objective to investigate the prevalence of enteroparasitoses among the Xerente indigenous population of the Salto village, in the city of Tocantínia, Province of Tocantins, Brazil.

MATERIAL AND METHODS

Studied population

Indigenous people of the Xerente ethnic group have been in contact with the non-indigenous society for more than two centuries, when they acquired, added and merged their knowledge with the culture of the non-indigenous world without losing their own identity and language.^[11] Thereby, the Xerente people, to keep in their culture and language, only speaks in Portuguese with people from outside of the village. Many children have difficulty expressing themselves in Portuguese because the literacy process is initially in their native language, and only in later scholar grade the Portuguese language is taught.^[12,13] Indigenous people of the Xerente and Xavante ethnic groups belongs to the linguistic branch Macro-Jê, and call themselves Akwë, which means, according to their own people, "something that is above all things", "the most remarkable", "human" or "people". At the end of the nineteenth century, the secession between these two groups occurred. Xavante people migrated to the Province of Mato Grosso and the Xerente group remained along the Tocantins River.^[13] Currently, Xerente are classified as Central-Jê, and are established at the city of Tocantínia, 76 km from Palmas, Province of Tocantins. They live in two reserves: Porteira and Funil, where 60 villages and 3350 inhabitants are

established, being 1689 (50.42%) men and 1661 (49.58%) women.^[13]

Research design and study field

This prevalence research has a descriptive and observational design, supported by laboratory fecal exams, with a representative sample. All procedures and the importance of the research were explained to the community members. Through random and free demand, after express consent of the participants or their caregivers, in case of children, indigenous people of the Xerente ethnic group with ages ranging from 1 to 74 years contributed to this research. All research procedures respected the ethical norms, culture deference, health preservation and the total integrity of the patients, as well as the maintenance of anonymity, based on the precepts of the Declaration of Helsinki, the XVII World Medical Assembly and the Convention 169 about Indigenous and Tribal Peoples of the International Labor Organization (ILO). The results of the parasitological research were delivered to all participants by individual medical cards with the appropriated antiparasitic drug and the dosage prescription.

Sample, material and laboratory methods

The research used a convenience and representative sampling, with 104 sample units. The collection of each fecal aliquot was explained regarding the procedure and preservation to the participants, donated voluntarily by the adults and, in case of children samples, their caregivers. All samples were identified for treatment purposes, in case of positivity for intestinal parasites. The samples were preserved in 10% formalin solution and sent to the Parasitology Laboratory of the Medicine School of the Presidente Antonio Carlos Institute (ITPAC) in the city of Porto Nacional, Brazil. The laboratory methods used were the techniques of Hoffman, Pons and Janer^[14], Ritchie and Kinyoun. In order to determine the prevalence of protozoan cysts, eggs and helminth larvae, two preparations between slide and coverslip for each sample were used.

RESULTS

Among the 104 analyzed samples, 93 were positive, corresponding to a prevalence rate for enteroparasitoses of 89.42%. In the studied indigenous population, there was a high incidence of parasitism, with predominance of *Ascaris lumbricoides* (63.46%) as the main representative of helminths and *Entamoeba coli* (31.73%) among protozoa. Two cases of *Enterobius vermicularis* infection were diagnosed, but this low number of positives is due to the fact that the employed technique was not the proper for the detection of this helminth, which requires the Graham technique (Scotch tape test). This technique was not used in our research, but the finding of *Enterobius vermicularis* through traditional coproscopy techniques reveals the existence of this parasite in the Salto village and points to an incidence rate higher than that found in our research. Prevalence rates by species were: *Ascaris lumbricoides*

(63.46%), *Hymenolepis nana* (20.19%), Ancylostomatidae (13.46%), *Strongyloides stercoralis* (7.69%), *Trichuris trichiura* (7.69%), *Entamoeba coli* (31.73%), *Entamoeba histolytica/dispar* (14.42%), *Giardia lamblia* (8.65%), *Endolimax nana* (7.69%) and *Iodamoeba butschlii* (4.81%). The number of multiparasited people was also significant, corresponding to 70.19% of the total population and 78.49% of the parasitized individuals, being the most frequent association between *Ascaris lumbricoides* and *Entamoeba coli*, with 19 cases.

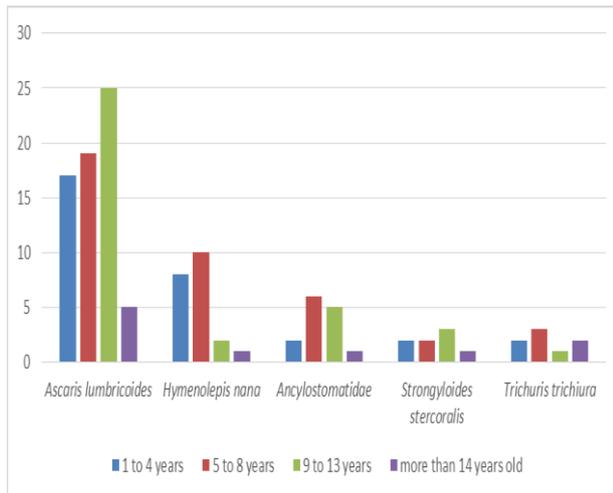


Figure 1: Parasitism cases by helminth species, distributed by age class, among Xerente ethnic people of the Salto village, city of Tocantínia, Province of Tocantins, Brazil.

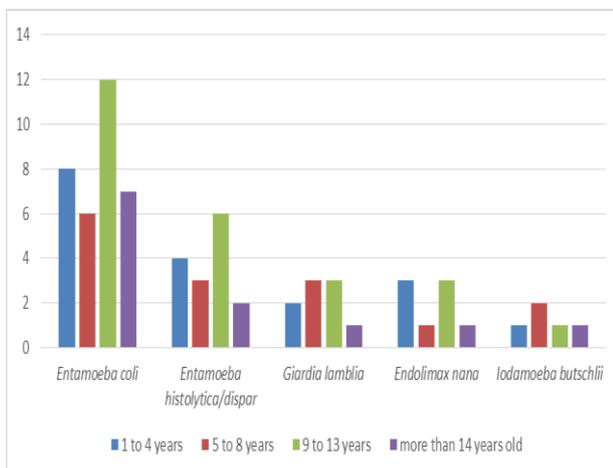


Figure 2: Cases of parasitism by protozoan species, distributed by age group, among Xerente indigenous people of Salto village, city of Tocantínia, Province of Tocantins, Brazil.

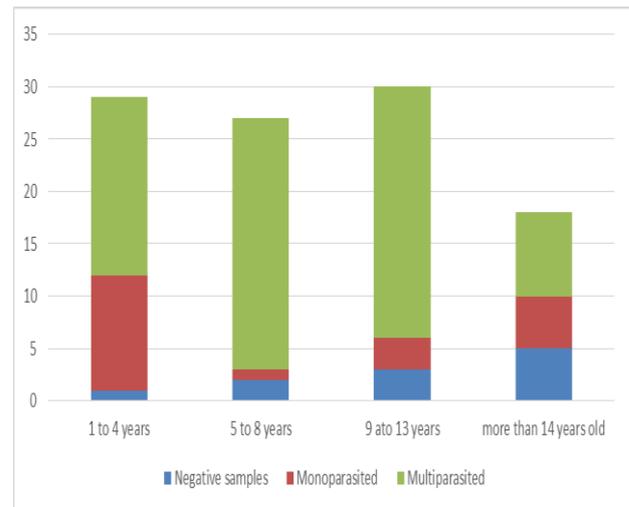


Figure 3: Distribution of cases of parasitism by one or more species of enteroparasites, by age group, among Xerente indigenous people of Salto village, city of Tocantínia, Province of Tocantins, Brazil.

DISCUSSION

The intestinal parasitoses in three indigenous Pankararé villages were evaluated by Souza-Oliveira *et al.*^[15] The villages are located in the semi-arid region of the city of Glória, in the northeast of the Province of Bahia, Brazil. The investigation analyzed 134 fecal aliquots. Laboratory tests were performed at the Laboratory of the 1st Infantry Company of the Brazilian Army, at the city of Paulo Afonso. The authors employed the methods of Hoffman, Willis and Kinyoun and identified infections by nematode helminths of the family Ancylostomatidae, cestodes of the species *Hymenolepis nana*, also parasitism by the protozoans *Cryptosporidium* spp, *Giardia lamblia*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba histolytica/dispar*. The total parasitism prevalence for this group was 37.1%, a rate lower than those found in other indigenous populations, including among the Xerente, where our results showed 89.42% of positivity. We consider that the low incidence of parasites among the Pankararé ethnic people may be related to the location of the villages, in the semi-arid region of the Brazilian northeast, where environmental conditions could be harder for the survival of some parasitic agents.

Andrade *et al.*^[16] performed a parasitological survey among the Kayapó indigenous people established in the rural area of the city of Ourilândia do Norte, in the Province of Pará, Brazil. The authors examined 28 fecal samples with universal population representativity. Samples were stored in Merthiolate-iodine-formalin solution (MIF) and the tests were performed by the techniques of Hoffman, Pons and Janer; Willis and Kinyoun. The identified parasites were: nematode helminth infections of the species *Ascaris lumbricoides*, *Enterobius vermicularis*, *Trichuris trichiura*, Ancylostomatidae, cestodes of the species *Hymenolepis nana*, and protozoa of the species *Cryptosporidium*

parvum, *Endolimax nana*, *Entamoeba coli*, *Entamoeba histolytica/dispar* and *Giardia lamblia*. There was registered a positivity of 85.6%, a prevalence rate very close to that found among the Xerente, which was 89.42%.

The frequency of intestinal parasitoses among Terena ethnic people in the Province of Mato Grosso do Sul, Brazil, was investigated by Norberg *et al.*^[17] 134 samples of people from the Moreira village were examined and the follow species were found: *Ascaris lumbricoides*, Ancylostomatidae, *Enterobius vermicularis*, *Strongyloides stercoralis*, *Trichuris trichiura*, cestodes of the species *Hymenolepis nana*, and protozoan of the species *Giardia lamblia*, *Endolimax nana*, *Entamoeba coli* and *Entamoeba histolytica/dispar*. These authors found an enteroparasitoses prevalence of 76,9%, lower than the results obtained among the Xerente ethnic people.

The prevalence of intestinal parasitoses among children of the indigenous community of Cacique Dobles, in the Province of Rio Grande do Sul, Brazil, was investigated by Incerti & Umpierre.^[18] The research results showed a positivity rate of 67.2%. The most frequent parasitic elements were *Ascaris lumbricoides*, *Hymenolepis nana*, hookworms, *Entamoeba coli* and *Iodamoeba butschilli*. Multiparasitism was more frequent in the age group from 7 to 9 years, with 32.6% of positive cases. The authors considered that the research was the first to identify the prevalence of parasitoses and sanitation conditions in the indigenous population of Cacique Doble, which confirmed the degree of social vulnerability, high rate of parasitic infection, and insufficient infrastructure for the waste destination of the village, and commented that similar aspects are observed in several indigenous ethnic groups in Brazil. We agree with the aspects cited by the authors when we found similar situations in the Salto village, which has a higher rate of parasitism, corresponding to 89.42% of the studied population.

The nutritional status, incident enteroparasitoses and sanitary conditions of the indigenous villages in the Province of Minas Gerais were reported by Xavier-Carvalho *et al.*^[19] These authors determined the distribution of intestinal parasites and its association with the nutritional and sanitation aspects, microbiological quality of the water and the virulence of the strains of *Escherichia coli* isolated from the drinking water used by people of these communities. The research exposed a high prevalence of intestinal parasites and contamination of water by *Escherichia coli*, an indicator of fecal matter contamination, in half of the investigated households. Our research with the indigenous Xerente also converges with the result found by the authors, with a high prevalence of enteroparasites. We did not perform colimetry in the water used for drinking, but we also considered that the high prevalence of enteroparasitoses should be related to the quality of the water used by the Xerente people. The main water source of the Salto

village is a nearby stream, and it is distributed without any kind of treatment process.

Malta^[20] investigated the prevalence of intestinal parasites in indigenous populations and poor populations and the key factors involved in the epidemiology of enteroparasitoses. The author performed an enteroparasitological survey in two indigenous villages: in the Bororó reserve in the city of Dourados, Province of Mato Grosso do Sul and in the Xingu reserve in the Province of Mato Grosso. The study involved Kayabi and Juruna indigenous people. The poor non-indigenous people were residents of two cities: Pontes and Lacerda, Province of Mato Grosso do Sul, and Itateguara, Province of Alagoas. A total of 2754 fecal samples were examined, and the results showed a 73% prevalence for enteroparasitoses among the indigenous population of the Bororó reserve, and 62.77% among the people living in the Xingu reserve; 52.61% among poor inhabitants of the city of Pontes and Lacerda and 67.42% in the poor people of Itateguara. The research showed that the prevalence of protozoa (42.6%) was higher than that of helminths (31.1%). The result revealed multiparasitism in 12.8% of the samples, and monoparasitism in 46.1%. Our results differ significantly from those found by Malta,^[20] since the intestinal parasitism rate among the Xerente was higher (89.42%), the prevalence of helminths was higher than that of protozoa, and multiparasitism was the most frequent infection condition for all age groups, corresponding to 78.49% of the total parasitized individuals. Such differences reinforce the need for researches regarding particularities of each indigenous population group, where cultural, environmental and socioeconomic conditions are determinant for parasitism rates and fundamental for the planning of public health treatment and preventive actions.

Cardona-Arias *et al.*^[21] performed a parasitological investigation among 184 indigenous children under fifteen years old living in Cañamomo-Lomapieta, region of Caldas, Colombia, and found a prevalence for pathogenic parasites of 83.4%. These authors also warned health authorities suggesting the need to improve education, health care and preventive health programs, considering the serious consequences of these infections and diseases for individual and collective health. We consider that such procedures should also be adopted in order to improve the living conditions of the Xerente indigenous people, considering that the prevalence of enteroparasitism was as high as that found by Cardona-Arias *et al.*^[21] in Colombia.

The prevalence of intestinal parasitoses among Warao ethnic people of the María López community, in the city of Benítez, Province of Sucre, Venezuela, was investigated by Guilarte *et al.*^[22] Fecal samples from 126 people aged from 2 to 64 years were examined. Among the identified parasites, helminths were predominant: Hookworms (79.6%), *Trichuris trichiura* (69.76%),

Blastocystis spp. (55.84%), *Ascaris lumbricoides* (25.58%), *Hymenolepis nana* (1.29%) and the Protozoan *Endolimax nana* (49.35%), *Entamoeba coli* (44.15%), *Iodamoeba butschlii* (38%), *Giardia duodenalis* (9.09%), *Chilomastix mesnili* (3.89%), *Entamoeba histolytica/dispar* (2.59%). These authors commented that the environment is the main source of contamination, considering that 81.75% of the inhabitants of this community defecate in the soil and do not attempt to basic hygiene norms. These researchers reflected that educative measures may lower prevalence rates of parasitism. We consider that similar preventive and educational measures should also contribute to lower parasitism rates among Xerente ethnic people and the results of this research can be the source to design these measures.

Gavina *et al.*^[23] determined the prevalence of intestinal parasitoses among children of the Nasa-Caldono indigenous reserve in the Province of Cauca, Colombia, and evaluated the distribution according to clinical, sociodemographic and health infrastructure variables. The research examined 62 fecal samples of indigenous children and the results of the coproscopies revealed a positivity for enteroparasites of 95.2%, including commensal and pathogenic parasites of the species: *Blastocystis* spp. (47.8%), *Entamoeba coli* (72.6%), *Endolimax nana* (50%), *Entamoeba histolytica/dispar* (46.8%), *Entamoeba hartmanni* (41.9%), *Ascaris lumbricoides* (32.3%), *Giardia intestinalis* (30.6%), *Chilomastix mesnili* (30.6%), *Iodamoeba butschlii* (25.8%), *Trichuris trichiura* (17.7%), *Cryptosporidium* spp. (3.2%), *Enterobius vermicularis* (1.6%). Regarding the clinical conditions of the studied population, the authors diagnosed anaemia (21.0%), chronic malnutrition (35.5%), acute malnutrition (8.1%). The authors emphasized that the prevalence of 95.2% corresponds to the highest rate reported by the National Survey of Intestinal Parasitism in Colombia, and considered that the high prevalence of parasitoses is related to the contamination of the environment with fecal matter, poor hygienic conditions and untreated drinking water.

A cross-sectional study to determine the prevalence of intestinal parasites among indigenous people of the San Antonio de Raudalito village in the Province of Bolivar, Venezuela, was performed by Devera *et al.*^[24] These authors examined 62 fecal samples of people aged between less than one year old and 72 years old and the prevalence of parasites was 88.7%, with no differences in the parasitic profile between the age groups. Of the 55 positive cases, 83.6% presented multiparasitism. Protozoa species found were *Entamoeba coli* (64.5%), *Giardia lamblia* (27.4%), *Entamoeba histolytica/dispar* (21.0%), *Iodamoeba butschlii* (19.3%), *Endolimax nana* (9.7%), *Chilomastix mesnili* (3.2%), and the Chromista *Blastocystis* spp 36 (58.1%). Among the helminths, hookworms (32.3%), *Trichuris trichiura* (6.5%), *Hymenolepis nana* (1.6%) and *Strongyloides stercoralis* (1.6%). Although the high levels of parasitism, similar

to those found in our research in Salto village, the inhabitants of the community of San Antonio del Raudalito did not present parasitism for *Ascaris lumbricoides*, the most prevalent parasite species among Xerente ethnic people.

The prevalence of enteroparasitoses among vulnerable children population of indigenous and non-indigenous communities of rural areas of Paraguay, and to evaluation of their socio-environmental characteristics, was studied by Echagüe *et al.*^[25] The researchers evaluated 247 children under five years old of both genders, performed coproscopical examinations and applied surveys to know the sociodemographic data. The results of coproscopies pointed epidemiological differences between indigenous and non-indigenous children. The frequency of parasitoses among indigenous children was 56.1%, while among non-indigenous children it was 35.5%. In both populations the most frequent enteropathogens were *Giardia lamblia* and *Blastocystis hominis*. Among Xerente ethnic people, parasitism rates were higher when compared to both populations studied by Echagüe *et al.*^[25]

A research of intestinal parasitism among Toba Qom ethnic children from the San Francisco de Asis village in the city of Benjamín Aceval, Paraguay, was performed by Norberg *et al.*^[26] Ninety fecal samples were examined through the techniques of Hoffman, Pons and Janer, Willis and Kinyoun, of which 58 were positive for enteroparasites (64.44%). The species found were: the nematodes *Ascaris lumbricoides* (1.11%), *Strongyloides stercoralis* (4.44%); cestodes of the species *Hymenolepis nana* (11.11%) and *Taenia* spp. (1.11%); protozoa of the species *Entamoeba coli* (25.55%), *Entamoeba histolytica/dispar* (10%), *Giardia lamblia* (7.78%), *Endolimax nana* (8.89%), *Iodamoeba butschlii* (6.67%) and the Chromista *Blastocystis* spp. (7.78%). According to the authors, the parasitological profile of the Toba Qom ethnic children has quite different characteristics when compared to that of other indigenous groups cited in the scientific literature. This fact is also observed in the comparison with our result. We highlight that the predominant parasite among the Xerente ethnic people, *Ascaris lumbricoides* (63.46%), was the least prevalent among the Toba Qom (1.11%).

CONCLUSION

From the analysis of the results, we concluded that there is a high prevalence of enteroparasites among the inhabitants of the Xerente ethnic people of Salto village, in the city of Tocantínia, Province of Tocantins, Brazil. Prevalence rates by species were *Ascaris lumbricoides* (63.46%), *Hymenolepis nana* (20.19%), Ancylostomatidae (13.46%), *Strongyloides stercoralis* (7.69%), *Trichuris trichiura* (7.69%), *Entamoeba coli* (31.73%), *Entamoeba histolytica/dispar* (14.42%), *Giardia lamblia* (8.65%), *Endolimax nana* (7.69%) and *Iodamoeba butschlii* (4.81%). The most frequent parasitic condition was multiparasitism (78.49%). These

results were the basis for a drug intervention against enteroparasitoses and the design of preventive and health education actions for the local population in order to avoid reinfection by these parasitic agents.

REFERENCES

1. Rey L. Parasitologia. Ed Guanabara Koogan, Rio de Janeiro, 2013.
2. Muchiutti B, Lima LLA, Gabriel D, Escobar M, Garcia A, Lima A. Prevalência de parasitoses intestinais em crianças de creches no município de Sinop, MT. Biosc J Uberlândia, 2013; 29(2): 487-498.
3. Coura JR. Dinâmica das Doenças Infecciosas e Parasitárias. Ed Guanabara Koogan, Rio de Janeiro, 2013.
4. Beniello VG, Milanese BA, Rosa AB, Bussular JPB, Moraes AM, Vieira-Filho SA *et al.* Intestinal parasites in students 10 to 15 years of school of São Matheus periphery, ES, Brazil. Eur J Sci Res, 2011; 53(2): 171-178.
5. Firmo-Oliveira V, Amor ALM. Associação entre ocorrência de parasitas intestinais e diferentes variáveis clínicas epidemiológicas em moradores da comunidade Ribeiro-Araci, Bahia, Brasil. RBAC, 2012; 44(1): 15-25.
6. Campos-Cardozo GE, Cañete-Duarte Z, Lenortois V. Frecuencia de enteroparásitos en niños y niñas del primer ciclo de la educación escolar básica de Escuelas Públicas de Ciudad del Este, Paraguay. Mem Inst Investig Cienc Salud, 2015; 13(1): 24-30.
7. Veronesi R, Focaccia R. Tratado de Infectologia. Ed Guanabara Koogan, Rio de Janeiro, 2015.
8. Marquez AS, Hasenack BS, Trapp EH, Guilherme RL. Prevalência de enteroparasitoses em crianças de um bairro de baixa renda em Londrina, Paraná. UNOPAR Cient Cienc Biol Saúde, 2002; 4(1): 55-59.
9. Sales-Barbosa GM, Teixeira AS. Índice de morbidade para enteroparasitoses intestinais: estudo descritivo dos exames coproparasitológicos do bairro de Austin, Nova Iguaçu, RJ, Brasil. Rev Cienc Tecnol UNIG, 2011; 11(1): 34-45.
10. Guerra-Sanches F, Machado ECS, Soares RP, Norberg AN, Madeira-Oliveira JT, Serra-Freire NM. Parasitismo intestinal na comunidade rural de Marancó, município de Santa Brígida, estado da Bahia, Brasil. Rev Saúde Física & Mental, 2013; 39-49.
11. Moi FP (org). Os Xerente: um enfoque etnoarqueológico. Ed Acervo, São Paulo, 2007.
12. Freire JVFF. Da assimilação à conquista do direito à diferença: educação escolar indígena no Brasil. UNB. Departamento de Antropologia, 2013.
13. Rocha TES, Costa NMS, Nascimento MM, Silva RP. Identificação da alimentação atual do povo Xerente nas aldeias indígenas no estado do Tocantins. Rev Investigação Qualitativa em Saúde, 2015; 1: 594-599.
14. Hoffman WA, Pons JA, Janer JL. The sedimentation-concentration method in schistosomiasis mansoni. Puerto Rico. J. Pub Health Med Trop, 1934; 9: 283-298.
15. Souza-Oliveira EP, Xavier NF, Norberg AN, Guerra-Sanches F, Norberg PRBM, Serra-Freire NM. Análise comparativa do parasitismo intestinal de ameríndios da etnia Pankararé em três aldeias no estado da Bahia, Brasil. InterScience Place, 2013; 26(1): 116-131.
16. Andrade RCR, Norberg AN, Serra-Freire NM, Madeira-Oliveira JT, Guerra-Sanches F, Santa-Helena AA, Norberg PRBM. Prevalência de parasitos intestinais em ameríndios Kayapós do estado do Pará, Brasil. Rev Saúde Física & Mental, 2013; 3(2): 50-58.
17. Norberg AN, Guerra-Sanches F, Norberg PRBM, Madeira-Oliveira JT, Santa-Helena AA, Serra-Freire NM. Enteroparasitismo en indígenas de la etnia Terena en el estado de Mato Grosso do Sul, Brasil. Rev Salud Pública, 2014; 16(6): 768-778.
18. Incerti J. Prevalência de parasitoses intestinais entre crianças da comunidade indígena de Cacique Doble / RS. UFRGS, 2013.
19. Xavier-Carvalho GL, Costa-Silva J, Queiroz-Silva S, Teixeira LFM, Reis VW, Marinho CC, Bahia MT *et al.* Estado nutricional, enteroparasitoses e condições sanitárias: uma análise dos povos indígenas aldeados em Minas Gerais. Rev Saúde Pública do SUS / MG, 2013; 1(1): 83-84.
20. Malta RCG. Enteroparasitoses em comunidades indígenas brasileiras. (Tese de Doutorado). Universidade de Campinas – UNICAMP, 2011.
21. Cardona-Arias J, Riveira-Palomino V, Carmona-Fonseca J. Salud indígena en el siglo XXI: parásitos intestinales, desnutrición, anemia y condiciones de vida en niños del resguardo indígena Cañamomo-Lamprieta, Caldas. Rev Colombia Med, 2014; 27(2): 29-39.
22. Guilarte V, Gómez E, Hen F, Garantón A, Marín L. Aspectos epidemiológicos y hematológicos asociados a las parasitoses intestinales en indígenas Waraos de una comunidad del estado Sucre, Venezuela. Rev Interciencia, 2014; 39(2): 116-121.
23. Gavina LM, Soscus D, Campo-Polanco LF, Cardona-Arias J, Ganván-Díaz AL. Prevalencia de parasitosis intestinal, anemia y desnutrición en niños de un resguardo indígena Nasa Cauca – Colombia. Rev Fac Nac Salud Publica, 2017; 35(3): 390-398.
24. Devera R, Barros C, Tomassi R, Espinoza P, Blanco Y, Amaya I, Requena I, Nastasi-Miranda J. Parásitos intestinales en habitantes de la comunidad indígena San Antonio de Raudalito, estado Bolívar, Venezuela. Saber Universidad de Oriente, 2018; 30: 314-320.
25. Echagüe G, Rosa L, Sosa L, Díaz V, Ruiz I, Rivas L, Granado D *et al.* Enteroparasitosis en niños bajo 5 años de edad, indígenas y no indígenas, de comunidades rurales del Paraguay. Rev Chilena Infectol, 2015; 32(6): 649-657.

26. Norberg PRBM, Meister-Villalba ML, Duarte-Ortellado L, Coronel M, Ribeiro PC, Silva MA *et al.* Intestinal parasitism among Toba Qom Ethnic children of the San Francisco de Assis village, city of Benjamín Aceval, Paraguay. *World J Adv Health Res.*, 2019; 3(2): 28-35.