Cryptosporidiosis among indigenous people of Toba Qom ethnic community of San Francisco de Asis, Benjamín Aceval city, Paraguay

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Abstract- *Cryptosporidium* is a genus of protozoa of the Apicomplexa phylum with worldwide distribution that parasites the edges of intestinal microvilli causing a clinical presentation characterized by abdominal pains, vomiting and diarrhea, mainly affecting children and immunodeficient people. The objective of this research is to investigate oocysts of *Cryptosporidium* spp. in the feces of the Toba Qom indigenous people of San Francisco de Asis community, in the rural area of Benjamín Aceval city, Paraguay. 90 fecal samples were examined from people of both genders from 1 to 70 years old. The samples were processed by the Ritcher technique. Slides of the obtained sediment were stained by the Kynioun method and examined under light microscopy at 1000x magnification. *Cryptosporidium* spp. oocysts were found in 8 of the 90 fecal examined samples, which correspond to a prevalence coefficient (PC) of 8.9%. The research revealed the need to improve health care programs in order to provide better living conditions to people of San Francisco de Asis community.

Index Terms- *Cryptosporidium* spp., cryptosporidiosis, diarrhea, enteroparasitosis, indigenous people

I. Introduction

The knowledge of the dynamics between man and the environment is fundamental for understanding and improving the situation of communities and overcoming health problems which affects specific population groups. The biotic and abiotic resources of ecosystems are fundamental to the particularities of this dynamic[1]. According to this, each population group interacting with the environment has a unique nature and the study of these particularities of the culture and the way of life itself, as well as the relationship between different societies, urbanized or not, with the environment where they live is important for the development of actions which promotes health efficiency[2,3,4].

According to the World Health Organization[5], more than 200 million people in the world are hosts of enteroparasites. Parasited people is most often in poor countries, between 20% and 30% of these are in Latin America, where the incidence of enteroparasitoses can reach around 50% to 95% among some indigenous groups[5,6]. Parasitic diseases have been neglected by health authorities in several countries, where there are few programs to combat and prevent such diseases[7]. In the rural environment or in traditional communities whose cultures are modified by the contact with dominant societies with the introduction of different manners, continuous contact with the polluted environment leads to infection by a great diversity of parasites. There are around 300 species of helminths and about 70 species of protozoa, and about 90 species of them causes the world's most important diseases[8,9].

The etiological agents of intestinal parasitoses are acquired by indigenous populations mainly through contact with non-indigenous society and later spread to the local population. The precarious economic conditions, the lack of sanitation facilities and poor health education that indigenous communities are subjected favours the dissemination of the parasitoses. Several researchers have evinced that the precariousness of sanitation conditions, which is often a reality in indigenous communities, is one of the main factors responsible for the high prevalence of intestinal parasitoses in these population groups[10,11].

San Francisco de Asis community is composed by people of Toba Qom ethnic group. It is located in the rural area of Benjamín Aceval city, at the Paraguayan Chaco region, near the district of Cerrito. The community have approximately 800 resident inhabitants.

From contact with the people of the Toba Qom ethnic group from the San Francisco de Asis community, it was verified that there are risk conditions to parasitic diseases and relevant reports of gastroenteritis in children. Based on this situation, this research had the objective of studying the presence of oocysts of *Cryptosporidium* spp. and other sporozoans in that community.

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II. Material and Methods

Design and research area

This research has a cross-sectional descriptive and observational design, with a representative sample of indigenous people of the Toba Qom ethnic group, established in the

community of San Francisco de Asis, located at the Benjamín Aceval rural area, in the Paraguayan Chaco region. All research procedures were guided by ethical norms, cultural respect, preservation of the health and 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). All research procedures and objectives were informed to community leaders and participants, and the results were delivered to all participants by individual medical cards.

Samples, research instruments and laboratory procedures

The search for oocysts of *Cryptosporidum* spp. was carried out in September 2017 among 90 people from Toba Qom ethnic group of both genders with ages ranging from 1 to 70 years. Voluntary participants were informed of the importance and objectives of the research and the procedures for sample collection before the express agreement. Samples of children were collected after parent's agreement. Aliquots of feces of each participant were conserved in 10% formaldehyde solution and sent to the Laboratory of Research on Parasitic Diseases of the UNIABEU University Center in the city of Belford Roxo, Rio de Janeiro, Brazil. The samples were processed by the Ritchie technique. From the obtained sediment, two slides were prepared for each sample per individual, which were stained by the Kinyoun method for the investigation of *Cryptosporidium* spp. oocysts. Slides were examined under light microscopy with 1000x magnification. Data were analysed using the total numbers and respective frequencies.

III. Results

From a total of 90 samples, eight were positive for *Cryptosporidium* spp., corresponding to a total prevalence of 8.9%.

Among the parasite people, the male gender predominated (62.5%) over the female (37.5%), but there was no significance. The incidence was markedly restricted to the age groups between one and five years, with the two-year age group being the most parasitized (37.5%)..

Table 1- Distribution of *Cryptosporidium* spp. by gender and age class among 90 fecal samples analyzed from Toba Qom ethnic group l.

Age class	N°	Total%	Men	Men %	Women	Women %
1 year	01	12,5	1	12,5	0	
2 years	02	37,5	2	25	1	12,5
3 years	02	25	2	25	0	
4 years	02	12,5	0		1	12,5
5 years	01	12,5	0		1	12,5
Total	**08**	**100,0**	**5**	**62,5**	**3**	**37,5**

IV. DISCUSSION

The indigenous people of the Toba Qom ethnic group belong to Guaicuru language branch, represented in Paraguay by 1939 people in the year of 2012 according to the Atlas of Indigenous Peoples Communities of Paraguay[12], being the community of San Francisco de Asis the most populous settlement of this ethnic group in Paraguay. The inhabitants of this community maintain frequent contact with the non-indigenous society. Family farming is mainly based on manioc, beans and vegetables. The most important incoming source is the sale of handicrafts made with wool, caraguata fiber, palm leaves, taquara, seeds, feathers, clay and wood carvings. The second incoming source by importance are informal services and jobs in nearby farms, and the third source of income is the production of charcoal from eucalyptus cultivation.

The transmission of microbial and parasitic elements between the indigenous and non-indigenous communities occurs with ease when considering that individuals in transit between the community and the urban environment take to the city the pathogens incident to the indigenous population and, when they return to the community, introduce other pathogens which were previously not incidents in the local population.

In relation to gastroenteritis diagnosed in Brazilian indigenous people, the researcher Garda, quoted by Giglio *et al.*[13], reported that during the year 2001, about 88,000 cases of intestinal infections and 87,000 cases of enteroparasitoses occurred in Brazil among 374,000 Brazilian indigenous people in that year. The infant mortality rate in 3000 communities located in several Brazilian provinces was of 56 deaths per 1000 births; above the Brazilian average, which was 29 per 1000. The infant mortality rate in Paraguay for the general population in the period from 2010 to 2015 was 28.8 per 1000[14]. There are no specific records for infant mortality among the Toba Qom people, as well as studies about enteroparasitoses incidence, but we believe that for the reasonable infrastructure and better living conditions of that group in relation to the average of the Brazilian and Paraguayan indigenous groups, infant mortality rates should be close to those of the general population of the country.

The incidence of enteroparasitoses among Terena indigenous ethnic at the Moreira community in the city of Miranda, Province of Mato Grosso do Sul, was researched by Norberg *et al.*[15] As parasite diversity, seven species of helminths nematodes and cestodes were diagnosed, and five species of protozoa, including *Cryptosporidium* spp. with the incidence rate of 0.97%, being a lower rate than found in our research, which obtained 8.9% of positivity.

Pawar *et al.*[16] considered that parasitic infections caused by species of *Cryptosporidium* and Cyclospora genera are emerging diseases and cause diarrhea especially in immunocompromised children. They examined faecal samples from 100 children which had abdominal problems and gastroenteritis hospitalized at Solapur Hospital, India. The research aimed to detect protozoa of the genera *Cryptosporidium*, *Isospora* and *Cyclospora*. The results of the coproscopies

revealed positivity for 64 children: 7 (10.4%) were positive only for species of the genus *Cyclospora* and 34 (53.13%) were positive for the combination of *Cryptosporidium* and *Cyclospora*. These authors concluded that the two protozoa identified were the most frequent etiological agents causing diarrhea among the studied children. The rate of *Cryptosporidium* infection found by these authors is much higher than the cases diagnosed in our research among Toba Qom natives, which was 8.9%.

A comparative research of the intestinal parasitism of Pankarare ethnic group living in three communities of the Province of Bahia, Brazil, was carried out by Sousa-Oliveira *et al.*[17] These researchers examined 134 fecal aliquots and identified helminth and protozoal infections. Among the parasites, they found a rate of 3% parasitism caused by *Cryptosporidium* spp., a much lower incidence than the 8.9% recorded among the Toba Qom.

Dabirzadeh *et al.*[18] performed an epidemiological survey about the incidence of cryptosporidiosis in children under four years old with diarrhea attended at health services in the city of Zabol, Iran. Fecal samples were stained by the Ziehel-Neelsen method for the detection of coccidia oocysts. The results showed positivity for *Cryptosporidium* in 9% of the samples, and concluded that there was a significant relationship between water supply and diarrhea in children with *Cryptosporidium*. We corroborate with the association of these authors when we observed deficient sanitary conditions of water supply in the indigenous community of San Francisco de Asis. The rate of cryptosporidiosis found by these authors is close to that recorded in our research.

The prevalence of diarrhea caused by *Cryptosporidium* spp. in patients attended at the Cachar Hospital in the district of Assam, India, was studied by Hussain *et al.*[19] Among 220 patients with gastroenteritis, the prevalence was 16.3% for *Cryptosporidium*, a rate higher than that found among the natives of the San Francisco de Asis community.

Borges *et al.*[20] performed an epidemiological survey of the intestinal parasitoses of Wai-Wai ethnic group in the Mapuera community, Oriximiná city, Brazil. The parasitological examination of 83 people revealed a diversity of helminths and intestinal protozoa, finding *Cryptosporidium* spp. with the rate of 3.66% (3 out of 83), lower than that found in our research.

The prevalence of cryptosporidiosis among 121 children less than 13 years old with oncological diseases treated at the Ramón González Valencia University Hospital in the city of Bucaramanga, Colombia, was researched by Carmeño *et al.*[21] The prevalence of *Cryptosporidium* spp. among children with cancer was 42% and the clinical complaint of abdominal pain was associated as the most aggressive factor. Our opinion is that the incompetence of the immune system of these children was the predisposing factor for the development of the high rate of cryptosporidiosis, considering that the rate among immunocompetent people is considerably lower.

Scopel & Santos[22] researched the occurrence of *Cryptosporidium* spp. in feces of children with gastrointestinal problem at the city of Lajes, Province of Santa Catarina, Brazil. Among the 26 analyzed samples, 38.46% (10 out of 26) were positive, a much higher rate than that found among the Toba Qom indigenous people.

Cryptosporidiosis among Potiguar indigenous group established in the city of Baía da Traição, Province of Paraíba, Brazil, was studied by Tardin *et al.*[23] They examined 109 fecal samples and found positivity for *Cryptosporidium* spp. with a prevalence coefficient of 8.26%, similar to that found among the Toba Qom.

King *et al.*[24] employed molecular techniques to identify *Cryptosporidium* parvum IIc, considered the most frequent genotype that causes diseases in developing countries. The research was conducted with 2641 fecal samples examined by microbiology laboratories in England and Wales. The results showed 5.6% (149 out of 2641) of positivity for C. parvum, and the authors commented that the rates found in people in England and Wales are lower than the rates recorded in other developing countries. The rate found by these authors was also lower than that registered in the San Francisco de Asis community.

The prevalence of *Cryptosporidium* spp among indigenous children up to fifteen years of the Colombian Amazon Basin was studied by Sánchez *et al.*[25] Among the 261 examined samples, only 5 (1.9%) showed positivity for *Cryptosporidium*, a significantly lower rate than that found among the Toba Qom ethnic people.

The researchers Ng-Hublin *et al.*[26] analysed the comparative epidemiology of cryptosporidiosis between aboriginal and non-aboriginal people in Australia between 2002 and 2012. During this period, a total of 2988 cases of cryptosporidiosis were reported, and there was a marked asymmetry in incidence rates between the two groups, where cases among aboriginal were 50 times greater than that of the non-aboriginal population. The authors also revealed that 93.2% of aboriginal cases were reported for children up to four years of age. In our study among Toba Qom people, all cases were found among children up to five years of age, a similar result to that found by the researchers in Australia

Rajoo *et al.*[27], in a cross-sectional research on parasitosis and malnutrition in indigenous communities in Sarawak, Malaysia, found a positive rate for *Cryptosporidium* of 0.3%. This rate is much lower than the prevalence of 8.9% found in our research, and reveals that there are important differences in the incidence of this parasitosis in relation to the diverse indigenous groups in the world, which can be explained by different conditions of life, habits, ways of life, relations with the environment and cultures.

V. CONCLUSIONS

From the analysis of the obtained results, it was concluded

that cryptosporidiosis is one of the intestinal parasitoses incident among the Toba Qom people. From a total of 90 fecal examined samples, in 8 of them *Cryptosporidium* spp. oocysts were found, corresponding to a prevalence coefficient (CP) of 8.9%. Based on the obtained results, we believe that there is a need to improve the health assistance programs and the sanitation conditions aiming at promote better living and health conditions to the Toba Qom indigenous people of the San Francisco de Asis community.

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