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ORIGINAL ARTICLE

PREVALENCE OF INTESTINAL PARASITES AND SOCIOECONOMIC EVALUATION OF A COUNTRY TOWN IN THE SERRA GAUCHA REGION, RIO GRANDE DO SUL, BRAZIL

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ABSTRACT

Worms are a serious public health issue in Brazil, easily transmitted in school-age children. To evaluate the prevalence of intestinal parasites and socioeconomic conditions in students in Ipê city, the children's guardians filled in a questionnaire to evaluate their knowledge about parasitosis and basic sanitary conditions; then, feces were analyzed with sedimentation and centrifugation-fluctuation techniques. Out of 124 analyzed samples, a positivity rate of 8.1% was observed, with the presence of *Entamoeba coli* (50%), *Giardia intestinalis* (20%), *Enterobius vermicularis* eggs (20%) or multiple parasites. The students' average ages were 8.2±1.5, of which 53.2% were female. In relation to the questionnaires, 80.6% of the respondents answered assertively concerning the definition of a parasite, and 91.1% thought they knew how parasitoses are acquired. Regarding basic sanitation, only 4% of the studied population does not possess piped drinking water at home, and waste collection was done in 89.5% of the residences. The current study found a low frequency of parasitoses, which may be due to the level of information on the part of the parents or guardians, to the basic sanitary conditions of the respondents and to the high percentage (84.7%) of students who had already used anti-parasitic drugs.

KEY WORDS: Parasites; prevalence, intestinal diseases.

INTRODUCTION

Intestinal parasitoses represent one of the main causes of morbidity and human death (Frei et al., 2008). The distribution of these infections is cosmopolitan (Santos & Merlini, 2010), being directly related to socioeconomic development rates in a given country (Quadros et al., 2004; Ross et al., 2012).

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This is due to the epidemiological triangle of parasitic diseases, that is, the relationship between host condition, parasite and environment (Santos & Merlini 2010). Parasites establish themselves well in hosts exposed to poor basic sanitary conditions, with low levels of education (schooling) and inappropriate hygiene habits (Basso et at., 2008).

Life, housing and basic sanitary conditions are, for the most part, causes of intestinal parasite transmission. Some, such as *Entamoeba histolytica, Giardia intestinalis, Hymenolepis nana, Taenia solium, Ascaris lumbricoides, Trichuris trichiura* and *Enterobius vermicularis*, are transmitted mainly via the fecal-oral route, through water or contaminated food. Others, such as *Ancylostoma duodenale, Necator americanus* and *Strongyloides stercoralis*, are transmitted by larvae penetration from the soil to the skin of the human host (De Carli, 2008; Bortolatto et al., 2017). Parasitoses prevalence is high in places where life and basic sanitary conditions are unsatisfactory or inexistent. Ignorance of personal hygiene and food preparation care enables infection and causes predisposition to reinfection in endemic areas (De Carli & Candida, 1992). Estimates show that 20% to 30% of the population of the Americas is infected by *Ascaris lumbricoides, Trichuris trichiura, Ancylostomid* or *Schistosoma mansoni* (Andrade et al., 2010).

The main risk group for parasite contamination is among school children (Basso et al., 2008), due to their immature immune system (Vasconcelos et al., 2011) and to precarious personal hygiene habits. Frequent soil and water contact are also considered eminent contamination sources (Araujo Filho et al., 2011; Bortolatto et al., 2017). All those factors combined with the lack of orientation at home or school (Frei et al., 2008) may determine transmission and prevalence of these diseases (Andrade et al., 2010; Frei et al., 2008; Souza et al., 2010). The importance given to these factors lies in the fact that parasitoses represent a very serious public health issue, some being related to morbidity through malnutrition and, thus, to learning, physical and intellectual development deficits in children (Ludwig et al., 1999; Marques et al., 2005), besides providing death risks in more severe cases (Rocha et al., 2000).

Ipê is a municipality located in the northeast region of Rio Grande do Sul State, Brazil, being part of the Campos de Cima da Serra micro region, bordering Muitos Capões, to the north; Antônio Prado, to the south; Campestre da Serra, to the East; and Protásio Alves and André da Rocha, to the West (Ipê, 2016). According to data from the Instituto Brasileiro de Geografia e Estatísticas (IBGE), the municipality has an estimated population of 6,412 inhabitants and a territorial area of 599.247 km² (square kilometers), resulting in a demographic density of 10.04 ppl/km² (people per square kilometer). Data from 2012 show that there were 1,057 students enrolled from pre-school to high school in public schools in the town, and 5,321 literate inhabitants. Ipê also has four basic public health units (Unidades Básicas de Saúde, SUS). The Human Development Index (2010) was 0.728. The municipality does not have sewage treatment plants –

water in the urban area is treated and distributed in its totality by Companhia Riograndense de Saneamento (CORSAN), and in the rural area by resident associations (IBGE, 2010). Therefore, the present study aims to evaluate the prevalence of intestinal parasites and establish a relation between that and the socioeconomic conditions of the students of Ipê, RS.

MATERIAL AND METHODS

A cross-sectional descriptive and analytical study was done with students of four schools, from both rural (three) and urban (one) areas of the municipality of Ipê, Rio Grande do Sul, Brazil, thus constituting a convenience sampling.

Meetings were carried out with the municipality's secretary of education, as well as with the schools directors, in order to present the research and invite them to participate in the project. An informed consent form was given to the parents and guardians, together with the questionnaire which evaluated knowledge of parasitoses and the socioeconomic conditions of each participant. The questionnaire was validated by Cavagnolli et al. (2015), using some adaptations aiming at making the evaluation more objective. Sample collection kits were handed out, containing instructions for collecting the sample, a plastic bag, a sterile vial for sample collection and an identification tag. For the morning students, samples were collected the day before and stored in the refrigerator until delivery, while afternoon students had samples collected on the day of delivery to the researchers. After gathering the samples, these were placed in refrigerated boxes appropriate for biological material transportation and processed within two hours at most. No preservatives were used in the vial for sample preservation, since some of them may modify parasitic structures. The gathering of the material was performed in June and July 2016. The inclusion criteria for participating in the study was having answered and delivered the questionnaire together with the stool samples, having signed the informed consent form, being 6 to 11 years of age, and enrolled in first to fifth grade of Elementary School.

For the stool sample analyses, Hoffman-Pons-Janer (HPJ) spontaneous fecal sedimentation method was used, which enables concentration and identification of protozoa cysts and oocysts and helminth eggs and larvae, besides being easily performed at a low cost (De Carli, 2008). After a minimum of two hours for sedimentation, two observers performed the microscopic analysis of the sediment between blade and coverslip with lugol. Faust et al. (1939) centrifugation-fluctuation method was also used, enabling better concentration and visualization of protozoa cysts and oocysts and light eggs (De Carli, 2008). After centrifugation, two observers performed the microscopic analysis of the supernatant material with lugol between blade and coverslip. All samples were processed and analyzed at the Laboratório de Parasitologia do Centro Universitário da Serra Gaúcha. The results were expressed as not presenting any parasitic structures observed in the analyzed sample or the scientific name of

the identified parasite. After that, the reports were analyzed by a physician, who prescribed two bottles of albendazole, a drug used for parasitoses treatment. The reports were handed to the participants and those presenting infections also received the doctor's prescription and medication. The present study was approved by the Ethics Committee of the Círculo Operário/FSG, under ruling 479.964.

The data obtained was expressed in frequencies and/or percentages. To make comparisons between outcomes, Chi-square test or Fisher's exact test were applied, where $p \leq 0.05$ was considered significant in the IBM SPSS Statistics 20.0 program.

RESULTS

Through the analyzes of the stool samples and the socioeconomic questionnaire answers, 124 Elementary School students of four local schools in Ipê, Rio Grande do Sul, Brazil, were evaluated from May to July 2016. 50.8% live in the urban area (n=63) and 49.2% in the rural area (n=61). The evaluated students were 6 to 11 years old. The average age was 8.2±1.5 for both sexes, 66 (53.2%) female and 58 (46.8%) male.

The average age of the parents or guardians was 33.5±12.5 years for both sexes, 101 (81.4%) female, 13 (10.5%) male and 10 (8.1%) who did not answer this question. The predominant education level was completed High School – which corresponds to a secondary level of education (83.1%), and 12% had complete or incomplete higher education. In relation to the parasitoses questionnaire, 80.6% answered positively concerning the meaning of a parasite and 91.1% answered correctly about parasite transmission. Most of the respondents claim to have knowledge of the subject through healthcare professionals (60.5%) and, also, 64.5% of them declared the information provided by these professionals was sufficient (Table 1).

In relation to parasitic disease diagnoses, 79.8% of the students had never been diagnosed through laboratorial examination. Of those who had previously had a positive parasite test result (20.2%), 11.3% attested having that result only once in their lives. A total of 73.4% claimed they had never done a parasite stool test, 7.2% were always tested after taking medicine, and 4.9% had done the test after medicine administration.

As for the use of antiparasitic drugs, 84.7% alleged having undergone treatment and 36.3% and 33.1% of the students answered that they ingest antiparasitic medication once a year and once every six months respectively. The most common type of medication was albendazole with 19.4% of the responses, followed by mebendazole with 14.5% and nitazoxanide with 12%. When asked how they acquired the medication, 33.5% of the respondents claimed they bought it whenever necessary, while 52.3% of the students bought or got their medication from the health center with medical prescriptions (Table 2).

Table 1. Level of education and knowledge concerning parasites and forms of transmission . Data obtained through questionnaires answered by parents and/or guardians of students from a municipality in the Serra Gaúcha, Rio Grande do Sul, Brazil, 2016.

Variable	Category	n	(%)
Level of Education of the parent or guardian	Incomplete Elementary School	42	33.9
	Complete Elementary School	16	12.9
	Incomplete High School	13	10.5
	Complete High School	32	25.8
	Incomplete Higher Education	7	5.6
	Complete Higher Education	8	6.4
	Did not answer	6	4.9
Do you know what a parasite is?	It's a bacterium that causes a disease	17	13.7
	It's a virus transmitted through the air	2	1.6
	It is a microorganism that is not environmentally friendly and can be transmitted through raw or poorly washed food.	100	80.6
	Other	5	4.1
How are parasitoses acquired?	Kiss	1	0.8
	Sexual intercourse	–	–
	Contaminated Food	113	91.1
	Other	10	8.1
What means do you use to keep informed?	TV	15	12.1
	Radio	1	0.8
	Newspaper	–	–
	Internet	12	9.7
	Healthcare Professionals	75	60.5
	Other	3	2.4
	More than one option	18	14.5
Is the information obtained sufficient?	Yes	80	64.5
	No	44	35.5

Table 2. Parasitic diseases diagnosis and antiparasitic medication used in students of a municipality in the Serra Gaúcha, Rio Grande do Sul, Brazil, 2016.

Variable	Category	n	(%)
Have you ever been diagnosed with a parasitic disease?	Yes	25	20.2
	No	99	79.8
How many times?	Once	14	11.3
	Twice	3	2.4
	Three times	2	1.7
	Four times	6	4.8
	Never	99	79.8
Have you done a stool exam while treating for a parasitic disease?	No	91	73.4
	Yes, before taking the medicine, every time	9	7.2
	Yes, after taking the medicine, every time	6	4.9
	Yes, before taking the medicine, sometimes	6	4.9
	Yes, after taking the medicine, sometimes	4	3.2
	Did not answer	8	6.4
Have you ever taken antiparasitic medication?	Yes	105	84.7
	No	19	15.3
Which one?	Albendazole	24	19.4
	Mebendazole	18	14.5
	Nitazoxanide	15	12.1
	Ivermectin	1	0.8
	Metronidazole	1	0.8
	Did not know/ Did not answer	65	52.4
How often?	Once a year	45	36.3
	Every six months	41	33.1
	Every two years	4	3.2
	Did not answer	34	27.4
How did you get the medicine?	Bought it at a drugstore when necessary	44	35.5
	Bought it at a drugstore with medical prescription	30	24.2
	Got it at a health center with medical prescription	35	28.2
	Is routinely supplied with the medicine by a health center or health campaign without medical appointment	2	1.6
	Did not answer	13	10.5

Table 3. Basic sanitary condition of student's houses in a municipality in the Serra Gaucha, Rio Grande do Sul, Brasil, 2016, and relation to prevalence.

Environmental sanitation variables	Households with variable presence n (%)[a]	Children with positive stool exam by the HPJ technique n=8 (%)[b]	*P* value (HPJ)	Children with positive stool exam by the Faust technique n=7 (%)[b]	*P* value (Faust)
Is there piped drinking water at home?					
Yes	119 (96.0)	8 (100)		7 (100)	
No	5 (4.0)	–	0.774‡	–	0.801‡
Is there waste collection and treatment?					
Yes	62 (50.0)	4 (50)		4 (57.1)	
No	62 (50.0)	4 (50)	0.897‡	3 (42.9)	0.820‡
Is the street where you live cleaned or the vicinity?					
Yes	90 (72,6)	5 (62.5)		4 (57.1)	
No	37 (27.4)	3 (37.5)	0.743‡	3 (42.9)	0.605‡
Is rainwater collected satisfactorily, avoiding accumulation?					
Yes	66 (53.2)	6 (75)		4 (57.1)	
No	58 (46.8)	2 (25)	0.406‡	3 (42.9)	0.686‡
Is garbage collected?					
Yes	111 (89.5)	5 (62.5)		4 (57.1)	
No	13 (10.6)	3 (37.5)	0.015‡	3 (42.9)	0.015‡
Is there satisfactory pest control (rats and insects)?					
Yes	60 (48.4)	6 (75)		6 (85.7)	
No	64 (51.6)	2 (25)	0.851‡	1 (14.3)	0.094‡

[a] Percentages calculated on the total (124).
[b] Percentages calculated on each technique and each category of the sanitation variables.
‡ Chi-square test.

Sanitation in the studied houses, was generally considered good in relation to the researched variables (drinking water, street cleaning, waste collection and treatment, rainwater harvesting and garbage collection). Lack of piped drinking water was registered only in 4% of the houses. A significant association was found between garbage collection and parasitoses prevalence (p=0.015) (Table 3).

The present study found an 8.1% (n = 10) prevalence of parasitic diseases, more than half of which were protozoa. Two diagnostic techniques, spontaneous sedimentation (HPJ) and centrifugation-fluctuation (Faust), were performed in the study. In the analysis by HPJ, 8 positive samples were obtained, of which 5 (62.5%) had *Entamoeba coli* cysts, 2 (25%) *Giardia intestinalis* cysts and 1 (12.5%) *Enterobius vermicularis* eggs. In the Faust technique, 7 samples were positive, of which 2 (28.6%) had *Entamoeba coli* cysts, 2 (28.6%) *Giardia intestinalis* cysts, 2 (28.6%) *Enterobius vermicularis* eggs and 1 (14.3%) presented multiple parasites (*Entamoeba coli* and *Iodamoeba butschlii*) (Figure). In 50% of the cases there was agreement between the analyzes, while in the other 50% the sample was positively diagnosed in only one of the techniques. All the samples received were of normal consistence, that is, there was no diarrheic material.

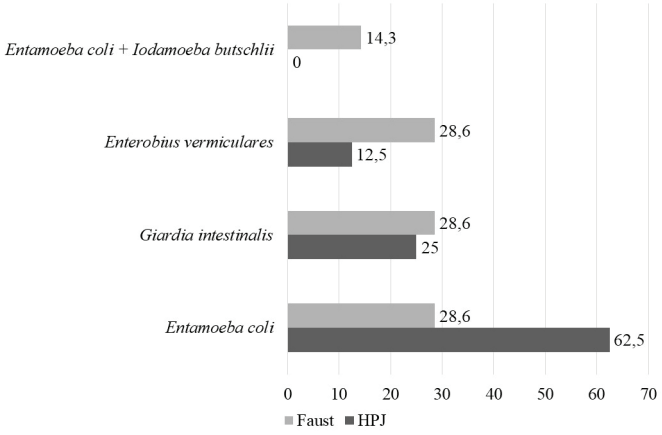

Figure. Parasitic prevalence in fecal samples analyzed by spontaneous sedimentation (HPJ) and centrifugation-fluctuation (Faust) methods.

DISCUSSION

The present study obtained similar results to those found in cities near the municipality of Ipê (also located in the Serra Gaúcha) in relation to the percentage of positive samples (8.1%). 10% were found in the city of Flores da Cunha, (Cavagnolli et al., 2015); 5.8% in Caxias do Sul (Camello et al. 2016) and

5.8% in São Marcos (Rech et al., 2016). In other studies conducted in southern Brazil, a higher prevalence of parasitoses was found. A prevalence of 39% was found in the state capital city of Porto Alegre, RS (Roque et al., 2005) and 22.4% in São Joaquim, SC (Schmitt & Paes, 1997). In the same region, results were close to those found in this study, such as in São Miguel do Oeste, SC, with 7.4% (Seger et al., 2010), in Sananduva, RS, with 8.1% (Bellin & Grazziotin, 2011) and in Osório, RS, with 10.3% (Abrahão, 2013).

There is a great variation in the prevalence of parasitoses in similar studies carried out in other cities in Brazil. These differences can be explained by the sanitary and socioeconomic conditions of the analyzed population. Inadequate hygiene, poor water supply and treatment, among other factors, are crucial for the transmission of these parasitic diseases (Ludwig et al., 1999; Viana et al., 2017). In a study in the municipality of Coari, AM, a 73% positivity index was noted (Silva et al., 2009). According to Santos et al. (2013), in that region only 6.5% of the studied population receives treated tap water, while 92% use untreated water and 87.5% live under precarious sanitary conditions. In a study with 383 children in the state of Ceará, 233 parasites were identified, 38% of the houses received only untreated water and 45% used septic tanks as a form of sanitation (Vasconcelos et al., 2011). This information diverges from this study, where 96% of the respondents receive piped drinking water, 50% of households have sewage collection and 89.5% have garbage collection, which demonstrates good basic sanitary conditions and may justify the low prevalence of parasitic diseases in the studied population. Studies in which the prevalence of intestinal parasites is high, demonstrate low environmental, sanitary and housing standards, as well as little information on the subject (Andrade & Ferreira, 2005). The present study demonstrated a significant relationship between basic sanitation and the prevalence of parasites - 13 residences do not have garbage collection, representing 10.6% of the studied population, of which 5 were diagnosed with parasitoses (38.4%). That is, residences that do not have garbage collection have a higher prevalence of parasitoses than those which do.

Only two cases of helmynth infection (*Enterobius vermicularis*) were verified among the positive cases, while the prevalence of protozoa was highest (*Entamoeba coli* 50% and *Entamoeba coli* + *Iodamoeba butschlii* multiple parasites 10%). These are commensal, cosmopolitan parasites, with a subtle relationship between infestation and socioeconomic, cultural factors and hygiene habits (Cavagnolli et al., 2015; Camello et al., 2016; Bortolatto et al., 2017). The presence of 20% *Giardia intestinalis* cysts was also noted. These results were also observed by Flores da Cunha, RS by Cavagnolli et al. (2015), where 55.9% of *Endolimax nana* cysts were found. In the city of São Marcos, RS, Brazil, 54.5% of *Entamoeba coli* cysts were found (Rech et al., 2016) RS, while a study by Camello et al. (2016) found 60% *Endolimax nana*, 26.7% *Entamoeba coli* and 13.3% *Giardia duodenalis* in Caxias do Sul, RS. Such results were also observed in the city of Bonito, MS, where 45.2% of the parasites were

protozoa (Brilhante et al., 2010). One aspect in which this study differs from the ones mentioned above and located near Ipê, concerns knowledge about what a parasitosis is and its forms of transmission, due to the fact that objective questions were asked instead of the presentation of self-reported data. However, a negative point similar to other studies was that the questionnaire was answered at home.

The distribution of parasitoses in regards to sex is similar to a study by Roque et al. (2005) in schoolchildren from the peripheral areas of Porto Alegre, RS, and by Camello et al. (2016) in schools in the urban area of Caxias do Sul, RS, where there was no significant difference between male and female students.

In this study two methodologies were used for parasitological stool examination, spontaneous sedimentation and centrifugation-fluctuation. The prevalence of parasitoses was low and no statistical difference was evidenced between the two techniques. It is noteworthy that one of the limitations of the study was the parasitological examination of feces in only one sample, since some parasites are known to have an intermittent cycle for the release of parasitic structures in feces (De Carli, 2008). Studies report that one of the limitations found in research involving children is the low return of fecal sample or incomplete data, which may be due to embarrassment on the part of the participants or the need for parental aid in collecting samples and completing the questionnaire (Abrahão, 2013; Camello et al., 2016). We believe that if this occurs for a single stool sample, requesting more than one would not allow us to have a significant number of participants.

One point worth mentioning is that 79.8% of the studied schoolchildren were never diagnosed with parasites, while 73.4% had never had a stool parasitological examination; however, 84.7% had already taken a vermifuge and 64,9%, take one once or twice a year, which demonstrates a high self-medication rate and lack of adequate knowledge about the diagnosis and treatment of parasitic diseases in the population of Ipê. This was also observed in studies with a similar population in the municipalities of Flores da Cunha, RS (Cavagnolli et al., 2015), Caxias do Sul, RS (Camello et al., 2016) and São Marcos, RS (Rech et al., 2016). Therefore, larger investments in public health are necessary, with informative campaigns for parents and students in regards to the consumption of vermifuges without parasitosis diagnosis.

This study concluded that the prevalence rate of parasite infection by helminth (*Enterobius vermicularis*) in the schoolchildren studied is low, due to the basic sanitary conditions, public garbage collection, access to treated water and the awareness of the population regarding parasites. However, a somewhat negative factor contributing to this low prevalence is self-medication. It is essential for public and private health agencies to plan and widespread information on how parasitic diseases are transmitted, diagnosed and treated so as to reduce or eliminate the various types of damage caused to the health of the population.

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