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ORIGINAL ARTICLE

THE PREVALENCE OF INTESTINAL PARASITOSIS ACCORDING TO GENDER IN A UNIVERSITY HOSPITAL IN SOUTHERN BRAZIL

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ABSTRACT

Introduction: Intestinal parasitoses lead to high morbidity and mortality rates, mainly in endemic areas; however, little is known about their prevalence in the Southern region of Brazil. The aim of the current study is to report the prevalence of intestinal parasitosis and to assess such prevalence according to gender. Methods: Analytical, transversal and retrospective design including parasitological stool tests performed in a university hospital. Results: We included 3,126 parasitological stool test results in the study – 44% of them were from men and 10.1% of the total were positive. Commensal protozoa were the most frequent parasites (7.7%) and *Endolimax nana* was the most prevalent protozoan (3.7%). *Giardia lamblia* was the most frequent pathogenic parasite (1.3%), and it was followed by *Strongyloides stercoralis* (0.7%). Men presented higher positive result rates (13.0% vs. 7.8%; p<0.001) for commensal (7.2% vs. 5.1%; p=0.016) and pathogenic parasites (4.5% vs. 1.8%; p<0.001); as well as for protozoa (10.7% vs. 6.4%; p<0.001) and for nematodes (1.4% vs. 0.6%; p=0.036). Similarly, men presented a higher positive result ratio for *E. nana* (5.2% vs. 2.6%; p<0.001), *Entamoeba coli* (3.5% vs. 1.6%; p<0.001), *G. lamblia* (2.2% vs. 0.6%; p<0.001) and *S. stercoralis* (1.1% vs. 0.3%; p=0.013) than women. Conclusion: parasites were found in 10% of the examined samples and commensal parasites were the most prevalent. Men showed higher enteroparasitosis rates than women.

KEY WORDS: Gender; enteroparasitosis; parasites; helminths; *Giardia lamblia*.

RESUMO

Prevalência de parasitoses intestinais de acordo com o gênero em um Hospital Universitário no Sul do Brasil

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Introdução: As parasitoses intestinais apresentam elevada morbimortalidade, especialmente em áreas endêmicas. O Brasil é um país de extrema heterogeneidade econômica e pouco se sabe sobre a prevalência de parasitoses intestinais na região Sul. O objetivo desse estudo é relatar a prevalência de parasitoses intestinais em exames de fezes, e avaliar se há diferenças em relação ao gênero. Métodos: Estudo de coorte histórico, analítico transversal, que avaliou exames parasitológicos de fezes (PPFs) realizados em laboratório de Hospital Universitário. Resultados: Foram incluídos 3.126 resultados de PPFs, onde 44,4% pertenciam a homens e 10,1% eram positivos. Protozoários comensais foram os mais frequentes (7,7%) e E. nana foi o mais prevalente (3,7%). Entre os patogênicos, o mais frequente foi *G. lamblia* (1,3%), seguido de *S. stercoralis* (0,7%). De uma forma geral, os homens apresentaram maior proporção de exames positivos (13,0% vs. 7,8%; P < 0,001), tanto para parasitos comensais (7,2% vs. 5,1%; P = 0,016), quanto para patogênicos (4,5% vs. 1,8%; P < 0,001); tanto para protozoários (10,7% vs. 6,4%; P < 0,001) quanto para nematodos (1,4% vs. 0,6%; P = 0,036). Igualmente, os homens apresentaram uma maior proporção de resultados positivos para *E. nana* (5,2% vs. 2,6%; P < 0,001), *E. coli* (3,5% vs. 1,6%; P < 0,001), *G. lamblia* (2,2% vs. 0,6%; P < 0,001) e *S. stercoralis* (1,1% vs. 0,3%; P = 0,013) quando comparados às mulheres. Conclusões: Parasitos foram encontrados em 10% dos exames, sendo os comensais mais prevalentes. Os homens exibiram maior proporção de enteroparasitoses que as mulheres.

DESCRITORES: Gênero; enteroparasitoses; parasitos; helmintos; *Giardia lamblia*

INTRODUCTION

Intestinal parasites are the most common cause of parasitic diseases, thus leading to significant morbidity and mortality rates, mainly in endemic areas. It is estimated that more than one quarter of the world population – 3.5 billion people – is infected with intestinal parasites (de Silva et al., 2003; WHO, 2004; Robertson et al., 2013). Approximately 58 million children are infected with protozoa every year (Pierce & Kirkpatrick, 2009). It causes 4 billion diarrhea cases and kills 1.6 million people annually (de Silva et al., 2003).

The protozoan parasites are spread globally and are an important cause of epidemics and endemics worldwide (Santos & Merlini, 2010). Intestinal parasites often occur in warm weather sub-tropical regions and in extremely poor places (Boonjaraspinyo et al., 2013; Hotez, 2014). The number of diagnoses recorded for these parasites indicates major public health issues, mainly in developing countries. Besides climate, lack of basic sanitation, health education and access to potable water, as well as the precarious personal hygiene practices adopted by the population in these sites, are common factors leading to the different prevalences of these parasites among regions that present different socio-economic rates (Marcogliese & Cone, 1997; Cotruvo, 2004; Hernandez et al., 2013). The higher prevalence of protozoa is reported among extremely poor individuals who live in the G20 countries, namely: Brazil, Indonesia, India, China, Saudi Arabia and Mexico, among others (Hotez, 2013). Parasitic infections are also common in the south of the United States (Hotez, 2008).

Parasites transmitted via the fecal-oral route (some trematodes, cestodes

and protozoa) are often found in rural communities. The infection appears in people who often feed on parasite-contaminated food (Macpherson et al., 2000; Dorny et al., 2009). Parasites transmitted via soil (nematodes) contaminate individuals who walk barefoot or who feed on soil-contaminated food (Naish et al., 2004; Nyarango et al., 2008). The infection may be asymptomatic or may present intestinal symptoms including: abdominal pain, acute or chronic diarrhea, constipation, vomiting and lack of appetite. Systemic manifestations such as fatigue, anemia, weight loss and skin rash, are not uncommon (Ortega et al., 2010). Immunosuppressed patients may progress to severe and lethal conditions (Narciso-Schiavon et al., 2007; Andre et al., 2014).

After analyzing the aforementioned scenario, it was possible to see how important it is to control intestinal parasitic diseases in order to improve public health conditions. Knowledge about the distribution of these parasites in the population as a whole, as well as their distribution between men and women in this population, may help when developing prevention campaigns. Thus, the aim of the current study was to find the ratio of positive parasitological stool test results in a public university hospital and to identify the most frequent parasitosis, according to gender.

MATERIAL AND METHODS

This retrospective cross sectional study was conducted using parasitological stool test results from individuals in different age groups. The tests were performed in the clinical analysis laboratory at Polydoro Ernani de São Thiago University Hospital (HU) of the Federal University of Santa Catarina (UFSC) between November 2011 and July 2013.

The study's protocol meets the ethical principles of the Helsinki declaration and it was approved by the Ethics Committee in Research on Human Beings, under number 550.602.

Information about the participants and their respective parasitological stool test results were collected from the files in the laboratory. The following variables were studied: gender and parasitological stool test results. The techniques by Hoffman, Baermann and Ritchie were used to perform the stool testing.

Statistical analysis

The qualitative variables were represented by frequency (%) and analyzed by chi-squared test or by Fisher's exact test, as appropriate. P values lower than 0.05 were considered to be statistically significant. Bivariate and multivariate analyses were performed to identify the different features between men and women. The Statistical Package for Social Sciences software, version 17.0 (SPSS Statistics, Chicago, Illinois, USA) was used in all the performed tests.

RESULTS

Sample features

Between November 2011 and July 2013, 3,128 parasitological stool tests were performed, but two of them were excluded from the sampling, since they presented insufficient data.

Three thousand one hundred and twenty six (3,126) tests were analyzed, 44% of which were from men, and 315 (10.1% of the total), were positive for parasites.

Commensal protozoa were the most common parasites (7.7%). *Endolimax nana* was the most prevalent protozoan (3.7%), and it was followed by *Entamoeba coli* (2.4%) and by *Blastocystis hominis* (1.6%). *Giardia lamblia* was the most common pathogenic parasite (1.3%), and it was followed by *Strongyloides stercoralis* (0.7%), *Entamoeba histolytica* (0.9%), *Ascaris lumbricoides* (0.1%), *Ancylostoma duodenalis* (0.1%) and *Enterobius vermicularis* (0.1%). There was only one positive result for *Iodamoeba butschlii* (0.01%). There was no positive result for *Taenia* sp.

Assessing the positivity rate for parasite presence according to gender

Overall, men presented higher positive result rates (13.0% vs. 7.8%; $p<0.001$) for commensal (7.2% vs. 5.1%; $p=0.016$) and pathogenic parasites (4.5% vs. 1.8%; $p<0.001$) (Figure 1A) than women.

After comparing genders (Figure 1B), it was found that men presented higher positive rates for protozoa (10.7% vs. 6.4%; $p<0.001$) and for nematodes (1.4% vs. 0.6%; $p=0.036$) than women.

It was observed that men presented higher positive result rates for *E. nana* (5.2% vs. 2.6%; $p<0.001$), *E. coli* (3.5% vs. 1.6%; $p<0.001$), *G. lamblia* (2.2% vs. 0.6%; $p<0.001$), and *S. stercoralis* (1.1% vs. 0.3%; $p=0.013$) than women, when parasites were individually analyzed. The comparative analysis of positivity for parasitological stool testing according to gender is shown in Table 1. The other parasites showed no evidence of differential prevalence according to gender. The multivariate analysis (Table 2) showed that *E. nana*, *E. coli*, *G. lamblia* and *S. stercoralis* were associated with male gender.

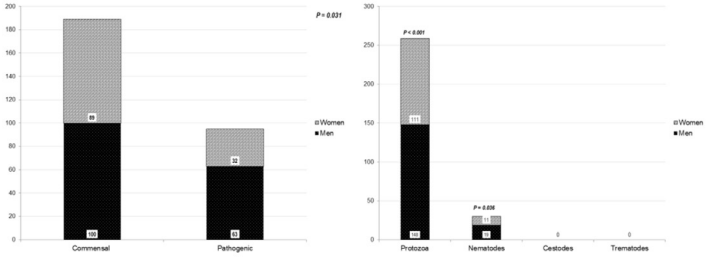

Figure 1. (A) Distribution of parasitological stool tests positive for commensal and pathogenic parasites according to gender. (B) Distribution of positive parasitological stool test results, according to gender.

Table 1. Positivity of parasitological stool test results, according to gender (n=3,126)

Parasite	Positive	n=315	Male	n=180	Female	n=135	
	n	%	n	%	n	%	*P*
Endolimax nana	117	3.7	72	5.2	45	2.6	<0.001[q]
Entamoeba coli	76	2.4	49	3.5	27	1.6	<0.001[q]
Blastocystis hominis	50	1.6	21	1.5	29	1.7	0.725[q]
Giardia lamblia	40	1.3	30	2.2	10	0.6	<0.001[q]
Strongyloides stercoralis	21	0.7	15	1.1	6	0.3	0.013 [q]
Entamoeba histolytica	29	0.9	17	1.2	12	0.7	0.136[q]
Ascaris lumbricoides	3	0.1	2	0.1	1	0.1	0.588[f]
Ancilostoma duodenale	3	0.1	1	0.1	2	0.1	1.000[f]
Enterobius vermicularis	3	0.1	1	0.1	2	0.1	1.000[f]
Iodameba butschilii	1	0.0	1	0.1	0	0.0	0.444[f]

[q]Chi-square test; [f]Fisher's exact test.

Table 2. Multivariate analysis to identify the parasites that independently associate with the male gender

	Odds Ratio	95% CI	P
Endolimax nana	1.810	1.225 – 2.675	0.003
Entamoeba coli	2.020	1.240 – 3.290	0.005
Giardia lamblia	3.671	1.781 – 7.565	0.000
Strongyloides stercoralis	3.180	1.225 – 8.250	0.017

DISCUSSION

Diseases caused by intestinal parasites were previously considered to be a phenomenon limited to the tropics but now are often diagnosed in Europe, USA and in other developed countries (Orlandi et al., 2002; WHO, 2004; Hotez, 2008), due to food globalization, immigration and to the adoption of children from endemic regions, as well as to touristic trips, the increase in raw food consumption and other direct or indirect forms of human relations between different regions in the world (Orlandi et al., 2002; D'Annibale et al., 2009; Robertson et al., 2014). However, developed countries have public agencies such as the Health Protection Agency (HPA) in the UK, and the Center for Disease Control and Prevention (CDC) in the USA, which are responsible for controlling infectious diseases.

Although Brazil is a developing country, comparison between its different regions shows extreme economic heterogeneity (Vieira Filho, 2013). After the National Development Plan was implemented, the South of Brazil – a region traditionally based on typical rural production – started to mechanize its primary sector and to industrialize its production. Such change enabled industrial growth in sectors linked to the meat and grain regional production chains (Alves & Costa, 2013). The region is seen as a low-endemicity zone when it is compared to the Northern and Northeastern regions of the country. Thus, the presence of parasites is a rare diagnosis suggested by assistant doctors, and it may jeopardize the prevention, diagnosis and treatment of infections caused by them (Roque et al., 2005). Besides, mild and unspecific symptoms as well as inadequate laboratorial methods may be the cause of the underestimated prevalence of parasites in Southern states (Hennessy et al., 2004).

The number of positive parasitological stool test results in the present study was lower than that described in the Northern and Northeastern regions of the country (from 35.8% to 58.7%) (Alves et al., 2003; Cristiane et al., 2009; Maia et al., 2009), as well as that described in the Southeastern region

(from 15.7 to 56.1%) (Dorea et al., 1996; Castro et al., 2004; Lodo et al., 2010; Belloto et al., 2011). The 10% parasitosis prevalence in Brazil is similar to the 11% prevalence reported by Masucci et al., in Italy (Masucci et al., 2011).

Commensal protozoa were the most prevalent parasites and *E. nana* was the most prevalent protozoan in the current study. *G. lamblia* was the most prevalent pathogenic parasite, and it was followed by *S. stercoralis*. Such prevalence rates change depending on the studied region, the sample, the time and on the applied techniques. The prevalence of *E. nana* varies between 1 and 18%, in Brazil (Dorea et al., 1996; Machado et al., 1999; Alves et al., 2003; Castro et al., 2004; Cristiane et al., 2009; Maia et al., 2009; Lodo et al., 2010; Belloto et al., 2011; Masucci et al., 2011) and between 0.1 and 7.3% overseas (Vieira Filho, 2013; Choi et al., 1971; Dorea et al., 1996; Alves et al., 2003; Castro et al., 2004; Hennessy et al., 2004; Roque et al., 2005; Cristiane et al., 2009; D'Annibale et al., 2009; Maia et al., 2009; Hsieh et al., 2010; Lodo et al., 2010; Belloto et al., 2011; Masucci et al., 2011; Ouermi et al., 2012; Alves & Costa, 2013; Robertson et al., 2014) and its higher prevalence is in Korea (Choi et al., 1971). The 3.7% prevalence found in the current study is similar to the 4% prevalence found by Belloto et al. (2011) in a school population in São Paulo State, Brazil.

B. hominis prevalence in Brazil ranges from 1.1 to 3.4% (Alves et al., 2003; Maia et al., 2009) and from 0.0 to 10.6%, abroad (Choi et al., 1971; D'Annibale et al., 2009; Hsieh et al., 2010; Masucci et al., 2011; Calderaro et al., 2014). Its higher prevalence is in Italy (Hsieh et al., 2010; Calderaro et al., 2014). The 1.6% prevalence found in the present study is similar to the 1.1% prevalence found by Maia et al. (2009) in children treated in first aid units in Manaus, Brazil. The role of *B. hominis* as a human pathogenic agent is controversial. The exact mechanism by which diarrhea is produced is yet not known. Despite the controversy, it is recommended to test all the stool samples for *B. hominis* during laboratorial testing. If this parasite is detected, the patient must be properly treated for it in case no other pathogen is detected (Basak et al., 2014). Infection by *B. hominis* is most often associated with diarrhea in immunosuppressed hosts such as HIV patients, and in homosexuals, travelers, children in day care centers, animal handlers etc. (Carbajal et al., 1997).

A. lumbricoides is the pathogenic parasite most often described abroad and its prevalence varies between 0.02 and 51.2% (Vannachone et al., 1998; Kim et al., 2003; D'Annibale et al., 2009; Hsieh et al., 2010; Masucci et al., 2011; Ouermi et al., 2012; Amare et al., 2013; Calderaro et al., 2014). It is more common in the Philippines (Kim et al., 2003), and was the third most common parasite in the current study. The 0.1% prevalence in the Southern region was lower than that described for Brazil as a whole. The country shows variation between 0.7% and 13.5% (Machado, Marcari et al., 1999; Alves et al., 2003; Castro et al., 2004; Maia et al., 2009; Lodo et al., 2010; Belloto et al., 2011). This result is quite similar to the 0.12% reported by Ouermi et al. (2012) at the Ouagadougou Medical Center in Burkina Faso, Africa. The empirical

treatment with a single albendazole dose is known in Brazil. It is effective to treat nematodiosis caused by *A. lumbricoides*, *Necator americanus* and *Trichuris trichiura* (Camillo-Coura et al., 1981). Such practice could justify the fact that *A. lumbricoides* is not the most commonly found parasite in the current study. A study carried out in the sub-district of Cavaco, in rural Brazil, a region where the single albendazole dose was administered to the whole population, showed significant reduction in the quantity of *A. lumbricoides* eggs eliminated in the feces, even six months after the treatment (Machado, Machado et al., 1996).

The pathogenic parasite presenting the highest prevalence in Brazil is *G. lamblia* (from 2.3 to 21.5%) (Dorea et al., 1996; Machado, Marcari et al., 1999; Alves et al., 2003; Castro et al., 2004; Cristiane et al., 2009; Maia et al., 2009; Lodo et al., 2010; Belloto et al., 2011). It was also the most frequent pathogenic parasite in the present study; however, its prevalence was lower than that reported in Brazil and similar to that described by Masucci et al., 2011; Machado, Marcari et al., 1999. Its prevalence ranges from 0.05 to 15.1% in foreign countries with different populations (Choi et al., 1971; D'Annibale et al., 2009; Hsieh et al., 2010; Masucci et al., 2011; Ouermi et al., 2012; Amare et al., 2013; Calderaro et al., 2014) and it is more common in Burkina Faso, Africa (Ouermi et al., 2012).

S. stercoralis is found in 0.1 to 4.1% of the Brazilian population (Belloto et al., 2011; Castro et al., 2004; Dorea et al., 1996; Lodo et al., 2010; Maia et al., 2009) and in 0.02 to 19% of foreign populations (Amare et al., 2013; Calderaro et al., 2014; D'Annibale et al., 2009; Hsieh et al., 2010; Masucci et al., 2011; Ouermi et al., 2012; Vannachone et al., 1998). Its highest reported prevalence is in Laos, Asia (Vannachone et al., 1998). The 0.7% prevalence found in the current study is similar to that described by Maia et al. (2009) in children from Manaus, Brazil and by D'Annibale et al. (2009) in laboratory samples in Perugia, Italy.

Few studies have assessed the differences in the prevalence of intestinal parasitoses according to gender (Calderaro et al., 2014; Choi et al., 1971; Dorea et al., 1996; Machado, Marcari et al., 1999; Phongluxa et al., 2013; Santos & Merlini, 2010). Overall, men presented higher positive result rates for commensal and pathogenic parasites in the current study than women. It was also observed that men presented higher positive result rates for both protozoa and nematodes, for *E. nana*, *E. coli*, *G. lamblia* and *S. stercoralis*, than women. Similarly, Dórea et al. (1996) assessed schools in rural São Paulo State, Brazil, and found a higher prevalence of *A. lumbricoides* (76.9 vs. 23.1%; $p<0.05$) and of *A. duodenale* (73.3 vs. 23.7%; $P<0.05$) in male children. Machado et al. (1999) assessed day care and school children in rural São Paulo State, Brazil, and observed that, in general, the frequency of infections in boys was higher than in girls; however, the differences were not significant. Santos & Merlini (2010) evaluated 431 individuals in Paraná State, Brazil, and did not observe

any difference in parasite prevalence between men and women. Calderaro et al. (2014) assessed more than 15,000 stool samples in a university hospital in Italy and observed higher prevalence in men of infection caused by helminths (1.8 vs. 1.1%; p=0.013) and by protozoa (21.7 vs. 18.8%; p<0.001). Men also presented 1.9 times more infection caused by *G. intestinalis* than women. Choi et al. (1971) did not observe parasite infection prevalence differences between genders in Korea, except in the prevalence of *Clonorchis sinensis*, which is twice as common in men (36.5 vs. 15.6%). Phongluxa et al. (2013) observed that *T. trichiura* was more frequent in men in Laos (37.5 vs. 28.4%; p=0.031). They also observed that some high risk habits such as not using the toilet were more common among men. Men often present infections caused by parasites because they do not look for medical assistance, do not care about the disease and also because they have a hard time remembering the appointed follow-ups (Oliveira & Romanelli, 1998; Miranda et al., 2000). Men have worse hygiene practices than women and are less informed about safe eating (Bergler, 1976; Patil et al., 2005).

One of the possible limitations of the current study may be the fact that it only assessed laboratory test results rather than individuals in a population. On the other hand, many other studies (D'Annibale et al., 2009; Lodo et al., 2010; Santos & Merlini, 2010; Masucci et al., 2011; Ouermi et al., 2012; Calderaro et al., 2014) used similar methods. Besides, the transverse design adopted for the present study did not include longitudinal attendance. Data about age, life conditions and hygiene habits, body mass index, dyspeptic symptoms, diarrhea, asthenia, nutrition status, hemoglobin and albumin level were not assessed in the current study. Consequently, it was not possible to analyze the effects of these variables on the positivity rates of parasitological stool tests in the studied population; however, the presented results corresponded with previously published information.

It is possible to conclude that approximately 10% of the parasitological stool tests done in the clinical laboratory of the university hospital were positive. The commensal protozoa were the most prevalent parasites. *G. lamblia* was the most common pathogenic parasite. Men showed higher enteroparasitosis rates than women.

Since the control of parasitic diseases is extremely important for public health, it is easy to understand the importance of the current study to the problem presented and to the search for effective solutions. Data about the differential prevalence between men and women may be used in health education activities in order to improve prevention and to help the early diagnosis and treatment of diseases caused by these parasites.

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