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## **AWARENESS AND UNDERSTANDING OF RISK FACTORS FOR INTESTINAL PARASITIC INFECTIONS AT A PUBLIC UNIVERSITY IN SOUTHERN BRAZIL**

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### **ABSTRACT**

Intestinal parasitoses are highly prevalent in underdeveloped countries such as Brazil. These infirmities may be analyzed looking at the epidemiological triad of the diseases, which consists of host health, the parasite itself and the environment in question. This study aimed to identify the presence of predisposing factors for contamination by enteroparasites in the students of a public university in the South of Brazil. A transversal and descriptive study was carried out with qualitative and quantitative components, and data prospection by means of a questionnaire answered by the students. Only 63.9% of the subjects wash their hands before meals. However, the most alarming factor observed was the environmental instance as the university restrooms are often unclean, which was reported in 99.0% of the questionnaires.

**KEY WORDS:** Intestinal parasites; undergraduate students; health-education

### **INTRODUCTION**

Parasitic diseases are among the major public health issues in the world, especially in underdeveloped countries such as Brazil (Cunha & Amichi, 2014). In this context, three main factors form the classic epidemiological triad of the diseases necessary for the infection to occur. They are host health, parasitic condition, and the environment (Frei et al., 2008).

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Host health consists of predisposing factors related to poor hygiene, both personal and collective, due to culture, age, and level of education. Factors such as nutritional and immunological status must also be taken into account. Therefore, the high prevalence and the increasing spread of parasitic diseases in developing countries are linked to deficient living conditions, especially in the poorest population groups. The behavioral patterns noted in these population groups enable contamination of an individual by a parasite (Carneiro & Antunes, 2000).

Environmental conditions, such as poor basic sanitation, associated with the factors above also favor the occurrence of infections and disease progression. As the main form of transmission for intestinal parasites is the fecal-oral route, the sanitary infrastructure of a certain region is highly correlated to contamination odds. The prevalence of a parasitic infection, therefore, reflects basic sanitation, living conditions, and hygiene deficiencies (Neghme & Silva, 1971).

Once the presence of deficient host hygiene and environmental lack of sanitation were directly related to the population's risk of contamination, the application of a questionnaire to the students of the State University of Maringá was defined, aiming to identify the presence of predisposing factors in this population. The main reason for this choice of sample universe was its high level of education, since this social group would be expected to answer basic questions regarding transmission and prophylaxis of such prevalent diseases satisfactorily. Besides, data were also collected on the situation of the sanitary facilities in the university, as the academic environment is expected to be able to provide its teachers, students, and employees with adequate facilities, to be correctly used.

## METHODS

### *Population and study area*

The graduate students attending full time, part time or evening courses in person at the main campus of the State University of Maringá, in Paraná, define the population of the study. The population at the time of the study was 12,311 students, divided according to their major field of study into 5,552 exact sciences students, 2,949 biological sciences students and 3,810 human sciences students.

The city of Maringá, where the main campus is situated, has a Human Development Index (HDI) of 0.808, a population of 357,077 inhabitants, and a demographic density of 730.08 inhabitants/km<sup>2</sup> and occupies the 23rd position in the HDI ranking among Brazil's 5,700 cities.

According to the Atlas of Human Development in Brazil (2013) its habitation indexes show that 99.2% of the population lives in homes with piped water, 98.9% have their garbage collected and 100% have electricity.

However, even with a high HDI, studies on intestinal parasite prevalence in the city show a relevant contamination rate among its citizens. According to Bianchini et al. (2015), after analyzing the results of tests on 45 isolated feces samples of 0-5 year-old children, enrolled in a nursery school in Maringá, a positivity of 15.5% was observed in the evaluated children, 71.4% *Giardia intestinalis*, followed by 14.3% *Endolimax nana* and 14.3% *Enterobius vermicularis*. Guilherme et al. (1999) also stated that the prevalence of intestinal parasites in horticulturists was 26% and in vegetables from “Feira do Produtor de Maringá”, the most important city market, 16.6%.

The university appears in 6th place among the Brazilian universities in the Times Higher Education (THE) ranking, which evaluates how universities are committed to the 17 Sustainable Development Goals of the United Nations. It also figures in 2nd place in the Leiden Ranking, regarding the number of higher education publications by female authors and is among the 1,300 best universities in the world according to the Center for World University Rankings (2020), and in 32nd place among the Brazilian institutions evaluated.

### *Type of study and ethical aspects*

The questionnaire answered by graduate students in the different courses offered by the university led to a transversal, observational and descriptive study approved by the Permanent Committee of Ethics in Human Beings Research (CAAE: 24146719.0.0000.0104) of the State University of Maringá. The participants signed a Term of Free and Informed Consent, agreeing to take part in the study.

### *Sample calculation*

The minimum sample size was calculated using Slovin’s formula, as there was no specific phenomenon being investigated:

$$n = \frac{N}{1 + N \times \alpha^2}$$

A confidence level of 95% ( $\alpha = 0.05$ ) was determined, and  $n = 12,311$ , which is the number of students registered on the main campus, as shown in the 2019 database (“Base de Dados de 2019 – UEM”) offered by the institution. Therefore, 388 students defined the minimum sample size, randomly chosen. By the end of the enquiry, the final sample numbered 391 students.

## *Questionnaire Application*

The questionnaire was divided into three stages. The first seeking to determine the study population based on variables such as income, habitation, schooling, and field of study. The second stage consisted of fourteen “yes / no” questions, to assess Knowledge, Attitude, and Practices (KAP) in regard to intestinal parasitoses, following the directives present on “The KAP survey model – Médecins du Monde”, with adapted questions from Mello et al. (1988) and Gebreyessus et al. (2018), as well as questions related to knowledge on preventive practices (Neves et al., 2016). The final stage focused on identifying the presence of favorable situations for the transmission of enteroparasites in the sanitary facilities of the university, based on the evaluation and experience of the students.

## *Statistical analysis*

With the data obtained, the “R” and “Excel” software were used to set up a simple descriptive statistical analysis, according to editors Norman & Streiner (2014), for each one of the questions in the questionnaire.

## RESULTS

Table 1 shows information regarding the questionnaire’s first stage, the socioeconomic stratification of the 391 individuals interviewed.

Regarding the habitation characteristics, almost all of the students interviewed (98.2%) lived in the urban zone in homes with basic sanitation (Table 1). This proportion is in accord with the reality of the city.

The majority of the interviewed owned pets (Table 1). Note that the sum (426) exceeded the number of students, as they sometimes had more than one species. The main income bracket ranged from four to ten minimum wages (Table 1), which, at the time of the research, corresponded to 998.00 Brazilian Reais as declared by the national government (2019).

Table 2 presents data referring to the second stage of the questionnaire, involving the students’ awareness, attitude, and practices towards parasitic diseases and prevention in general.

Notably 16.1% of the interviewed believe that only washing vegetables with running water is an efficient sanitizing method and part of them (39.9%) considered potable water completely free of intestinal parasites (Table 2). Another remarkable fact was the lack of hand washing by more than 1/3 of the students before meals and by 7.7% after going to the toilet (Table 2).

Table 3 brings information on the students' experiences regarding the sanitary facilities at the university. The data collected points out that almost all of the interviewed (99.0%) had, on at least one occasion, found no soap in the restrooms, and 94.6% had been in lavatories without toilet paper.

*Table 1.* Socioeconomic stratification of 391 students at the State University of Maringa, Parana, Brazil. 2019

Questions	n	%
<b>Sex</b>		
Female	237	60.6
Male	154	39.4
<b>Habitation characteristics</b>		
Rural zone without basic sanitation	0	0.0
Rural zone with basic sanitation	4	1.0
Urban zone without basic sanitation	3	0.8
Urban zone with basic sanitation	384	98.2
<b>Pet ownership</b>		
Cat	63	16.1
Dog	201	51.4
Others	28	7.2
No pet ownership	134	34.3
<b>Family income bracket (in minimum wages)</b>		
Up to 2	37	9.5
From 2 to 4	84	21.5
From 4 to 10	159	40.7
From 10 to 20	73	18.7
More than 20	38	9.7
<b>Major field of study</b>		
Exact sciences	132	33.8
Human sciences	103	26.3
Biological sciences	156	39.9

*Table 2. Answers on the transmissibility and prophylaxis of parasitoses by 391 students of the State University of Maringa, Parana, Brazil. 2019*

Questions	n	%
Is treated water risk-free for the transmission of parasites?		
Yes	156	39.9
No	235	60.1
Is washing vegetables only in running water an adequate sanitizing method?		
Yes	63	16.1
No	328	83.9
Do you clip your nails frequently?		
Yes	350	89.5
No	41	10.5
Do you always wash your hands before meals?		
Yes	250	63.9
No	141	36.1
Do cats and dogs transmit parasites to humans?		
Yes	353	90.3
No	38	9.7
Has any individual close to you ever been infected by an intestinal parasite?		
Yes	111	28.4
No	280	71.6
Do you always wash your hands after going to the bathroom?		
Yes	361	92.3
No	30	7.7
Do you take vermifuges annually?		
Yes	117	29.9
No	274	70.1
Can sneezes transmit intestinal parasites?		
Yes	106	27.1
No	285	72.9
Do people infected with intestinal parasites always show symptoms?		
Yes	42	10.7
No	349	89.3
Can sexual fluids (semen and vaginal discharge) transmit intestinal parasites?		
Yes	135	34.5
No	256	65.5
Can intestinal parasitic infections be acquired through the skin?		
Yes	223	57.0
No	168	43.0
Regarding animal proteins, does only undercooked pork meat present a risk for human health?		
Yes	24	6.1
No	367	93.9

*Table 3.* Answers by 391 students on the restrooms in the State University of Maringá, Parana, Brazil. 2019

Questions	n	%
Have you ever entered restrooms at the university where there was no toilet paper?		
Yes	370	94.6
No	21	5.4
Have you ever entered restrooms at the university where there was no hand washing soap?		
Yes	387	99.0
No	4	1.0
Have you ever entered restrooms at the university where there were no toilet seats?		
Yes	325	83.1
No	66	16.9
Have you ever entered restrooms at the university where there were no paper towels for hand drying?		
Yes	386	98.7
No	5	1.3
Do you consider the quality of the university restrooms acceptable?		
Yes	42	10.7
No	349	89.3

## DISCUSSION

The data obtained allowed the analysis of the epidemiological predisposing factors that influence the study population. In relation to the “Environmental” factor, according to Visser et al. (2011) there is no doubt that the lack of basic sanitation offers greater risk of infection by parasites to the community and the existence of good sanitary facilities is essential for the health of a population. Therefore, satisfactory levels of sanitation in the student’s homes (99.2%) indicate one less epidemiological factor for the transmission of intestinal parasites. However, a considerable number of UEM students come from other municipalities or even from other States where sanitary standards may not be as high as in Maringá and may contribute to the spread of these pathogens.

Nevertheless, even though there are sewage installations in most of the residences, the “Host” factor is still relevant for contamination.

A considerable percentage of the interviewed (39.9%) considered that treated water was completely risk-free regarding the transmission of parasites. Undoubtedly, water chlorination brings benefits to human health, given that chlorine is a common disinfectant capable of destroying and/or inactivating most of the harmful water-borne pathogens (Santos et al., 2011).

Although 91% of urban and 23.8% of rural habitations presented treated water according to the Brazilian Institute of Geography and Statistics, Rose et al. (2002) claim, that it is well known that conventional water-treatment is not effective against certain parasites. Protozoans *Cryptosporidium* and *Giardia*, have chlorine and high temperature-resistant cystic forms, remaining viable for longer in the environment. There are reports in the scientific literature of the presence of *Cryptosporidium* and *Giardia* in treated water presumed to be potable (Azman et al., 2009).

Another aggravating aspect of the “Host” factor is incorrect sanitizing of fruit and vegetables. Beuchat et al. (2001) claim that washing these in running water may reduce up to 90% of the microbial load present in vegetables, however it is insufficient to keep their contamination at safe levels, therefore the application of a sanitizing antimicrobial agent is essential (Nascimento & Silva, 2010). Such knowledge was not present in 16.1% of the students, making this an important source of infection, considering that 16.6% of the 144 samples of five different types of vegetables from the most important market in town were contaminated with intestinal parasites (Guilherme et al., 1999). The vegetables and fruit consumed by the students and general population probably come from the rural area of the municipality or even from other municipalities, where enteroparasitoses may be more prevalent.

Therefore, hand washing is a correct, simple and effective measure for fighting infections, reducing the load of infective forms ingested (Bloomfield, 2001). Even so, 36.1% of the interviewed denied washing their hands before meals increasing the risk of enteroparasitic transmission. A literature review on the role of this health procedure verified that educational programs that encouraged hand washing reduced considerably the incidence of infectious diseases, especially diarrheas (Luby, 2001).

Furthermore, contact with domestic animals may transmit intestinal parasites. 90.3% (Table 2) of the students, were aware of this, a good indicator, given that 74.7% of them own pets (Table 1) and living close to pets favors the occurrence of zoonosis such as giardiasis (Santos e Castro, 2006).

In addition, in Table 2 the statements that verify awareness of enteroparasitic transmissibility via sexual fluids were considered correct by 34.5%. Even though there is no evidence of transmission through these fluids, it is significant that the sexual act may enable transmission of enteroparasites



by oral-anal contact, considering that giardiasis is a sexually transmissible disease (Escobedo et al., 2014).

Moreover, the possibility of being infected by intestinal parasites through the skin was considered accurate by 57% of the students. It is known that some infectious agents are capable of penetrating skin, as occurs in infections by hookworms and *Strongyloides stercoralis*, whose third-stage filariform larvae is the infective form for humans, as it penetrates through the host's skin and makes its way to the intestine, where it evolves to the adult form (Rey, 2001).

The questionnaire also pointed out that the majority (93.9%) (Table 2) are aware that not only undercooked pork presents a health risk. This is important considering that in Brazil there are important zoonoses that may also be transmitted through the consumption of other types of meat. As an example, cysticercosis is the most frequently diagnosed zoonosis in slaughterhouses and the number one cause for elimination of slaughtered bovines (Almeida et al., 2002). The prevalence of bovine cysticercosis in slaughterhouses inspected in the State of Espírito Santo from 2007 to 2010 was noted in a study showing that the average prevalence was 3.9%, with lower values in 2007 (3.2%) and higher in 2009 (4.7%) (Cipriano et al., 2015).

A predisposing factor is living with infected people. 28.4% of the students (Table 2) stated that people they lived with had already had a parasitic disease. However, many cases are asymptomatic, with the carrier unaware of being contaminated, not to mention the students who were aware but felt embarrassed by the fact. Consequently, the percentage above may be even higher given that some regions in Brazil present infection rates close to 30% for only one species of parasite (Waldman & Chieffi, 1989) and also for the fact that 10.7% of the interviewed believe that intestinal parasitoses are always symptomatic (Table 2).

The annual use of vermifuge medication, declared by 29.9% of the participants (Table 2), indicates that preventive chemotherapy, utilized in specific groups in a coordinated way, is an important measure for controlling the soil-transmitted helminthes-related morbidity (Mupfasoni et al., 2019), schoolchildren are an example of a group frequently present in that context. Yet it must be highlighted that anthelmintic drugs need to be used with caution as excessive use may be related to drug-resistance to some strains (Frei et al., 2008).

In short, it is clear that a significant number of students present precarious formal knowledge about the means of contamination by the country's most prevalent intestinal parasitoses as well as hardly understanding how to avoid them, facilitating the dissemination of diseases.

Regarding the "Environment" factor, Table 3 presents information on the experiences reported by the students regarding the sanitary facilities of the university where the study was conducted. The data evidences insalubrious

situations, as almost all of the interviewed had already entered restrooms where there was no hand washing soap, no toilet paper or even toilet seats. Therefore, it is comprehensible that 89.2% consider the sanitary facilities on the campus unacceptable.

This study presents a limitation, as stool-specimen examination for intestinal parasites among participants was not performed. However, considering that most infections by intestinal parasites are acquired through fecal-oral transmission, the fact that university students are in an environment that does not offer adequate sanitary conditions and are, therefore, unable to put into practice their previous knowledge on prophylactic measures, presents a hypothetical risk of contamination in the case of a contaminated student using the same installations. For this reason, the “Environment” factor is highlighted as a potential parasite dissemination source within the studied population.

The results of this study lead to the conclusion that university students are mostly unaware of the importance of hand washing since unclean hands are a potential means of contamination, as well as being unaware of the prophylaxis of intestinal parasites. In addition, the university restrooms should be provisioned with the adequate hygiene material, contributing to an effective reduction in predisposing factors for intestinal parasites in the population studied.

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## CONFLICTS OF INTEREST

The authors declare no conflict of interest in relation to this article.

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