# OCCURRENCE OF INTESTINAL PARASITES IN COLLECTORS OF RECYCLABLE MATERIALS IN SOUTHERN BRAZIL

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### ABSTRACT

Solid waste produced by modern society, together with lack of basic sanitation and poor hygiene practices result in risks to public health. 46 workers from the cities of Pelotas, Canguçu, Morro Redondo, Rio Grande and Capão do Leão were evaluated by parasitological examination of two fecal samples by Ritchie, Hoffman, Pons and Janer- HPJ techniques and Sheather method as well as a consented interview. 47.8% (22/46) of the examined individuals were parasitized, with no significant difference between both groups (garbage dump and recycling volunteers). Most of the samples evaluated presented forms of helminths (68.2%) while protozoa were found in 31.8% of the samples. Helminths found, and their respective prevalence were: Ascaris lumbricoides (31.8%), Ascaris lumbricoides/Trichuris trichiura (18.2%), Trichuris trichiura (9.1%), Taenia sp (4.6%) and Trichuris trichiura/Ancylostomids (4.6%). Protozoa were: Giardia intestinalis (13, 6%), Entamoeba spp. (9.1%) and Endolimax nana (9.1%). Monoparasitism was observed in 77.3% of the cases. Most of the population consisted of women, 21-40 years of age, low educational level and monthly income less than one minimum wage. The majority of the workers did not use protective equipment. Multivariate analysis revealed that infection from parasites in scavengers who lived near open sewers was 6.65 times higher (p = 0.0065) than in the other workers. In the localities studied, our results showed that the risk of acquiring parasitic infections was related to poor sanitation and the lack of sewerage systems; and not actually due to handling these types of waste. The parasitological indices found are similar to those described previously in other parts of the country.

KEY WORDS: Waste pickers; intestinal parasites; solid waste; basic sanitation; garbage.

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The industrial revolution ended craftsmanship, therefore increasing manufacturing processes. Industry brought development with it and, consequently, the consumption of processed products. These are acquired excessively by modern society, often without the least concern for the environment or people's health. As a result, pollution has become a serious problem. The degree to which pollution has increased because of industrialization and urbanization, has reached a global scale (Ferreira, 1997; Leal et al., 2008).

Solid waste generated by modern society, combined with the lack of basic sanitation and inadequate home care and personal hygiene practices, result in public health risks. A third of the population in cities in developing countries live in environmental conditions favorable to the spread of parasitic infections (Cavalcante & Franco, 2007).

Intestinal parasites can cause debility in individuals, specially in waste pickers who are directly exposed to this garbage (Gamboa et al., 2003). Chronic diarrhea and malnutrition may therefore affect the physical and intellectual development of this population.

From the social point of view, there is an increase in the group of individuals who are excluded from the formal labor market and who have found in the marketing of solid waste an alternative income. Thus, in recent years recycling cooperatives have emerged, enabling income generation and reducing the environmental impact caused by waste. Initially, the emergence of these cooperatives was limited to large cities, but they have spread to small Brazilian towns, which also present difficulties concerning the final destination of waste as well as increasing social exclusion (Astal, 2004).

The prevalence of enteroparasitosis is one of the best indicators of the socioeconomic status of a population (Velloso, 2005). These infections may be associated with different factors such as: inadequate sanitation, fecal contamination of water and food, sociocultural factors, contact with animals, absence of or poor sanitation, besides host age and the type of infecting parasite (Visser et al., 2011).

Thus, this study aimed to investigate the prevalence of intestinal parasites in waste pickers in southern Brazil, Rio Grande do Sul State, in order to forward the infected individuals to local Health Services for appropriate treatment.

#### METHODS

The researched group included both men and women waste pickers working in landfill or solid waste recycling cooperatives. The study was conducted in the following cities: Capão do Leão, Pelotas, Canguçu,

Morro Redondo and Rio Grande, all in southern Rio Grande do Sul, Brazil. The region is located between latitudes 31° 45' 48" S and longitudes 52° 29' 02" W, latitudes 31° 46' 19" S and longitudes 52° 20' 33" W, latitudes 31°23'42"S and longitudes 52° 40' 32" W, latitudes 31°35'18"S and longitudes 52° 37' 55" W and latitudes 32° 1' 60" S and longitudes 52° 5' 55" W respectively.

Each participant answered an epidemiological questionnaire regarding level of education, age, working conditions, food from garbage and basic health care. Fecal examinations for intestinal parasites were performed by the Parasitology Laboratory in the Biology Institute, Federal University of Pelotas (UFPel). For these tests, two feces samples were collected per individual, on alternate days, in identified vials containing preservative MIF (merthiolate, iodine and formaldehyde). Samples were preserved at 10 °C until processing. During the distribution of collector vials, participants received explanations regarding the purpose of the work and the care that should be taken during the collection of feces. After clarification, the participants signed a consent term.

Samples were analyzed by Ritchie, Hoffman, Pons and Janer- HPJ techniques and Sheather method. Participants received individual guidance on how contamination occurs, as well as on prevention methods when the coproscopy results were delivered. They were also handed an official report, and the positive cases for enteroparasitosis were forwarded to the nearest Basic Health Unit in order to receive specific medication and medical care.

In the last stage of this study, participants attended a lecture on health education where they received educational folders as well as information regarding the main parasites responsible for human infections, modes of infection and prevention. This study was conducted from July 2011 to August 2013. The procedure was approved by the Ethics Committee of the Federal University of Pelotas (UFPel), registration number 069/11.

The statistical analysis was performed using the software programs Statistix 9.0 to perform univariate analysis through Chi-square test and Fisher's exact test. The multivariate analysis was performed by using the model of logistic regression (Epi-info software version 3.5.2)

# RESULTS

The individuals participating in this study came from different locations. 85.7% (6/7) of the cooperatives recycled solid waste, while 14.3% (1/7) were dumpsites. All workers (n = 77) were invited to participate, and 59.7% (46/77) of them accepted, answering the epidemiological questionnaire and collecting the fecal samples.

After the collection period, the dump was closed down, and this form of waste disposal prohibited. According to Law 12.305 (August 2, 2010), all dumps in the country should have been replaced by sanitary landfills by the year 2014. Furthermore, recyclable waste is not allowed to be sent to landfills, and non-compliance with this standard results in fines for municipalities.

Table shows the variables possibly influencing the presence or absence of parasitic infections in these workers. The only variable noted with a statistically significant influence on infections by enteroparasites was living in places with open sewers.

Regarding gender, 30.4% (14/46) were male and 69.6% (32/46) were female. The age bracket was 15-63 years; specially those aged 21-40 years (53%). Among the workers evaluated, only 2.2% (1/46) finished elementary school and 8.7% (4/46) high school. 91.3% (42/46) proved to be literate while 8.7% (4/46) were illiterate. Regarding the use of personal protective equipment, only 58.7% (27/46) made regular use.

In Capão do Leão, the waste pickers were scavenging on the dump ground that existed in the city. These scavengers received personal protective equipment (PPE) provided by the local administration, but did not always use it. The family income was approximately R\$ 1,500.00 monthly. All belonged to the same family and had worked there full time over a long period.

In the recycling cooperatives in Pelotas, Canguçu, Morro Redondo and Rio Grande, the collectors received the PPEs from their respective local administrations. The cooperative members of Morro Redondo (4 people, all male) received R\$ 1,000.00 monthly. In the other municipalities these workers usually received salaries beneath the minimum wage. A total number of 44.7% of the studied workers ingested food found in the garbage while working. The existence of open sewage near homes was reported by 55.3% of respondents. 47.8% (22 / 46) of participants were parasitized by one or more genera of parasites, with prevalences ranging from zero (Morro Redondo) to 100% (Rio Grande). Among the dump ground workers parasites were present in 60% (6/10), while in recycling cooperative this rate was 44.4% (16/36). Monoparasitism was more frequent in the study group (77.3%), as only 22.7% (5/22) of workers presented multiple infections. *Table.* Frequency of positive results for intestinal parasites in fecal samples from workers of different types of garbage dumps in southern Rio Grande do Sul; and its relationship with the possible risk factors by univariate and multivariate analysis.

Variables	Samples n (%)	Positives n (%)	Univariate Odds Ratio	р	Multivariate Odds Ratio	р
Residence with open sewers						
No	18 (60.9)	3 (16.7)	1		1	
Yes	28 (39.1)	16 (57.1)	6.66	0.0065	6.67	0.01
Workplace						
Recycling cooperatives	36 (78.3)	13 (36.1)	1			
Dumping ground	10 (21.7)	6 (60)	2.65	0.17		
History of intestinal parasitosis						
No	22 (47.8)	7 (31.8)	1			
Yes	24 (52.2)	12 (50)	2.14	0.21		
Age						
18 - 30	19 (41.3)	10 (52.6)	1			
> 30	27 (58.7)	9 (33.3)	0.45	0.19		
Foods like sausage consumption						
No	24 (52.2)	7 (29.2)	1			
Yes	22 (47.8)	12 (54.5)	2.91	0.08		
Presence of parasites in underwear						
No	44 (95.7)	17 (38.6)	-			
Yes	2 (4.3)	2 (100)	-	0.16*		
Street food consumption						
No	27 (58.7)	8 (29.6)	1			
Yes	19 (41.3)	11 (57.9)	3.26	0.055		

\* Fisher's exact test



*Figure*. Frequency of eggs \ helminth cysts \ protozoa in solid waste pickers in southern RS region.

Figure shows that the frequency of various parasites found in the solid waste scavengers was 31.8% by protozoa (parasites and commensal) and 68.2% by helminths. Multiple infections occurred in five individuals (22.7%), and the most frequent association was between *Trichuris trichiura* and *Ascaris lumbricoides* (18.2%). Twenty-five collectors (53.2%) had negative fecal examination.

## DISCUSSION

In Brazil, the occurrence of parasitic diseases varies considerably from one region to the next, and is related to the socioeconomic situation of the people and the methodology applied in the studies. Waste recycling has become a new job opportunity and has attracted more and more individuals. Daily new recyclable waste separation cooperatives are formed in big cities, but there is still no social and specific health policy to cater for the needs of this important group of workers (Velloso, 1995).

The refusal of some workers to participate in this study (40.3%), revealed ignorance of the importance of diagnosis and control of parasitic diseases. Many individuals were afraid that other illnesses might be detected, such as alcoholism or illicit drug use, and even after clarification, chose not to participate. In a study conducted in a community in the outskirts of Manaus (Amazonas State, Brazil), similar levels of non-participation were reported (33.6%) (Anjos & Ferreira, 2000).

Most of the study population were women, 21 to 40 years old. Similar ages were found in a study in Rio de Janeiro, where 46% of the waste pickers were aged 30 to 39. Similarly, in a study of 70 workers at the Municipal Urban Cleaning Company of Rio de Janeiro (RJ), the average age of the scavengers studied was 34.6 years (Velloso et al., 1997). In a study conducted in Pelotas (RS) most collectors (57%) were in the 18-40 age group (Silva, 2006). We noted, therefore, that the individuals studied were in the age bracket which allows for other types of activities, but who lack other job options. Regarding the level of education of the workers evaluated, only 8.7% were illiterate, a rate lower than that found in Rio de Janeiro (RJ) and São Paulo (SP) (Pereira MG, 2001). However, this study showed that 80.4% (37/46) of solid waste pickers had not completed elementary school, whereas this index was 66.6% among the collectors in the Municipal Urban Cleaning Company of Rio de Janeiro (RJ) (Velloso, 1995). We detected that the vast majority of participants did not have elementary schooling and their monthly income was less than one minimum wage. The low family income noted shows how this work is not valued or recognized officially. Therefore, work with solid waste is not economically attractive and is only performed due to the absence of other options, such as temporary jobs.

Most workers did not use protective equipment, on the allegation that they made it difficult to separate the materials. Waste received in cooperatives comes from selective collection already implemented in these municipalities. Others reported not using protective equipment daily, due to the heat, and claimed the waste was clean, besides being more difficult to separate the material wearing gloves. 83.0% were aware that the handling of waste offered health risks. Although they did not know what kind of contamination, the workers demonstrated a sense of danger due to waste.

The low use of personal protective equipment (PPE) among collectors was described in Pelotas: only 22% reported the use of gloves, 16% wore boots and only 1% reported the use of masks (Ferreira, 1985). In this study only 58.7% (27/46) said they made regular use of these items, which did not prove to be true as noted during visits. Other workers reported not making proper use of the equipment on a daily basis, because the waste was clean and it was more difficult to separate the material using gloves. Still, the majority (82.6%) were aware that handling waste offered health risks. Scavengers hardly ever used personal protective equipment due to the discomfort caused by such items, risking accidents, such as cuts and punctures. In addition, parasitosis are related to poor sanitary conditions and the poor quality of life of the population (Velloso et al., 1997; Pereira & Souza, 2001).

When asked about the possible risk to their health, due to the work environment, 20% of the respondents believed there was no risk, since the waste they handled was recyclable. Different results were found among Joâo Pessoa city garbage collectors (PB), who in general have no feeling of danger and are unaware of the health problems that waste can cause (Boia et al., 1999).

Parasitic diseases are caused by certain environmental changes, but are also closely associated with human behavior, which may be a preventive or transmission agent (Mati et al., 2011). The prevalence of intestinal parasitoses depends on several factors, and exposure to the working environment is considered a primary element for parasitic infections. Moreover, housing conditions, basic sanitation, socioeconomic status and health care are predisposing factors for contamination (Nunes et al., 2006). As for parasitic infections, 51.1% of the assessed workers had presented infection by intestinal parasites diagnosed in a laboratory or by visualization of parasites in feces. Of these, 36.2% did not carry out treatment, 53.2% had some type of treatment using antiparasitic drugs with medical guidance and 10.6% had practiced selfmedication. 59.6% had never had a stool examination as this had not been requested by doctors. In addition, they were unaware of the importance of parasitological diagnosis for determining appropriate treatment.

In the present study we found 46.8% prevalence of enteroparasitosis in recyclable material collectors. Comparisons between prevalences, and even the workers' positivity, are affected due to the different methodologies applied in collecting, target group and diagnostic techniques (Oliveira, 2003).

The analyzed garbage collectors had higher rates of helminth infection than protozoan, unlike those observed in Minas Gerais, where a higher prevalence of *Entamoeba coli* was detected (Marquez et al., 2002). The most common parasites were *Ascaris lumbricoides* and *Giardia intestinalis*. Similar results were obtained in the municipality of Goioerê (PR), with 195 individuals seen at Basic Health Units, aged 0-70, where the most prevalent parasites were *Ascaris lumbricoides* (39.2%) followed by *Entamoeba coli* (31.6%) and *Giardia intestinalis* (13.5%) (Quadros et al., 2004).

Generally in parasitological surveys the most commonly found species is *Ascaris lumbricoides*, both in adults and children (Carrillo et al., 2005). This is due to the degree of socio-economic development of the population, large adhesion capacity of the eggs to surfaces, oviposition capacity of females (200,000 eggs/day) and high resistance of the eggs in the environment, which may remain infectious in the soil for several months. This helminth is the most prevalent species of all the parasites that affect humans in countries with poor socioeconomic conditions (Ferreira, 1997).

The analysis of human intestinal parasites through parasitological investigations, has been a measure used to assess the health conditions of people living in precarious conditions, with regard to sanitation and low socioeconomic status (Dallangnol & Vieira, 2011). Data and systematized information on work-related diseases are limited in Latin American countries. As for work-related illnesses of recyclable material collectors, this information practically does not exist (Chieff & Neto, 2003).

Monoparasitism was more frequent in the study group (77.3%), similar to that seen in adults treated at the Biomedicine Laboratory of the Feevale University in Novo Hamburgo (RS) (Souza & Freitas, 2010).

The individuals who worked directly on the garbage dump, presented a higher parasite index than those in cooperatives, although this difference was not statistically significant (p = 0.3039). These data indicate similar exposure in both groups. However, the open sewer in the home or outside the home was a significant risk factor (p = 0.05), which increased 6.67 times the risk of acquiring intestinal parasites, enabling environmental contamination of water and food. Similar data were obtained in a study conducted with children in the city of Pelotas (RS) (Velloso, 1995; Brasil, 2016).

A sewerage survey in Iporanga (SP) found that the surveyed watercourses showed microbiological indices resulting from pollution by open sewers. In this region sanitation was inadequate and about 91% of the households had excreta in rudimentary fosses (32). This is still true in many places, such as in a community on the outskirts of the city of Manaus (AM), where only 4.7% of the households were connected to the public sewage system (Anjos & Ferreira, 2000).

The absence of sanitation services is one of the causes of the spread of infectious and parasitic diseases, causing a decreases in worker productivity. According to the Instituto Trata Brazil and the Fundação Getulio Vargas (FGV), work absences due to intestinal infections in employees whose homes are connected to sewerage systems are 6.5 lower than for workers whose homes do not have same access (Brasil, 2016).

The presence of intestinal parasites reflects basic sanitation (water treatment, sewage and garbage), housing, food hygiene and even health education of a population (Brasil, 2010). Education is an effective prophylactic measure and has been used preventively for intestinal parasites (Dias, 2005).

In this case, the implementation of adequate health infrastructure is fundamental to reduce the prevalence of parasitic infections. Changes in infrastructure and behavior are needed, which will be possible if the population has access to preventive information and health promotion policies (Dias, 2005). It is clear that the investment of public resources in sanitation, and the reduction / elimination of open sewers, definitely decreases infection by intestinal parasites.

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