

ORIGINAL ARTICLE

**FREQUENCY OF INTESTINAL PARASITES AND
COMMENSALS IN STREET WASTE PICKERS
FROM TWO COOPERATIVES IN THE BRAZILIAN
FEDERAL DISTRICT**

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ABSTRACT

This study describes the occurrence of intestinal parasites and commensals among street waste pickers (SWPs) of two cooperatives of recyclable materials in the Federal District, Brazil. Stool samples from 75 individuals were analyzed using the Rugai method and spontaneous sedimentation. A questionnaire was applied to assess the awareness of SWPs regarding diseases caused by garbage handling and their prevention methods. Sixty SWPs (80%) were diagnosed with intestinal helminths or protozoa. The most frequent protozoa found were *Entamoeba coli* (43%), *Endolimax nana* (28%), and *Entamoeba hartmanni* (15%), and helminths such as *Ascaris lumbricoides* (12%), hookworms (8%), and *Strongyloides stercoralis* (8%) were also found. Other species identified in the workers were *E. histolytica/dispar* (8%), *Giardia lamblia* (7%), *Hymenolepis diminuta* (3%), and *Hymenolepis nana* (3%). Thirty nine SWPs (65%) had mixed infections. Most (80%) SWPs reported having parasitic diseases in the past, and 72% reported having undergone a stool test. All individuals considered important to use personal protective equipment but only 40% wore gloves. The adoption of healthy hygiene habits and the proper use of personal protective equipment should decrease the occurrence of intestinal parasites in these individuals.

KEY WORDS: Parasites; commensals; waste pickers; Federal District, Brazil.

RESUMO

Frequência de parasitos intestinais e comensais em catadores de lixo de duas cooperativas no Distrito Federal, Brasil

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Este estudo descreve a ocorrência de parasitos intestinais e comensais em catadores de lixo de duas cooperativas de materiais recicláveis do Distrito Federal. Amostras de fezes de 75 indivíduos foram analisadas segundo os métodos de Rugai e da sedimentação espontânea. Um questionário foi aplicado para avaliar os conhecimentos dos catadores acerca de doenças causadas pelo manuseio do lixo e das formas de prevenção. Foram diagnosticados 60 (80%) indivíduos com protozoários ou helmintos intestinais. Os protozoários mais frequentes nos indivíduos infectados foram *Entamoeba coli* (43%), *Endolimax nana* (28%) e *Entamoeba hartmanni* (15%). Helmintos, como *Ascaris lumbricoides* (12%), ancilostomídeos (8%) e *Strongyloides stercoralis* (8%), também foram encontrados. As outras espécies identificadas foram: *E. histolytica / dispar* (8%), *Giardia lamblia* (7%), *Hymenolepis diminuta* (3%) e *Hymenolepis nana* (3%). Entre os catadores, 39 (65%) apresentaram infecções mistas. A maioria (80%) afirmou que tivera alguma doença parasitária e 72% informaram que já haviam realizado exame de fezes. Todos os indivíduos consideraram importante o uso de equipamentos de proteção individual, porém apenas 40% trabalhavam com luvas. A adoção de hábitos saudáveis de higiene e o uso adequado de equipamentos de proteção individual devem reduzir a ocorrência de parasitos intestinais nestes indivíduos.

DESCRITORES: Parasitos; comensais; catadores de lixo; Distrito Federal; Brasil.

INTRODUCTION

The consumption of processed products has increased in the last decades, causing more waste production (Hoornweg et al., 2013). Improper storage of garbage promotes the dissemination of synanthropic organisms and pathogens, including protozoa and helminths (Alvarado-Esquivel et al., 2008; Alvarado-Esquivel, 2013; Coelho et al., 2000; Ferreira et al., 2013; Nunes et al., 2006). These parasites have different stages and are transmitted by skin penetration by infective larvae or by the fecal-oral route, mainly when individuals eat food contaminated with eggs, larvae, cysts and oocysts (Borges et al., 2009; Dhama et al., 2013; Knopp et al., 2012; Santos et al., 2014).

Street waste pickers (SWPs) may be considered as a group at risk of developing parasitic diseases because they often handle garbage without personal protective equipment (PPE). SWPs predominantly collect cans, bottles, and cardboard. During collection, they have direct contact with harmful and potentially contaminated material; also they are subjected to occupational hazards such as wounds, cutting-contusion injuries, cutting injuries, excoriations, and environmental contamination (Binion & Gutberlet, 2012; Robazzi et al., 1997). The presence of chronic non-communicable diseases (Auler et al., 2014), bacterial (Alvarado-Esquivel et al., 2015), and viral (Martins et al., 2014) infections among SWPs was also reported. Moreover, parasitic infections by *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Trichuris trichiura*, *Enterobius vermicularis*, hookworms, *Toxocara canis*, *Schistosoma mansoni*, *Hymenolepis spp.*, *Taenia spp.*, *Giardia lamblia*, *Toxoplasma gondii* and *Entamoeba spp.*, are already registered in SWPs (Alvarado-Esquivel et al., 2008; Alvarado-Esquivel, 2013; Coelho et al., 2000; Ferreira et al., 2013;

Nunes et al., 2006). Therefore, garbage collection is one of the most risky and unhealthy professions.

The objectives of this study were to describe the occurrence of intestinal parasites and commensals among SWPs of two cooperatives of recyclable materials in the Brazilian Federal District (FD), and to assess the awareness of these workers regarding diseases caused by waste handling, and their prevention measures.

MATERIAL AND METHODS

The study was conducted between March and June 2013. Two cooperatives of recyclable materials in the FD were selected by convenience: Cooperative for the Selective Collection of Recyclable Materials and Solid Waste (Cooperativa de Coleta Seletiva de Materiais Recicláveis e Resíduos Sólidos - RECICLO) and Pre-Cooperative Association of Solid Waste Pickers of Brasília (Associação Pré Cooperativista de Catadores de Resíduos Sólidos de Brasília - APCORB) located at the Recanto das Emas and Avenida das Nações, respectively. Recyclable materials such as paper, cardboard boxes and aluminum cans are collected by these cooperatives.

The sample size (n=75) was calculated on the basis of the study of Machado & Costa Cruz (1998). A total of 75 SWPs aged above 18 years participated in the study (29 from RECICLO and 46 from APCORB). They signed a free and informed consent form according to the resolution 196/96 of the National Health Council. The study was approved by the Ethics Committee on Human Research of the Health Secretariat of FD (No. 042342/2012).

Questionnaires were initially applied to assess age, sex, education level, length of service, occupational risks, occurrence of parasites, stool examinations in the last year, clinical manifestations associated with parasitic infections and prevention and use of PPE.

Three stool samples were subsequently collected in 80 g plastic bottles without preservation solutions, with the maximum range of 4 to 5 days between each collection. The parasitological diagnosis was performed using two methods, spontaneous sedimentation (Hoffmann et al., 1934) and Rugai (1954). Once processed, the samples were stored in 10% formaldehyde. For each sample, nine microscope slides were stained with Lugol and examined using an optical microscope at 100x and 400x magnification. Parasites and commensals were morphologically identified (Rey 2010; De Carli, 2014), measured using an ocular micrometer, and photographed using a digital camera (Sony™ Cyber-shot 5.1MP) attached to the microscope (Olympus BX 41).

The procedures for the preparation of the microscope slides and diagnosis were performed as described in the literature (Machado & Costa Cruz, 1998; Santos et al., 2014). The detection of intestinal helminths or

protozoa in the samples by at least one method was considered for the individual diagnosis. The results of parasitological examinations were given to the SWPs and they were referred to medical health centers, where they received specific treatment.

RESULTS

All subjects examined were adults aged between 20 and 60 years. Of these, 92% were women. With regard to their level of education, 60% had primary education, 19% were semi-literate, 16% were illiterate, 5% had high school education, and no worker had higher education.

Of the 75 individuals, 53 (71%) had worked for more than 5 years in cooperatives, and 50 (67%) of them lived with more than four people. Also, 63 (84%) were aware of the existence of occupational health risks and 68 (90%) believed that animals associated with the waste could transmit diseases. All individuals considered important to use PPE in accident prevention and health maintenance. However, only 30 (40%) reported wearing gloves, 26 (34%) wore boots, 11 (14%) wore masks, eight (10%) wore aprons and two (2%) wore other PPE.

Forty SWPs (53%) reported having experienced accidents when handling garbage such as abrasions, cuts, sprains, scorpion and dog bites. Sixty-one (81%) of them had consumed food from the garbage and 72 (96%) reported performing hand hygiene after handling garbage and before consuming food, and 69 (92%) reported wearing shoes. Among the respondents, 54 (72%) had undergone stool examination and 60 (80%) reported having acquired a parasitic disease in the past.

The reported symptoms indicative of parasite infection were headache, weakness, irritability, stomach pain, loss of appetite, abdominal pain, excessive flatulence, constipation, nausea, vomiting, and weight loss. In addition, they reported experiencing itchy skin, insomnia, itchy nose and genitals, excessive hunger, drowsiness, cough, difficulty in breathing, diarrhea and fever.

A total of 2,025 slides were analyzed during stool examinations. Altogether, 60 (80%) of the individuals were diagnosed with intestinal protozoa or helminths. The most frequent protozoa found in infected SWP were *E. coli* (n=26; 43%) (Figure 1A), *E. nana* (n=17; 28%), and *E. hartmanni* (n=9; 15%). Helminths such as *A. lumbricoides* (n=7; 12%) (Figure 1B), hookworms (n=5; 8%) (Figure 1C), and *S. stercoralis* (n=5; 8%) were also found among infected SWPs. The other species identified were *E. histolytica/dispar* (n=5; 8%), *G. lamblia* (n=4; 7%), *H. diminuta* (n=2; 3%), and *H. nana* (n=2; 3%) (Figure 1D). Thirty nine SWPs (65%) had mixed infections by two or more species of protozoa and/or helminths. Most mixed infections were by *E. coli*, *E. nana*, and *E. hartmanni* (Table).

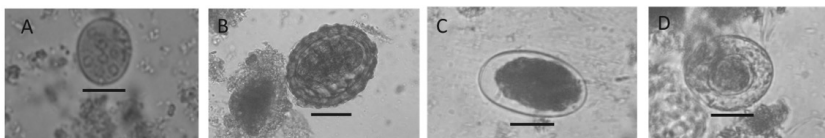


Figure 1. Parasites and commensals detected in stool samples of street waste pickers from two cooperatives in the Brazilian Federal District, Brazil, between March and June 2013. A) *Entamoeba coli* cyst. B) *Ascaris lumbricoides* egg. C) Hookworm egg. D) *Hymenolepis nana* egg. Scale bar, 25µm.

Table. Mixed infections by two or more species of protozoa and/or helminths in street waste pickers from two cooperatives in the Federal District, Brazil, between March and June 2013.

Protozoa and/or helminths	Number	Percentage
Ancylostomidae + <i>Entamoeba coli</i>	1	2
Ancylostomidae + <i>Endolimax nana</i>	1	2
Ancylostomidae + <i>Entamoeba histolytica/dispar</i>	1	2
Ancylostomidae + <i>Giardia lamblia</i>	1	2
Ancylostomidae + <i>Ascaris lumbricoides</i>	1	2
<i>A. lumbricoides</i> + <i>E. coli</i>	1	2
<i>A. lumbricoides</i> + <i>E. nana</i>	1	2
<i>E. histolytica/dispar</i> + <i>E. coli</i>	2	3
<i>Strongyloides stercoralis</i> + <i>E. coli</i>	1	2
<i>Hymenolepis nana</i> + <i>E. hartmanni</i>	1	2
<i>E. coli</i> + <i>E. hartmanni</i>	1	2
<i>E. coli</i> + <i>E. nana</i>	8	13
Ancylostomidae + <i>Ascaris lumbricoides</i> + <i>E. coli</i>	1	2
<i>Entamoeba histolytica/dispar</i> + <i>E. coli</i> + <i>E. nana</i>	2	3
<i>E. coli</i> + <i>E. nana</i> + <i>E. hartmanni</i>	11	18
<i>G. lamblia</i> + <i>E. coli</i> + <i>E. nana</i>	1	2
<i>G. lamblia</i> + <i>E. coli</i> + <i>E. hartmanni</i>	1	2
<i>Hymenolepis diminuta</i> + <i>E. coli</i> + <i>E. hartmanni</i>	1	2
<i>S. stercoralis</i> + <i>E. coli</i> + <i>E. hartmanni</i>	1	2
<i>S. stercoralis</i> + <i>E. coli</i> + <i>E. nana</i> + <i>E. hartmanni</i>	1	2
Total	39	65

DISCUSSION

The present study revealed a high occurrence of intestinal parasites and commensals in SWPs from two cooperatives of FD. Moreover, the results show that these workers are exposed to helminth infections such as hookworms, *A. lumbricoides*, *S. stercoralis* and *Hymenolepis spp.* This is the first study to show the presence of intestinal parasites in the SWPs of FD and the first step to understanding the association between parasitic infections and this group of workers in Central Brazil.

Among the subjects interviewed, 54% had experienced occupational accidents when handling the garbage. Moreover, an SWP can ingest contaminated food scraps in the garbage and thus acquire infections. The accidents may have occurred owing to the lack of use or inappropriate use of PPE (Velloso et al., 1997). Occupational accidents could be avoided by creating awareness among the SWPs about the need for proper use of PPE (Ivens et al., 1997). However, some workers do not make an effort to wear them and there is no requirement from cooperatives in this respect. The availability of appropriate PPE and the increased awareness of these individuals about the importance of PPE use can help decrease the incidence of some of these occupational accidents, including cuts, punctures, and bruises (Binion & Gutberlet, 2012; Robazzi et al., 1997; Yang et al., 2001). The high frequency of SWPs reporting parasitic diseases in the past suggests that these individuals are exposed to enteroparasites while performing their work.

The commensal protozoan *E. coli* was common among this population of SWPs. This result was expected, considering that workers handle material potentially contaminated with human feces, and they are exposed to synanthropic organisms, which may mechanically transmit such protozoa (Graczyk et al., 2005). In addition, SWPs did not often wear gloves while working and reported consuming food from the garbage. This behavior could favor dissemination of protozoa that favor the fecal-oral route of transmission. *E. coli* was also the most common protozoan (32%) among SWPs from a municipality of Minas Gerais (Nunes et al., 2006). Although this protozoan does not trigger important pathological manifestations, its occurrence indicates that individuals are exposed to parasite infections that use similar mechanisms of transmission to *E. coli* such as the pathogenic protozoa *E. histolytica* and *G. lamblia* (Lujan et al., 2006; Santos et al., 2008). Although less frequent, *E. histolytica/dispar* also occurred among the SWPs, indicating the possibility of amoebic infections. Some individuals might develop amoebic colitis with abdominal pain, nausea, vomiting, and diarrhea (Santos et al., 2008), which were symptoms reported by SWPs during interviews.

In the present study the frequency of hookworms was 8%. This frequency was similar to that observed by Coelho et al. (2000) and less than that observed by Ferreira et al. (2013), wherein more than 50% of the SWPs

were infected. The transmission route for hookworm involves the penetration of the host's skin or mucosa by filariform larvae (Knopp et al., 2012; Rey, 2001). This transmission mechanism is similar to that of *S. stercoralis*. The low use of gloves reported by workers in the two cooperatives should favor infection by these helminths.

Of the infected SWPs evaluated, 12% were diagnosed with *A. lumbricoides*. This frequency was lower than that observed in other studies involving SWPs (Coelho et al., 2000; Ferreira et al., 2013). The frequency of *H. nana* (3%) was also low considering that 44% of the 73 children sampled from the Riacho Fundo II region in the FD, where the RECICLO workers collect the garbage, were positive for this cestode (Santos et al., 2014). The low occurrence of helminths among SWPs can be associated with two main factors: adults have better hygiene habits compared to those in children, and cellular and acquired immune responses in most immunocompetent adults can eliminate enteroparasites or maintain them at low levels (Grencis et al., 2014).

Other diagnostic methods, such as Faust, could improve detection of protozoa such as *G. lamblia* (Machado et al., 2001) but these organisms are also detected by spontaneous sedimentation. Inclusion of the Faust method could have increased the chances of detection, which reinforces the hypothesis of a high frequency of intestinal protozoa among SWPs. Though we have used two parasitological methods to detect intestinal protozoa and helminths, other parasites were not found, such as *Cryptosporidium spp.*, which is detected by using other parasitological techniques (Omoruyi et al., 2014). Future studies including SWPs in other FD cooperatives as well as family members of these workers will clarify the impact of garbage collectors on the transmission of pathogens.

The application of measures for the control of parasitic diseases such as changes to hygiene habits, proper washing of food, wearing shoes, provision of sanitary facilities and rapid treatment of diagnosed persons is important to prevent the spread of pathogens. Thus, guidelines about appropriate personal hygiene habits and food preparation are some simple measures that if adopted, may interrupt the life cycle of the parasites, and the resultant infections in animals and the human population (WHO, 1987).

CONCLUSIONS

The present study shows that SWPs are exposed to parasitic infections by protozoa and helminths in FD. In addition, the SWPs know the risks and importance of prevention of parasitic diseases. Thus, education practices in health care should be implemented to increase the knowledge of healthy hygiene habits and proper use of PPE among the SWPs to reduce the occurrence of intestinal parasites in these individuals.

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