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SHORT REPORT

HIGH FREQUENCY OF *Ascaris lumbricoides* IN PUBLIC PLAYGROUNDS IN CENTRAL BRAZIL

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ABSTRACT

Public playgrounds may be sources of parasite infections. This study analyzed the occurrence of intestinal parasites in playgrounds in the Federal District of Brazil (DF). Seventy sand samples were collected in 14 playgrounds distributed around the DF in 2015-2016 and were processed using the Willis and Hoffman methods. All playgrounds were contaminated with parasites. The parasites identified were *Ascaris lumbricoides* (33%), *Strongyloides* sp. (6%), *Ancylostomidae* (4%), *Giardia* sp. (4%), *Trichuris* sp. (3%) *Toxocara* sp. (3%) and *Hymenolepis nana* (1%). Results show the potential risk of transmission of parasitic diseases (mainly ascariasis) in playgrounds in central Brazil.

KEY WORDS: Parasites; contamination; sand; *Ascaris lumbricoides*.

Soil-transmitted parasites infect people worldwide, particularly in America, Africa and Asia. These parasite infections can lead to premature death of children and are associated with poor sanitation, especially in the outlying areas of large cities (Hotez et al., 2008). In these areas, playgrounds might be present risk for transmission of various pathogens to humans, including intestinal parasites, and the child population is the main risk group (Guimarães et al., 2005). Transmission may occur by accidental ingestion of sand contaminated with parasites from human feces or pet feces. For example, pet dogs and stray animals could defecate in playgrounds, thus contaminating the environment with parasites and favoring zoonotic transmission (Traversa et al., 2014).

Sand in public playgrounds may be the source of parasite infections that can affect people who accidentally ingest contaminated sand, a situation noted in several studies in Europe (Dado et al., 2012), Asia (Akdemir et al., 2010), Central America (Paquet-Durand et al., 2007) and South America (Santarém et al., 2004; Guimarães et al., 2005; Araújo et al., 2008; Cassenote

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et al., 2011; Coelho et al., 2011; Marques et al., 2012; Prestes et al., 2015) with frequencies ranging from 35-68% by different parasite species such as *Giardia* sp., *Entamoeba histolytica*, *Cryptosporidium* sp., microsporidia, *Strongyloides stercoralis*, *Ascaris* sp., but mainly *Toxocara* sp., *Ancylostomidae*, and *Trichuris* sp. Dogs and cats defecating in park sand are considered the main contaminating sources, exposing human users to zoonoses (Traversa et al., 2014).

In central Brazil, there are several public playgrounds, presenting high frequency of intestinal parasites in children (Santos et al., 2014) and dogs (Dantas-Torres and Otranto, 2014), therefore the occurrence of parasites in these places is expected. The aim of this study was to verify the occurrence of intestinal parasites in public playgrounds in the administrative regions of the Federal District of Brazil.

The study was carried out in the urban area of 14 administrative regions of the Federal District of Brazil between 2015 and 2016. All playgrounds had fences; the location and other characteristics of the playgrounds are described in Table 1. Five points in each playground were chosen randomly for sand samples (approximately 200 grams each). These samples were placed in clean, non-sterile labeled plastic bags, and taken to the Laboratory of Medical Parasitology and Vector Biology, Faculty of Medicine, University of Brasília, where they were stored at room temperature until processing.

Table 1. Characteristics of the public playgrounds included in the present study.

Locality	Shaded area	Condition of playground equipment	Visual warnings to avoid pets
Asa Norte	Large	Good	Yes
Asa Sul	Large	Good	Yes
Bandeirante	Small	Regular	No
Cruzeiro Novo	Large	Poor, broken	No
Cruzeiro Velho	No	Poor, broken	No
Estrutural	No	Good	No
Recanto das Emas	No	Good	No
Riacho Fundo 1	Small	Poor, broken	No
Riacho Fundo 2	No	Poor, broken	No
Samambaia Sul	No	Regular	No
North Taguatinga	No	Poor, broken	No
Ceilândia	Small	Regular	Yes
Guará	Large	Regular	No
Brazlândia	Small	Poor	Yes

Seventy samples were collected. Each sample was divided into four portions, where 50 g of each sample were analyzed according to the parasitological methods described by Hoffmann (spontaneous sedimentation) and Willis (centrifugal flotation) (De Carli, 2001). For the spontaneous sedimentation method, two spoonfulls of each sample were diluted in 250 mL of distilled water. Then, the solution was filtered through gauze (eight layers). The calyces were identified and maintained at room temperature. After the first 24 hours, the appearance of the solution was observed and in cases of suspended sediment, the supernatant was discarded and a further 250 mL of distilled water were added to the pellet, homogenized and stored for another 24 hours. For each sample, eight microscope slides were stained with Lugol and examined using an optical microscope (see below) for the visualization and identification of parasites. For the Willis method, 10 g of each sample was placed in a 10 mL beaker and homogenized with a saturated sodium chloride solution and enough distilled water to fill the recipient to the top. A microscope slide was placed on the edges of the flask in contact with the solution for three minutes. Later, the slide was removed by pouring the side that was in contact with the solution up. Then a drop of Lugol was added and the slides were examined using an optical microscope (Olympus BX 41) with 10x and 40x objectives. Parasites were morphologically identified (De Carli, 2001), measured using an ocular micrometer, and photographed using a digital camera (SonyTM Cyber-shot 5.1MP) attached to the microscope.

All playground areas were contaminated with one or more species of helminths or protozoa (cysts, eggs or larvae) (Table 2). All samples from the Ceilândia and Samambaia playgrounds were positive for parasites; the frequency of positive samples in the other areas ranged from 20-80%. The parasites identified were *Ascaris lumbricoides* (33%), *Strongyloides* sp. (6%), *Ancylostomidae* (4%), *Giardia* sp (4%), *Trichuris* sp (3%) *Toxocara* sp. (3%) and *Hymenolepis nana* (1%). *A. lumbricoides* positive samples showed a higher number of eggs/sample (Table 2). Amongst the methods for parasites detection, spontaneous sedimentation showed a higher number of positive samples. Moreover, the non-pathogenic intestinal protozoa *Entamoeba coli* was detected in all playgrounds with frequencies ranging from 2% to 15%.

Public playgrounds showed high percentage of contamination by *A. lumbricoides*, an unexpected result considering that pet parasites of the genera *Trichuris*, *Toxocara* and the family *Ancylostomidae* are commonly found in sand samples (Santarém et al., 2004; Guimarães et al., 2005; Paquet-Durand et al., 2007; Araújo et al., 2008; Akdemir et al., 2010; Cassenote et al., 2011; Coelho et al., 2011; Dado et al., 2012; Marques et al., 2012; Prestes et al., 2015). These studies discuss the importance of sand contamination by domestic animals that defecate in playgrounds. The higher frequency of *Ascaris* in sand samples in the present study indicates that human feces are the main source of contamination considering the low occurrence of pigs in urban areas. Human feces contamination could be caused by homeless people who defecate in these places (Prestes et al., 2015) or unappropriately disposed of dirty baby diapers. The frequent occurrence of the human intestinal protozoa *E. coli* reinforces this hypothesis. Consequently, the inclusion of physical barriers (screens or fences) around playgrounds to prevent entry of domestic animals should not be the only strategy to reduce environmental contamination by parasites. Health education and the development of social projects involving homeless people should also be carried out, as well as with parents who must pay attention to the defecation behavior of their children during recreation in playgrounds. Moreover, sand changes in playgrounds should be carried out more frequently by the local administration. Maintenance is probably not frequent in most of the analyzed playgrounds as evidenced by the presence of broken equipment (Table 1).

Strongyloides sp. and *Giardia* sp. occurred less frequently when compared with other studies (Dado et al., 2012; Prestes et al., 2015), but this could be due to the method used for parasite recovery (Dado et al., 2012). *H. nana* was detected for the first time in sand samples from playgrounds in central Brazil. These parasites can occur in several animal species with diverse contamination sources. Differences in the occurrence of parasites among playgrounds may be related to the frequency of domestic animals in the parks as well as their structure (presence of fences, feces, shading, etc.). Cassenote et al. (2011) showed that the number of dogs, presence of fecal samples and the use of fences had an impact on soil contamination by parasites.

The results of the present study show that playgrounds are potential places for parasite infection. Thus, parents should be aware that such environments should not be frequented by pets like dogs and cats, as they are parasitic disseminators. In addition, these results reinforce the need of playground maintenance and health education since human contamination is also suggested. Improvements should be made by placing warning signs indicating the prohibition of animals and replacing the sand periodically. Public adminstrations need to be aware that these areas need to be cared for and kept clean, as they present risks regarding parasite infections, and it is imperative to safeguard the health of its users.

Table 2. Frequency of intestinal parasites detected in sand samples from public playgrounds between 2015 and 2016 in 14 Administrative regions of the Federal District of Brazil.

Administrative regions	Ancylostomidae	*A. lumbricoides*	*Giardia* sp.	*H. nana*	*Strongyloides* sp.	*Toxocara* sp.	*Trichuris* sp.
Asa Norte	0	1[c]	0	0	0	0	0
Asa sul	0	1[d]	0	0	0	0	0
Bandeirante	0	3[e]	0	0	0	0	0
Brazlândia	0	3[c]	0	0	1[a]	0	0
Ceilândia	1[a]	2[c]	0	0	1[a]	1[a]	0
Cruzeiro Novo	0	2[c]	1[a]	0	0	0	0
Cruzeiro Velho	0	1[c]	0	0	0	0	0
Estrutural	1[a]	2[d]	0	0	0	0	0
Guará	0	1[b]	1[a]	0	0	0	0
Recanto das Emas	0	2[c]	0	0	0	0	0
Riacho Fundo 1	0	2[d]	0	1[a]	0	1[a]	0
Riacho Fundo 2	0	1[c]	0	0	1[a]	0	0
Samambaia	1[a]	1[e]	1[a]	0	1[a]	1[a]	0
Taguatinga	0	1[c]	0	0	0	0	2[a]

Letters indicate number of eggs, larvae or cysts observed in the positive samples (or average if more than one sample was positive):
a: <3; b: 3-5; c: 6-8; d: 9-10; e:> 10.

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