Soil contamination by zoonotic gastrointestinal parasites of mammals in Garanhuns, Pernambuco, Brazil

[*Geocontaminação por parasitos gastrointestinais zoonóticos de mamíferos em Garanhuns Pernambuco, Brasil*]

"Artigo Científico/Scientific Article"

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Abstract
The increase of canine population in urban areas, which englobes stray or domiciled dogs, has an important epidemiological role in soil contamination of public areas. This increase contributes for the dissemination of infections by parasites via faeces of infected animals. The aim of this study was to detect the presence of immature forms of gastrointestinal parasites of mammals in soil from public roads and squares of the municipality of Garanhuns, state of Pernambuco, Brazil. A total of 211 soil samples were obtained and evaluated through the Faust and Rugai techniques. Out of 211 soil samples, 49.29% (104/211) scored positive the presence of immature forms of gastrointestinal parasites of mammals, being *Ancylostoma* sp. (37.91%) the most frequent. In conclusion, the soil of different parts of the municipality of Garanhuns is contamined by parasites of medical and veterinary concern. Therefore, the implementing of integrated prophylaxis measures is necessary to prevent the soil contamination, reducing the risk of infection for humans.

Keywords: *Ancylostoma* sp.; environment contamination; dogs; zoonosis.

Resumo
O aumento da população canina em áreas urbanas, tanto de animais errantes quanto domiciliados, tem papel epidemiológico importante na contaminação do solo de áreas públicas. Esse aumento contribui para a disseminação de infecções por parasitos por meio de fezes de animais infectados. O objetivo deste estudo foi verificar a presença de formas imaturas de parasitos gastrintestinais de mamíferos em solo de vias públicas e praças do município de Garanhuns – PE, Brasil. Um total de 211 amostras de solo foram coletadas e avaliadas por meio da utilização das técnicas de Faust e de Rugai. Das 211 amostras de solo, 49,29% (104/211) foram positivas para formas imaturas de parasitos gastrointestinais de mamíferos, sendo *Ancylostoma* sp. (37,91%) o mais frequente. Conclui-se que o solo de diferentes partes do município de Garanhuns está contaminado por parasitos de importância médica e veterinária, fazendo-se necessária a implantação de medidas integradas de profilaxia para minimizar os riscos de infecção para humanos.

Palavras-chave: *Ancylostoma* sp.; contaminação do ambiente; cães; zoonoses.

Introdução

Pets, in particular dogs, play an important role in the physical, emotional, and social development of humans (Campos Filho and Barros, 2008). Recently, the increase of dogs' population has favoured the soil contamination of public areas such as streets, squares, children parks, gardens, beaches and sand boxes in schools (Cassenote et al., 2011; Moura et al., 2013, Traversa et al., 2014, Studzinska et al., 2017). Currently, this is considered an important threat for

Recebido 25 de janeiro de 2018. Aceito 21 de dezembro de 2018.
DOI: https://doi.org/10.26605/medvet-v13n1-2611

the public, being present in various urban areas of Brazil, where the population of stray dogs occurs. Sometimes, due to the lack of information, dog owners let theirs animals loose in public areas, where they may defecate, contributing for soil contamination by immature forms of gastrointestinal parasites with zoonotic potential (Guimarães et al., 2005).

Immature forms of some parasites, for instance, *Ancylostoma caninum* and *Toxocara canis* are frequently detected in soil (Cassetone et al., 2011; Moura et al., 2013), and accidently infect humans. Nonetheless, humans are not the natural host of these parasites which cause *Cutaneus Larva Migrans* (CLM) and *Visceral Larva Migrans* (VLM) (Matesco et al., 2006). In general, CLM and VLM do not cause mortality, but may be responsible for cases of allergy, inflammatory reactions, bleeding and blindness (Vasconcelos et al., 2006).

Soil contamination by zoonotic parasites has been reported in public areas in several parts of Brazil (Chen and Mucci, 2012; Sprenger et al., 2014; Prestes et al., 2015). These studies highlight the epidemiological importance of these parasites, and the risk for humans which access contaminated areas such as squares, children parks, gardens, beaches and sand boxes in schools. Based on the lack of information in some areas of Brazil, the aim of this study was to evaluate the presence of immature forms of gastrointestinal parasites of mammals in soil of the municipality of Garanhuns, state of Pernambuco, Northeaster Brazil.

Material and methods

Study area

The study was conducted in the municipality of Garanhuns (latitude 8º53'25"S; longitude 36º29'34"E), located in the state of Pernambuco, Northeast region of Brazil. The study area is 900 metres above sea level and has an annual average temperature of 24 °C, average rainfall of 147 mm (from 25 mm to 295mm), and air relative humidity of 90%.

Collection and processing of samples

Sample collections were monthly performed from August 2012 to July 2013 in seven distinct points of the study area (Table 1). Soil samples (approximately 250 g) were collected in public squares and roads, from a minimal distance of five metres from the faecal material exposed in the environment. The soils were collected with a gardening shovel with five centimeters deep (Santarém et al., 1998). Samples were stored in plastic bags and maintained at 8 °C for transport to the laboratory, followed by sample processing. The sampling was defined probabilistically by convenience (Reis, 2003).

The sample processing was performed through the centrifuge-flotation with zinc sulphate technique (Faust et al., 1938) for the observation of eggs, and the Rugai technique (Rugai et al., 1954) for detection of larva. For each sample, one slide was prepared and observed through microscope at magnification of 10X and 40X.

Table 1. Distribution of samples by point of collection represented by neighbourhoods from Garanhuns – PE, Brazil.

Points of Collection	Squares	Public roads	Total
Brasília	0	9	9
Magano	9	33	42
COHAB I	12	11	23
COHAB III	3	71	74
Indiano	0	27	27
Heliópolis	11	1	12
Quartel	12	12	24
Total	47	164	211

Data analysis

Descriptive statistical analysis was performed. In addition, the Lilliefors test was used to verify the normality of the data. The Chi-square test with Yates correction (χ^2) was used to compare the occurrence of parasites in the environments (public roads or squares), as well as the occurrence of parasites species in different ecotypes. A 5% significance level was considered. The BioEstat software version 5.3 was used for statistical evaluation (Ayres et al., 2000).

Results

A total of 211 soil samples (47 squares and 164 public roads) were collected in different points of the municipality of Garanhuns. Out of all samples analyzed, in 49.29% (104/211) were

detected eggs and immature forms of gastrointestinal parasites of mammals. A higher contamination was observed in squares (68.09%; 32/47) than in public roads (43.90%; 72/164) (χ^2 = 7.607; p = 0.0058), in squares simple contamination was observed, whereas in the public roads simple and mixed contamination were (Table 2 and 3). Eggs of *Ancylostoma* sp. were predominant in squares than in public roads (χ^2 = 18.698; p = 0.0000). *Ancylostoma* sp. was the most frequent parasite detected with 37.91% (80/211) of positivity (Table 2).

Table 2. Simple contamination in squares and simple/mixed contamination in public roads by immature forms of gastrointestinal parasites in soil samples collected from the municipality of Garanhuns, PE.

Squares		**Public roads**	
Simple contamination		**Simple contamination**	
Parasite	**% (n/N)**	**Parasite**	**% (n/N)**
Ancylostoma sp.	65.95 (31/47)	*Ancylostoma* sp.	29.87 (49/164)
Strongyloides sp.	02.12 (01/47)	*Strongyloides* sp.	07.92 (13/164)
-	-	*Entamoeba coli*	00.60 (01/164)
Mixed contamination		**Mixed contamination**	
-	-	*Ancylostoma* sp. + *Strongyloides* sp.	03.04 (05/164)
-	-	*Ancylostoma* + sp. *Strongyloides* sp. + *Toxocara* sp.	02.43 (04/164)

Table 3. Frequency of parasites detected in soil samples from Garanhuns PE.

Parasites	**Frequency**	
	%	**n/N°(211)**
Ancylostoma sp.	37.91	(80/211)
Strongyloides sp.	06.63	(14/211)
Entamoeba coli	00.47	(01/211)
Ancylostoma sp. + *Strongyloides* sp.	02.36	(05/211)
Ancylostoma sp. + *Strongyloides* sp. + *Toxocara* sp.	01.89	(04/211)
Total	49.28	(104/211)

Discussion

This study assessed the presence of immature forms of gastrointestinal parasites of mammals in soil samples. It is known that the soil contamination by these parasites is a real problem and should be highlighted in developing countries due to their relevance in public health (Papini et al., 2012).

In Brazil, in the municipality of Curitiba, 63.6% squares (42/66) and 65.2% of the public roads (45/69) presented geohelminth contamination, presenting a higher frequency (14.5%; 50/345) for *Ancylostoma* spp. (Sprenger et al., 2014). Conversely, in Guarulhos, 74.5% (35/47) of the public areas investigated were contaminated by immature forms of gastrointestinal parasites (e.g., *Toxocara* spp. eggs) of mammals (Marques et al., 2012). Different from other countries, for example, in Cameroon, *Ascaris* spp. eggs were most frequent (2%; 8/400) (Tchakounté et al., 2018).

Interestingly, the contamination in squares was higher than in public roads, however in this first site only simple contamination has been observed. The presence of a wide range of parasites in public roads may be due to the presence of stray dogs, which has been considered an important trouble in Brazil (Marques et al., 2012). A factor influencing these results is that most squares are located on central areas, which present a lower number of stray dogs most likely due to the socioeconomic status of the residents (Habluetzel et al., 2003).

Among the parasites herein detected, *Ancylostoma* sp. was the most frequent (37.91%; 80/211). Similar results have been found in previous studies, with frequencies ranging from 41.07% to 71.03% (Scaini et al., 2003; Castro et al., 2005; Capuano and Rocha, 2006). Nonetheless, another study performed in the state of Bahia, Brazil, demonstrated that the frequency of *Strongyloides stercoralis* was higher than *Ancylostoma* sp. in sand samples collected from soil beaches. This variation on the contamination profile may be related to the climatic influence as sand sediment may suffer greater influence, associated to wind and rain, than soil from public roads and squares (Silva et al., 2017). The influence of climatic conditions is important

factors that affect the frequency of geohelminths in each region, justified by the fact that it favours the development and survival of eggs (Tchakounté et al., 2018). From an epidemiological point of view, these findings are relevant, especially considering the zoonotic aspect of those worms (Feldmeier et al., 2006).

This study reinforces the importance of assessment of contamination of soil through mammal faeces in urban areas. This is extremely important, as it allows the knowledge of possible risks for human population, especially children. Therefore, the implementations of preventive measures are needed, as gastrointestinal parasites represent a serious problem in public health.

Conclusion

The results obtained in this study confirm the presence of zoonotic parasites (*Ancylostoma* sp.) in public roads and squares in the municipality of Garanhuns, highlighting the importance of the veterinarian in the use of prophylactic antiparasitic drugs and in the indication of control programs for stray animals.

Conflict of interests

Authors declare no conflict of interests.

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