Parasites with zoonotic potential in canine fecal samples from Garanhuns, Pernambuco, Brazil

[*Parasitos com potencial zoonótico em amostras fecais caninas de Garanhuns, Pernambuco, Brasil*]

"Artigo Científico/Scientific Article"

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Abstract
Among the gastrointestinal parasites of dogs that present public health importance, the species of the genus *Ancylostoma* and *Toxocara* are the most frequently detected, and have been important cause of soil contamination. The aim of this study was to detect gastrointestinal parasites in dog's feces collected in households, streets and public squares of the city of Garanhuns, Pernambuco, Brazil. Fecal samples (n = 640) were collected in the environment and evaluated by parasitological methods of Willis-Mollay and Hoffman, Pons and Janer. Out of all samples, 51.09% (327/640) were positive for gastrointestinal parasites. In particular, in 70.94% (232/327) of the samples were detected eggs of *Ancylostoma* spp., and in 11.01% (36/327) coinfection by *Ancylostoma* spp. and *Toxocara canis.* In conclusion, the presence of eggs of zoonotic parasites in feces collected from the environment in the city of Garanhuns represent a risk for the transmission of Cutaneous Larva Migrans and Visceral Larva Migrans for the human population.

Keywords: *Ancylostoma* spp.; *Toxocara canis*; zoonosis.

Resumo
Dentre os parasitos gastrintestinais de cães com importância em saúde pública, as espécies dos gêneros *Ancylostoma* e *Toxocara* são as mais frequentemente encontradas, e contaminam o solo. O objetivo desse estudo foi detectar parasitos gastrintestinais em fezes de cães coletadas em domicílios, ruas e praças públicas da cidade de Garanhuns, Pernambuco, Brasil. Amostras fecais (n = 640) foram coletadas no ambiente e avaliadas pelos métodos parasitológicos de Willis-Mollay e Hoffman, Pons and Janer. De todas as amostras, 51,09% (327/640) foram positivas para parasitos gastrintestinais. Em particular, em 70,94% (232/327) das amostras foram detectados ovos de *Ancylostoma* spp., e em 11,01% (36/327) coinfecção por *Ancylostoma* spp. e *Toxocara canis.* Em conclusão, a presença de ovos de parasitos zoonóticos em fezes coletadas no ambiente na cidade de Garanhuns representa risco para a transmissão de Larva Migrans Cutanea e Larva Migrans Visceral para a população humana.

Palavras-chave: *Ancylostoma* spp.; *Toxocara canis*; zoonose.

Introduction

Several species of gastrointestinal parasites of dogs have been considered important threat for the public health, since they may be important cause of zoonosis in human population (Santos et al., 2007; Ferreira et al., 2016). Over the last decades, the habit of people to walk with animals, mainly dogs, in public places (e.g., squares and parks) have been increasing considerably. At the

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same time, the risk of human infection is also rising due to the elimination of eggs, larvae and/or oocysts of zoonotic parasites in the environment (Santarém et. al., 2004; Rinaldi et al., 2006; Tarsitano et al., 2010; Moura et al., 2013).

Among the parasites of dogs, the nematodes *Toxocara canis* and *Ancylostoma* spp. present great importance as the zoonotic agents of Visceral Larva Migrans (VLM) and Cutaneous Larva Migrans (CLM), respectively (Genari et al., 1999; Vasconcellos et al., 2006). The CLM is a very common manifestation in humans in tropical areas and it is mainly caused by larva of *Ancylostoma braziliense* and *Ancylostoma caninum.* Erythematous, vesicular, linear or meandering lesions and intense itch characterize this disease (Brenner and Patel, 2003). On the other hand, the VLM caused by *T. canis* and *Toxocara cati* is characterized as a systemic disease in which larvae migrate through different organs (e.g., liver, lungs, eyes and central nervous system) (Rubinsky-Elefant et al., 2010).

For a long time, epidemiological studies of gastrointestinal parasites have been performed throughout Brazil. In general, the most common parasites detected are *Ancylostoma* spp. and *T. canis* followed by *Trichuris vulpis*, *Strongyloides stercortalis*, *Dipylidium caninum*, *Giardia duodenalis*. and *Cystoisospora* spp. (Funada et al., 2007; Moura et al., 2013; Ferreira et al., 2016).

Due to the importance of these parasites (e.g., *Ancylostoma* spp., *T. canis*, *G. duodenalis* and *S. stercoralis*) to public health, this study aimed to detect gastrointestinal parasites in feces of dogs collected from the environment in the municipality of Garanhuns, Pernambuco state, Brazil.

Material and Methods

Study area

The study was performed in the municipality of Garanhuns (latitude 8º53'25"South and longitude 36º29'34"West), located in the Agreste Microregion of state of Pernambuco, Northeast region of Brazil. The region presents annual average temperature of 24°C, 900 meters above sea level, average rainfall of 147 mm (from 25 mm to 295mm), and air relative humidity of 90%. Pernambuco Agency for Water and Climate (APAC, 2018).

The estimated population of dogs in the study area was determined based on the study by World Health Organization (WHO, 2005).

Sample collection

Canine fecal samples (n = 640) were collected in the environment, 297 in public roads, 271 in households and 72 in public squares around the municipality, for a period of two years.

The samples were placed in plastic vials, and stored into isothermal boxes at 4°C until laboratory processing.

Laboratorial procedures

The evaluation of samples was performed by parasitological methods of Willis-Mollay simple flotation (Willis, 1921) and Hoffmann, Pons and Janer spontaneous sedimentation (Hoffmann et al., 1934). After sample processing, the material was examined at magnifications (10X and 40X). The identification of eggs and/or oocysts of parasites was performed according Taylor et al. (2010).

Data analysis

Data were statistically analyzed for absolute and relative frequencies. The Qui-square with Yates correction (x^2) was used to compare the presence of gastrointestinal parasites and the location areas (squares, public roads and households) where the feces were collected. The significance level was set at 5%. All analyzes were performed using the statistical software BioEstat version 5.0 (Ayres et al., 2007).

Results

Out of all samples analyzed, 51.09% (327/640) were positive for the presence of gastrointestinal parasites. In particular, samples collected in households presented a positivity of 54.61% (148/271), followed by public roads with 52.53% (156/297) and 31.94% (23/72) for public squares ($x^2 = 12.152$; $p = 0.0023$).

The general results of parasites detected are reported on Table 1. *Ancylostoma* spp. was the more frequent (70.94%; 232/327) parasite herein detected, as well as the coinfection between *Ancylostoma* spp. and *T. canis* (11.00%; 36/327) (Table 1).

Discussion

This study evaluated the presence of parasites in dogs' feces collected from the environment. The overall frequency herein observed was higher than others previously reported, in which frequencies of 37.16% (Ferreira et al., 2013) and 20.5% (Ferreira et al., 2016) have been reported. The differences herein observed may

Table 1. Simple infections and coinfections detected in fecal samples of dogs in the city of Garanhuns, Pernambuco state, Brazil.

Parasite	Frequency % (AF[1]/n)			Freq. %
	Public roads	Households	Squares	Total (AF/N)
Ancylostoma spp.	73.72 (115/156)	66.86 (99/148)	78.26 (18/23)	70.94 (232/327)
Toxocara canis	2.56 (4/156)	10.13 (15/148)	-	5.50 (18/327)
Cystoisospora spp.	0.64 (1/156)	-	-	0.30 (1/327)
Dipylidium spp.	1.28 (2/156)	-	-	0.61 (2/327)
Strongyloides spp.	-	0.68 (1/148)	-	0.30 (1/327)
Ancylostoma spp. and *Toxocara canis*	7.05 (11/156)	14.20 (21/148)	17.39 (4/23)	11.00 (36/327)
Ancylostoma spp. and *Cystoisospora* spp.	2.56 (4/156)	-	-	1.22 (4/327)
Ancylostoma spp. and *Dipylidium* spp.	3.20 (5/156)	4.06 (6/148)	-	3.36 (11/327)
Ancylostoma spp. and *G. duodenalis*	-	-	4.35 (1/23)	0.30 (1/327)
Ancylostoma spp. and *Trichuris* spp.	1.28 (2/156)	-	-	0.61 (2/327)
Ancylostoma spp. and *Strongyloides* spp.	-	0.68 (1/148)	-	0.30 (1/327)
Dipylidium spp. and *Toxocara canis*	1.28 (2/156)	1.35 (2/148)	-	1.22 (4/327)
Cystoisospora spp. and *Strongyloides* spp.	-	0.68 (1/148)	-	0.30 (1/327)
Cystoisospora spp. and *Toxocara canis*	-	0.68 (1/148)	-	0.30 (1/327)
Ancylostoma spp., *Dipylidium* spp. and *Toxocara canis*	1.92 (3/156)	0.68 (1/148)	-	1.22 (4/327)
Ancylostoma spp. and *Dipylidium* spp. and *Trichuris* spp.	0.64 (1/156)	-	-	0.30 (1/327)
Ancylostoma spp., *Toxocara canis* and *Strongyloides* spp.	0.64 (1/156)	-	-	0.30 (1/327)
Ancylostoma spp., *Toxocara canis*, *Trichuris* spp. and *Cystoisospora* spp.	3.20 (5/156)	-	-	1.62 (5/327)
Ancylostoma spp., *Trichuris* spp., *G. duodenalis.* and *Cystoisospora* spp.	-	0.68 (1/148)	-	0.30 (1/327)
Total %	100	100	100	100

[1]**Absolute Frequency**

be related to several factors such as age of the animals, parasitic burden and the diagnostic method used in each study (Funada et al., 2007).

Interestingly, there was a higher frequency in households (54.61%) when compared to the other collection areas. Most likely, the backyards were not paved and the contact between animals and soil favoured the environmental contamination as reported previously (Silva et al., 2019).

In a previous study performed in Paraná, a positivity rate of 60.1% was detected in household samples, followed by public roads (52.53%) and squares (31.94%) (Ribeiro et al., 2015). Some factors may contribute for these findings, for instance, in the households where the samples were collected, backyard with humid soil, protected against sunlight and with poor hygienic conditions were a common situation. The analysis of fecal samples collected from the environment has been performed worldwide where eggs of *Toxascaris leonina*, *T. vulpis* and oocysts/cysts of *C. canis*, *Giardia* spp. and *Cryptosporidium* spp. have been frequently detected (Veneziano et al., 2006; Rinaldi et al., 2008; Papini et al., 2009). The increase in the transmission of these parasites usually occurs under uncontrolled urbanized conditions, which are combined, to environmental changing and lack of basic sanitation (Lima et al., 2010).

The most frequent parasite was *Ancylostoma* spp. (70.94%). These findings are similar to those from previous studies where *Ancylostoma* spp. were observed in 71.3% (Blazius et al., 2005) and 70.90% (Scaini et al., 2003) from the analyzed samples.

Curiously, the nematode *T. canis*, common in tropical areas, was only found in 5.5% of the positive samples. Previous studies demonstrated a wide variation ranging from 1.2% (Castro et al., 2005) to 24.2% (Capuano and Rocha 2006) in the frequency of this nematode in fecal samples collected from the environment. This variation may occur due to the period (wet or dry) in which samples were collected, or due to the different methods of retrieval of eggs (Santana et al., 2015). It is important to highlight that *Ancylostoma* spp. and *T. canis* present great importance to public health, as they are the causative agents of CLM and VLM in human population.

Other parasites were detected in this study, but in lower frequencies (Table 1). For instance, *G. duodenalis* were found in households and public squares. Protozoa belonging to this genus presents zoonotic potential and is associated to intermittent or chronic diarrhoea in humans (Ballweber et al., 2010).

From a general perspective, in public roads, households and public squares the higher frequency found was for eggs of *Ancylostoma* spp., which present a potential risk for the human population. In areas studied of the city there are few or none structure of basic sanitation in the streets, and these situations favor the risks of infections in humans and animals due to the dissemination of eggs and oocysts of parasites with zoonotic potential.

Conclusion

In conclusion, there is the risk of transmission of CLM and VLM to the human population in Garanhuns due to the presence of canine feces in the environment contaminated with *Ancylostoma* spp. and *T. canis*. Therefore, it is important to perform the chemical control of gastrointestinal parasites in these animals, avoiding the environmental contamination and consequent dissemination of zoonotic gastrointestinal parasites. In addition, preventive measures of sanitary education, as well as personal hygiene are needed.

Conflict of Interest

The authors declare no conflict of interest.

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