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Contamination of public parks in Presidente Prudente (São Paulo, Brazil) by *Toxocara* spp. eggs

Contaminação de praças públicas de Presidente Prudente, São Paulo, Brasil, por ovos de *Toxocara* spp.

Vamilton Alvares Santarém[1]*; Vanessa Cristina Pereira[2]; Beatriz Cristina Porto Alegre[2]

[1]Laboratory of Preventive Veterinary Medicine II (Animal Parasitology), Veterinary Teaching Hospital, Universidade do Oeste Paulista – Unoeste, Presidente Prudente, SP, Brazil

[2]Veterinary Medicine Course, Universidade do Oeste Paulista – Unoeste, Presidente Prudente, SP, Brazil

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Abstract

This study aims to evaluate soil contamination by *Toxocara* spp. eggs in public parks in Presidente Prudente, São Paulo, Brazil. Soil samples (500 g) were collected every month over a 12-month period, from 25 parks in different parts of the city (northern, southern, eastern, western and central areas). Two 10-g aliquots of the material collected from each park were subjected to the centrifuge-flotation method to recover *Toxocara* spp. eggs. Twenty-four out of the 25 squares studied (96.0%) were contaminated and the number of eggs recovered ranged from 1 to 398 per sample. Eggs were recovered all over the year. Despite the number being greater in autumn ($p < 0.001$), there was no correlation between number egg number and average monthly temperature ($r = –0.492$; $p = 0.148$) or between egg number and monthly rainfall ($r = –0.299$; $p = 0.402$). Park localization does not influence egg presence ($p = 0.7116$). Because of the high level of contamination of the parks by *Toxocara* spp. eggs, prevention of contamination of public areas by larva migrans agents is indicated.

Keywords: Environment contamination, epidemiology, toxocariasis, larva migrans.

Resumo

O objetivo do estudo foi avaliar a contaminação do solo de praças públicas por ovos de *Toxocara* spp. em Presidente Prudente, São Paulo. Amostras de solo (500 g) foram coletadas mensalmente, durante um período de 12 meses, de 25 praças de cinco diferentes setores da cidade (norte, sul, leste, oeste e central). Duas alíquotas de 10 g do material coletado foram submetidas ao método de centrífugo-flutuação (sulfato de zinco; d = 1.200 g/cm^3), para recuperação dos ovos. Das 25 praças estudadas, 24 (96,0%) estavam contaminadas e o número variou de 1 a 398 ovos por amostra analisada. A recuperação foi verificada durante todos os meses do ano, sendo maior no outono ($p < 0,001$). Entretanto, não houve correlação entre o número de ovos e a temperatura média ($r = –0,492$; $p = 0,148$) e a precipitação pluviométrica ($r = –0,299$; $p = 0,402$) mensal. Não houve influência da localização dos parques sobre a quantidade de ovos ($p = 0,7116$). Devido ao alto nível de contaminação de parques públicos por ovos de *Toxocara* spp., a prevenção da contaminação de áreas públicas pelos agentes de larva migrans é indicada.

Palavras-chave: Contaminação ambiental, epidemiologia, toxocaríase, larva migrans.

Despite inclusion on the list of neglected diseases, human toxocariasis (ocular/visceral larva migrans) is one of the most widespread geohelminth zoonotic diseases in both disadvantaged and developed countries. Human infection is most commonly caused by accidental ingestion of larvated *Toxocara* spp. eggs that are present in contaminated environments, particularly soil in public areas such as parks and gardens that are frequented by dogs, cats and humans (SANTARÉM et al., 2011).

In Brazil, several studies over the last decade have demonstrated contamination of public places by *Toxocara* spp. eggs (CAPUANO; ROCHA, 2005; SANTARÉM et al., 2010; CASSENOTE et al., 2011). Previous studies have considered that contact with soil is a risk factor for toxocariasis in humans. Thus, the presence of environmental contamination is considered to be the best risk indicator for *Toxocara* spp. infection of human populations.

The aim of this study was to evaluate the influence of climate, season and geographical location on the presence of *Toxocara* spp. eggs in public parks in Presidente Prudente, state of São Paulo, Brazil.

*Corresponding author: Vamilton Alvares Santarém
Laboratório de Medicina Veterinária Preventiva (Parasitologia), Hospital Veterinário, Universidade do Oeste Paulista – Unoeste, Rod. Raposo Tavares, Km 572, Bairro Limoeiro, CEP 19067-175, Presidente Prudente, SP, Brasil
e-mail: vamilton@unoeste.br

Presidente Prudente (22° 10' 30" S and 51° 25' 28" W) is the biggest city in the western part of the state of São Paulo, and its current population is approximately 220,000. The city has 47 public parks, and 44 of them contain children's playgrounds. In order to study soil contamination, five parks from each of different areas of the municipality (central, southern, northern, eastern and western areas) were randomly selected, thus totaling 25 (53.2%) out of the 47 squares. A total of 500 g of soil was sampled every month, between March 2010 and February 2011. To recover *Toxocara* spp. eggs, a technique described elsewhere was used (SANTARÉM et al., 2009). The Kruskal-Wallis test was used to compare the number of eggs in different areas, months and seasons, while Spearman's correlation was used to evaluate the influence of temperature (°C) and rainfall (mm) on the number of eggs.

It was observed that 96% (24/25) of the studied parks were contaminated by at least one *Toxocara* spp. egg. The numbers of eggs recovered ranged from 1 to 398 within the same sample. The contamination observed in this study was higher than what had previously been observed in other studies carried out in Brazil (SANTARÉM et al., 2010; CASSENOTE et al., 2011).

It has been stated that environmental and technical factors, such as the type of soil and the technique used for egg recovery, presumably influence the recovery of ascarid eggs from environmental samples (NUNES et al., 1994; SANTARÉM et al., 2009). Consequently, these factors can influence the process of egg recovery, which creates difficulties in comparing the results from different investigations.

Egg recovery was observed in all the months of the year. A higher number of eggs was observed in the autumn ($p < 0.001$) (Table 1). No correlation was found between the number of eggs recovered and the average monthly temperature ($r = –0.492$; $p = 0.148$) or between the number of eggs and the monthly rainfall ($r = –0.299$; $p = 0.402$). Seasonal fluctuation may also influence the recovery of eggs from soil samples (CHIEFFI; MÜLLER, 1976; QUEIROZ et al., 2006). Nevertheless, in southern Brazil, there are no difference between the numbers of eggs recovered in summer and winter (TIYO et al., 2008). In the present study, eggs were detected throughout the year, but the recovery rate was significantly higher in autumn, in contrast with some studies carried out in south Brazil. Chieffi and Müller (1976) observed the greater contamination in winter and spring, while Gallina et al. (2011) verified the greatest incidence of parasites in the spring.

Viable eggs were observed in 183 (61%) out of the 300 samples analyzed. Larvated eggs were observed in eight out of 183 (4.4%), while embryonated eggs were recovered in 175 samples (95.6%).

Table 1. Mean numbers of *Toxocara* spp. eggs ± standard deviation (SD) in 25 public parks s in from the municipality of Presidente Prudente (São Paulo, Brazil), between March 2010 and February 2011, according to the seasons.

Season	Mean ± SD	95% Confidence Interval
Autumn	13.0^{A} ± 28.0	0.6310 – 23.742
Winter	0.51^{B*} ± 0.74	0.2012 – 0.8121
Spring	0.32^{B*} ± 0.41	0.1492 – 0.4908
Summer	0.08^{B**} ± 0.28	-0.0343 – 0.1943

Means followed by different letters are significantly different. Kruskal-Wallis test (*$p < 0.01$; **$p < 0.001$).

These data suggest that the soil composition and climatic factors may have a positive influence on the viability of the eggs in the environment. According to Nunes et al. (1994), the distribution of ascarid eggs is more homogeneous in sandy soil, which was the most common type of soil observed in the children's playgrounds where the samples were collected.

Regarding the frequencies of eggs in the parks in different areas, taking into account the season, the highest average count was found in the eastern zone. Egg recovery was significantly higher in the autumn in all the areas studied ($p < 0.01$), excluding the southern area. No significant difference was seen in comparing the average numbers of eggs obtained from the five areas in the same month ($p = 0.7116$). There is some controversy regarding the influence of sampling location on soil contamination. In this study, there was no significant correlation between the average number of eggs and the locations of the parks. On the other hand, in other studies carried out in Brazil, the highest frequency of contamination was present in parks located on the outskirts (CHIEFFI; MÜLLER, 1976; COELHO et al., 2001; SANTARÉM et al., 2010). Thus, it is possible that climatic factors influenced the conditions for maintaining the eggs throughout the year.

Ancylostomatidae eggs (n = 15) were recovered in 12 (48%) of the studied parks, ranging from 1 to 2 eggs per sample. Recovery of both Ancylostomatidae and *Toxocara* spp. eggs in the soil samples points towards free access by pets, with consequent contamination of the soil. Access by dogs and cats to the parks may influence the degree of soil contamination by *Toxocara* spp. eggs. Cassenote et al. (2011) observed that the frequency of geohelminth findings in fenced parks (11.1%) was significantly lower than in non-fenced-off areas (45.3%). In the present investigation, it was seen that pets had access to the parks, even those that were fenced.

The climatic conditions of Presidente Prudente and the characteristics of the soil in its parks are favorable for maintenance of *Toxocara* spp. eggs throughout the year. In addition, the frequency of eggs together with the free access of pets to the parks creates an important resource for infection of population by agents of larva migrans.

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