Seasonal fluctuations in prevalence of dog intestinal parasites in public squares of Mar del Plata city, Argentina and its risk for humans

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ABSTRACT

The aim of this work is to analyze whether there is a seasonal prevalence of parasites in dog feces from public squares in Mar del Plata city, Argentina, and to evaluate the climatic conditions that promote the development of parasites and allow the transmission to people. The study was performed in 21 squares from June 2001 to May 2002. Samples were processed by the Willis technique. Differences in prevalence of parasites were examined for significance by the Chi-square test. Climatic data were obtained from the Library of the National Meteorological Service of Argentina. Total parasitic prevalence was higher in winter than in summer. The prevalence of *Ancylostoma* spp. was higher in the summer-autumn period. For *Toxocara canis,* the prevalence was higher in winter whereas for *Trichuris vulpis,* it was higher in winter, spring and summer. This work shows high prevalence of total parasites throughout the year. For *Ancylostoma* spp., summer and autumn might be the seasons with higher sanitary risk. On the other hand, *T. canis* could present the higher risk to people in winter and, *T. vulpis*, would be transmitted throughout the whole year. The seasonal variation in prevalence of dog parasites results in continuous exposure to people visiting the squares, not only Mar del Plata residents but also tourists from other regions of Argentina and the world, with at least one species of parasite with sanitary risk.

Key words: dog, environmental contamination, intestinal parasites, seasonal prevalence, Argentina

RESUMEN

Estacionalidad en la prevalencia de parásitos intestinales caninos en plazas públicas de Mar del Plata, Argentina, y su riesgo para la salud humana. El objetivo de este trabajo es analizar la variación estacional de la prevalencia de los parásitos presentes en las heces caninas halladas en plazas públicas de la ciudad de Mar del Plata y evaluar aquellas condiciones climáticas que promueven su desarrollo y permiten su transmisión a la gente. El estudio se realizó en 21 plazas desde junio de 2001 hasta mayo de 2002. Las muestras fueron procesadas con la técnica de Willis. Se utilizó el test de χ^2 para comparar la prevalencia de los diferentes parásitos. Los datos climáticos fueron obtenidos en la biblioteca del Servicio Meteorológico Nacional. La prevalencia total de parásitos fue considerablemente más alta en invierno que en verano. *Ancylostoma* spp. fue la especie prevalente en el período otoño-verano. La incidencia de *Toxocara canis* fue más alta en invierno que en el resto de las estaciones, y la de *Trichuris vulpis* fue alta en invierno, primavera y verano. Este trabajo muestra alta prevalencia de parásitos totales a lo largo de todo el año en las plazas públicas de Mar del Plata. Para *Ancylostoma* spp. verano y otoño podrían ser las estaciones con riesgo sanitario más alto para la gente. Por otra parte, *T. canis* podría presentar mayor riesgo para la gente en invierno y *T. vulpis* sería transmitido durante todo el año. La variación estacional en la prevalencia de los distintos parásitos caninos, con al menos una especie con riesgo sanitario, hace que la exposición para la gente que visita las plazas sea continua e involucre no sólo a la gente que vive en Mar del Plata sino también turistas de otras regiones de Argentina y el mundo.

Palabras clave: perro, contaminación ambiental, parásitos intestinales, prevalencia estacional, Argentina

INTRODUCTION

Parasitic disease transmitted by dogs is a major public health problem in many countries (6). The transmission of diseases between humans and dogs is principally due to contamination with dog feces in squares and public walks having free access to human beings and dogs (14, 21). The number of dogs that coexist with human beings is high in most cities of the world. As a consequence, this brings about great quantity of feces, which constitute a potential risk of infection for human beings, especially for children due to their land- grabbing habits (3).

Fecal deposits of pets contaminate public places with eggs and helminthic larvae of different species of zoonotic parasites. *Toxocara canis,* which causes the visceral and ocular larva migrans syndromes, *Trichuris vulpis,* that

produces trichurosis and *Ancylostoma* spp. which causes cutaneous larva *migrans* among others, (5, 8, 9, 11, 18, 22) are found among these zoonotically important species.

Because the distribution and intensity of the diseases are influenced by climatic, geographical, cultural and economic factors, it is necessary to analyze the situation in every city (15, 17). For example, temperature and humidity determine the distribution and survival of eggs, helminthic larvae and cysts, consequently producing seasonal variations in the frequencies of parasites, determining periods of principal sanitary risk. The success in the continuity of the parasite evolutionary cycle finally consists in the capacity of the parasite of persisting in the environment by means of resistance mechanisms inherent to the species (4, 16, 23).

The development of the parasite larvae in the soil and the transmission to people need conditions such as moderate temperature, a high percentage of humidity and also, certain chemical and biological conditions such as: type of soil, aeration and light, which favor the development of the eggs and prolong their survival (5).

A higher diversity of parasites is found in moderate, tropical and subtropical climates depending on climatic conditions which are appropriate for their development (15, 17).

In different countries of the world, studies about the prevalence of parasites in dog feces have been carried out and some seasonal variations have been detected. In Wisconsin, U.S.A., Coggins registered the highest prevalence of parasites from July to October. In Maracaibo, Venezuela, Ramírez Barrios *et al.* (17) found a higher prevalence of parasites in December and January and, specifically for *Ancylostoma* spp., the prevalence was statistically superior during the dry season. In Sao Paulo State, Brazil, Oliveira – Sequeira *et al.* (15) cited high prevalence of *Ancylostoma* spp. during the summer-autumn period. Similar results for *Ancylostoma* spp. were found in Pennsylvania, U.S.A., and in Brisbane, Australia (10, 13). For *T. vulpis,* a similar prevalence across the year was registered in Pennsylvania, U.S.A., and in Sao Paulo State, Brazil (10, 15). *T. canis* showed higher prevalence in the dry season in Mexico City (7).

In Mar del Plata city, where there are nearly 110,000 dogs according to the information provided by the City Bureau of Sanitary Protection, previous studies about the prevalence of dog parasites were performed by our working group (1, 2). However, up to the moment, the possible seasonal variations in parasite prevalence have not been analyzed.

The aim of this work is to analyze whether there is a seasonal prevalence of dog parasites in feces in public squares of Mar del Plata city, Argentina, to evaluate those climatic conditions that encourage the development of parasites and allow the transmission to people visiting the squares and to determine the seasons with high sanitary risk.

MATERIALS AND METHODS

The present research was carried out in the city of Mar del Plata, Buenos Aires province, Argentina (37° 56" S, 57° 35" W) from June 2001 to May 2002. It was performed in 21 public squares located in the Center (urbanized zones) and in the Periphery (zones with more precarious conditions).

Each square was sampled once each season. All samples were collected when the total number of feces in the squares were under 100, whereas, when the total samples exceeded 100, 10% of them were collected. This sampling criterion was based upon the situation observed in the squares. In peripheral squares, there were normally very few samples (1 to 10) whereas in central squares, in general, there were more than 100. To avoid collecting all samples and so that the numbers of samples were comparable, we decided to take only 10% at random in the central ones.

Fecal samples were collected without fixing or preserving and transported as soon as possible for examination. Once in the laboratory, samples were processed by the Willis flotation-sedimentation technique (12, 20). Under an optical microscope, the fecal samples were carefully examined using the 10 × objective. Each observed egg was identified by the morphological characteristics previously described (19, 20). *T. canis* was differentiated from *T. cati* by size: *T. canis* egg size – 75 μm x 85-90 μm and *T. cati* egg size – 70 μm x 75 μm (19). Samples were classified as positive if at least one egg was observed. Sample examination was carried out within 48 hours in every case.

Differences in prevalence of parasites for each season were examined for significance by the Chi-square test and were considered significant at p ≤ 0.05.

In order to deduce those conditions allowing the development of each parasite species, climatic data such as temperature, rain and humidity were obtained from the Library of the National Meteorological Service of Argentina.

The average temperatures registered in degrees Celsius (ºC) were: 8.69 ºC in winter; 14.33 ºC in spring; 19.72 ºC in summer and 12.66 ºC in autumn. The record of rain in litres (l) per square meter (m²) was194.3 l/m² in winter; 516.3 l/m² in spring; 333.5 l/m² in summer and 318.4 l/m² in autumn. The percentages of humidity were 83.00% in winter, 79.00% in spring, 76.75% in summer and 81.75% in autumn.

RESULTS

From 400 total samples examined during the study period, 165 (41.25%) turned out to be positive for the presence of parasites.

The parasitic prevalence for each season was as follows: in winter 65/128 (50.78%) of the samples collected were positive for parasites. In spring 34/81 (41.98%) of the samples collected were positive for parasites. During summer 35/109 (32.11%) samples were positive for parasites. In autumn 31/82 (37.80%) were positive.

The statistical comparison between seasons shows that the total parasitic prevalence results significantly higher in winter than in summer (χ^2= 8.41, p= 0.003). The prevalence of *Ancylostoma* spp. was higher in autumn than in winter (χ^2= 5.53, p= 0.018). For *T. canis,* the prevalence was higher in winter than in summer (χ^2= 7.63,

p= 0.005). And for *T. vulpis,* the prevalence was higher in winter, in spring and in summer compared with autumn (χ^2= 16.06, p= 0.000; χ^2= 10.52, p= 0.001; χ^2= 5.14, p= 0.023 respectively). Figure 1 shows the seasonal prevalence in each season for each parasite species in squares of Mar del Plata city.

DISCUSSION

High quantities of feces were registered in public squares of Mar del Plata city. Nearly half of them tested positive for parasites. Furthermore, this work shows high prevalence of total parasites during the four seasons of

Figure 1. Seasonal prevalence in the 4 seasons for each parasite species in squares in Mar del Plata city.

the year in public squares of Mar del Plata city. The highest total prevalence of parasites was found in winter and the lowest in summer. These results correlate with the recorded results in Maracaibo, Venezuela (17) and this could be explained by what Shimizu says about temperature. He states that the lowest prevalence in summer is due to the higher temperature which prevents the survival of the parasites. The results of this research are the same as those results found in Pennsylvania, U.S.A. (10).

In our study, for the *Ancylostoma* spp., the prevalence increased from winter to autumn. A similar situation was found in Pennsylvania, U.S.A. (10), Tacuarembó, Uruguay (11), Brisbane, Australia (13) and in Sao Paulo State, Brazil (15). It might suggest that this type of parasite has the ideal conditions for development and hatch in summer and autumn, seasons when high temperatures (19 °C), humidity near to 80% and an intermediate rain pattern (333.5 l/m²) in Mar del Plata city prevail. In consequence, these would be the seasons with higher sanitary risk for people with regard to this parasite.

T. canis presented a notable decrease in summer and the highest prevalence in winter, which has the lowest rain pattern. This correlates with the findings in Pennsylvania, U.S.A., and Mexico City (10, 17) and might indicate that this species persists in our city at the lowest temperature levels (8 to 12 °C), the highest percentage of humidity (82.00 to 83.00%) and the lowest rainfall patterns of the year (194-318 l/m²). This situation is directly related to the structural characteristics of the *T. canis* egg, which presents a double cover which allows the parasite
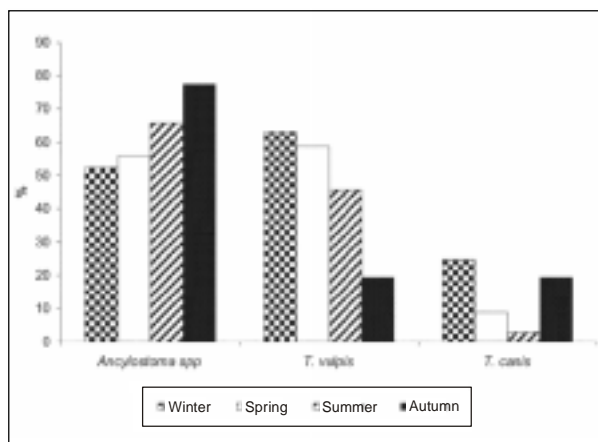
Table 1. Total prevalence and prevalence for each parasite species during the 4 seasons in the different countries.

City, Country	Summer Total parasite prevalence (%)			Autumn Total parasite prevalence (%)			Winter Total parasite prevalence (%)			Spring Total parasite prevalence (%)		
	Ancylostoma spp	*Trichuris vulpis*	*Toxocara canis*	*Ancylostoma* spp	*Trichuris vulpis*	*Toxocara canis*	*Ancylostoma* spp	*Trichuris vulpis*	*Toxocara canis*	*Ancylostoma* spp	*Trichuris vulpis*	*Toxocara canis*
Brisbane, Australia	38	- [1] - [1]	- [1]	- [1]	- [1] - [1]	- [1]	22	- [1] - [1]	- [1]	- [1]	- [1] - [1]	- [1]
Mar del Plata, Argentina	65.7	32.1 45.7	2.8	77.4	37.8 19.4	19.4	52.3	50.7 63.1	24.6	55.8	41.9 58.8	8.8
Maracaibo, Venezuela	18.6	29.6 2.7	7.1	21	35.2 3.9	15.1	29.5	43.3 4.1	11.03	18.8	29.2 0.7	12
Mexico DF, Mexico	64.7	- [1] - [1]	2.9	61.6	- [1] - [1]	17.4	61.6	- [1] - [1]	17.4	64.7	- [1] - [1]	2.9
Pennsylvania, USA	18	33 10	2.5 [2]	11	37 14	7.5 [2]	11	35 13	6 [2]	18	36 14	5 [2]
Sao Paulo State, Brazil	18- 37.5	- [1] 5-10	5-10	37.5 - 32.5	- [1] 10- 0	10- 0	32.5- 25	- [1] 0- 5	0- 10	25-10	- [1] 5-2.5	10-2.5
Wisconsin, USA	- [1]	45.5 - [1]	- [1]	- [1]	41.7 - [1]	- [1]	- [1]	40.3 - [1]	- [1]	- [1]	37.7 - [1]	- [1]

[1] No data registered
[2] Ascarids

to survive under the previously detailed conditions (5). Finally, winter would be the season which presents higher risk of transmission of this parasite to people.

T. vulpis registered a similar prevalence in all seasons except for autumn which presented the lowest prevalence. Again, the results are similar to the ones recorded in Pennsylvania, U.S.A., (10) and Sao Paulo State, Brazil (15). Its similar prevalence in almost all seasons indicates that T. vulpis is a species adapted to cold and moderate climates which represents a constant sanitary risk for people throughout the year.

Table 1 shows the prevalence for each parasite species in the different countries.

This work allows us to conclude that public squares in Mar del Plata city are contaminated with canine feces that present some parasite species with sanitary risk throughout the year. The variation in prevalence and in the presence or absence of each parasite species , results in continuous exposure of people visiting the squares to dog feces that contaminate with at least one parasite species with sanitary risk.

On the other hand, this situation is aggravated if it is considered that Mar del Plata is a touristic city which receives about three million tourists from all parts of the country and the world between December and March and they could be affected, as they not only go to the beaches but sit in the sun or take their pets for a walk in the squares. Another point to consider is that the number of stray dogs increases at the end of the summer when some tourists leave their pets behind in the streets of the city.

Due to all the above mentioned, the measures of canine control and sanitary quality in public environments must be constantly enforced throughout the year in order to effectively solve this situation.

REFERENCES

1. Andresiuk MV, Denegri GM, Sardella NH, Hollmann P. Encuesta coproparasitológica canina realizada en plazas públicas de la ciudad de Mar del Plata, Buenos Aires, Argentina. Parasitol Latinoam 2003; 58: 17-22.
2. Andresiuk MV, Rodríguez F, Denegri GM, Sardella NH, Hollmann P. Relevamiento de parásitos zoonóticos en materia fecal canina y su importancia para la salud de los niños. Arch Arg Ped 2004; 102: 325-9.
3. Castillo D, Paredes C, Zañartu C, Castillo G, Mercado R, Muñoz V, et al. Contaminación ambiental por huevos de Toxocara sp. en algunas plazas y parques públicos de Santiago de Chile, 1999. Bol Chil Parasitol 2000; 55: 86-91.
4. Chieffi P, Müller E. Estudo da varaçao mensal na conta-
minaçao do solo por ovos de Toxocara sp. (Nematoda, Ascaroidea), na zona urbana do Municipio de Londrina, Estado do Paraná, Brasil. Rev Inst Adolfo Lutz 1978; 38: 13-6.
5. Ciarmela ML, Minvielle MC, Lori G, Basualdo JA. Biological interaction between soil fungi and Toxocara canis eggs. Vet Parasitol 2002; 103: 251-7.
6. Coggins JR. Effect of season, sex, and age on the prevalence of parasitism in dogs from Southeastern Wisconsin. J Helminthol Soc Wash 1998; 65: 219-24.
7. Eguía-Aguilar P, Cruz-Reyes A, Martínez-Maya JJ. Ecological analysis and description of the intestinal helminthes present in dogs in Mexico City. Vet Parasitol 2005; 127: 139-146.
8. Hendrix CM, Bruce HS, Kellman LJ, Harrelson G, Bruhn BF. Cutaneous larva migrans and enteric hookworm infections. J Am Vet Med Assoc 1996; 209: 1763-7.
9. Kenney M, Yermakov V. Infection of man with Trichuris vulpis, the whipworm of dogs. Am J Trop Med Hyg 1980; 29: 1205-8.
10. Kirkpatrick CE. Epizootiology of endoparasitic infections in pet dogs and cats presented to a veterinary teaching hospital. Vet Parasitol 1988; 30: 113-124.
11. Malgor R, Oku Y, Gallardo R, Yarzabal I. High prevalence of Ancylostoma spp. infection in dogs, associated with endemic focus of human cutaneous larva migrans, in Tacuarembó, Uruguay. Parasite 1996; 3: 131-4.
12. Méndez O. Lecciones prácticas sobre enteroparasitosis humanas. Acta Bioquím Clín Latinoam 1998; Supl 1.
13. Mc Carthy J, Moore TA. Emerging helminth zoonoses. Int J Parasitol 2002; 30: 1351-60.
14. Oge S, Oge H. Prevalence of Toxocara spp. eggs in the soil of public parks in Ankara, Turkey. Deutsch Tierärztl Wschr 2001; 107: 72-5.
15. Oliveira-Sequeira TCG, Amarante AFT, Ferrari TB, Nunes, LC. Prevalence of intestinal parasites in dogs from Sao Paulo State, Brazil. Vet Parasitol 2002; 103: 19-27.
16. Pierangeli NB, Giayetto AL, Manacorda AM, Barbieri LM, Soriano SV, Veronesi A, et al. Estacionalidad de parásitos intestinales en suelos periurbanos de la ciudad de Neuquén, Patagonia, Argentina. Trop Med Int 2003; 8: 259-63.
17. Ramírez-Barrios RA, Barboza-Mena G, Muñoz J, Angulo-Cubillán F, Hernández E, González F, et al. Prevalence of intestinal parasites in dogs under veterinary care in Maracaibo, Venezuela. Vet Parasitol 2004; 121: 11-20.
18. Shimizu T. Prevalence of Toxocara eggs in Sandpits in Tokushim City and its outskirts. J Vet Med Sci 1993; 55: 807-11.
19. Soulsby EJL. Parasitología y enfermedades parasitarias en los animales domésticos. México DF, Nueva Interamericana, 1987.
20. Thienpont D, Rochette F, Vanparijs O. Diagnóstico de las helmintiasis por medio del examen coprológico. Beerse, Belgium, Janssen Research Foundation, 1979.
21. Uga S, Oikawa H, Lee CC, Amin-Babjee SM, Rai SK. Contamination of soil with parasite eggs and oocysts in and Kuala Lumpur, Malaysia. Jpn J Trop Med Hyg 1996; 24: 125-7.
22. Vázquez TO, Valencia RS. Tricocefalosis por Trichuris vulpis en un niño. Acta Pediatr Méx 1998; 19: 233.
23. Zunino MG, De Francesco MV, Kuruc JA, Schweigmann N, Wisnivesky-Colli C, Jensen, O. Contaminación por helmintos en espacios públicos de la provincia de Chubut, Argentina. Bol Chil Parasitol 2000; 55: 78-83.