

## URBAN CONTAMINATION WITH ZONOTIC PARASITES IN THE CENTRAL REGION OF ARGENTINA

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**Abstract** Adult worms develop in dogs and their eggs are shed in the feces. Non-embryonated eggs of *Toxocara canis* become infectious after about 2-6 weeks in the soil and the likelihood of their transmission to humans is through ingestion. In 2004 studies were carried out in the areas of urban recreation in the central region of Argentina. A total of 393 dog excrement samples were collected in eight different cities: 59.3 per cent were positive for parasites. These areas of urban recreation are contaminated with zoonotic parasites in the cities of Paraná (19 of 24 areas), Santa Fe (20 of 26), and Santo Tomé (14 of 18). Eggs of *T. canis* were present in 101 of 393 (25.7%) of the excrement samples, and eggs could be found in 53 of the 68 (77.9%) areas of urban recreation studied in these cities. This contamination is greater in areas of lower socio-economic conditions. The object of this paper is to discuss markers of parasitic contamination with the aim of triggering the necessary control measures.

**Key words:** *Toxocara canis*, environment, parasites, contamination

**Resumen** *Contaminación urbana con parásitos zoonóticos en la región central de la Argentina.* Uno de los parásitos de cánidos de riesgo para la salud de los niños es el *Toxocara canis*. Las formas adultas y sus huevos no embrionados son liberados con las heces al medio ambiente. Después de aproximadamente dos semanas en el suelo, los huevos se transforman en infectivos y su ingestión por el ser humano puede provocar una infección parasitaria. En primavera y otoño de 2004, se llevaron a cabo estudios en áreas urbanas de recreación en una amplia zona geográfica de la Región Centro de la Argentina. Un total de 393 muestras de heces de canes fueron colectadas y analizadas en ocho ciudades; 59.3% de esas muestras fueron positivas para otros parásitos, además del *T. canis*. Las áreas de recreación pública de las ciudades demográficamente más importantes mostraron resultados positivos para parásitos zoonóticos en 19 de 24 áreas en Paraná, 20 de 26 en Santa Fe y 14 de 18 en Santo Tomé, es decir 53 de 68 (77.9%). Se encontraron huevos de *T. canis* en 101 de las 393 (25.7%) muestras fecales, y en el 60% de los parques públicos investigados en todas las ciudades. Esta contaminación fue mayor en barrios con condiciones socioeconómicas más bajas. En este trabajo se proponen medidas sanitarias de control y prevención.

Palabras clave: *Toxocara canis*, ambiente, parásitos, contaminación

The study of the environment is quite complex and there are various aspects to be taken into account. Modern urban areas have witnessed a growth in the number of animals kept as domestic pets, many of which are heavily infected with zoonotic hookworm species. These urban areas where most Argentinians live (78%) present serious risk factors for human health, among them, zoonotic parasites in public areas of urban recreation (AURs), such as parks, playgrounds and squares.

One of these zoonotic parasites is *Toxocara canis* whose immature stages eliminated with dog feces contaminate the environment. The embryonated eggs of *T. canis* (infective stage after about 2-6 weeks in the soil) turn into larvae and actively penetrate tissues if ingested by humans. This can cause parasitic disease. Apart from the syndromes described<sup>1</sup>, at the moment serious cases can be found in different parts of the world<sup>2,3</sup> including Latin America<sup>4,5</sup>.

*Ancylostoma caninum*, an egg shed in dog feces into a suitably moist environment will develop into a larvae that can then infect new hosts through skin contact. Other zoonotic parasites have been mentioned, but they have a minor pathologic importance for human beings.

In spring and autumn of 2004 studies were carried out in AURs in the Central Region of Argentina. Dog feces

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found in public places and parks of various cities were analyzed.

In this study, we have studied the environmental contamination with eggs of *T. canis* in an extended area of this country and recommend control measures to be applied in an Epidemiological Surveillance System.

## Materials and Methods

This work was performed in a large geographical area of Argentina known as "Pampa Húmeda and Mesopotamia" (latitude 29° to 32° S). In spring and autumn of 2004, the study focused on two provincial capital cities (Santa Fe and Paraná) and six other cities of the Santa Fe Province (Avellaneda, Reconquista, Calchaquí, Hersilia, San Carlos Centro and Santo Tomé). The average annual temperature in these cities is between 17 and 25°C, with an average annual rainfall over 1 000 mm. The area is crossed by the Paraná River, one of the most important rivers in South America, producing high levels of humidity in the zone (65-85%) with an impact on its sanitary conditions and a population of about a million inhabitants.

The protocol intended to collect dog feces (3-4 samples) at random in AURs frequently attended by a population of around 10 000 people each. The distance between the samples collected was 20 meters minimum and 50 meters maximum, so that the number of samples was higher than the number of AURs. The AURs were selected so that they were widely and uniformly distributed around the cities mentioned above. The samples were collected using plastic spoons and were stored in a 5% saline solution in plastic containers to preserve them. A

total of 393 samples were collected, which were processed through of parasite concentration method. With the purpose of parasite shape identification, the samples processed were placed on three different slides and examined with a microscope by two investigators.

Five AURs in each capital city were observed for an hour to calculate the number of people attending, and quantify the ratio between boys and girls in each AUR.

The two capital cities and the city of Santo Tomé were divided into areas corresponding to three socio-economic levels: low, medium and high. The levels were determined taking into account different parameters: type of housing, transport facilities, availability of potable water, waste disposal, number of people living in each household, children's education, type of parents' employment, and level or responsibility towards domestic animals. In some cases, these parameters could be assessed at first sight and a further survey around the AUR was unnecessary. The households with less of 30% of the parameters under consideration were esteemed "low"; those between 30-60% were considered "medium", and those with over 60% were considered "high".

## Results

The AURs were contaminated with parasites (not only *T. canis* eggs) in the cities of Paraná 19 of 24, Santo Tomé 14 of 18, and Santa Fe 20 of 26.

After examination of the 393 dog feces samples collected in the nine cities mentioned above, a total of 233 (59.3%) were found positive for parasites, 101 (25.7%) for *T. canis* and 114 (29.0%) for *A. caninum* (Table 1). No statistically significant difference in the principal cities

TABLE 1.— Parasites in dog feces in the central region of Argentina, 2004

City	Total number of dog feces samples	<i>Toxocara</i> <i>canis</i>	<i>Ancylostoma</i> <i>caninum</i>	<i>Trichuris</i> <i>vulpis</i>	Dog feces samples positives N4 (%)
	N	N1 (%)	N2 (%)	N3 (%)	
Santa Fe	200	62	67	12	141
Paraná	61	7	14	—	21
Santo Tomé	54	5	9	—	14
San Carlos Centro	24	6	8	3	17
Calchaquí	17	5	2	1	8
Avellaneda	15	6	5	1	12
Hersilia	12	5	4	1	10
Reconquista	10	5	5	-	10
Total	393	101 (25.7)	114 (29.0)	18 (4.6)	233 (59.3)

N: total number of dog feces samples studied in each city

N1, N2, N3: positive number for different parasites in each city

N4: number of dog feces samples positives for all parasites

TABLE 2.— *Socio-economic level and parasite eggs in dog feces of areas of urban recreation (public places, public parks, playgrounds and squares), 2004*

Socio economic level	Positive areas of urban recreation n/N	Positives excrement samples n/N	City
Low	6/6	7/14	Santa Fe
Medium	7/9	8/27	
High	7/11	7/33	
Low	6/6	10/15	Paraná
Medium	11/15	16/35	
High	2/3	3/11	
Low	4/5	7/15	Santo Tomé
Medium	9/10	15/30	
High	1/3	1/9	

n: positive number for parasites

N: total areas of urban recreation or dog feces samples

were observed: Santa Fe  $p=0.59$ , Paraná  $p=0.09$  and Santo Tomé  $p=0.25$  (Chi<sup>2</sup> test).

The Santa Fe city had a greater contamination of *T. canis* eggs in dog feces samples, 62/200 (31.0%), compared to 11.5 and 9.3% in Paraná and Santo Tomé respectively (Table 1). These results are statistically significant  $p=0.00018$  (Chi<sup>2</sup> test).

The results of the zoonotic parasite contamination studies performed in the AURs and positive excrement samples classified according to the socio-economic levels mentioned above are shown in Table 2. The comparison between the zoonotic parasite in dog feces samples and socio economic level, were statistically significant in Santa Fe  $p=0.04$  and Paraná  $p=0.04$ , but not in Santo Tomé  $p=0.07$ ; (Chi<sup>2</sup> test). Although the little number of samples suggest a tendency, in AURs not statistically significant difference were found: in Santa Fe city Low (6/6) versus High (7/11)  $p=0.139$ ; in Paraná Low (6/6) High (2/3)  $p=0.333$ ; while in Santo Tomé Low (4/5) High (1/3)  $p=0.286$  (Fisher exact test) (Table 2).

Finally, the boy/girl ratio quantified in each AUR resulted 7/1.

## Discussion

Dog feces and soil samples have been studied to determine the prevalence of *Toxocara sp.* eggs in several countries including Argentina<sup>6,7</sup>. In London, 66% of dog feces samples were found parasitically positive while in Paris 77% of the gardens were contaminated<sup>8</sup>.

In Argentina, people go to public places, playgrounds and parks with their pets for them to defecate there. They

are not advised or compelled to clean, as in other countries. Neither are they fined for failing to do so. Moreover, in the city of Santa Fe after the 2003 great flood, numerous stray dogs live in areas of urban recreation without any type of control. As a result, the AURs in all the cities investigated showed high levels of zoonotic parasite.

In this region seasonal influence is another factor to be taken into account. In Townsville, Australia (latitude 19°S) domestic environment is presumably contaminated by canine feces containing eggs of *A. caninum*<sup>9</sup>. According to this author, worm loads and the consequent egg production for host-specific ancylostomiasis both in humans and dogs decrease in winter and then increase in summer.

Taranto et al., reported that the average number of *T. canis* and *A. caninum* egg/gram of dog feces found in winter in the region known as "Chaco Salteño" (latitude 22° S), Argentina, were 200 and 3871, respectively<sup>10</sup>. In Santa Fe city, the amount of eggs of *T. canis* is higher in summer than in winter.

Hygienic conditions are worse in summer because the staff in charge of cleaning has their annual vacations, and children (also on holidays) visit the AURs more frequently. Besides, the sandy and humid soil of this region is most appropriate and contributes to the long-term survival of *Toxocara* eggs.

The socio-economic condition is a determining risk factor in contamination. It can be observed that there is a significant difference in parasitic contamination between low and high socio-economic level; but not when AURs were studied. This is obvious for the number of feces analyzed in each AURs.

Campos Junior et al., suggest a high prevalence of childhood toxocariasis in Brasilia, with children from lower income brackets being the most affected<sup>11</sup>. In our region we demonstrated major seroprevalence in children, 40.8% (Martín UO et al., 2006, unpublished data). Thus showing in this region of Argentina the AURs as the most propitious environment for infection transmission. Our results, urban contamination, and prevalence of children, toxocariasis in Brasilia<sup>11</sup>, and studies in Butantã region, São Paulo, Brasil<sup>12</sup> show the importance of the socio-economic risk factors.

Therefore, the human being becomes an accidental host in the developed world but in underdeveloped countries *T. canis* infection is not accidental but determined by epidemiological variables.

From a Control Program point of view, dog feces samples are more appropriate and accurate for investigation than soil samples. The examination of dog excrements in public places is more practical and less hazardous. Unembryonated eggs in dog feces are visible, and in about 2-6 weeks they reach in the soil the infective stage (embryonated eggs), and are able to in-

fect other canids and paratenic hosts. Thus, the risks of infection and environmental contamination are increased.

In Argentina, the contamination of AURs seems to be determined mostly by the lack of public health programmes, environmental hygiene and by people's bad habits.

A critical opinion about dogs, parasites and humans was exposed by Barcat<sup>13</sup>.

The possible existence of *Toxocara* in public sandpits is easier to be tackled with since the incidence of *T. cati* does not imply the same epidemic importance and can be solved by changing the sand every 7-10 days, i.e., before the embryonic stage starts.

People infected with *A. caninum* are not properly followed up and notified in the region and, consequently, their incidence is unknown.

This work and an extensive bulk of research carried out in other regions of Argentina show worrying results. These should be taken into account for implementing urgent prevention measures when eggs are found in dog excrements for an Epidemiological Surveillance System in the area: a) control of dog population; b) antihelminthic treatment of dogs; c) health education programme in schools and other related institutions. c) rodent control programme; and d) alert in human health services.

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*Medicine is not merely a science but an art. The character of the physician may act more powerfully than the drugs employed.*

La medicina no es sólo una ciencia sino también un arte. El carácter del médico puede actuar con más fuerza que las drogas que usa.

Philipus Aureolus Paracelsus (c 1493-1541)  
*Archidoxies 151*