ACTA UNIVERSITARIA
Multidisciplinary Scientific Journal

| VOLUMEN 29 | 2019 |
ISSN online 2007-9621
http://doi.org/10.15174/au.2019.2113

Zoonotic parasites in dog feces from Leon, Mexico

Parásitos de potencial zoonóticos en heces de perros en León, México

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Abstract

Dogs are associated with at least 60 zoonotic diseases. Statistically, intestinal parasites stand out. The objective of this study is to evaluate the presence of zoonotic parasitic forms in dog feces collected from public parks and median strips in the city of Leon, México. Between June and August, 2015, dog feces were collected from 60 public parks and four median strips of the city. Samples were processed by the formalin-ether concentration technique and analyzed by optical microscopy. A total of 439 fecal samples from 64 areas were analyzed; the median of collected samples was 6 (Q1 to Q3: 2 to 12) per park. Contamination was present in 46 (71.88%) areas. It was identified that five (1.14%) areas tested positive for at least one parasite and one (0.23%) turned out positive for more than one parasite. The most common parasite was *Ancylostoma* spp., appearing in 3/439 samples (0.68%), among others. The rate of parks with fecal contamination was 71.88%, of which 10.87% showed parasitic contamination. *Ancylostoma* spp. was the most prevalent parasite. Sanitary measures are needed to lower fecal contamination in public parks and the number of parasitized dogs.

Keywords: Zoonoses; intestinal parasites; dogs; public parks; *Ancylostoma*, Mexico.

Resumen

Los perros están asociados con 60 enfermedades zoonóticas, por prevalencia, destacan las parasitosis intestinales. El objetivo de este estudio fue evaluar la presencia de formas parasitarias de potencial zoonótico en heces caninas recolectadas de parques, jardines y camellones de la ciudad de León, México**.** Entre junio y agosto de 2015 se recolectaron muestras de heces en 60 parques y jardines y cuatro camellones; las muestras se procesaron por el método de sedimentación de Ritchie y se analizaron con microscopía óptica. Se analizaron 439 muestras fecales de 64 áreas estudiadas; la mediana de muestras recolectada fue de 6 (Q1 a Q3: 2 a 12) por parque. De las áreas, 46 (71.88%; IC 95%: 59.87% a 81.41%) presentaron contaminación fecal. Se identificaron cinco (1.14%; IC 95%:0.4% a 2.8%) áreas que resultaron positivas al menos a un parásito y una (0.23%; IC 95%:0.01% a 1.47%) resultó positiva a más de un parásito. El parásito identificado más común fue *Ancylostoma* spp. en 3/439 (0.68%; IC 95%: 0.18% a 2.15%) muestras, entre otros. El porcentaje de parques con contaminación fecal fue del 71.88%; IC 95%: 59.87% a 81.41% y, de estos, el 10.87%; IC 95%: 4.07% a 24.36% mostraron contaminación parasitaria. *Ancylostoma* spp. fue el más prevalente. Se requieren medidas sanitarias que reduzcan la contaminación fecal en parques públicos además de la cantidad de perros parasitados.

Palabras clave: Zoonosis; parasitosis intestinales; perros; parques públicos; *Ancylostoma*; México.

Recibido: 17 de octubre de 2017 **Aceptado:** 26 de ferero de 2019 **Publicado:** 6 de septiembre de 2019

Como citar: Hernández-Muñoz, E. A., Martínez-Canseco, J., Beltrán-Rico, A., Hernández-Tavera, R., González-Aguilera, B., & Pérez-González, L. B. (2019). Zoonotic parasites in dog feces from Leon, Mexico. *Acta Universitaria 29*, e2113. doi. http://doi.org/10.15174.au.2019.2113

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ISSN online 2007-9621

Introduction

Dogs are associated with at least 60 zoonotic diseases; statistically, intestinal parasites stand out, specifically helminthiasis. In underdeveloped countries, like the ones in Sub-Saharan Africa, Latin America and Asia, helminthiasis are a public health issue (Hotez *et al.*, 2007; Rinaldi *et al.*, 2006). Studies carried out in different cities reported the presence of gastrointestinal (GI) parasites in dog feces, mainly in public parks and median strips. In Leon, Mexico, these places have not been evaluated. These are common recreational places in which humans and dogs meet, so attending places are considered a risk factor to acquire parasites, for both dogs and humans (Smith, Semeniuk, Kutz & Massolo, 2014). Children have an increased risk due to geophagy (Elliot, Tolle, Goldberg & Miller, 1985).

Zoonotic GI parasites can be classified in nematodes, tapeworms and protozoans. *Toxocara canis*, *Acylostoma* spp., *Strongyloides stercolaris* and *Trichuris vulpis* stand out in the group of nematodes for being part of the group of tropical neglected diseases (Hotez *et al.*, 2007). It is also worth mentioning *Uncinaria stenocephala* and *Toxascaris leonina* due to their zoonotic potential.

Previous research in Mexico reported parasitosis rates between 6.2% and 47.48% for *T. canis* (Rodríguez-Vivas *et al.*, 2011; Vélez-Hernández *et al.*, 2014), 17.88% to 88.1% for *A. caninum* (Alvarado-Esquivel *et al.*, 2015; Vélez-Hernández *et al.*, 2014), and 42% to 51% for *G. intestinalis* (Ponce-Macotela, Peralta-Abarca & Martínez-Gordillo, 2005). One study in Leon reported a rate of 8% for *T. canis* (Méndez, Arreguín-Nava, Aguilar-Orozco & Álvarez, 2012). The objective of this study was to document the rates of fecal contamination in public parks and GI parasites found in dog feces in Leon, Mexico.

Methods

A descriptive, transversal and observational study was developed in the summer between June and August of 2015 in Leon, Mexico (21°12′27″N-101°67′72″O). Leon city is in the center of Mexico, 1800 meters (5905 ft) above sea level. Its population is 1.4 million people (Instituto Nacional de Estadística y Geografía [INEGI], 2010) and around 200 000 dogs of which 10% are stray dogs (Unidad Municipal de Acceso a la Información Pública, 2014). The weather in Leon is warm with a subtropical temperate variation, with summer rains with annual precipitation ranging from 378 mm to 840 mm and an average temperature of 18.1 °C (64.58 °F) and 27.3 °C (81.14 °F) (Sistema Meteorológico Nacional [SMN], n.d.).

The city was divided in six sections. Sixty public parks and four median streets were selected randomly. All the parks were located at residential or commercial areas, and some had schools nearby. The total of collected fecal samples was 443. Each spot was visited once, and the samples were collected in polyethylene bags that contained phenol, alcohol and formaldehyde (PAF) for its preservation and transportation at room temperature. The samples were stored in the Laboratory of Microbiology of the University of Guanajuato for its future analysis. The maximum time between preservation and observation was four months. The samples that lost air tightness were discarded.

The samples were analyzed by the formalin-ether sedimentation technique (Salazar-Schettino, 2011). The sediment was stained with iodine solution for parasitology. Samples were observed under a light microscope at 10X and 40X objective lenses, up to three times. All the observations were done by qualified staff from the laboratory. The identification of parasites was made according to their morphologic characteristics. The qualitative variable results were expressed as frequencies and rates with its confident interval of 95% (CI 95%). The results of the quantitative variables were expressed as the median, and its range was expressed as Q1 to Q3, not to show a normal distribution according to the Kolmogorov-Smirnov analysis.

ISSN online 2007-9621

Results

Of the 64 studied areas (figure 1), 46 showed fecal contamination (71.88%; 95% IC: 59.87% to 81.41%) and, from these 46, at least one parasite was found in five areas (10.87%; 95% IC 4.07% to 24.36%). A total of 443 samples were collected, and the median was 6 (Q1 to Q3: 2 a 12) samples by park. Four samples lost air tightness and were discarded. From the 439 remaining samples, five (1.14%; 95% IC: 0.4% to 2.8%) were positive for one parasite and one (0.23%; 95% IC: 0.01% to 1.47%) for two. The general prevalence was 1.4%. The most common parasite was *Ancylostoma* sp. in 3/439 (0.68%; 95% IC:0.18% to 2.15%) samples, followed by *T. canis* (eggs) 1/439 (0.23%; 95% IC: 0.01% to 1.47%), *Strongyloides* sp. 1/439 (0.23%; 95% IC: 0.01% to 1.47%), and G. intestinalis (cysts) 1/439 (0.23%; 95% IC: 0.01% to 1.47%); the positive sample for two parasites contained *Strongyloides* sp. and *Ancylostoma* sp. (figure 2).

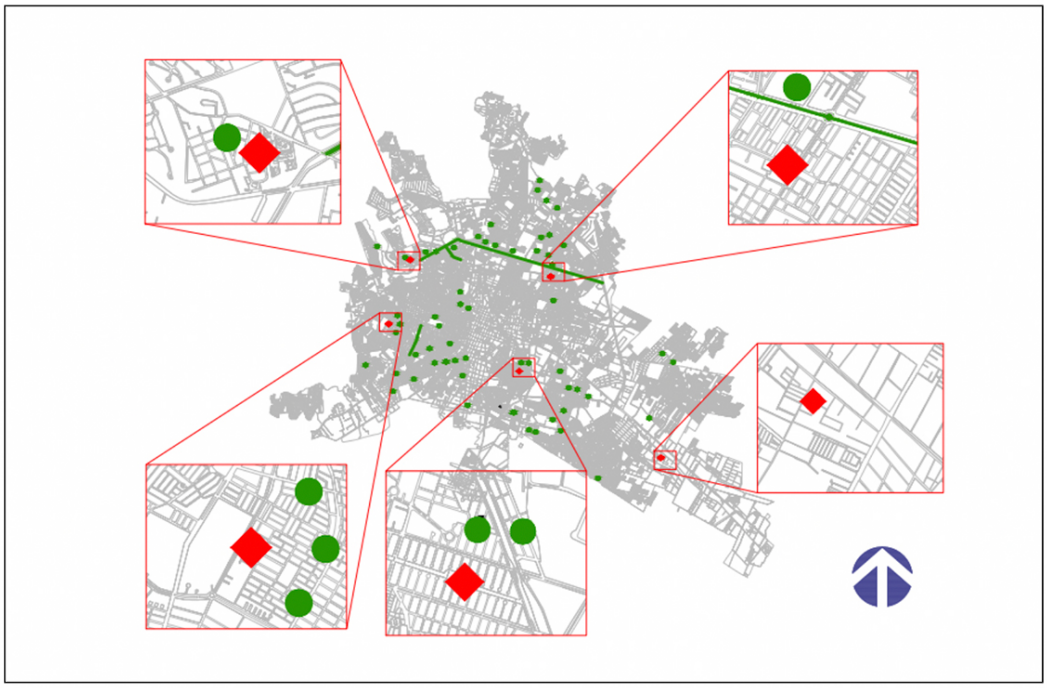

Figure 1: Map of Leon, Mexico, which shows the 64 studied areas. Circles are negative for parasitic forms by formalin-ether sedimentation technique and diamonds are positive.
Source: Map of the City of León, Guanajuato. Courtesy of Architect Jorge Mauricio Hernández Hidalgo.

ISSN online 2007-9621

Figure 2: Photomicrograph of parasitic forms found in the study, stained with iodine solution for parasitology. A *Toxocara canis* egg B *Strongyloides* sp. larvae C *Ancylostoma* sp. larvae.
Source: Author´s own elaboration.

Discussion

A general prevalence of parasites of 1.4% was found, this differs with studies made in other cities of Mexico which report rates from 37% to 98% (Alvarado-Esquivel *et al*., 2015; Martínez-Barbabosa, Gutiérrez-Cárdenas, Alpízar-Sosa & Pimienta-Lastra, 2008). The sample collection was carried out only in summer, when parasite rates are higher (Ponce-Macotela *et al*., 2005). A possible explanation to these results is that the rainy season in Leon occurs during summer. The samples might have been washed out, because an accumulated precipitation of 125 mm in July 2015 was reported (SMN, 2015). Also, it is not possible to discard that most of the samples came from house dogs, treated regularly with antiparasitic drugs.

Canine health depends on their owner's care, including administration of antiparasitic drugs and fecal recollection from public places. The rate of public parks contaminated with feces and the number of fecal samples collected show a poor interest of dog owners in collecting their dog's feces. The education of the owners should be promoted in several ways in which dog breeders, veterinarians, physicians, and other owners should be involved. This education can take place during vaccination and sterilization campaigns, dog-related events, veterinary attention and social networks.

In Leon, there are city programs to encourage an appropriate dog care and feces disposition, these programs include conferences in elementary schools. During 2015, the Animal Control Center of Leon gave nine conferences and in 2016 at least 106. The public health system of Mexico has a zoonosis prevention program that offers free antiparasitic drugs and vaccines. These programs function all year round and were implemented in 2015 (Non-published data from the Animal Control Center of Leon 2016). In the same year, 1253 dogs were dewormed. Until October 2016, at least 2445 dogs were dewormed. In Leon, there are many

civil organizations offering antiparasitic drugs at a low cost, this allows more accessibility to deworming treatments (Non-published data from the Animal Control Center of Leon 2016). This could explain that in a previous work done in Leon, the rate of parasites found in collected dog feces was higher (18%) (Méndez *et al.*, 2012).

The formalin-ether sedimentation technique is used to detect helminth eggs, larvae and protozoan cysts (Uga, Tanaka & Iwamoto, 2010). In addition, the preservation of the samples was done with PAF which preserves trophozoites, cysts, eggs, and larvae. Other studies based on the same technique reported *T. leonina, T. vulpis, D. caninum, E. granulosus,* and *Cryptosporidium* spp.; however, none of the aforementioned was found and *Cryptosporidium* spp. was not searched intentionally.

This study has some limitations. The feces were collected from public parks and it is unsure which belongs to stray dogs or housedogs. There is no gold standard for intestinal parasite detection; however, the formalin-ether sedimentation technique is more suitable for the detection of larvae and eggs than the direct exam and flotation techniques (Salazar-Schettino, 2011; Yimer, Hailu, Mulu & Abera, 2015). The microscopic feces exam depends on the skill of the laboratory technician and allows to detect between 20% and 90% of eggs and parasites (McHardy, Wu, Shimizu-Cohen, Couturier & Humphries, 2014). Another limitation is that the fecal analysis was made with one sample and the evidence shows that the probability of detecting any parasitic form with a single fecal sample is 83% compared to 95% obtained with two samples (Thomson, Haas & Thompson, 1984). More studies are needed to evaluate the efficacy of local antiparasitic programs, the percentage of owners who dewormed their dogs as well as the frequency, the most commonly used anti-parasite schemes by veterinarians, and the intentional search for gastrointestinal parasites in stray dogs.

Despite the low parasitic index found in dog feces in the city of Leon, Mexico, 1.14% 95% IC: 0.4% to 2.8% compared to other studies, the percentage of parks with fecal contamination was high 71.88%; 95% IC: 59.87% to 81.41%. Educating dog owners is crucial in reducing the risk of transmission of gastrointestinal parasites to other dogs and to humans. Apparently, free deworming campaigns reduced the rate of parasitosis in domestic dogs, so it is necessary to continue with education programs and sanitary measures to reduce both fecal contamination in parks and the number of parasitized dogs.

Acknowledgments

To José Antonio de Jesús Álvarez Canales for his valuable support in the area of biostatistics and revision of the manuscript. To Jorge Mauricio Hernández Hidalgo for the elaboration of the map of the city.

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