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Prevalence of gastrointestinal helminths in dogs from the Health service in Tulancingo, Hidalgo

Prevalencia de helmintos gastrointestinales en perros procedentes del servicio de Salud de Tulancingo, Hidalgo

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ABSTRACT

The aim of the present study was to determine the prevalence of gastrointestinal helminths in dogs and their possible relationship as zoonosis. One hundred partial gastrointestinal (TGI) tracts of dogs were obtained, the TGI were classified in relation to the age and gender of each dog, and from the TGI the helminths were obtained and classified according to their morphology using a stereoscopic microscope. The overall prevalence of helminths was 84%. In fact, *Dipylidium caninum* was higher in females than in males (P <0.02). On the other hand, *Toxocara canis* was 71.11% in young animals and 38.18 % in adult animals (P <0.02). In addition, the prevalence of *Taenia spp* was 4.44 % and 25.45%, for young and adult dogs, respectively (P <0.05). In relation to *Uncinaria stenocephala*, the prevalence was 2.22% and 16.36% for young and adult dogs, respectively (P <0.05). In conclusion, a high prevalence of gastrointestinal helminths in dogs that roam the street was found involving public health risk for the population.

Keywords: zoonosis, parasites, public health.

RESUMEN

El objetivo del presente estudio fue determinar la prevalencia de helmintos gastrointestinales en perros y su posible relación como zoonosis. Se obtuvieron cien tractos gastrointestinales (TGI) parciales de perros. Los TGI fueron clasificados en relación a la edad y sexo de cada perro, a partir de los TGI fueron obtenidos los helmintos y se clasificaron de acuerdo a su morfología utilizando un microscopio estereoscópico. La prevalencia general de helmintos fue del 84%. En efecto, *Dipylidium caninum* fue mayor en las hembras que en los machos (P<0.02). Por su parte, *Toxocara canis* fue de 71.11% en animales jóvenes y de 38.18% en animales adultos (P<0.02). Asimismo, la prevalencia de *Taenia spp* fue de 4.44% y de 25.45%, para perros jóvenes y adultos, respectivamente (P<0.05). En relación a *Uncinaria stenocephala* la prevalencia fue de 2.22% y de 16.36% para perros jóvenes y adultos, respectivamente (P<0.05). En conclusión, se encontró una elevada prevalencia de helmintos gastrointestinales en perros que deambulan por la calle, implicando riesgo de salud pública para la población.

Palabras clave: zoonosis, parásitos y salud pública.

INTRODUCTION

Animals represent a way of life for much of the world, so the closeness between people and pets has created a special relationship known as the human-animal bond. Dogs provide benefits such as emotional development, socialization and physical well-being (Paul *et al*., 2010). Around the world the number of urban households that maintain "domestic dogs" has increased and this trend increases the frequency of human-animal companion contact (Bwalya *et al*., 2011).

It is known that dogs can be reservoirs of intestinal nematodes with zoonotic potential (Moskvina y Ermolenko, 2016; Medina-Pinto *et al*., 2018), such as, *Taenia* spp. (Beiromvand *et al*., 2018), *Dipylidium caninum*, *Ancylostoma* spp., *Giardia* spp., *Cryptosporidium* sp. (Soriano *et al*., 2010) or *Toxocara canis* (Chen *et al*., 2018). These represent a potential public health risk, with a significant socio-economic impact, particularly in impoverished communities (Chen *et al*., 2018) and in children; since they have more direct and indirect contact with dogs, compared to adults (Xhaxhiu *et al*., 2011).

In the Mexican Republic, specifically in Mexico City, *Toxocara canis* and *Ancylostoma caninum* have been as the most frequent parasites reported, in dog feces (Eguia-Aguilar *et al*., 2005). Other studies conducted in Chiapas states (Martínez-Barbosa *et al.,* 2008) y Yucatán, México (Medina-Pinto *et al*., 2018) (Martínez-Barbosa *et al.,* 2008) and Yucatán, México (Medina-Pinto *et al*., 2018) position *Toxocara canis* and *Ancylostoma caninum* among the most frequent parasites in dog feces, which roam the parks and streets of these towns. On the other hand, Vélez-Hernández *et al*. (2014) also mentions *Dipylidium caninum* as a parasite of high prevalence in feces, collected from the soil, from wandering and owner dogs from Puerto Escondido, Oaxaca, Mexico. All these pathogens can be in the human environment found, such as water, soil, food, parks and contamination by dog feces, which represents a high risk for people (Romero *et al*., 2015). However, in the municipality of Tulancingo de Bravo, Hidalgo, no studies have been in this regard, conducted.

The objective of this study was to determine the prevalence of gastrointestinal helminths in dogs from the Health Services in Tulancingo, Hidalgo and their possible relationship as zoonosis.

MATERIAL AND METHODS

Place of study

The investigation was during the months of January to July 2012 conducted, with samples obtained from dogs slaughtered in the Health Jurisdiction No. 2 of the Health

Services of Hidalgo State, located in Tulancingo de Bravo municipality, Hidalgo, Mexico. The region is geographically located between parallels 20° 03' and 20° 13' of North Latitude; the meridians 98° 14' and 98° 31' west longitude, and an altitude between 2200 and 2700 m a.s.l. It has a climate ranging from semi-dry temperate subhumid with rains in summer, too mild subhumid with rains in summer (INEGI, 2009).

Sample size

The sample size was determined based on the proportion of positive animals to parasites (P=0.5), assuming maximum variability; with a reliability of 0.95 and an estimation error of less than 0.1. The result was to take 96 samples; however, it was to 100 samples adjusted, because Sanitary Jurisdiction No. 2 performs the sacrifice of dogs only once a week, so samples of 5 dogs were taken per week for 20 weeks. Samples from partial digestive tracts were obtained using systematic sampling with random start (Martínez, 2010).

Collection and analysis of samples

After the slaughtering of the animals, the esophagus, stomach and small intestine were obtained. Each gastrointestinal tract (TGI) was in relation to the age and sex of each dog, classified. Age classification was performed by teething, in two categories; young animals up to 12 months of age and adult animals older than 12 months. Subsequently, the TGI were placed in plastic trays and were taken to the Parasitology Research Laboratory of the Academic Area of Veterinary Medicine and Zootechnics, Institute of Agricultural Sciences, Autonomous University of Hidalgo State. All the TGI were dissected longitudinally to collect the intestinal content, subsequently this content was examined in a dark-bottomed tray to highlight the parasites. The helminths were washed in physiological saline solution (SSF) and identified by their morphological characteristics, using a stereoscopic microscope (UPSEHKRAFT brand), with 10x and 40x objectives and an optical microscope (IROSCOPE brand, model WB-3) with the objective 10x (MAFF, 1986).

Data analysis

Sample data were analyzed at a 95% confidence interval (CI) (Martínez, 2010), using the chi-square test (Fisher's exact), to compare the prevalence of the various parasites according to the classes of dogs, forming groups according to age and sex.

RESULTS

Prevalence of helminths in dogs

From the 100 samples processed, 84% (95% CI: 75.57-89.90), were positive for some helminth. Six different species of helminths were found (Table 1), the most prevalent were *Toxocara canis* (53%; 95% CI: 42.28-62.48) and *Ancylostoma*

caninum (50%; 95% CI: 40.38-59.61); those with the lowest prevalence were *Uncinaria stenocephala* (10%; 95% CI: 5.52-17.43) and *Spirocerca lupi* (1%; 95% CI: 0.17-5.44).

Prevalence of helminths in relation to the sex and age of dogs

In the prevalence of helminths by sex, 68 digestive tracts were female, of which 88.23% were positive for some helminth and 32 digestive tracts were male, with 75% positive for some parasite (Table 2) (P> 0.05). The prevalence of *Dipylidium caninum* was 47.06% in females and 25.02% in males (P <0.02).

Table 1. Prevalence of gastrointestinal helminths in dogs, Tulancingo Hidalgo, Mexico.

Parasite by species	Percentage	CI to 95%
Toxocara canis	53	43.28-62.48
Ancylostoma caninum	50	40.38-59.61
Uncinaria stenocephala	10	5.52-17.43
Spirocerca lupi	1	0.17-5.44
Dipylidium caninum	40	30.94-49.79
Taenia spp	16	10.09-24.42

Table 2. Prevalence of gastrointestinal helminths according to the sex and age of the dogs, Tulancingo Hidalgo, Mexico.

Variable	Females (%)	Males (%)	Youth (%)	Adults (%)
Positive samples/processed samples	60/68	24/32	40/45	44/55
Percentage (CI to 95%)	88.23 (78.46-93.91)	75.00 (57.89-86.74)	88.88 (76.50-95.15)	80.00 (67.63-88.44)
Toxocara canis	38 (55.88)	15(46.88)	32^{a} (71.11)	21^{b} (38.18)
Ancylostoma caninum	35 (51.47)	15 (46.88)	20 (44.44)	30 (54.55)
Uncinaria stenocephala	7 (10.29)	3 (9.38)	1^{a} (2.22)	9^{b} (16.36)
Spirocerca lupi	0 (0)	1 (3.13)	0 (0)	1 (1.82)
Dipylidium caninum	32^{a} (47.06)	8^{b} (25.02)	19 (42.22)	21 (38.18)
Taenia spp	9 (13.24)	7 (21.88)	2^{a} (4.44)	14^{b} (25.45)

[ab] Different literals, between columns of females and males or between youth and adults, indicate difference (P <0.02).

On the other hand, for the prevalence of helminths in relation to the age of the animals, was obtained that 88.88% of young dogs and 80% of animals older than one year of age were positive for some helminth (P> 0.05). In addition, the prevalence of *Toxocara canis* was 71.11% in young animals and 38.18% in adult animals (P <0.02). On the other hand, the prevalence of *Taenia* spp was 4.44% and 25.45%, for young and adult dogs, respectively (P <0.05). Finally, in relation to *Uncinaria stenocephala* the prevalence was 2.22 and 16.36 for young and adult dogs, respectively (P <0.05).

DISCUSSION

The prevalence of helminths in the present study (84%) is similar to studies conducted in dogs in Mexico; Querétaro with 78.60% (Fernández y Cantó, 2002) and 72.8% (Canto *et al*., 2011), Mexico City with 85% (Eguia-Aguilar *et al*., 2005); as well as in other regions of the world such as Zambia with 78.3% and sub-Saharan Africa with 71% (Chidumayo, 2018). The high prevalence of parasites could be, because the samples examined belonged to dogs without owners, or that they came from canine rabies control centers; in whose cases they are not subject to deworming programs. However, in Zambia, Bwalya *et al*. (2011) also reported a high prevalence of helminths in dogs with owners (78.3%).

These authors point out that it is an important finding, since it emphasizes that there is no care for pets with respect to helminth control through regular deworming. Romero *et al*. (2015) and Idika *et al*. (2017), presented parasite prevalence of 13.10% and 51.7%, respectively. This low prevalence could be because of the processed samples came from dogs with owners, which are regularly subject to control and prevention treatments for parasitic diseases. On the other hand, Trasviña-Muñoz *et al*. (2017), reported a general prevalence of 21.5%. These researchers mention that the low prevalence could be due to the climate of the place of study, where they have temperatures that vary from 36 °C to 50 °C, with low humidity, which can delay or even suppress the development of parasite eggs.

The helminths found according to the order of prevalence were *Toxocara canis*, *Ancylostoma caninum*, *Dipylidium caninum*, *Taenia* spp, *Uncicaria stenocephala* and *Spirocerca lupi*, which generally coincides with the findings of Fernández y Cantó (2002) and Eguia-Aguilar *et al*. (2005). Dogs are the main transmitters of toxocariasis to men especially in developing countries, where most have access to public parks and playgrounds, which serve as the main source of soil contamination and represent a great risk of human exposure to *Toxocara* eggs (Chen *et al*., 2018). Similarly, the larvae of *Toxocara canis* can pass through the feces of infected animals, and humans can become infected with these larvae when they work with soil or play in contaminated areas. This infection seems to be more prevalent in children and in socioeconomically disadvantaged populations, due to inconsistent hygiene practices (Chen *et al*., 2018).

In the present investigation, a high prevalence was found for *Ancylostoma caninum*, which is important since the presence of *Ancylostoma* larvae or hookworm in dog feces can infect humans, which impacts on public health. *Ancylostoma* larvae can penetrate

the skin when walking barefoot in a contaminated soil, and although they cannot reproduce in the human body, they produce red papular lesions that move under the skin as the larvae migrate. Clinically it manifests itself by severe itching, especially at night (O'Neil, 2018).

Dipylidium caninum was the most prevalent cestode of the present study, which is consistent with the high prevalence reported in studies conducted in Querétaro, Mexico (Canto *et al*., 2011) and Mexico City, Mexico (Eguia-Aguilar *et al*., 2005). This prevalence could be due to the increase in stray dogs that do not receive any type of antiparasitic treatment, and consequently, they are with fleas and lice frequently infested, which can be intermediaries of *Dipylidium caninum*. When the canine host ingests infected adult fleas, the cystecercoid is released in the stomach, subsequently settling in the small intestine of its definitive host (Beugnet *et al*., 2018; Labuschagne *et al*., 2018); however, fleas can occasionally infect humans, especially children living with pets, who do not have veterinary control for ectoparasites (Neira *et al*., 2008; Ayala *et al*., 2012).

The second cestode found in the present investigation was *Taenia* spp., with a prevalence of 16%; which is less than 25.7% reported in feces collected from dogs from rural areas of Khuzestan, province of Iran (Beiromvand *et al*., 2018). The importance of *Taenia* spp., is that the domestic dog can be a definitive host when acquiring the infection, by consuming the carcasses removed from infected herbivorous domestic animals; mainly sheep carcasses (Beiromvand *et al*., 2018). The sheep, the cattle (Alemu *et al*., 2015) and less commonly the human being, can be intermediate hosts, after the ingestion of eggs of these parasites (Sonmez *et al*., 2017).

The general prevalence of helminths was similar among young and adult animals. However, young dogs had a higher prevalence of *Toxocara canis*; This may be because the most important form of *Toxocara canis* infection in dogs is the prenatal transmission of larvae; also known as transplacental or intrauterine transmission (Schnieder *et al*., 2011), where female dogs that harbor somatic larvae can infect up to 100% of newborn puppies (Gawor *et al*., 2015). A higher prevalence was also found in adult animals for *Uncinaria stenocephala*. This parasite is one of the agents related to cutaneous parasitosis in humans, known as a completely as cutaneous migrans larva. This zoonosis occurs especially in areas where there are dogs and cats without owners, as well as in sandy and humid soils, such as beaches and recreational parks (Plascencia *et al*., 2013); This explains the relatively low prevalence of this nematode in the present investigation.

The prevalence of *Taenia* spp was higher in adult animals; Fernández y Cantó (2002) reported contrary data. The highest prevalence in adult animals of the present study may be because adult animals may acquire the infection by consuming the infected animal carcasses (Beiromvand *et al.,* 2018).

The results of prevalence of helminths by sex of dogs show no difference; however, the prevalence of *Dipylidium caninum* was higher in females than in males; Similar data were reported by (Chávez *et al*., 2012), who mentions that females are more prone to Dipylidium caninum. In this sense, Hernández *et al*. (2007), mention that the general prevalence of *Dipylidium caninum* is higher during the coldest time of the year. It is probably because stray dogs usually congregate in greater numbers, to seek refuge from colder temperatures; which facilitates the propagation of vectors, by increasing promiscuity among them and consequently the chances of infection with *Dipylidium caninum* are increased.

The present study was carried out during the period of greatest reproductive activity in the dog, which runs from March to July (Choy y Echevarría, 2005), so it is possible that in our case, the females had a higher prevalence of Dipylidium caninum, due to the contact they have with parasitized male flea dogs.

CONCLUSIONS

High prevalence of gastrointestinal helminths of dogs from the Health Services of Tulancingo de Bravo, Hidalgo, Mexico was observed; which demonstrates the public health risk that mean dogs without owners that roam the streets. Some of the parasites found have a high risk of zoonosis, so it is necessary to implement awareness campaigns for the general population, about the responsible possession of companion animals, such as dogs.

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