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Prevalence of Gastro-Intestinal Parasites in stray dogs (*Canis familiaris*) from Grenada, West Indies

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ABSTRACT

In the present study, fecal samples from 445 stray dogs, collected during July 2008 to December 2012 were examined for gastrointestinal parasites. Fecal samples were collected throughout the six parishes of the country, under the national rabies control program. Fecal samples were examined for gastrointestinal (GI) parasites by flotation technique. Out of 445 dogs 394 (88.5 %) (95% Confidence interval (CI) 84.54% to 91.46%) dogs were found infected with one or more species of gastrointestinal parasites. The results revealed the presence of at least one parasite egg of 73 % *Ancylostoma spp.*, 15.7 % *Trichuris vulpis,* 3.8% *Toxocara canis,* 1.4% *Coccidia spp.* and 1.1% *Strongyloides spp.* The prevalence of the GI parasites according to stray dog age groups was statistically significant ($p < 0.05$, χ^2). There was no significant difference between male and female dogs ($p>0.05$, χ^2). Analyzing the prevalence of GI parasites in various age groups the results showed that dogs under 12 weeks of age had a higher prevalence than juveniles (12-24 weeks) and adults (over 24 weeks). The presence of zoonotic parasites in stray dogs in Grenada, poses possible risks of contamination of the environment which may have public health implications.

Keywords: Gastrointestinal parasites, Stray dog, Grenada

Since ancient times, the dog has become one of the closest domestic animals to man. Dogs act as definitive hosts for many intestinal parasites, some of which cause zoonotic diseases (Craig and MacPherson, 2000; Rhindali *et al.* 2006; Katagiri and Oliveira- Sequeira, 2008; Khante *et al.* 2009).

Stray dogs or free -roaming dogs are domestic dogs that are not confined to a yard or house. With the lack of veterinary care and poor nutrition, stray dogs suffer from many disease conditions. The ubiquitous problem of stray dogs in urban and rural areas worldwide emphasizes the need to diagnose, treat and prevent zoonoses including parasitic nematodes (Slater 2001; Eva and Annamaria 2012).

The common gastrointestinal parasites in dogs are *Acylostoma caninum, Toxocara canis, Dipylidium caninum, Strongyloides stercoralis, Taeniidae, Trichuris vulpis and Isospora* spp (Barutzki and Schaper, 2003; Moreno *et al.* 2007; Sowemimo, 2009; Abere *et al.* 2013).

In developing countries like Grenada, the number of stray dogs that coexist with the human population is high. They pose a possible risk of zoonotic infections including parasitic zoonoses. Several studies have been carried out on gastrointestinal parasitism of owned and stray dogs throughout the world but there is lack of information regarding the prevalence of gastrointestinal parasites in stray dogs in Grenada. The purpose of this study was to estimate the prevalence of gastrointestinal parasites of stray dogs in Grenada.

MATERIALS AND METHODS

Study area

Grenada located at 12°07′ latitude north, 61°40′ longitude

west, / / 12.117; -61.667 is the most southern of the Windward Islands between the Caribbean Sea and Atlantic Ocean, north of Trinidad and Tobago. Grenada, a tropical small state is divided into six parishes. It has an area of 433 square kilometers. The annual average Temperature 29°C (84.2°F) is constant throughout the year with the average relative humidity which ranges from 68% to 80%.

Study Animals

The present study was conducted during July 2008 to December 2012. Stray dogs 445 (male 237 and female 208) of all age group were caught from all 6 parishes of Grenada, during the rabies annual control /immunization program of the Government of Grenada. Stray dogs were humanely euthanized and transported to the pathology laboratory, School of Veterinary Medicine, St. George's University for proper disposal.

Sample Collection and Methodology

Fecal samples were collected directly from the rectum of euthanized dogs and stored in 10% formalin in a sterile large plastic container. Information on sex and age was recorded. Age was estimated by dental analysis. The dogs were categorized as puppies (less than 12 weeks); juveniles (12 week to 24 week); and adults (over 24 week of age). The criterion for this study was to determine the qualitative parasitic infections in stray dogs by fecal flotation technique. Fecal sample was considered positive when at least one parasite egg or cyst was observed in high magnification (100 X) under light microscope. Saturated solution of common salt (NaCl) was used for flotation fluid. Identification of the parasitic egg/ova and oocysts of coccidia was performed as described by Foreyt (1997).

STATISTICAL ANALYSIS

To assess differences in the proportion of parasites for the age groups and gender, a chi-square test was conducted. A level of significance of P< 0.05 was used. SPSS v21 and Excel statistical software were used to analyze the data. (https://www.ibm.com/developer works).

RESULTS AND DISCUSSION

Of a total of 445 dog fecal samples (273 from females (52.8%) and 208 (47.2%) from males) (Table 3), the overall prevalence of GI parasites was 394 /445 (88.5 %; 95% Confidence interval (CI) 84.54% to 91.46%). The prevalence of various species of GI parasites is presented in table 1.

Ancylostoma caninum was the most common GIT parasite (73.0 %) followed by *Trichuris vulpis* (15.6%) in all age groups. Other parasites had less than 4.0% prevalence. The prevalence of GI parasites amongst puppies was higher than adult dogs. A statistical significant difference ($p<0.05$, χ^2) was found for the prevalence of GIT parasites in various age groups of dogs. The results are presented in table 2.

Result of the prevalence of GI parasites by gender is presented in table 3. No statistical significant difference was found ($P> 0.05$, χ^2) between male and female dogs (table 3).

Table 1: Prevalence of Gastrointestinal parasites in stray dogs (445) in Grenada, West Indies

Parasite	Positive No. and percentage (%)
Ancylostoma spp	325 (73.0)
Trichuris	70 (15.7)
Toxocara spp	17 (3.8)
Coccidia	6 (1.4)
Strongyloides spp	5 (1.1)

Table 2. Prevalence of Gastrointestinal parasites by age in stray dogs in Grenada, West Indies

Parasite	Adult (n=405)	Juvenile (n= 32)	Puppy (n=8)	p-value
Ancylostoma spp	300 (74.1%)	18 (52.2 %)	7 (87.5%)	<0.001
Trichuris	65 (16.0)	3 (9.4%)	2 (25.0%)	<0.001
Toxocara spp	13 (0.7)	0 (0.0%)	4 (50.0%)	<0.001
Coccidia	3 (0.7)	3 (9.4%)	0 (0.0%)	<.0001
Strongyloides spp	5 (1.2)	0 (0.0%)	0 (0.0%)	0.01

Table 3: Prevalence of gastrointestinal parasites by gender in stray dogs in Grenada, West Indies

Parasite	Female (n=237)	Male (n=208)	p-value
Ancylostoma spp	175 (73.8)	150 (72.1)	.07
Trichuris	38 (16)	32 (15.4)	.04
Toxocara spp	10 (4.2)	7 (3.4)	.21
Coccidia	3 (1.2)	3 (1.5)	.87
Strongyloides spp	2 (0.8)	3 (1.4)	.36

The present study provides an indication of severity of gastrointestinal parasites in stray dogs of Grenada. Result showed a very high level of prevalence of parasites as reported from other parts of the world. In this study, 88.5 % (95% CI: 85.54% to 91.46%) of the examined dogs were positive for at least one of the GI parasites. This overall prevalence of GI parasites in stray dogs is in accordance with previous studies: Mukaratirwa and Singh (2010) South Africa (82.5%); Gholami *et al*. (2011) in Iran (90 %); Ramirez-Barriose *et al.* (2004) in Venezuela (93.5 %); Lavallen *et al.* (2011) in Argentina (89.13%); Dagmawi, *et al.* (2012) (86.8%) and Dejene *et al.* (2013) (84.6%) in Hawassa Town, Ethiopia; Umar (2009) in Kaduna State, Nigeria (93.8%).

The prevalence of GI parasites amongst puppies was higher than adult dogs. The study showed that the infection occurs in all age groups; however, high prevalence in young dogs may be due to their immature acquired immunity and mode of transmission; trans-placental route (Overgaauw, 1997; Bowman, 2009).

Gastrointestinal parasitic infections predominated over protozoan infections in this study which coincides with other studies (Labruna *et al.* 2006). Bugg *et al.* (1999) reported the increased infection of helminth compared to protozoon in dogs getting routine deworming. The history of deworming of the dogs used in our study was unknown hence, comparison with dogs getting regular deworming will not be appropriate.

Ancylostoma spp. was the most prevalent parasite (73%) which is similar to findings from Lusaka and Katete districts of Zambia (Bwalya *et al.* 2011). The species of *Ancylostoma* are the most pathogenic in dogs and are also involved in human infection as the cause of cutaneous larva migrans (Katagiri and Oliveira-Sequeira, 2008). The high prevalence suggests that the environmental conditions in Grenada are favorable for the survival and transmission of the parasite; however, there are no published reports of human infection.

Trichuris vulpis is one of the common intestinal parasite in dogs in South America (Katagiri and Oliveira-Sequeira, 2008; Klimpel *et al.* 2010), and in Europe (Radev *et al.* 2015; Barutzki and Schaper, 2003; Georgieva, *et al.* 1999). The prevalence of 15.7 % from this study falls off the wide range of values that have been reported by the above authors. Human infections by *T. vulpis* have been reported from many countries (Singh *et al.* 1993; Kagei *et al.* 1986 and Kenney and Yermakov, 1980) and have been attributed to humans being in continuous contact with an environment contaminated by *T. vulpis* infected dogs. However, there are no reports of human infection with *T. vulpis* from Grenada.

The over all Prevalence of *Toxocara spp.* (3.8 %) observed in the present study is similar with that obtained from Canada 4.2 % (Joffe *et. al.* 2011), but lower than what has been reported from Brazil 5.54% (Oliveira-Sequeira *et al.* 2002) and 7.9% by Mukaratirwa and Singh (2010) in stray dogs in South Africa. The Low prevalence of *Toxocara spp.* observed in the present study may be partly explained by the small number of puppies sampled. Otherwise, most Ascarids have been found mainly in dogs younger than one year old (Moreno *et al.* 2007). *Taxocara spp.* predominated in puppies (Table 2), but was also found in adult animals, in accordance with the observations of Overgaauw (1997). According to Maizels and Meghji (1984), some adult dogs continue to be completely susceptible to *Toxocara* spp. infection, even when repeatedly exposed to the parasite and despite the production of specific antibodies. Therefore, adult dogs may significantly contribute to the contamination of the environment with eggs of *Toxocara* spp.

Coccidia spp. was recovered with a prevalence of 1.4% in the present study. Although it was not possible for us to determine the genus and species of coccodia in the present study, it was likely that this was *Isospora* spp since it is the main coccidian found in dogs, mostly in younger animals (Mukaratirwa and Singh, 2010; Ramírez-Barrios *et. al.* 2004).

The prevalence of *Strongyloides* spp. was 1.1% in the present study which is similar with that reported in Canada

0.7% by Gaunt and Carr (2011). The lower prevalence of the eggs of this parasite observed in the current study may be attributed to the type of fecal samples collected. Stray dogs roaming freely in residential areas exacerbate the risk of zoonotic disease transmission to healthy dogs, livestock and humans. Therefore it is essential to avoid the contamination of environment, food and water with their feces.

The results from this study serve as baseline information on zoonotic parasites in stray dogs in Grenada. There is need to educate the Grenadian population regarding the risk of zoonotic parasitic infection. The populace should be made aware of the measures for control and prevention of parasitic infections in dogs.

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