



Regional report

Canine gastrointestinal nematode transmission potential in municipal dog parks in the southeast United States

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ABSTRACT

Monthly canine parasite prophylactic products prevent not only adult heartworm infection, but also patent infections with specific gastrointestinal parasites. While most monthly products control and treat certain hookworm and roundworm infections, fewer are labeled for whipworm (*Trichuris vulpis*). Therefore, we hypothesized that fecal samples collected from municipal dog parks will have a greater prevalence of whipworm eggs compared to hookworm and roundworm eggs. In this study, canine fecal samples were collected from municipal dog parks in three southeastern states, with up to 20 fecal samples were collected from each park. A total of 200 fecal samples were obtained from dog parks in Georgia, North Carolina, and South Carolina. All fecal samples were examined for the presence of gastrointestinal helminths by a simple centrifugal flotation using sheather's sugar flotation solution. Of the 200 samples collected, 27% were positive for gastrointestinal helminths by fecal flotation. Of these infected fecal samples, 8.5%, 17%, and 1.5% contained whipworm, hookworm, and roundworm, respectively. However, the majority of hookworm-positive samples were collected from one park, whereas whipworm and roundworm samples were collected from multiple parks. These results could indicate that dogs are at risk of infection by all three parasites at dog parks, and that preventive strategies may need to be tailored not only to the specific region, but to specific infected dog parks.

1. Introduction

Canine gastrointestinal helminths can be a major cause of disease, especially in the young and immunocompromised. Gastrointestinal helminths such as whipworms (*Trichuris vulpis*), hookworms (*Ancylostoma caninum*), and roundworms (*Toxocara canis*) are transmitted by the fecal-oral route and, in the case of hookworm, percutaneous penetration. While many canine heartworm preventive products provide treatment for infection by common gastrointestinal helminths, these parasites remain a problem for many animals, and transmission persists when infections cannot be cleared (Adolph et al., 2017). Many dog owners frequent their local municipal dog park in order to provide exercise and socialization with other dogs. Despite providing a positive outlet for many dogs, we need to be aware that these parks also provide ample opportunity for transmission of pathogens, significant among which are endoparasites (Morales Sánchez et al., 2016). Infectious feces

that are not properly disposed of by pet owners at dog parks may allow not only for transmission of parasites to other dogs, but potentially also to humans.

Trichuris vulpis, *T. canis* and *A. caninum* can cause clinical signs in their definitive hosts. The later two parasites also have zoonotic potential. *Trichuris vulpis*, canine whipworms, can cause diarrhea, tenesmus and weight loss in dogs, and their eggs can persist in grass and soil environments for extended periods of time due to their protective shell, sometimes surviving up to seven years in the environment (Spindler, 1929). *Toxocara canis*, canine roundworms, can cause similar disease in dogs, especially pups, and visceral and ocular larva migrans in humans and other paratenic hosts; their eggs can survive in the environment for months to years depending on the climate (Schantz, 1989). *Ancylostoma* spp., canine hookworms, can cause anemia in dogs, and cutaneous larva migrans and eosinophilic enteritis when transmitted to humans. Even with the treatment of canine hookworm

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infections, larval leak (i.e., a condition in which the intestinal tract is repopulated by larvae embedded in the intestinal wall) can result in continued transmission of this parasite until all worms are cleared (Bowman, 2009). Even more concerning, multiple anthelmintic resistance has been reported in this species and may significantly affect the efficacy of existing products (Kitchen et al., 2019).

There are many prescription heartworm preventive products that may treat various gastrointestinal parasites. Of these combination preventive products, most treat hookworm and/or roundworm infections while fewer are labeled to treat whipworm infections. We hypothesized that a greater number of fecal samples collected from municipal dog parks would test positive for whipworm eggs than either hookworm or roundworm eggs. This study compares the number of fecal samples infected with gastrointestinal parasites collected from municipal dog parks located in the southeastern United States.

2. Material and methods

A total of 200 fecal samples were collected from municipal dog parks with a maximum of 20 samples from each dog park during the month of March and April. Dog parks sampled originated from Georgia, South Carolina, and North Carolina. Cities sampled include Athens, Savannah, and Dacula, Georgia; Greenville, South Carolina; and Charlotte, North Carolina (Fig. 1). Only fresh or moderately fresh fecal samples as determined by appearance, specifically that the feces were not desiccated, that were left on the ground at each dog park were obtained, and all fecal samples were analyzed within 48 h of collection. When possible, samples were refrigerated by 24 h post collection.

For each sample a simple centrifugal sugar float was performed to

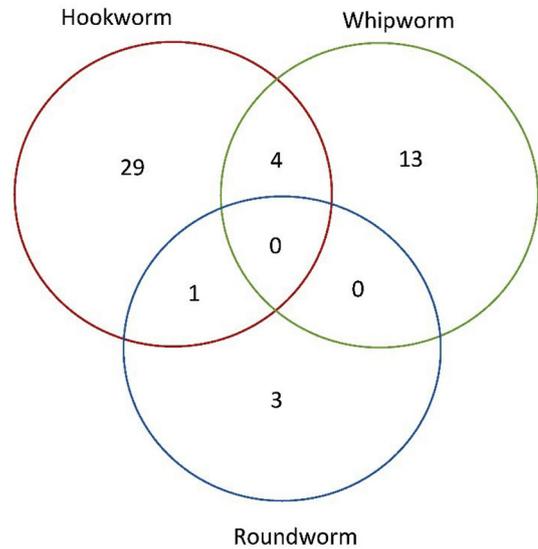


Fig. 2. Distribution of positive fecal samples by parasite: Number of fecal samples collected that contained *Ancylostoma* spp., *Trichuris vulpis*, and *Toxocara* spp. eggs. A total of 200 fecal samples were tested from municipal dog parks.

analyze the presence of gastrointestinal helminths (Adolph et al., 2017). Briefly, 1 g of feces was mixed with 15 mL of Sheather's sugar flotation solution (specific gravity = 1.27), strained through a cheesecloth into a 15-mL conical tube, and centrifuged at 250 RCF for 10 min with a

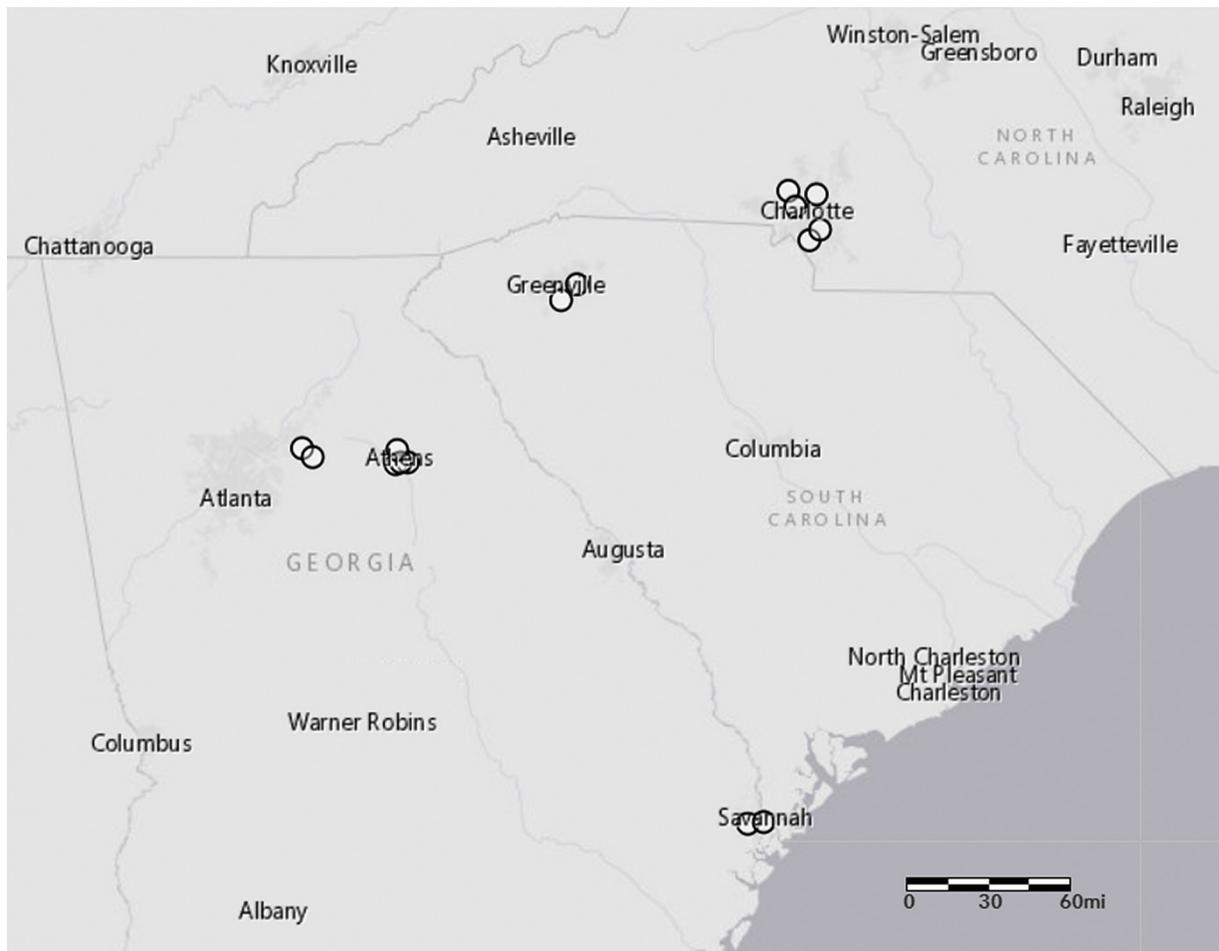


Fig. 1. Graph of fecal collection sites: Location of municipal dog parks in which fecal samples were collected.

coverslip on top. After centrifugation the coverslip was removed, placed on a glass slide, and examined microscopically. Total number of eggs per coverslip was recorded as eggs per gram.

3. Results

Of the total 200 fecal samples collected, 54 (27%) tested positive for the presence of at least one canine gastrointestinal helminth. From the 54 fecal samples that tested positive, 17 (31.5%) samples were positive for *Trichuris vulpis* eggs, 34 (63%) samples were positive for *Ancylostoma* spp. eggs, and 4 (7.4%) samples were positive for *Toxocara* spp. eggs (Fig. 2). There were five (9.3%) fecal samples that tested positive for more than one gastrointestinal helminth. These include four samples co-infected with *T. vulpis* and *Ancylostoma* spp., and one sample co-infected with *Ancylostoma* spp. and *Toxocara* spp. Of the total 34 fecal samples collected containing *Ancylostoma* spp. eggs, 22 (65%) of these samples (n = 34) were collected from a single dog park.

From the 20 different municipal dog parks sampled in the study, at least one fecal sample tested positive for the presence of gastrointestinal nematodes in 18 (90%) dog parks with only 2 dog parks where no parasites were recovered in the fecal samples obtained. Infections ranged from 1 egg per gram to 4286 eggs per gram of feces (*T. vulpis* = 0–1102 eggs per gram; *Ancylostoma* spp. = 0–4286 eggs per gram; *Toxocara* spp. = 0–230 eggs per gram). No other intestinal parasites were identified.

4. Discussion

While dog parks provide opportunities for socialization and exercise, it is important for veterinarians and pet owners alike to understand the risk that dog parks may pose in the transmission of pathogens such as gastrointestinal helminths. Understanding the risk of parasite transmission in local areas such as dog parks provides vital information to veterinarians about potential problems to which their patients and clients might be exposed.

Effective control programs rely on sufficient blocking of transmission by treatment or prevention. In order for control efforts to be successful, all sources of parasite transmission need to be targeted. These data suggest that small animal parasite preventive product administration is necessary, especially for dogs that visit dog parks in which gastrointestinal helminths may be present. Regular disposal of dog feces by the owner immediately upon defecation of the animal will prevent contamination of the environment. This behavior must be a regular component of any control program.

Canine gastrointestinal prevalence studies have documented infection in defined populations. One study performed analyzed fecal samples submitted to Antech Diagnostics in 2006. Of the total 6555 dog fecal samples submitted, 2.2% tested positive for *Toxocara* spp., 2.5% tested positive for *Ancylostoma* spp. and *Uncinaria stenocephala*. Eggs, and 1.2% tested positive for *T. vulpis* eggs (Little et al., 2009). Additionally, it was noted that fecal samples were most commonly identified as positive for hookworm eggs if the sample originated from the Southern United States, with a prevalence of 4.0% (Little et al., 2009). Another prevalence study evaluated canine fecal samples submitted in a veterinary clinic in West Virginia in 2010. This study determined that 79 out of the total 231 (34.2%) dogs, tested positive for one or more gastrointestinal nematodes, with 23.4% testing positive for *A. caninum*, 7.8% testing positive for *T. vulpis*, and 6.9% testing positive for *T. canis* (Savilla et al., 2011). These prevalence studies confirm the need for continued surveillance and control efforts. Canine gastrointestinal helminth infections not only pose a health risk to their hosts but are also zoonotic and pose a threat to pet owners or other humans who may inadvertently come into contact with a fecal-contaminated environment. Zoonotic transmission of canine hookworm can cause cutaneous

larva migrans (Bowman, 2009), while canine roundworm can cause visceral and ocular larva migrans. With dog parks serving as a concentrated focus of egg shedding, the potential for zoonotic transmission to visitors is increased.

Additionally, this data indicates the need for improved client education in the care for their animals and the concept of One Health, which recognizes the connection between human and veterinary well-being. Veterinarians have particularly useful opportunities to discuss this with their clients and discourage habits that contribute to parasite transmission potential; similarly, it is important for human healthcare professionals to understand the risk of zoonosis and how their patients can mitigate this. Additionally, public health agencies at all levels can contribute by improving education and awareness efforts. With increased knowledge of affected parks and how to prevent parasite transmission, the prevalence of infected fecal samples present in dog parks may decrease and therefore decrease the transmission potential both to pets and people.

5. Conclusion

Dog parks are a source of feces containing gastrointestinal helminth eggs and these locations should be targeted for parasite transmission control. Additionally, surveillance for gastrointestinal nematodes in dog parks allows for additional information to enhance education which may play an important role in breaking parasite transmission.

Ethical statement

No animals were used experimentally in this study. Field fecal samples were obtained without direct contact with humans or animals during collection.

Declaration of Competing Interest

Molly Savadelis, Kristen Mabry, Leanne LeFavi, Christopher Evans, and Andrew Moorhead declare that there is no conflict of interest. At the time of this study, Bruce Klink and Cristiano von Simson were employed by Bayer Animal Health.

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