Determining the Most Prevalent Parasitic Worms Found in Canines Surrounding the Bryan/College Station Area

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Abstract: Parasitic worm incidences are common in canines but can typically be contained with existing treatments. When not contained, these can go on to infect humans and cause different medical problems depending on the parasite. Therefore, further researching was conducted on the following parasitic worms in canines, *Isospora* (coccidia), *Toxocara canis* (roundworms), *Trichuris vulpis* (whipworms), *Dipylidium caninum* (tapeworms), and *Ancylostoma caninum* (canine hookworm). We decided to test canine fecal samples to determine the prevalence of each in the Bryan/College Station area. The samples collected were tested for the presence of oocytes and eggs from parasitic worms using Fecasol solution as part of a fecal flotation test. The results indicated over half of the samples collected tested positive for a parasitic worm infection of a certain species. The highest number of positive cases were from those infected with hookworms. In canines with more than one parasitic worm, the most common grouping was hookworms with roundworms. This research emphasized the need for greater public awareness on worm treatments to prevent possible spread to humans via zoonotic disease and to maintain dog health. This information can also be included as part of a public awareness campaign to address the risks of canine to canine transmission and canine to human transmission when dogs are not treated with preventatives.

Keywords: *worms, preventatives, canine, fecal*

The aim of the project was to identify the most predominant parasitic worms of canines in the Bryan/College Station area. The main parasitic worms tested for included *Isospora* (coccidia), *Toxocara canis* (roundworms), *Trichuris vulpis* (whipworms), *Dipylidium caninum* (tapeworms), and *Ancylostoma caninum* (canine hookworm).

The most commonly recognized coccidia found in cats and dogs are of the genus *Isospora*, which are unique in that their asexual and sexual life cycle may occur in the same host (Dubey et al. 2009). The infective stage is the sporozoite, in which the parasite invades the intestine. The final stage occurs when unsporulated oocysts are excreted in the feces of the definitive host (Dubey et al. 2009). Transmission is by the direct fecal-

oral route in which a dog swallows soil or any other substance containing the feces of other dogs. Enzootic infections of canines are seen in areas of congestion, such as kennels. Coccidiosis may be prevented by frequently removing dog's' feces from the environment. Common treatment to eradicate coccidia includes sulfa-type antibiotics (Dubey et al. 2009).

Trichuris vulpis is a common whipworm found in the intestinal tract of dogs where eggs can form and are transported outside by means of defecation. The eggs will remain in the soil for a long period of time, usually dormant, until an innocent bystander comes in contact with the contaminated soil, water, or food by ingestion. There are many problems associated with a host having whipworms. While some are minor such as vomiting, diarrhea, etc., others are more extensive forms such as malnutrition, bloody diarrhea and even death. A recurring problem associated with diagnosing whipworm is that it is asymptomatic, making it hard to diagnose. Usual treatment comes in annual fecal examination. Proper checkups are a must in order to stop the cycle in which the adult whipworm will lay eggs in the large intestine. Medications should be taken regularly to kill all remaining eggs (Johnson 2009).

Ancylostoma braziliense and *Ancylostoma caninum* are two identified hookworm species that use dogs as their definitive hosts. A hookworm matures in a dog's small intestine and causes problems, ranging from blood loss, anemia, and even death (Bowman et al 2010). Aside from skin penetration and ingestion, transmission of hookworms can occur through the transmammary route in puppies and hunting of other animals. Treatment for hookworms is done through regular deworming of dogs in order to minimize or eliminate infection (Bowman et al 2010).

The life cycle of *Toxocara canis* (Roundworm) starts when eggs are passed through feces and deposited on soil. In warmer temperatures, the eggs become embryonated after about a week. Once the embryonated eggs are ingested, they hatch, and the larvae make their way to the small intestine. From here, the larvae can enter the circulatory system and invade organs such as the eye, brain, or liver. Pregnant dogs can pass the eggs to their puppies by transplacental or transmammary routes. Additionally, eggs can be transmitted when a dog eats a paratenic host such as a small rodent, earthworm, or certain beetles. Lastly, the eggs can be ingested directly when dogs eat infected feces or dirt (Despommier 2003). Death can occur if the intestine gets obstructed or ruptures. Depending on the age of the dog, different forms of anthelmintic (antiparasitic) drugs are taken repeatedly in order to kill and flush out *T. canis.*

The common dog tapeworm is *Dipylidium caninum.* It lives in dogs, cats, and sometimes humans. An adult tapeworm lives in the small intestine of the dog, attaching to the intestinal wall, and has segments that contain eggs, which are eventually passed through feces. There are several safe prescription drugs that treat tapeworms in dogs that can be given in a shot or tablet form. Your dog should be

given flea prevention in order to prevent tapeworms from infecting your pet (Bolette 1998).

Materials and Methods

Source of samples

The five different parasites specifically tested for were *Isospora* (coccidia), *Toxocara canis* (roundworms), *Trichuris vulpis* (whipworms), *Dipylidium caninum* (tapeworms), and *Ancylostoma caninum* (canine hookworm). The eggs and oocytes of these worms show up in fecal floats, indicating a positive result. The feces samples were collected in plastic baggies (S.C. Johnson & Son, Racine, Wisconsin) over a period of two weeks at highly dog concentrated locations in the Bryan/College Station area. The main areas of interest were the University Dog Park, Steeplechase Dog Park, and grassy spots outside of Petsmart. Samples were all at least 2 grams or more, slide and examined under a microscope. A scan of the entire cover slide was performed were less than 24 hours old, and all came from canines. There was no record keeping of the age, breed, or gender of dog. When collecting samples, tapeworms are commonly seen with the naked eye rather than using a fecal test.

Fecal flotation method

Immediately after collection of the feces, testing was performed. Only a small piece (2-4 grams) of the sample was needed to be tested. Each small piece was placed in its own plastic container, then the container was filled all the way to the top with a solution called Fecasol (Vetoquinol, Fort Worth, Texas). Once the feces had floated to the top of the container, a cover slide was placed on the top. Over time, the eggs and oocytes would float to the top and present on the cover slide. A timer was set for ten minutes, after that the cover slide was placed on a microscope

to check and identify any eggs or oocytes of the parasitic worms mentioned above.

Results

In the past 2 months, collected fecal specimens in Bryan/College Station, Texas have been tested for parasite oocytes and eggs. Each sample collected was examined to look for canine hookworms, roundworms, coccidia, tapeworms, and whipworms. Over the two months collection time, 65 samples were tested. Of those 65, 47 of them tested positive for any of the five types of parasites listed above. Many of the samples also contained more than one type of parasitic worm. Of the 47 that tested positive, 28 had hookworms, 11 roundworms, 11 coccidia, 4 whipworms, and 2 with tapeworms. The most grouping of parasitic eggs and oocytes was hookworms and roundworms, closely followed by hookworms, roundworms, and coccidia. For samples that had tapeworms, no eggs showed up on fecal floats. There was positive identification based on the segment of worms being present in the fecal sample that could be seen with the naked eye.

Type of parasite	Number of samples found
Hookworms	28
Roundworms	11
Coccidia	11
Whipworms	4
Tapeworms	2
Hookworms and roundworms	5
Hookworms, roundworms, and coccidia	3
Hookworms, roundworms, and whipworms	1

Table A: Summary of results

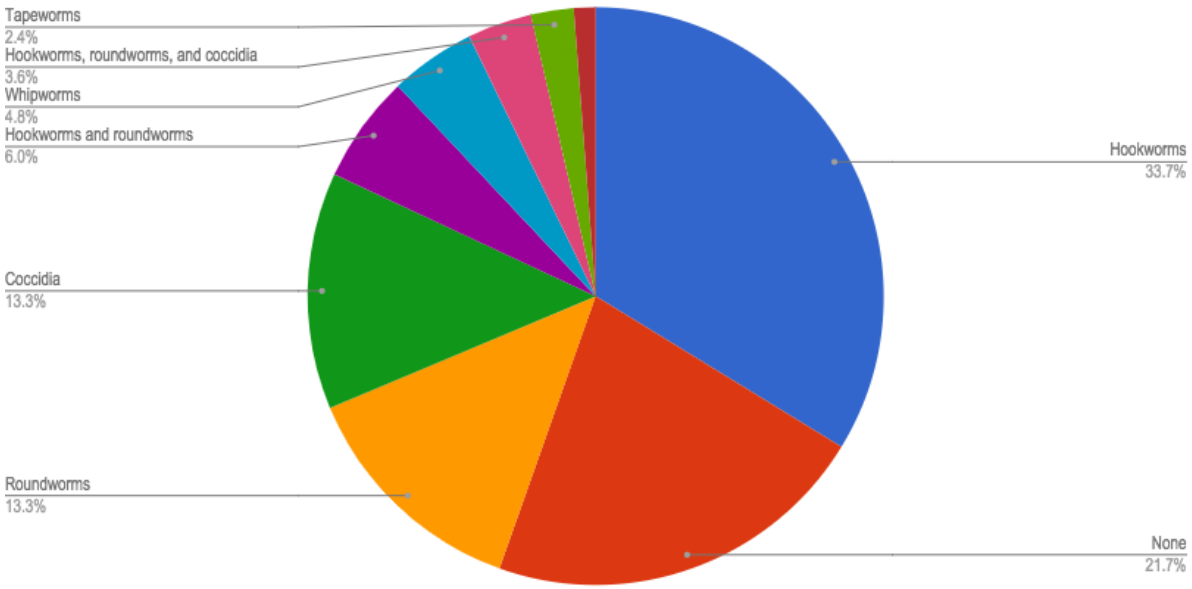

Fig. A: Breakdown of the types of samples collected

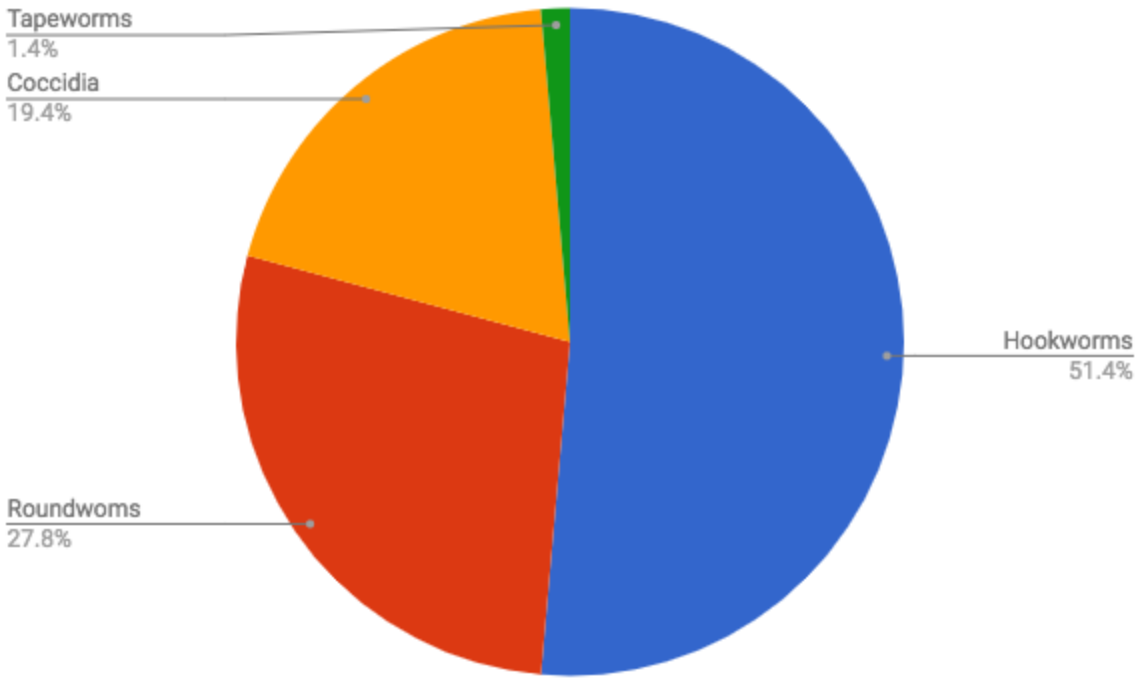

Fig. B: Percent of samples by type of parasite

Conclusion & Discussion

The implications of this study were to increase awareness for the prevalence of these parasitic worms in the environment and their routes of transmission, as well as to advocate preventative medications and behaviors. Our results revealed that 72.3% of canine fecal samples tested positive for parasitic worms, with the most prevalent worm being the hookworm seen in 51.4% of the positive samples (including those with multiple parasites). There are several reasons why we are seeing these parasitic organisms in dog's fecal matter. We hypothesize a major factor contributing to this is that living in a majority-college populated area, many people do not have the economic standing for maintaining preventative medication. The breakdown data by age shows that the majority of the residents are between the ages of 18 and 24. City data has shown that in 2015, 26.5% of the residents in Bryan had an income below the poverty level. For College Station, the percentage was much higher at 36.5%. Another reason may be attributed to a lack of public health initiatives created to inform and educate the local community on the prevalence of parasitic worms, their transmission, and preventative measures which can be taken to inhibit transmission.

The prevalence of parasitic worms is medically and clinically relevant to the human population. A number of infectious diseases are zoonotic parasitic diseases, meaning the disease can be spread from animal to human. For example, a zoonotic

hookworm infection can result in a skin condition known as Cutaneous larva migrans (CLM). CLM is often reported in tropical regions where humans are exposed to soil or sand that has been contaminated by free-ranging dogs and cats infected with hookworms. It can lead to severe itchiness and raised red lines on the skin. Additionally, secondhand bacterial infections occur from scratching. Furthermore, Toxocariasis is a zoonotic infection caused by the parasitic roundworms. This disease most often occurs in young children who play in the dirt or eat dirt infected with *Toxocara* eggs. Many individuals do not experience symptoms, but serious infections can lead to Ocular toxocariasis, or when *Toxocara* larvae migrate to the eye. This may lead to damage to the retina, eye inflammation, or even vision loss. Preventative measures that greatly reduce the predominance of parasitic worms will indirectly decrease the transmission of zoonotic parasitic diseases.

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