

Endoparasite Prevalence of Shelter Dogs at the Enid SPCA
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2019

Abstract:

Shelter medicine is a unique discipline of veterinary science that faces challenges that are often uncommon to private practitioners. Shelters must incorporate a balance of the healthcare of individual animals with the financial stability of the shelter. In order to maintain this balance shelters are provided with specific protocols for the healthcare of homeless animals that are brought to the shelter. One aspect of these protocols is parasite control. This study was to determine if the current protocol for parasite control at the Enid SPCA in Enid, Oklahoma was the most effective. This was accomplished by diagnosing 93 canines using fecal floatation. Results indicated that of those 93, 18.3% harbored intestinal parasites. Roundworms and hookworms had the highest parasite prevalence. Whipworms, tapeworms, and coccidia had the lowest parasite prevalence. The current protocol requires canines to be treated with Pyrantel pamoate upon intake and every two weeks thereafter. Whipworms, tapeworms, and coccidia are to be treated with Panacur granules only after fecal diagnosis or upon signs of symptoms. Based on these results and the low rate of parasite prevalence the current protocol is effective for parasite control.

Background:

Shelter medicine is a unique branch of veterinary medicine that faces many challenges that are uncommon for private practices, but shares the same goal of providing healthcare and a humane environment for animals until they find their forever homes. Shelter medicine has greatly evolved from the first shelters in the 1800s. These dog pounds were primarily a form of population control where animals were not well cared for and were often killed using rather inhumane methods (Broaddus, 2019). Shelters and rescues today primarily serve as a stop-over point for animals to receive the medical attention and care they need before they reach their

forever home. Shelters have shifted in purpose from population control to providing healthy, adoptable animals and with these expectations come many challenges.

The American Society for the Prevention and Cruelty to Animals (ASPCA) was one of the first non-profit organizations whose mission was to seek out a world where animals were treated with kindness and respect. The ASPCA, like many shelters, had to overcome many obstacles to provide the best possible care for shelter animals. One of the primary hurdles that shelters must overcome is their limitation of resources. Medical supplies, facilities, staff, and veterinarians are all necessities that shelters must balance in order to have the best possible care for the animals.

The ASPCA balances these necessities by creating protocols for every aspect of the shelter including sanitation, vaccination, spay/neuter clinic, vaccines, and preventative vaccines. Part of the preventative vaccine protocol is parasite control (ASPCA, 2019). The current ASPCA protocol for parasites is to treat all dogs, cats, puppies and kittens, for heartworms, ascarids (roundworms), hookworms, fleas, and ticks upon intake or if an infestation is evident. Only upon diagnoses or if the animal displays symptoms are they to be treated for other endoparasites such as giardia, whipworms, or tapeworms (ASPCA, 2019). These protocols are written by veterinarians from the American Association of Feline Practitioners (AAFP), the American Animal Hospital Association (AAHA), and the Association of Shelter Veterinarians (ASV) to provide the best healthcare options for animals found in shelters. Many shelters follow these same protocols or similar ones.

This study focused on the prevalence of endoparasites found in canines at the Enid SPCA (ESPCA) in Enid, Oklahoma. Endoparasites are parasites that cause infection within an animal, for instance. The purpose of the study was to determine if the current protocol for parasite

control was the most effective it could be. The current protocol was developed by the veterinarians who provide the healthcare based on parasite control protocols written by some of the previously mentioned agencies. The protocol states that all canines are to be treated with Pyrantel pamoate every two weeks upon intake. Pyrantel pamoate is a popular antihelminthic that was developed in 1966 to treat hookworms and ascarids, which one study found these to be the most prevalent parasites behind *Giardia spp.* in pet dogs across the United states (Little, 2009). However, Pyrantel is not effective against whipworms or tapeworms (Kopp, 2008). One of the most common hookworm species in dogs in Australia, *Ancylostoma caninum* became resistance to Pyrantel in regions of Australia. In one case a puppy was treated with five times the suggested dose of a combination of Pyrantel/Oxantel which still failed to effectively treat the infection with *A. caninum* (Kopp, 2008). This suggests that Pyrantel pamoate may not be the most cost effective antihelminthic drug available.

In cases where canines are diagnosed or display symptoms such as weight loss, diarrhea, dehydration, and anemia (Trifexis, 2018) due to infections with whipworms or tapeworms the Enid SPCA orally administers Panacur (Fenbendazol) Granules 22.2% for five consecutive days. Panacur is effective against ascarids (*Toxocara canis*, *Toxascaris leonine*), hookworms (*Ancylostoma caninum*, *Uncinaria stenocephala*), whipworms (*Trichuris vulpis*), and tapeworms (*Taenia pisiformis*) (Merck Animal Health, 2018). While Pyrantel pamoate tends to be more cost effective, in terms of treatment Panacur is effective against a greater number of parasite species. This study determines how effective the current protocol for treating endoparasites at the Enid SPCA is based on the prevalence of parasites found in shelter dogs.

Methods:

Canine fecal samples ($n=117$) were obtained at the Enid SPCA from May 2018 to January 2019. These samples were largely based on availability of dogs at the shelter. Of the 117 fecal samples, 24 of the canines were sampled twice to determine effectiveness of treatment. This subgroup had fecal tests that were initially sampled where, on average, most of the dogs had been treated with Pyrantel before the first test was conducted. The second fecal sample was taken two-three weeks after the first due to Pyrantel being administered every two weeks. Overall parasite prevalence was then determined from the 93 canines sampled. Fecal samples were examined under a light microscope using fecal floatation. Fecal floatation mixes feces with sodium nitrate which suspends the oocysts of the parasites to the top of the container (Knoll, 2010). A glass slide is placed over the opening at the top of the container and the oocysts as they rise to the top will stick to the slide. A cover slide is placed over the sample and examined under the microscope at 40x total magnification (Knoll, 2010).

Results:

Out of all the canines sampled 18.3% ($n=93$) were found to be host to an intestinal parasite. The most commonly found endoparasite was ascarids (7.5%), followed by hookworms (6.5%), whipworms (2.2%), and finally coccidia and tapeworms had the lowest prevalence (1.2%). These results were taken from the initial samples of the 93 dogs (Figure 1). Parasite prevalence was found to be highest in younger dogs whereas all dogs infected with parasites were three years old or younger and categorized as “young adult.” All dogs infected with ascarids were below one year of age. These findings were relatively consistent with another study that reported ascarids having the highest prevalence of pet dogs across the entire United States and parasite prevalence decreased with increased dog age (Little, 2009).

The 24 canines that were sampled twice, 16.3% had a parasite present in their first fecal sample and 8.3% were found to have a parasite present in the second sample (Figure 2). Samples were taken within 2-3 weeks of each other and treatment with Pyrantel was given before the first fecal test. The 8.3% of canines that had parasites present in the second fecal tested positive only for hookworms.

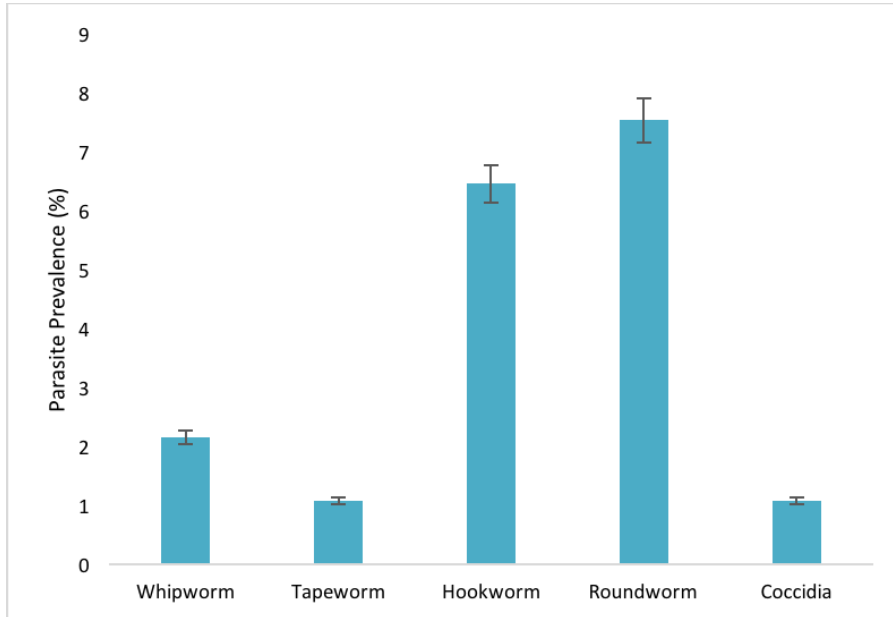


Figure 1: Parasite prevalence of ($n=93$) canines in Enid, Oklahoma from May 2018 – January 2019

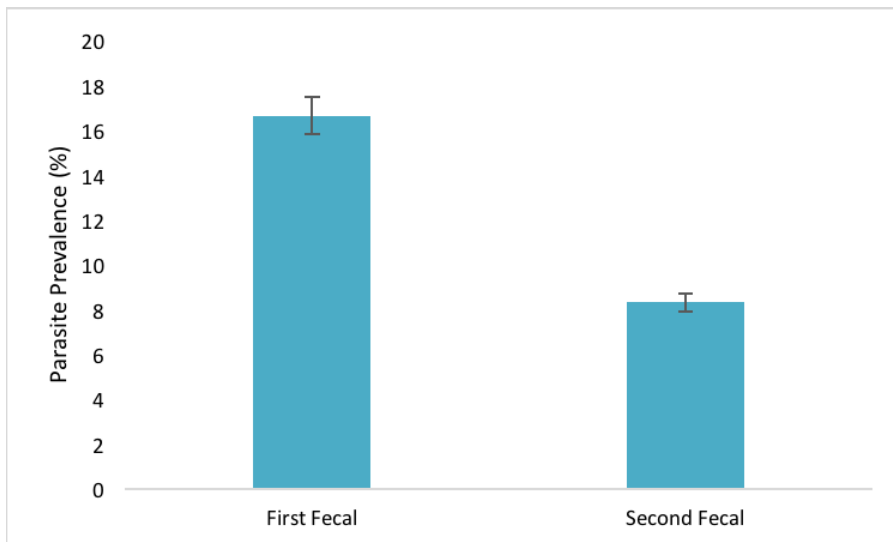


Figure 2: Parasite prevalence of canine subgroup ($n=24$) upon intake (first fecal) and 2-3 weeks after treatment with Pyrantel pamoate (second fecal).

Discussion:

Parasites being present within a shelter is inevitable and no matter how many animals are treated, parasites will be present. Having a better understanding of the specific parasites present can aid shelters in developing the best possible protocols with which to treat them. In this study 18.3% of canines tested positive for intestinal parasites at the Enid SPCA. All the dogs positive for parasites were three years of age or younger after treatment with Pyrantel pamoate. Of those positive for intestinal parasites 7.5% harbored an ascarid species. Ascarids, have a high prevalence in young canines due to transplacental infection (Blagburn, 1996). Newborn puppies can also become infected with ascarids through the mammary glands (Schmidt, 2009). However, for older dogs the most common way ascarids are transmitted is by ingestion of eggs in feces or ingestion of a paratenic host that harbors the ascarid eggs (Harris-Linton, 2001). One species of ascarids, *Toxocara canis*, have sturdy eggs that can survive in the environment for up to three weeks allowing for ample time to be ingested by another host (Harris-Linton, 2001). Once the eggs have been ingested the larvae will hatch, molt, and reside in the digestive tract of the canine where they will reproduce and the cycle begins again (Harris-Linton, 2001). Ascarids do pose some risk as a zoonotic parasite, but as humans are not definitive hosts they tend to not pose a significant risk. However, one rare, but serious condition that can occur is visceral larva migrans. This is when the larvae migrate to areas of the body outside the digestive tract and cause infection such as in the eyes, lungs, liver, and even the brain (Schmidt, 2009).

The second most common parasite found at the Enid SPCA was hookworms (6.5%). Hookworms thrive in warm temperatures and high humidity, thus Enid, Oklahoma provides a very suitable environment in the summer (Schmidt, 2009). Transmission is similar to ascarids and other nematodes in that larvae are ingested, usually within feces, resulting in infection.

Transmission can occur transplacentally and through the mammary glands as well, although it is more rare in hookworms (Saeed, 2003). Hookworms can also enter the body of a host through direct contact with their skin. If hookworms are transmitted through the skin in humans the larvae can cause dermal larval migrans, a condition where the larvae travel throughout the subcutaneous layer of skin for months (Saeed, 2003). Whipworms were the third most common infection (2.2%). Whipworms have a similar life cycle and transmission as the first two nematodes in that the eggs must be ingested for an infection to occur.

Tapeworms and coccidia had the lowest prevalence (1.2%). Tapeworms differ from the nematode species as they are categorized as flatworms. Their lifecycles require fleas as an intermediate host and canines become infected after ingesting an infected flea. Therefore, if tapeworm eggs are found in a canine's feces then it can be assumed the canine was also infested with fleas at some time (Schmidt, 2009). Coccidia is similar to the nematode parasites in that it is transmitted by ingestion of the eggs that have been expelled in feces (Schmidt, 2009).

Pyrantel has been used in parasite control for companion animals for approximately fifty years since it was first put on the market in the 1970s (Kopp, 2008). Pyrantel is an imidazothiazole-derived tetrahydropyrimidine and is available as a pamoate, tartrate, and citrate salt. Pyrantel pamoate is utilized most frequently because it is insoluble in water. Therefore, when it reaches the digestive tract of the animal it cannot be absorbed and is effective in treating intestinal parasites. However, due to this property Pyrantel pamoate is ineffective against parasites outside the gastrointestinal tract such as heartworms. Pyrantel is also a rather inexpensive anthelmintic drug which is why it is so commonly used in shelter medicine. At the ESPCA Pyrantel is purchased for \$18.40/oz. Pyrantel is proven effective against species of

hookworms and roundworms, however the downside is that it is ineffective for whipworms and tapeworms (Kopp, 2008).

In incidences where a canine has been infected with whipworms or tapeworms the ESPCA protocol is for the canine to be treated with Panacur Granules 22.2%, (active ingredient Fenbendazole) (Merck Animal Health, 2018). Panacur is effective against roundworms, hookworms, whipworms, and *Taenia spp.* tapeworms, however it is more expensive compared to Pyrantel. The ESPCA purchases Panacur granules for \$349.80/lb. therefore, Panacur costs about 95% more per dog than Pyrantel. Fenbendazole binds to the microtubules of the cells in the intestine and tegmental cells of intestinal parasites which causes less glucose to be taken in, ATP production is decreased, and eventually leads to death of the parasites (Wiebe, 2015). Although, Pyrantel is inexpensive and treats the most common intestinal parasites, roundworms and hookworms, there was a case in Australia in the late 1980s of a Pyrantel resistant *Ancylostoma caninum* (Kopp, 2008). *Ancylostoma caninum* is one of the most common hookworms to infect canines world-wide. After this case was reported not much research has been done to follow-up, so current prevalence of this Pyrantel-resistant hookworm is unknown

Considering the results of this study the current protocol for intestinal parasites at the Enid SPCA is effective. The most prevalent parasites found were roundworms and hookworms (Figure 1) which the current protocol treats for upon intake and every two weeks as long as the canines are housed there. The subgroup of 24 canines that were tested twice rendered 8.3% that harbored an intestinal parasite during the second fecal test in which hookworms were the only parasite found. Whipworms, tapeworms, and coccidia had the lowest prevalence (Figure1) and are all treated after fecal diagnosis or upon signs of symptoms of infection with these intestinal parasites. One suggestion that may further reduce the prevalence of whipworms and tapeworms

however, is doing fecal tests every two weeks or whenever the dogs receive their Pyrantel pamoate treatment. However, due to limited staff and time this may not be a feasible option. Overall, the Enid SPCA had a considerably low parasite prevalence based on the samples taken rendering their current protocol as effective in parasite control.

Acknowledgments

Special thanks to Dr. Hickman, Dr. Fairbanks, Crissia Bullock, Vickie Grantz, Dr. Hensley-Hubbert, and Linda Taylor for teaching me how to do fecal floats and allowing me to conduct this study at the Enid SPCA!

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