



ADDRESSING *GIARDIA* IN KENNELS:

Implications for canine health, management and welfare

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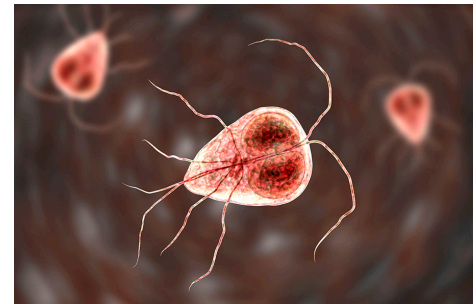
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Introduction

Giardia species are predominant intestinal parasites of dogs and cats all over the world. They are particularly common in dogs kept in kennels (Bowman and Lucio-Forster 2010). *Giardia* is well adapted to its specific host, making zoonotic infections rare. However, certain genotypes may pose a small risk of zoonotic infection, especially in immunocompromised individuals. *Giardia* is spread through contaminated soil, food and water sources. The cyst stage of *Giardia* is resistant and can survive in the environment for several months. Controlling *Giardia* infection and eradicating it entirely from kennels can be particularly challenging. This parasite can survive in both indoor and outdoor areas of kennels and homes and is very difficult to kill with chemical cleaners. To reduce the adverse effects of *Giardia* on canine welfare, it is important to understand how the parasite is transmitted, know what steps can be taken to address and minimize infections, and appreciate the role of diligent kennel management.



A computer illustration of *Giardia lamblia*.

Giardia life cycle and clinical signs

The life cycle of *Giardia* alternates between two distinct developmental stages: a motile, replicating trophozoite stage in the small intestine of the dogs, and a non-motile, transmissible cyst stage passed in the feces of an infected dog. These cysts are resistant and can survive in the environment for up to several months. Dogs become infected by ingesting the cysts from the environment (food and water sources contaminated with *Giardia* cysts). Infection can also occur by direct contact with feces of *Giardia*-infected dogs.

Following ingestion, the cysts transform into trophozoites in the intestine. Trophozoites feed and multiply in the gut and interfere with the normal digestive processes. An infected dog may begin experiencing symptoms between five to 14 days after ingestion of the cyst stages (Jokipii, A.M.M and Jokipii, L. 1977; Kirkpatrick 1987). Diarrhea (malodorous, gray, greasy and voluminous) is the most prominent clinical sign associated with *Giardia* infection (giardiasis). However, infected dogs do not always exhibit such clinical signs (Robertson et al., 2010). Thus, it is possible for apparently healthy dogs to shed *Giardia* cysts in their feces and spread the infection to other dogs in the kennel or household. The negative health and welfare implications of giardiasis are significant, particularly for puppies and older dogs. In fact, the disease can be fatal if left untreated in immunocompromised individuals (Bowman & Lucio-Forster, 2010). Giardiasis does not result in bloody diarrhea; presence of blood indicates other underlying health problems requiring immediate veterinary attention.

Diagnosis and treatment of *Giardia*

Giardia infection can be diagnosed in a few ways. Fecal exams that detect *Giardia* in the feces, and immunodiagnostic assays that detect either *Giardia* itself and/or *Giardia* antigen in the feces, are available. These methods are variable in their sensitivity and specificity (Saleh et al., 2019) and therefore it is best to use a combination of testing methods.

- Microscopic examination of the feces: Zinc sulfate centrifugal flotation is considered the “gold standard” for detection of *Giardia* in an infected dog. Because *Giardia* cysts are shed intermittently by infected hosts, an animal may need to be tested three times on alternating days to increase the chance of cyst detection.
- Immunodiagnostic assays: Two types of immunoassays are available – (a) Direct fluorescent antigen (DFA) test, in which *Giardia* in a fecal smear are fluorescent-labelled and visualized using fluorescent microscope; and (b) Fecal enzyme linked immunoassay (ELISA) that detects *Giardia* antigens in the feces. While the latter test is highly sensitive, false positive results may occur even when there is no active shedding of the cyst. Since it is unclear how long the parasite antigens persist after treatment, this test is unsuitable for determining treatment efficacy or reinfections.
- Different strains of *Giardia* exist and have been grouped into assemblages (A-H). Commercial molecular testing (polymerase chain reaction) is available for assemblage detection. At present, this testing is not widely available.

No drugs are specifically approved in the U.S. for treatment of giardiasis in dogs. Fenbendazole is approved

in Europe as an effective treatment for *Giardia* infections in dogs (Companion Animal Parasite Council, 2020). Metronidazole can also be given in combination with fenbendazole, and this combination therapy may be more effective at eliminating the parasite than either treatment given individually (Companion Animal Parasite Council, 2020). Another drug combination that has been proven efficacious includes praziquantel, pyrantel pamoate and febantel. In a study that evaluated the use of ronidazole (Fiechter et al., 2012), that drug, when used in combination with intensive hygiene management (detailed below), showed better efficacy than the previous recommendations of fenbendazole and metronidazole.

Infection with *Giardia* does not always result in disease and therefore does not necessarily warrant treatment at all times. Licensed veterinarians are the only people who should prescribe any drug treatments, and the decision should be made carefully, depending on factors such as (i) whether the animal is symptomatic or asymptomatic; (ii) prior treatment history; (iii) presence of susceptible hosts; and (iv) test(s) used for diagnosis of giardiasis. Dietary supplementation with probiotics and high fiber is recommended for supportive treatment. There are reports of treatment failure resulting from lack of drug efficacy or development of resistance. Presence of drug-resistant isolates in a population will pose severe challenges in treating animals with giardiasis.

Control of *Giardia*

Strict hygiene and sanitation are the keys to prevention of *Giardia* infection. As noted previously, *Giardia* cysts are resistant and can survive for several months in water or soil. Additionally, because they are resistant to many disinfectants, including chlorine, control is a significant challenge. Control and prevention of *Giardia* infection should use an integrated approach involving (i) proper treatment of infected animals; (ii) elimination of cysts from the environment; and (iii) prevention of new infections by direct contact (Saleh et al., 2016; Patton, 2013).

Once a case of *Giardia* has been confirmed in a home or kennel, it is best to isolate the infected animal until the end of the treatment regimen. If isolation is not feasible, minimize contact with additional animals and watch for clinical signs in all dogs that come in contact with infected animals. All animal feces should be picked up and disposed of as soon as possible to avoid high environmental contamination of the premises and water sources. Bathing of the animals at the end of treatment regimen ensures removal of cysts that may be attached to their coats. Concurrent to this, disinfection of the kennel using bleach, quaternary ammonium compounds, steam and/or hot water under high pressure is recommended

to eliminate environmental contamination. It is critical to read and strictly adhere to the label recommendations of specific cleaning agents to ensure their effectiveness in killing *Giardia*. Routine cleaning alone is not effective. All treated areas should be allowed to dry thoroughly after being cleaned (Saleh et al, 2016; Patton, 2013). These practices will reduce the chance of new infection and/or reinfection.

It is crucial to ensure that dogs have access to clean drinking water. Feces containing *Giardia* cysts can contaminate water sources, and in cold water *Giardia* can survive for several months (cdc.gov; Kirkpatrick 1987). Although it is known that temperatures above 250C can reduce the survival rate of *Giardia*, boiling water and filtration are the only ways to effectively get rid of *Giardia*. Despite all measures, if *giardiasis* becomes a persistent problem, then choose to get water sources (surface and well water) on the premises tested by a water-testing laboratory recommended by your local health department.

Giardia can persist in cold and moist soil for up to several months. Because grass yards and runs are virtually impossible to disinfect effectively, these areas may remain contaminated for up to 7-8 weeks after an infected dog has had access to the area, especially if the area is moist and cool. The contamination time may be shorter in warmer or dryer areas.

Finally, know that *Giardia* spp. are highly host-adapted. Therefore, the risk of zoonotic infections is rare. Nevertheless, certain genotypes have been reported in both dogs and humans and are considered a public health hazard. These genotypes can only be identified using commercial molecular testing that is not widely available. Therefore, it is prudent to practice hygienic measures such as wearing gloves while handling feces and cleaning a kennel environment, washing hands often, using foot-baths and changing shoes when working with animals to minimize disease transmission.

Conclusion

Infections can endanger the health and welfare of dogs and other animals and humans with whom they come in contact. *Giardia* is common in kennels and is increasingly challenging to treat. A robust kennel hygiene program should be in place, and dogs' access to water sources should be diligently monitored to reduce their chances of ingesting the parasite.

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