



Zoonotic Importance of *Giardia* spp. Infections in Asymptomatic Dogs

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ABSTRACT

Giardia intestinalis (*G. lamblia*, *G. duodenalis*) is a common protozoan in human and other mammals worldwide causing diarrhea, vomiting, abdominal pain, weight loss and dehydration. The major infection occurs via directly faecal-oral route or indirectly contaminated food and water consumption. Dogs can carry the zoonotic genotypes of *Giardia* without any clinical signs and contaminate the environment. Asymptomatic carrier dogs living in the same environment with humans, food and water contaminated with these dogs' faeces can be a source of infection for humans. The aim of this review is to emphasize the asymptomatic course of *Giardia* spp. infections in dogs and to evaluate the effects of asymptomatic carriage on human health and the environment.

Keywords: *Giardia*, Dog, Zoonotic Diseases

ÖZ

Asemptomatik Köpeklerde *Giardia* spp. Enfeksiyonlarının Zoonotik Önemi

Giardia intestinalis (*G. lamblia*, *G. duodenalis*) tüm dünyada yaygın olarak görülen, insanlarda ve diğer memelilerde ishal, kusma, kilo kaybı, abdominal ağrı ve dehidrasyona neden olan bir protozoondur. Başlıca bulaşma direkt olarak feko-oral yolla veya indirekt olarak kontamine gıda ve su tüketimi ile gerçekleşir. *Giardia duodenalis* köpeklerde asemptomatik seyredabilmektedir. Köpekler *Giardia* spp.'nin zoonotik genotiplerini herhangi bir klinik belirti göstermeksizin taşıyıp çevreye saçabilmektedir. İnsanlarla aynı ortamda yaşayan asemptomatik taşıyıcı köpekler ve bu köpeklerin dışkıyla kontamine gıda ve su, insanlar için enfeksiyon kaynağı olabilmektedir. Bu derlemenin amacı köpeklerde görülen *Giardia* spp. enfeksiyonlarının asemptomatik seyirinin vurgulanması ve asemptomatik taşıyıcılığın insan sağlığı ve çevre üzerine etkilerinin değerlendirilmesidir.

Anahtar Kelimeler: *Giardia*, Köpek, Zoonotik Hastalıklar

INTRODUCTION

Giardia intestinalis (*G. lamblia*, *G. duodenalis*) is a common intestinal protozoan of humans and other mammals (Thompson et al. 2001; Lebbad et al. 2011). It is one of the the parasitic causes associated with diarrhea commonly seen in humans (Lebbad et al. 2011). Especially due to its effects on children and public health in developing countries, it's been included in the "Neglected Diseases" list of the World Health Organization (Savioli et al. 2006). The prevalence of *Giardia* is 10% in well-cared dogs, 36-50% in puppies, and up to 100% in shelter dogs (Hahn et al. 1988; Barutzki et al. 2007; Ballweber et al. 2010). *Giardia* infections are most common in the environments where its cysts and environmental contamination are high, such as breeding facilities, shelters, dog parks, pet shops, and free-range dog communities (Thompson et al. 2012).

The clinical presentation may be acute, chronic or asymptomatic. Clinical symptoms are generally including diarrhea, vomiting, weight loss, abdominal pain, and dehydration. The host's immune system, age, nutritional status, genotype of the agent, the dose of the infection and possible co-infections can also play a role in the development of the disease (Ryan et al. 2013; Halliez et al. 2013; Olson et al. 2010).

Host Specification and Genetic Groupings

Giardia has a wide host range (Thompson et al. 2004; Ryan et al. 2013). Currently, eight genetic groups (assemblages) associated with *G. duodenalis* have been identified. Two of these groups (groups A and B) are found in both humans and animals, while the remaining six (group C-H) are host-specific and do not infect humans. Some different genotypic groups are similarly specific to specific animal hosts. Host specificity of the parasite is important not only



in grouping the agent but also in understanding the zoonotic feature of the agent (Ryan et al. 2013).

Giardia cysts are highly resistant to environmental conditions provides an advantage in the transmission of the parasite directly from the infected animal to another or indirectly through environmental and food contamination (Thompson et al. 2004). The transmission of the disease occurs mainly by consumption of contaminated food and water or by the faecal-oral route. Cysts that are excreted in feces can live in the environment for months, contaminating food and water. The most important *Giardia* outbreaks in humans are associated with drinking water consumption contaminated with infected human and pet faeces (Thompson et al. 2004; Aydın et al. 2004; Thompson et al. 2000; Van et al. 2002; Stein et al. 2000). People living in the same environment with pet animals may take the parasite from asymptomatic carrier dogs by the faecal-oral route when hygiene conditions are not sufficient (Traub et al. 2004).

Zoonotic Potential of Asymptomatic Dogs

Although *Giardia* is fairly common in dogs, clinical manifestation of the disease is rarely seen (Bouزيد et al. 2015). Cases in which clinical giardiasis has been reported are generally associated with stressful environments such as shelters (Thompson et al. 2004; Robertson et al. 2000). According to a study in Australia (Palmer et al. 2008) *Giardia* was reported as the most common parasite in healthy dogs. The parasite is commonly found in asymptomatic dog feces as well as in symptomatic dogs in developed and developing countries (Yason et al. 2007; Ryan et al. 2013; Duncan et al. 2020; Sokolow et al. 2005). Nevertheless, it may lead to intestinal pathologies causing chronic malabsorption without clinical symptoms in asymptomatic infected animals. These can be listed as villous atrophy, diffuse shortening of microvilli, decrease in disaccharidase activity, loss of epithelial barrier function, increased permeability and enterocyte apoptosis (Palmer et al. 2008; Anderson et al. 2004). Molecular data clearly shows that dogs host the zoonotic genotypes of *G. duodenalis* (Thompson et al. 2001). Therefore, asymptomatic carriers of *Giardia* may act as reservoirs and create potential sources of infection for humans and other animals (Anderson et al. 2004). There are many studies suggesting the zoonotic potential of *Giardia* between humans and dogs (Rimhanen-Finne et al. 2007; Huber et al. 2005; Anderson et al. 2004; Meireles et al. 2008; Jacobs et al. 2001; Naser et al. 2017). In subclinical infections, asymptomatic carrier animals shed *Giardia* cysts in their feces for a long time and cause environmental contamination (Uchôa et al. 2017). In a study about the prevalence of *G. duodenalis* in Spain (Dado et al. 2012), zoonotic A and B groups were isolated from the stool samples of dogs. As a result of the study, it was stated that these animals have a high zoonotic potential and pose a public health risk.

Discussions and researches on *Giardia's* zoonotic role have continued since the World Health Organization (WHO) recognized Giardiasis as a zoonotic disease. Recent developments in biology, genetics and taxonomy isolates of *Giardia* obtained from different hosts and molecular similarities of these isolates in different hosts clearly reflect the zoonotic potential of the disease. Giardiasis poses a health risk for both humans and animals in terms of its high prevalence and its ability to infect (Feng et al. 2011; Caccio et al. 2015). Faeces play an important role in the transmission of the disease, it should be kept in mind that carrier dogs can be a source of infection for people

who share the same environment with dogs even if the dog does not show any symptoms.

The fact that water resources are one of the most important factors that play a role in the spread of *Giardia* suggests that it may also cause infections in aquatic life and have negative effects on ecosystem health (Fayer et al. 2004). It is important for environmental health to control the water contaminated with the feces of domestic animals. In our opinion, it may be important to ensure the control of environmental water resources used in human and animal consumption due to the fact that it contains *Giardia* groups that have zoonotic potential as a result of the contamination of water resources in our country (Anderson et al. 2004).

Giardia infections are more common in young animals, dogs living in-doors, crowded environments and shelters (Jacobs et al. 2001). Because asymptomatic infected dogs can be a source of infection for other animals and the zoonotic potential of the parasite, dogs that are kept at home and housed in crowded environments should be checked for *Giardia* regularly and appropriate treatment should be applied if necessary. Some studies suggest the necessity of treatment in asymptomatic dogs (Thompson et al. 2001; Palmer et al. 2008). A single test method is not always sufficient for fecal analysis used in the diagnosis of *Giardia* in dogs and intermittent scattering of the organism can cause false negative results. Therefore, when considered in terms of public health, more advanced diagnostic methods and more effective treatment and prevention strategies are needed in patients with asymptomatic giardiasis. Although cases have been reported that the vaccine applications developed for *Giardia* reduce fecal cyst shedding and are effective in elimination of the disease (Olson et al. 2001; Olson et al. 2000), it is stated that the effectiveness of the vaccine is controversial in asymptomatic cases (Anderson et al. 2004).

In conclusion, *Giardia* infections in dogs can be asymptomatic. Zoonotic *Giardia* groups can cause fecal contamination from the carrier dog in the environment. Fecal cysts may infect humans directly or indirectly through the faecal-oral route. Because of the zoonotic potential of the disease, dogs living in the same environment with humans need regular veterinary control and *Giardia* testing to provide treatment and prophylaxis. Waterborne contamination is the most important risk factor, drinking water sources used for consumption of both human, pet and livestock should be regularly checked for *Giardia* contamination. In our opinion, developing and using effective and routine vaccination practices of *Giardia* in dogs in our country will be beneficial in reducing the prevalence of asymptomatic *Giardia*.

CONFLICT of INTEREST

The authors declare that they have no conflict of interest.

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