

Prevalence of giardiasis of stray cats in the Daejeon city

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Giardiasis is widespread all over the world, and it is a disease that causes both acute and chronic digestive symptoms. It is zoonotic disease that affects animals and humans. There are few studies on giardiasis in stray cats due to difficulties in catching and sampling. Therefore, this study evaluated the prevalence of giardiasis in stray cats in the Daejeon city because of increasing interest as zoonotic disease. The specimens were the feces of stray cats captured for the neutering project (TNR) in Daejeon; 30 fecal samples were collected from 2021 to 2022 in each of 5 districts in Daejeon. A total of 150 samples were collected. All samples were tested for giardiasis using the *Giardia* SNAP kit (SNAP[®] test, IDEXX Laboratories, Inc., Westbrook, ME). The overall prevalence rate was 46 out of 150 cats (30.7%). By age, 25 out of 71 juvenile cats (35.2%) were positive, and 21 out of 79 adult cats (26.6%) were positive. A total of 19 out of 69 cats (27.5%) with diarrhea were positive, and 27 out of 81 asymptomatic cats (33.3%) were positive. For gender, 38 out of 99 females (38.4%) were positive, and 8 out of 51 males (15.7%) were positive. The positive rate of giardiasis in stray cats was over 30%, which is high compared to other research results. It is necessary to increase the public's awareness of the value of deworming stray cats and the sanitation of people who have come into contact with them.

Key Words: *Giardia*, Prevalence, Daejeon, Stray cat

INTRODUCTION

Giardiasis occurs when the host ingests oocysts from a contaminated environment. Ingested oocysts swell and are activated by gastric acid and pancreatic enzymes in the duodenum (Tangtrongsup and Scorza, 2010). The released trophozoites then become mature and freely swim or attach to intestinal epithelium using the ventral disc of the organism (Ettinger and Feldman, 2010). The trophozoites proliferate in the intestinal tract and then are enveloped by an unknown mechanism (Ettinger and Feldman, 2010). *Giardia*'s infection mechanisms include toxin production, destruction of normal flora, induction of inflammatory bowel disease, inhibition of normal enterocyte enzyme function, microvilli blunting, and induction of ataxia (Ettinger and Feldman, 2010; Tangtrongsup and Scorza, 2010).

Giardia is a parasite found in the intestinal tract of human beings and most domestic animals throughout the world (Tangtrongsup and Scorza, 2010). Most cats infected with *Giardia* are asymptomatic, but when clinical symptoms appear, it is a chronic wasting disease that occurs with acute small bowel diarrhea and weight loss (Ettinger and Feldman, 2010; Janeczko and Griffin, 2010). In addition, it is a zoonotic infection that can cause acute diarrhea, abdominal pain, and vomiting in humans (Ettinger and Feldman, 2010). Diagnostic methods include direct smear examination, zinc sulfate concentration, ELISA, direct fluorescent antibody test, and PCR (Ettinger and Feldman, 2010).

Other studies on the prevalence of *Giardia* have been extensive in dogs. Various studies have been conducted on the distribution of *Giardia* in the environment (Chung et al, 2015).

In the past, research on and contact with stray cats was difficult, so the prevalence of giardiasis in stray cats was not known. However, due to changes in the perception of stray cats, catchers, temporary guardians, shelter-related persons, salespeople, and veterinary hospital workers are often in direct or indirect contact with stray cats (Piekara-Stępińska et al, 2021).

Therefore, it is important to judge the prevalence of giardiasis in stray cats, to treat the disease, to assess the possibility of transmission to humans, and to prevent public health problems. Therefore, this study investigated the prevalence of giardiasis in stray cats in the Daejeon, South Korea.

MATERIALS AND METHODS

Sample collection

Fecal samples from stray cats were obtained through the TNR (Trap-Neuter-Return) project in 2021-2022. A total of 150 samples were collected from the five administrative districts (Seo-gu, Yuseong-gu, Jung-gu, Dong-gu and Daedeok-gu) of the Daejeon, South Korea.

ELISA test

Each stool sample was analyzed using a commercially available *Giardia* ELISA kit (SNAP[®] *Giardia* ELISA kit, IDEXX Laboratories, USA). The SNAP[®] *Giardia* ELISA kit is a rapid enzyme immunoassay for the detection of *Giardia lamblia*, otherwise known as *Giardia intestinalis* or *Giardia duodenalis*, the primary species in canine and feline feces. The presence of the *Giardia* antigen in fecal samples indicates that the animal either has ingested *Giardia* cysts, may be actively infected, and may be shedding cysts in feces. All procedures were performed according to the manufacturer's recommendations. When using the kit, a negative result is represented by the appearance of a single dot in the positive control area of the membrane. A positive result is indicated by the presence of dots in both the positive

control area and the test area of the membrane.

Statistical analysis

The prevalence of *Giardia* in stray cats was analyzed according to age (<1 year, over 1 year), sex (males, females), and presence symptoms (asymptomatic, symptomatic). Data were compared using an X^2 test with the IBM SPSS Statistics (Version 26.0, IBM software, USA). Results were considered significantly different if $P < 0.05$.

RESULTS

The overall prevalence rate 46 of 150 cats (30.7%). By age, 25 of 71 (35.2%) cats less than one year old were positive, and 21 of 79 (26.6%) cats over 1 year old were positive. A total of 19 of 69 (27.5%) cats with diarrhea were positive, as were 27 of 81 (33.3%) asymptomatic cats. When looking at gender, 38 of 99 (38.4%) females were positive, as were 8 of 51 (15.7%) males.

The prevalence by region was 6 of 30 cats (20.0%) in Yuseong-gu, 10 of 30 (33.3%) in Jung-gu, 13 of 30 (43.3%) in Dong-gu, 11 of 30 (36.7%) in Daedeok-gu and 6 of 30 (20.0%) in Seo-gu (Table 1).

DISCUSSION

Giardiasis is the most common intestinal protozoan in humans and animals worldwide (Tangtrongsup and Scorza, 2010). This study examined the prevalence of giardiasis using the IDEXX SNAP *Giardia* test kit in the five districts of Daejeon. The overall positive prevalence rate in stray cats was 30.7%.

The kit has a very high sensitivity of 92.0% and specificity of 99.8% (Carlin et al, 2006). In a large-scale study using the IDEXX SNAP *Giardia* kit, the positive rates were 10.8% in the United States (Carlin et al, 2006) and 20.3% in Europe (Epe et al, 2010). No regional significance was observed in the United States, and in European studies, the prevalence was half or less in the UK, Spain, Netherlands, and Italy compared to Germany,

Table 1. Prevalence of giardiasis from stray cats in the Daejeon city

	Dong-gu			Jung-gu			Seo-gu			Daeduk-gu			Yuseong-gu			All cats			P
	NE	NP	PR (%)	NE	NP	PR (%)	NE	NP	PR (%)	NE	NP	PR (%)	NE	NP	PR (%)	NE	NP	PR (%)	
Sex																			
Females	22	10	45.5	20	8	40.0	18	6	33.3	21	9	42.9	18	5	27.8	99	38	38.4*	0.004
Males	8	3	37.5	10	2	20.0	12	0	0.0	9	2	22.2	12	1	8.3	51	8	15.7	
Age																			
<1	18	7	38.9	20	6	30.0	1	0	0.0	22	8	36.7	10	4	40.0	71	25	35.2	0.547
>1	12	6	50.0	10	4	40.0	29	6	20.7	8	3	37.5	20	2	10.0	79	21	26.6	
Symptom																			
Symptomatic	18	7	38.9	14	2	14.3	7	0	0.00	16	6	37.5	14	4	28.6	69	19	27.5	0.219
Asymptomatic	12	6	50.0	16	8	50.0	23	6	26.1	14	5	35.7	16	2	12.5	81	27	33.3	
Total	30	13	43.3	30	10	33.3	30	6	20.0	30	11	36.7	30	6	20.0	150	46	30.7	

NE, number of examined; NP, number of positive; PR, positive rate.
*Significant differences were observed ($P < 0.05$).

while only in Belgium it was higher (Epe et al, 2010). The above studies were conducted on cats with symptoms visiting the hospital, and the positive rate was lower than that of stray cats with symptoms in present study.

In a study by Mircean et al. (2011) using a commercial kit in Romania, 27.9% of cats were positive, as were 32% of cats with diarrhea; these results were similar to the present study.

In Denmark, it was reported that 7% of cats visiting hospitals were positive, while 48.5% of cats in catteries were positive (Enemark et al, 2020). Compared to this study, this was a high positive rate. Polak et al. (2014) reported that a group survey of animal holders had a positive rate of 56% due to malnutrition, poor management, and poor veterinary care when living in a cluster. Compared to this study on stray cats, the positive rate was significantly higher due to a high-density living environment.

Procesi et al. (2022) reported that stray cats had a positive rate of 35.3% in Italy, results similar to the present study. A study by direct smears and flotation methods by López-Arias et al. (2019) in Colombia yielded a 20% positive rate for cats with symptoms, which was lower than in this study. Giardiasis detection by PCR in indoor cats produced a very low positive rate of 3.9% in

Poland (Piekara-Stępińska et al, 2021) compared with this study.

López-Arias et al. (2019) reported that kittens (28.3%) were more often infected with giardiasis than adult cats (14.6%), and he reported younger cats being at a higher risk of infection. In this study, 35.2% cats less than one year old were positive, and 26.6% cats over 1 year old were positive.

Another study revealed the positive rate of cats with diarrhea was almost double that of asymptomatic cats (Epe et al, 2010). There was no significant difference between the prevalence in males (43.0%) and females (41.0%). However, in this study, the prevalence was 38.4% in females and 15.7% in males. The infection rate of female stray cats was significantly higher than that of the males. This was a different outcome compared to the Epe et al's (2010) results, probably due to regional differences.

With the changes in social perceptions of abandoned animals, stray cats, who had not had much contact with humans in the past, have recently come into contact with many people, much more frequently (Polak et al, 2014). Because stray cats were difficult to capture and test, evaluation of their diseases and the associated prevalence rates was not well done (Procesi et al, 2022).

According to the results of this study, the prevalence

of giardiasis in stray cats is very high, even for individuals without symptoms.

Accordingly, it is necessary to provide anti-antigen and anti-parasitic worm treatments for stray cats, and people who have come in contact should also be aware of personal hygiene and infection.

CONCLUSION

The positive rate of giardiasis in stray cats is high in the Daejeon city, South Korea. It is necessary to administer anti-parasitic agents to *Giardia*-positive stray cats and to raise the public health awareness of those who have come into contact with them.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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REFERENCES

- Carlin EP, Bowman DD, Scarlett JM, Garrett J, Lorentzen L. 2006. Prevalence of *Giardia* in symptomatic dogs and cats throughout the United States as determined by the IDEXX SNAP *Giardia* test. *Vet Ther* 7: 199-206.
- Chung DW, Lee SE, You MJ, Seo KW, Song KH. 2015. Prevalence of canine giardiasis in the Daejeon and Chungnam area. *J Vet Clin* 32: 477-480.
- Enemark HL, Starostka TP, Larsen B, Takeuchi-Storm N, Thamsborg SM. 2020. *Giardia* and *Cryptosporidium* infections in Danish cats: risk factors and zoonotic potential. *Parasitol Res* 119: 2275-2286.
- Epe C, Rehker G, Schnieder T, Lorentzen L, Kreienbrock L. 2010. *Giardia* in symptomatic dogs and cats in Europe-results of a European study. *Vet Parasitol* 173: 32-38.
- Ettinger SJ, Feldman EC. 2010. Textbook of veterinary internal medicine, 7th ed. St. Louis: Elsevier. p.1582-1583.
- Janeczko S, Griffin B. 2010. *Giardia* infection in cats. *Compend Contin Educ Vet* 32: E4.
- López-Arias Á, Villar D, López-Osorio S, Calle-Vélez D, Chaparro-Gutiérrez JJ. 2019. *Giardia* is the most prevalent parasitic infection in dogs and cats with diarrhea in the city of Medellín, Colombia. *Vet Parasitol: Reg Stud Rep* 18: 100335.
- Mircean V, Györke A, Jarca A, Cozma V. 2011. Prevalence of *Giardia* species in stool samples by ELISA in household cats from Romania and risk factors. *J Feline Med Surg* 13: 479-482.
- Piekara-Stępińska A, Piekarska J, Gorczykowski M, Bania J. 2021. Genotypes of *Giardia duodenalis* in household dogs and cats from Poland. *Acta Parasitol* 66: 428-435.
- Polak KC, Levy JK, Crawford PC, Leutenegger CM, Moriello KA. 2014. Infectious diseases in large-scale cat hoarding investigations. *Vet J* 201: 189-195.
- Procesi IG, Carnio A, Berrilli F, Montalbano Di Filippo M, Scarito A, Amoroso C, Barni M, Ruffini M, Barlozzari G, Scarpulla M, De Liberato C. 2022. *Giardia duodenalis* in colony stray cats from Italy. *Zoonoses Public Health* 69: 46-54.
- Tangtrongsup S, Scorza V. 2010. Update on the diagnosis and management of *Giardia spp.* infections in dogs and cats. *Top Companion Anim Med* 25: 155-162.