Prevalence of *Giardia intestinalis* Infection in Household Cats of Tohoku District in Japan

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ABSTRACT. Fecal samples obtained from 600 household cats (244 males and 356 females) kept in 3 prefectures of Tohoku district in Japan were examined for *Giardia intestinalis* antigen, using a commercial enzyme-linked immunosorbent assay (ELISA) kit. *G. intestinalis* antigen was detected in 40% of the fecal specimens. The factors such as the age, life style or environmental condition of cats could be significantly related to the positive rate of *G. intestinalis* antigen. In contrast, the investigative district, appearance of feces, sex, breed or origin produced no significant difference in the positive rate. The present results suggest that *G. intestinalis* infection is widely spread in household cats of Tohoku district.

KEY WORDS: feline, *Giardia intestinalis*, prevalence.

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The pathogenic protozoa *Giardia intestinalis* is a ubiquitous parasite of cats and other mammals including humans and cause acute, chronic or intermittent diarrhea in some cases [6, 12, 17, 18]. Since the recent molecular biological evidences suggest that some isolates of *G. intestinalis* from cats have zoonotic potential [1, 11, 12, 18, 19], a survey on the prevalence of *G. intestinalis* infections in household cats should be needed to prevent zoonotic transmission of the protozoa. However, only a few numbers of studies have been described on the *G. intestinalis* infections in household cats in Japan [13–15, 17]. The purpose of the present study was to determine the prevalence and epidemiologic background of *G. intestinalis* infections in household cats of Tohoku district in Japan.

Fecal samples were obtained from 600 household cats presented to 3 veterinary practitioners in Aomori (n=353), Akita (n=188) and Fukushima (n=59) Prefectures during the period from April, 2003 to May, 2005. The animals included 244 male and 356 female cats of 11 breeds (554 Japanese domestic cat, 15 American Shorthair, 7 Persian, 6 Scottish Fold, 5 Himalayan, 5 Russian Blue, 3 Abyssinian, 2 Norwegian Forest cat, 1 Siamese cat, 1 Main Coon and 1 American Curl) with the age between 1 month and 22 years old. Fecal specimens were collected immediately after passed, grossly examined for their appearance (normal, soft, diarrhea) and stored at –20°C until analysis. *G. intestinalis*-specific antigen in fecal samples was detected by enzyme-linked immunosorbent assay (ELISA) using a commercially available kit (RIDASCREEN® Giardia, R-Biopharm AG, Germany) according to the manufacture's instruction. The age (1–6 months old, 7 months–1 year old, 2–5 years old, over 6 years old), life style (indoors, indoors/outdoors, outdoors), environmental condition (urban, suburban), origin (private cat owner, pet shop/breeding cattery) were also recorded for the cats. The statistical significance of differences in the positive rates of *G. intestinalis* antigen was ana-

lyzed by Fisher's exact probability test. A p-value of < 0.05 was considered significant.

G. intestinalis antigen was detected in 240 (40%) fecal samples of cats from 1 month to 22 years old. Association between the positive rate of *G. intestinalis* antigen and profile data of the animals was shown in Table 1. The positive rate of kitten from 1 to 6 months old (49%) was significantly ($p<0.05$) higher than that of over 6 years old (32%). In addition, the cats kept indoors (33%) had a significantly ($p<0.05$ or 0.01) lower prevalence than those kept indoors/outdoors (45%) or outdoors (53%). The environmental condition also related to the positive rate of *Giardia*: suburban cats (42%) had a significantly ($p<0.05$) higher prevalence than urban cats (29%). In contrast, the investigative district or the appearance of feces showed no significant difference in the positive rate. Differences in prevalence between the cats originated in private cat owner and in pet shop/breeding cattery and between males and females were also not significant. The breeds such as Persian (71%), Russian Blue (60%), Norwegian Forest cat (100%), Main Coon (100%) and American Curl (100%) revealed high prevalence of *Giardia* infections, although the number of animals examined was limited. When comparing the prevalence of Japanese domestic cat to that of pure breeds, there was no significant difference between them.

The present study suggested that *G. intestinalis* infection would be widely spread in household cats of Tohoku district, since the high positive rates for *G. intestinalis* antigen were recorded in three different prefectures of Tohoku. Saito *et al.* [13–15] previously reported the lower detection rates of *G. intestinalis* such as 0.8–1.7% in household cats in Hiroshima Prefecture, Japan, based on the results of conventional microscopic fecal examination (concentrated brine flotation technique). This contradiction is probably not due to the investigative district but due to the analyzing method to examine *Giardia* infection, because the ELISA kit used in

Table 1. ELISA-positive rates for *Giardia intestinalis* in household cats of Tohoku district in Japan

Profiles of cats	Positive rate (%)	(Positive cats/examined cats)
Prefecture		
Aomori	42	(148/353)
Akita	40	(75/188)
Fukushima	29	(17/59)
Appearance of feces		
Normal	39	(183/468)
Soft	39	(34/88)
Diarrhea	52	(23/44)
Age		
1–6 months old	49 ^{a)}	(70/144)
7 months–1 year old	39	(77/199)
2–5 years old	39	(64/165)
Over 6 years old	32 ^{b)}	(29/92)
Sex		
Male	43	(104/244)
Female	38	(136/356)
Breed		
Japanese domestic cat	40	(220/554)
Pure breed	43	(20/46)
Life style		
Indoors	33 ^{a,c)}	(110/331)
Indoors/outdoors	45 ^{b)}	(75/166)
Outdoors	53 ^{d)}	(55/103)
Environmental condition		
Urban	29 ^{a)}	(27/92)
Suburban	42 ^{b)}	(213/508)
Origin		
Pet shop/breeding cattery	45	(15/33)
Private cat owner	40	(225/567)

a) VS b) : Significant statistical difference ($p < 0.05$).c) VS d) : Significant statistical difference ($p < 0.01$).

the present study is more sensitive for detecting *Giardia* infection than the conventional microscopic techniques [4, 8, 16]. McGlade *et al.* [8] showed that the positive rates for *G. intestinalis* in 40 feline fecal samples were 5, 80 and 60% by means of microscopy (zinc sulfate flotation technique), polymerase chain reaction (PCR) and ELISA, respectively.

The detection of *G. intestinalis* antigen showed no relation to fecal appearances in the present study. Furthermore, 90% (217/240) of the cats those were positive for *G. intestinalis* antigen had no diarrhea. Sugano *et al.* [17] also reported that some of the cats infected with *Giardia* had no diarrhea. The cats that are positive for *Giardia* and develop no clinical symptoms will play an important role for the transmission of *Giardia* as carrier. There was no difference in positive rate between the cats originated from private cat owner and from pet shop/breeding cattery, although the examined number of cats from pet shop/breeding cattery was limited. The previous studies in dogs have been demonstrated that the pet shop/breeding kennel provides the chance for *Giardia* infection [3–5]. On the other hand, the present study suggests that the pet shop/breeding cattery seems to be not essential for *Giardia* infection in cats. Further investigation is needed to evaluate the transmission of *Giardia* in pet shop/breeding cattery, because the sample

size from pet shop/breeding cattery was small in the present study.

The positive rate of *G. intestinalis* antigen in cats aged 1 to 6 months old was significantly higher than that in adults over 6 years old. The dogs and cats less than 1 year of age are more likely to be infected with *Giardia* than older animals because of the immaturity in their immune system [6]. The significantly lower prevalence was recorded in cats kept indoors compared to those kept indoors/outdoors and outdoors. The cats kept indoors will have less opportunity to ingest *Giardia* cysts from the environment.

Difference in positive rates of *G. intestinalis* antigen between urban cats and suburban cats is probably associated with their life style. Because 78% (72/92) of urban cats were kept indoors with less chance of *Giardia* infection, while 51% (259/508) of suburban cats were kept indoors. In dogs, the high percentage infection of *G. intestinalis* is recognized in animals aged 1–6 months old, kept indoors and from pet shop/breeding kennel [3, 4]. In contrast, the high level infection was recorded in cats of all ages, kept indoors/outdoors and outdoors. Furthermore, the suburban cats showed higher *G. intestinalis* infection. The results of present study suggest that the field contamination with *Giardia* cysts would play an important role in *G. intestinalis*

infection in household cats. Although some of the breeds showed high prevalence, no difference between Japanese domestic cats and pure breeds supports the findings that breed-related resistance or susceptibility to *Giardia* has been unknown [6].

G. intestinalis is divided into several genotypes, and at least 6 genotypes (Assemblage A, B, C, D, E and F) have been isolated from cats [1, 2, 7–11, 18, 19]. Itagaki *et al.* [2] recently reported that 3 *Giardia* isolates from cats in Japan were entirely Assemblage F, which appears to be specific for cats. However, the possibility of zoonotic transmission of *G. intestinalis* from cats to humans will be undeniable, because Assemblage A and B, which have zoonotic potential [9–12, 18, 19], have been often reported in cats of overseas [1, 11, 12, 18, 19]. Further studies on genotyping will be necessary to confirm the zoonotic potential of *G. intestinalis* isolated from household cats in Japan.

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REFERENCES

1. Berrilli, F., Di Cave, D., De Liberato, C., Franco, A., Scaramozzino, P. and Orecchia, P. 2004. *Vet. Parasitol.* **122**: 193–199.
2. Itagaki, T., Kinoshita, S., Aoki, M., Itoh, N., Saeki, H., Uetsuki, J., Izumiyama, S., Yagita, K. and Endo, T. 2005. *Vet. Parasitol.* **133**: 283–287.
3. Itoh, N., Muraoka, N., Aoki, M. and Itagaki, T. 2001. *Jpn. Assoc. Inf. Dis.* **75**: 671–677.
4. Itoh, N., Muraoka, N., Aoki, M. and Itagaki, T. 2004. *J. Jpn. Vet. Med. Assoc.* **57**: 579–582 (in Japanese with English summary).
5. Itoh, N., Muraoka, N., Saeki, H., Aoki, M. and Itagaki, T. 2005. *J. Vet. Med. Sci.* **67**: 717–718.
6. Kirkpatrick, C. E. 1987. *Vet. Clin. North Am. Small Anim. Pract.* **17**: 1377–1387.
7. Lalle, M., Pozio, E., Capelli, G., Bruschi, F., Crotti, D. and Caccio, S. M. 2004. *Int. J. Parasitol.* **35**: 207–213.
8. McGlade, T. R., Robertson, I. D., Elliot, A. D. and Thompson, R. C. A. 2003. *Vet. Parasitol.* **110**: 197–205.
9. Monis, P. T., Andrews, R. H., Mayrhofer, G. and Ey, P. L. 1999. *Mol. Biol. Evol.* **16**: 1135–1144.
10. Monis, P. T., Andrews, R. H., Mayrhofer, G., Mackrill, J., Kulda, J., Isaac-Renton, J. L. and Ey, P. L. 1998. *Parasitology* **116**: 7–19.
11. Read, C. M., Monis, P. T. and Thompson, R. C. A. 2004. *Infect. Genet. Evol.* **4**: 125–130.
12. Robertson, I. D., Irwin, P. J., Lymbery, A. J. and Thompson, R. C. A. 2000. *Int. J. Parasitol.* **30**: 1369–1377.
13. Saito, T., Hashiguchi, H., Shimatani, K., Miyano, S., Yamaashi, K., Yamaguchi, H., Yoshida, K., Ikeda, F., Kuya, M., Utsunomiya, K. and Tongu, Y. 2004. *J. Vet. Med. (Tokyo)* **57**: 11–14 (in Japanese with English summary).
14. Saito, T., Morishige, K. and Tongu, Y. 1995. *Jpn. J. Parasitol.* **44**: 149–153 (in Japanese with English summary).
15. Saito, T., Yamaguchi, H., Yoshida, K., Kusaura, J., Wada, E., Morishige, K. and Tongu, Y. 1998. *J. Vet. Med. (Tokyo)* **51**: 889–892 (in Japanese with English summary).
16. Schunk, M., Jelinek, T., Wetzels, K. and Nothdurft, H. D. 2001. *Eur. J. Clin. Microbiol. Infect. Dis.* **20**: 389–391.
17. Sugano, H., Yano, A. and Minami, H. 1986. *J. Jpn. Vet. Med. Assoc.* **39**: 504–507 (in Japanese with English summary).
18. Thompson, R. C. A. 2000. *Int. J. Parasitol.* **30**: 1259–1267.
19. Thompson, R. C. A. 2004. *Vet. Parasitol.* **126**: 15–35.