



Prevalence of intestinal parasites in pet shop kittens in Japan

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Abstract

The present study examined the prevalence of intestinal parasites in kittens from five pet shops in East Japan. Fresh faecal samples were collected from 555 kittens (aged 1–3 months) on a single occasion. The samples were tested for the presence of *Giardia* species coproantigen using a commercially available enzyme-linked immunosorbent assay kit. Other intestinal parasites were identified microscopically using the formalin-ethyl acetate sedimentation technique. The overall prevalence of intestinal parasites was 27.2%; two genera of protozoa (*Giardia* species and *Cystoisospora* species) and one nematode (*Toxocara cati*) were detected. Faecal condition was not related to intestinal parasite infections. Significant differences among the pet shops were observed in the overall prevalence of intestinal parasites and the presence of *Cystoisospora* species infections.

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Intestinal parasites are common feline pathogens and often lead to obstruction of the digestive tract.¹ The zoonotic potential of some of these parasites is a serious problem.^{2,3} For instance, human infection with *Toxocara cati* and *Toxocara canis* can result in visceral and ocular larva migrans.^{4,5} *Giardia* species that affect cats also have zoonotic potential because cats can also harbour zoonotic genotypes (assemblages A and B).^{3,6} Previously, researchers have demonstrated that the prevalence of intestinal parasites in private-household cats was significantly higher in young cats aged 1–6 months old.⁷ As a proportion of private cat-owners obtain their animals from pet shops, estimating the prevalence of intestinal parasites in pet shop kittens is of obvious importance for the welfare of both kittens and humans. However, there is no up-to-date published data regarding the presence of intestinal parasites in pet shop kittens in Japan. To address this, the present study determined the prevalence of intestinal parasites in more than 500 kittens at five pet shops in east Japan.

Between January 2011 and December 2012, fresh faecal samples were randomly collected on a single occasion from 555 kittens (aged 1–3 months, males $n = 243$; females $n = 312$) with or without a history of diarrhoea, at five pet shops (1–5) in east Japan (Tohoku district: three shops; Kanto district: two shops). All faecal samples were donated by the pet shop owners, who granted permission to include their kittens in the survey. The

samples were collected immediately after natural defaecation and were stored at 4°C until examination (within 3 days). The presence of *Giardia*-specific coproantigens was determined using a commercially available enzyme-linked immunosorbent assay (ELISA) kit (SNAP *Giardia*, IDEXX Laboratories). Other intestinal parasites were identified microscopically using the formalin-ethyl acetate sedimentation technique described previously.^{7,8} The data were analysed according to the faecal condition (formed vs unformed) and pet shop. It was not possible to obtain data for anthelmintic treatment. Data were analysed using Fisher's exact probability test. The significance level was $P < 0.05$.

Of the 555 pet shop kittens, 27.2% (151 kittens) were positive for at least one genus of intestinal parasites (see Table 1). Two genera of protozoa (*Giardia* species: 10.1%; *Cystoisospora* species: 19.6%) and one nematode (*T. cati*: 0.2%) were identified. Multiple infections were

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Table 1 Prevalence of intestinal parasites in pet shop kittens in Japan

	Overall (n = 555)	Faecal condition		P
		Formed (n = 453)	Unformed (n = 102)	
<i>Giardia</i> species	10.1% (56)*	10.2% (46)	9.8% (10)	NS
<i>Cystoisospora</i> species	19.6% (109)	19.2% (87)	21.6% (22)	NS
<i>Cystoisospora felis</i>	16.4% (91)	16.1% (73)	17.6% (18)	NS
<i>Cystoisospora rivolta</i>	3.2% (18)	3.1% (14)	3.9% (4)	NS
<i>Toxocara cati</i>	0.2% (1)	0.2% (1)	0% (0)	NS
Total infection	27.2% (151†)	26.5% (120†)	30.4% (31†)	NS

*Number of infected kittens

†This total number is smaller than sum of each parasite because of multiple infections

NS = not significant

Table 2 Prevalence of intestinal parasites in individual pet shop kittens in Japan

	Shop 1 (n = 70)	Shop 2 (n = 134)	Shop 3 (n = 24)	Shop 4 (n = 86)	Shop 5 (n = 241)
<i>Giardia</i> species	11.4% (8)*	11.9% (16)	4.2% (1)	11.6% (10)	8.7% (21)
<i>Cystoisospora</i> species	11.4%† (8)	24.6%‡ (33)	0%§ (0)	9.3%¶ (8)	24.9%∞ (60)
<i>Cystoisospora felis</i>	8.6%† (6)	20.9%‡ (28)	0%§ (0)	5.8%¶ (5)	21.6%∞ (52)
<i>Cystoisospora rivolta</i>	2.9% (2)	3.7% (5)	0% (0)	3.5% (3)	3.3% (8)
<i>Toxocara cati</i>	0% (0)	0.7% (1)	0% (0)	0% (0)	0% (0)
Total infection	22.9% (16)	32.1%# (43**)	4.2%†† (1)	19.8% (17**)	30.7%# (74**)

*Number of infected kittens

**This total number is smaller than sum of each parasite because of multiple infections

P < 0.01 for # vs ††, † vs §, ‡ vs ¶, § vs ∞ and ¶ vs ∞. P < 0.05 for † vs ‡ and † vs ∞

recorded in 15 kittens (2.7%). The most common multiple infections involved *Giardia* species and *Cystoisospora* species (14 kittens), while there was a single case of concomitant infection with *Giardia* species and *T. cati*. There was no significant difference in faecal condition between kittens with or without intestinal parasites. *Giardia* species were found in samples from all the pet shops, and *Cystoisospora* species (both *Cystoisospora felis* and *Cystoisospora rivolta*) were also present in samples from all shops except for one (see Table 2). Significant differences in the overall prevalence and in the presence of *Cystoisospora* species (*C. felis*) were observed among the pet shops. In contrast, there were no significant differences in the presence of *Giardia* species among the pet shops.

Only two genera of protozoa, *Giardia* and *Cystoisospora*, and one species of nematode, *T. cati*, were detected in faecal samples in the study. A high prevalence of *Giardia* (10.1%) and *Cystoisospora* (19.6%) species infections was recorded in this study. Recently, it has been reported that the prevalences of *Giardia* and *Cystoisospora* species infections in 1–6 month-old cats presented to veterinary clinics in Japan were 3.1% (ELISA) and 4.8% (sedimentation technique) respectively.⁷ In Germany, private household cats up to the

age of 3 months showed a high prevalence of *Giardia* species (19.5%; ELISA) and *Cystoisospora* species (12.8%; flotation methods).⁹ It is difficult to compare the levels of parasite infections between previous studies and the present study because of the different methods of faecal examination and cat populations used. In particular, although ELISA for detection of *Giardia* species infection is assuredly useful in veterinary practice,^{10,11} polymerase chain reaction is a more sensitive and convenient technique for detecting and genotyping *Giardia* species in cats.^{11–14} Previous studies have reported that infection with *Giardia* species and *Cystoisospora* species are common in kittens of pet shops and breeding catteries owing to easy transmission of these pathogens in a limited space.^{12,15,16} This suggests that insufficient control and/or the underestimation of intestinal protozoan parasites are serious problems in this population. *Giardia* and *Cystoisospora* species infections were not always associated with an alteration in faecal condition,^{11,15–17} as was observed in the present study. This situation may contribute to the underestimation of these parasites, as faecal examination is unlikely to be carried out if the faeces are normal. Although there is no information regarding the sanitary management and deworming histories of animals in this study, it is highly likely that the

infections in pet shops and/or breeding catteries arise from environmental contamination. This is supported by the fact that these protozoa cannot be transmitted vertically, so a simple faecal–oral transmission is the only route of infection.^{11,17} Furthermore, pet shop kittens are unlikely to have been exposed to the paratenic host (rodent) of *Cystoisospora* species infection. *Giardia* species cysts and *Cystoisospora* species oocysts are markedly stable in the environment.^{11,17} Considering these features of *Giardia* and *Cystoisospora* species infections, re-infection via environmental contamination is of great importance in pet shop kittens. Once these protozoa find their way into pet shops, they are difficult to eliminate from this environment. The differences in overall prevalence and the presence of *Cystoisospora* species infection among the pet shops may also depend on the sanitary management in each facility. Therefore, giardiasis and coccidiosis should be treated aggressively in order to reduce the level of environmental contamination. In addition, it is necessary to increase the understanding of *Giardia* and *Cystoisospora* species infections amongst veterinarians and pet shop managers.

In the present study, *T. cati* infection was detected in only one kitten. Other studies have also revealed a low level of *T. cati* infection in pet shop kittens.¹² As *T. cati* is one of the most important helminth infections seen in cats, pet shop managers are likely to have a good understanding of this parasite and may, therefore, ensure that kittens and their mothers are regularly treated with anthelmintics. Another reason for this low prevalence is the lack of exposure of pet shop kittens to the paratenic hosts, such as rodents, earthworms, and insects.^{18,19}

Conclusions

This study demonstrates a high prevalence of *Giardia* and *Cystoisospora* species infections in pet shop kittens in Japan. Further investigation of these intestinal parasites, including the genotyping of *Giardia* species, is recommended to help minimise the zoonotic risks.

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