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Cryptosporidiosis in Dogs and Cats in Hyogo Prefecture, Japan

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Abstract

Various aspects of *Cryptosporidium* infection were studied in 213 dogs and 507 cats captured in Hyogo Prefecture. Their rectal contents were examined by sucrose centrifugal-floatation technic.

Oocysts of *Cryptosporidium* were detected in 3 dogs (1.4%) and 20 cats (3.9%). The 3 positive dogs showed normal feces and were 6 months or less in estimated age. On the other hand, 10 of the 20 (50.0%) positive cats were aged 1 year or more. Of the cats examined, 66 (13.0%) showed diarrhea and 441 (87.0%) evacuated normal feces. *Cryptosporidium* infection was observed in 6.1% of the former cats and 3.6% of the latter, with no significant difference of prevalence ($p > 0.05$). However, the mean number of discharged oocysts was 1,817 in cats with diarrhea as compared with 191 in "non-diarrhea" cats. Other parasites than *Cryptosporidium*, 5 species of 5 genera, were also detected, but no particular relationship was noted between *Cryptosporidium* infection and these parasites.

Key words: *Cryptosporidium*, cryptosporidiosis, dog, cat

Introduction

Cryptosporidiosis is an infectious disease caused by a coccidian parasite belonging to the genus *Cryptosporidium*. The protozoan was first detected in the gastric glands of the mouse by Tyzzer in 1907, and has come to be also known as a cause of parasitic zoonosis since the first human cases was reported (Nime *et al.*, 1976). More recently, the parasite has attracted greater attention as it was shown to cause chronic diarrhea in patients with Acquired Immunodeficiency Syndrome (AIDS) and in other immunologically compromised individuals. Instances of natural infection with *Cryptosporidium* have been reported (Fayer and Ungar, 1986) in not only mammalians but also birds, reptiles and fish. However, most reports on animal cases did no more than describe individual cases, and little has been made on epidemiological investigation such as evaluation of the frequency and intensity of infection or the state of mixed infection with other parasites. Furthermore, since *Cryptosporidium* infection is known to occur directly via the feces of infected individuals or animals (Koch *et al.*, 1985; Moon and Bemrick, 1981), information about the state of contamination with the protozoan among dogs and cats which are in close contact with humans, is considered to be essential in evaluating the dynamics of human cryptosporidiosis.

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Materials and Methods

The present study was conducted over a period of 1 year and 7 months from June, 1987 to December, 1988. Of the dogs and cats committed to the Animal Administration Office of Hyogo Prefecture during this period, 213 dogs (85 males and 128 females) and 507 cats (228 males and 279 females) were examined for *Cryptosporidium* and other parasite infections. These animals were

originated from six regions distributed all over Hyogo Prefecture other than Kobe City shown by stripes in Fig. 1: cities (Hansin), agricultural regions with warm climates throughout the year (Toban and Seiban), an agricultural region with heavy snowfall during winter (Tajima), a mountain region (Tanyu), and an island geographically isolated from surrounding regions (Awaji). The dogs and cats killed with carbon dioxide were recorded in terms of the sex, body weight, age estimated from the appearance as well as the degree of dental development, and degree of obesity. Two grams of rectal contents (feces) were collected from large intestine, and their quality (normal or diarrhea) was also recorded. One gram of the feces was examined for the presence of oocyst of *Cryptosporidium* by oocyst concentration method using sucrose solution, and the remaining 1 g was used for general parasite-detection test by routine centrifugal sedimentation method.

The details of the method for detection of *Cryptosporidium* oocyst were described previously (Uga *et al.*, 1988). Briefly, the 1 g of fecal sample was suspended in 10 ml of 2% potassium dichromate solution and filtered through gauze. The filtrate was centrifuged at 650 × *g* for 10 min, and the supernatant was discarded. A sucrose solution with a specific gravity of 1. 200 was added to the sediment, mixed thoroughly, and centrifuged at 650 × *g* for 10 min. Oocysts floating on the surface were recovered using a bacteriological loop and observed under a phase contrast microscope at a magnification of ×600 and *Cryptosporidium* oocysts were counted in 20 microscopic fields.

Results

Fig. 2 shows the oocysts detected from a cat (No. 3 in Table 2). Oocysts shone brightly under a microscope and could be readily distinguished from other materials. They were nearly spherical with a diameter of 4-5 μm and had a thin oocyst wall. Four sporozoites contained in each oocyst were not clearly identified, but one residual body was observed as a distinct black spot.

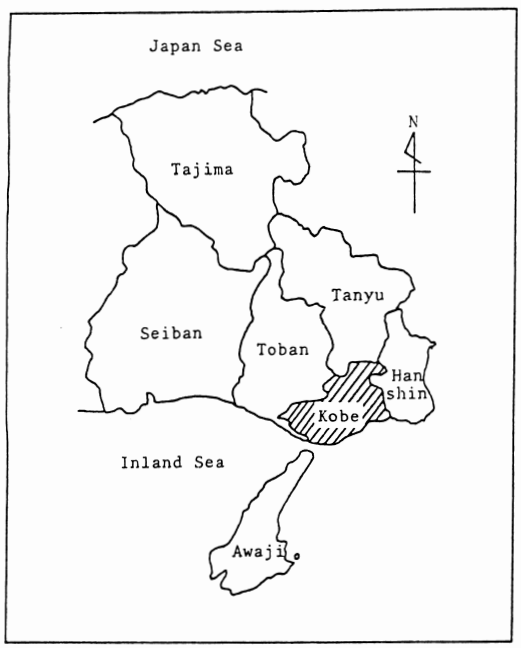

Fig. 1. Map of Hyogo Prefecture. The survey covered all areas except for the striped area.

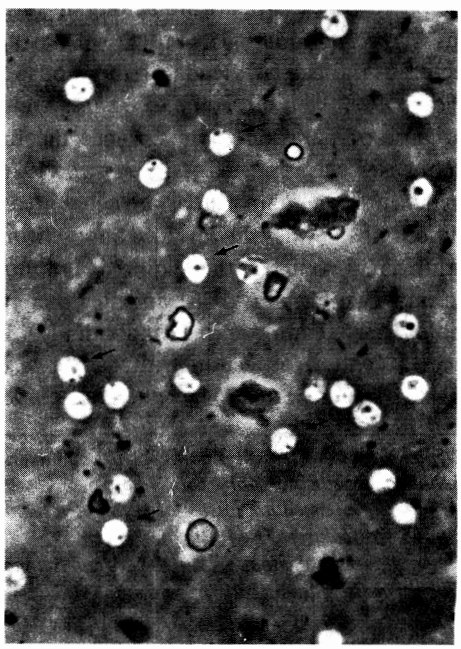

Fig. 2. *Cryptosporidium* oocysts (arrows) recovered from cat stool (No. 3 in Table 2) by sucrose density centrifugation.

Cryptosporidium infection was observed in 3 of the 213 (1.4%) dogs and 20 of the 507 (3.9%) cats examined, with the percent higher in cats than in dogs.

Infection in dogs

Table 1 summarizes the data concerning the 3 positive dogs. No particular characteristics were observed in the place of capture, sex, or body weight of the dogs. Of 217 dogs examined, 138 were considered to be 6 months or less of estimated ages (the first posterior molar not having erupted) and 3 of 138 were positive. On the contrary, 79 dogs were estimated to be more than 6 months of age and all of them were negative. The feces of 3 positive dogs were considered to be normal. The number of *Cryptosporidium* oocysts detected was 6 at the maximum, and the infection was not considered to be severe. The simultaneous fecal examination demonstrated eggs of *Toxocara canis* only in dog No. 3.

Infection in cats

Twenty cats were shown to be positive for *Cryptosporidium* infection during the study (Table 2). They were distributed in all 6 regions covered by the study with no regional differences in the infection rate. The cats consisted of 11 males and 9 females. Concerning the relationship between the age and the percent positivity, 8 of 241 (3.3%) cats aged 3 months or less (no milk teeth having been replaced with permanent teeth) and 10 of 209 (4.8%) aged 1 year or more (abrasion of incisors having begun) were positive with no significant difference ($p>0.05$). Of the 20 positive cats, those aged 1 year or above accounted for 50.0% (10/20).

Diarrhea was observed in 13.0% (66/507) and not in 87.0% (441/507) of cats examined. The frequency of *Cryptosporidium*-positive cats was 6.1% (4/66) in the former and 3.6% (16/441) in the latter with no significant difference ($p>0.05$). However, the numbers of oocysts detected in cats showing diarrhea were 22, 1,500, 5,200, and 544 (mean 1,817) and tended to be greater than the numbers in those not showing diarrhea (mean 191). Five of 20 (25.0%) positive cats and 113 of 487 (23.2%) negative cats were considered to be lean, showing no relationship between *Cryptosporidium* infection and the degree of obesity.

Five species of parasites other than *Cryptosporidium* were also detected; *Toxocara cati* (from 11 cats), *Isospora felis* (5), *Spirometra erinacei* (2), *Pharyngostomum cordatum* (2), and *Capillaria* sp. (1). However, no particular relationship was observed between *Cryptosporidium* infection and these parasites (Table 2).

Discussion

Reports concerning *Cryptosporidium* have increased rapidly since 1980, and epidemiological studies of human cryptosporidiosis have been carried out recently in various regions of the world. Fayer and Ungar (1986) reviewed that prevalence rates in Europe and North America were most often reported as 1 to 2% and 0.6 to 4.3%, respectively. In contrast, prevalence rates in Asia, Australia and Africa were 3 to 20%. They concluded that *Cryptosporidium* was associated in all area of the world but was most

Table 1 *Cryptosporidium* and other parasites found in dogs in Hyogo Prefecture, Japan

Dog no.	Region	Dogs* sex	Dogs* weight	Dogs* age	Feces† N or D	No. of oocysts‡	Other parasites detected
1	Tanyu	M	5.0	4	N	2	—
2	Hansin	F	6.0	6	N	1	—
3	Seiban	M	1.5	2	N	6	*T.canis*

* : In order of sex (male or female), kg, and month.
† : N; Normal, D; Diarrhea
‡ : Number of oocysts in 20 fields.

Table 2 *Cryptosporidium* and other parasites found in cats in Hyogo Prefecture, Japan

Cat no.	Region	Cats* sex	weight	age	Feces† N or D	No. of oocysts	Other parasites detected§
1	Toban	M	2.0	6	D	22	—
2	Toban	F	3.0	24	D	1,500	—
3	Toban	F	3.4	36	D	5,200	—
4	Toban	M	4.2	24	N	1	S.e, P.c
5	Toban	F	2.0	12	D	544	T.c, I.f
6	Toban	M	4.2	36	N	4	C.sp
7	Tanyu	M	1.5	8	N	4	I.f, S.e, P.c
8	Hansin	M	3.8	24	N	1	T.c
9	Hansin	F	3.0	24	N	24	T.c
10	Hansin	F	0.5	3	N	1	T.c
11	Hansin	M	0.5	3	N	2,140	T.c
12	Seiban	M	2.8	36	N	1	—
13	Awaji	F	0.9	2	N	74	T.c, I.f
14	Awaji	F	1.1	2	N	79	T.c, I.f
15	Awaji	M	1.2	3	N	110	T.c, I.f
16	Tajima	M	4.8	24	N	2	—
17	Tajima	M	1.2	3	N	18	—
18	Tajima	F	1.2	3	N	108	T.c
19	Tajima	F	1.4	3	N	166	T.c
20	Tajima	M	2.0	12	N	316	T.c

* : In order of sex (male or female), kg, and month.
† : N; Normal, D; Diarrhea
‡ : Number of oocysts in 20 fields.
§ : S.e ; *Spirometra erinacei* P.c ; *Pharyngostomum cordatum*
T.c ; *Toxocara cati* I.f ; *Isospora felis*
C.sp; *Capillaria* sp.

prevalent in the less developed regions. The infection is reported to be more frequent in children than in adults, particularly young children (Fayer and Ungar, 1986). Of 697 children with gastroenteritis 4.7% were positive for *Cryptosporidium*, but only 1.6% in 187 adults (Tzipori *et al.*, 1983).

Nearly 20 separate species have been reported in the genus *Cryptosporidium*, but these species are still under evaluation. Iseki (1986) observed the species with larger oocysts (7—8 × 5—6 μm) in the *Rattus norvegicus* other than those found in this study. This large form of oocyst has been detected in mice, rats, and cattle, but was not observed in dogs and cats in the present study.

In our epidemiological study on dogs and cats in Hyogo Prefecture, the percentage of *Cryptosporidium* infection was 1.4% in dogs and 3.9% in cats. Iseki (1979) detected *Cryptosporidium* oocyst in 5 of 13 domestic cats. We also found the similar prevalence rate of 10 to 40% in our two-year survey among cats that were bred in the Animal Laboratory in our University (data unpublished). It is most likely that the infection is strongly affected by breeding condition of the cat. Concerning the relationship between age and infection, half of the infected cats were adults aged 1 year or more, unlike the results in humans (Tzipori *et al.*, 1983). Diarrhea is considered to be the most prominent symptom in human (Tzipori *et al.*, 1983; Suzuki *et al.*, 1986) and

other domestic animals. In our study, however, no relationship was observed between *Cryptosporidium* infection and diarrhea. Although the number of oocysts detected tended to be larger in cats showing diarrhea, it is unknown whether they had diarrhea because of the severe infection or the infection was severe because of the diarrhea. Koch *et al.* (1983) reported no clinical illness in the infected cat where feces were sometimes foul smelling and soft.

Our previous epidemiological surveys on helminth infection in dogs (Uga *et al.*, 1982) and cats (Uga *et al.*, 1983) have revealed that the fauna of parasites is closely related to surrounding environments of host habitats and that interactive habitat segregation was observed in some parasites. In protozoan *Cryptosporidium*, however, such phenomena were not observed.

As observed above, the epidemiological profiles of dogs and cats with *Cryptosporidium* infection were different from that of humans. Whether this was due to differences in the species of *Cryptosporidium* or differences in host susceptibility must be further studied.

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