NOTE *Parasitology*

Survey of Gastrointestinal Parasitic Infections in Quarantined Dogs in Taiwan

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ABSTRACT. Intestinal helminth and protozoan infection in the quarantined dogs in Taiwan were examined using fecal examination between January to December, 2004. Of the 376 dogs imported from 11 countries, 63 (16.8%) were found to be infected with at least one species of intestinal parasite. The parasites detected were oocysts of *Isospora canis* and eggs of *Toxocara canis*, *Trichuris vulpis* and hookworms. Of the 63 infected dogs, 11 were found to have a mixed infection of two different species of parasites. This paper illustrates that parasites are transmitted from one country to another through the transport of animals. Moreover, there is also a possibility of parasitic infection among quarantined dogs as well as the zoonotic potential for quarantine officers during the quarantine period.
KEY WORDS: gastrointestinal parasites, quarantined dog, Taiwan.

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Taiwan is located in a sub-tropical region and surrounded by sea. It has been declared as a rabies-free country since 1960. Thus, rabies vaccination certificate is required for all dogs and cats being brought into Taiwan. Twenty-one days quarantine period is imposed on dogs from non-rabies-free countries. However, with the exception of rabies, none of the other infectious agents, including parasites, have been made target for surveillance during the quarantine period of imported dogs in Taiwan.

Zoonotic parasitic diseases transmitted by dogs are known to include toxocariasis [1], baylisascariasis [5, 7] and echinococcosis [4]. In most cases, dogs infected with the parasites mentioned above do not always show any clinical signs. However, some of the gastrointestinal parasites usually excrete a large amount of eggs that have infectivity to the other animals and humans. Workers at the quarantine station as well as pet owners are high risk group for exposure to these parasitic infections [7]. In this study, a survey of intestinal parasites in the quarantined dogs by fecal examination was carried out.

Feces of 376 dogs brought into Taiwan from various countries, from January to December, 2004, were examined for intestinal parasitic helminths and protozoa (Table 1). The dogs were aged between 4 months and 2 years old. The samples were examined for the presence of helminth eggs and coccidian oocysts by the following methods; direct smear method, sucrose flotation method using one gram of feces and simple sedimentation method or formalin-ethyl acetate method. Each fecal sample was examined in duplicate. For sucrose flotation method, Sheather's sucrose solution was used. The size of the eggs and oocysts detected were measured using a calibrated ocular micrometer.

Of the 376 fecal samples examined, 63 (16.8%) were positive for eggs or oocysts. The incidence of respective species was 30 (8.0%) for hookworms, 28 (7.5%) for *Isospora canis*, 12 (3.2%) for *Trichuris vulpis* and 4 (1.1%) for *Toxocara canis* (Table 2). Seven dogs had mixed infection of *T. vulpis* and hookworms, 2 with *T. canis* and *T. vulpis*, and one dog with *I. canis* and hookworms, and the other one with *T. canis* and hookworms, respectively (Table 2). Of the dogs examined, 256 (68.1%) were poodle aged between 4 and 12 months, which were imported from Thailand. These poodles were imported by a dog breeder in Taiwan, and *T. canis* eggs were not seen in their fecal examination. However, *T. canis* infection was observed in three dogs from the U.S.A. and one from Argentina. Neither parasite eggs nor oocysts in fecal samples were found in the dogs from Canada (11 dogs), Vietnam (4 dogs), Japan (2 dogs) and Germany (1 dog).

To date, re-emerging parasitic diseases have been reported in developed countries due to the infective agents being brought from endemic area. Such a case has been reported for malaria by Barawan Somali refugees who resettled to the U.S.A. [6]. Echinococcosis has been found to spread to Honshu-island from Hokkaido, Japan, through the transport of a pet dog [4]. This indicates that the monitoring of pet dog to prevent the spread of hydatid disease is very important. From October 2004, new regulations on the infectious diseases of animals were enforced in Japan. The new rule specifically states that veterinarians must report to the health authority (Ministry of Health, Labor and Welfare) on the infection of echinococcosis in dogs because the animal serves as the definitive host of this important zoonotic parasite. It has been suggested that puppies younger than 3 months infected with *T. canis* should be considered as a transmitter of the parasite to other dogs as well as humans [2]. On October 4, 2004, the Bureau of Animal and Plant Health Inspection and Quarantine, Taiwan, announced that dogs and cats imported from Thailand must be examined for highly pathogenic avian influenza (HPAI; H5N1) infection. This led to the requirement of RT-PCR and HI test on their

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Table 1. Number of dogs with single or multiple parasitic infection as related to the exporting countries

Exporting country	No. imported	Parasites								No. of dogs with parasitic infection
		Single infection				Mix infection				
		I. c.	Hk	*T. v.*	*T. c.*	*T. c.* + *T. v.*	*I. c.* + Hk	*T. v.* + Hk	*T. c.* + Hk	
Thailand	256	22	15	1			1	2		41/256(16.0%)
South Korea	26		3	1				4		8/26(30.8%)
U.S.A.	38	2	1		1	1			1	6/38(15.9%)
Hong Kong	6	1								1/6(16.7%)
Canada	13									0
Japan	2									0
Argentina	3			1		1				2/3(66.7%)
Hungary	1	1								1
Philippine	10		2					1		3/10(30.0%)
Germany	4									0
Vietnam	4									0
Unknown	13	1								1/13(7.7%)
Total		27	21	3	1	2	1	7	1	
	376	52 (13.8%)				11 (3.0%)				63/376 (16.8%)

I. c.: *Isospora canis*, Hk: hookworms, *T. v.*: *Trichuris vulpis* and *T. c.*: *Toxocara canis.*

Table 2. Surveillance of parasites in imported dogs to Taiwan by fecal examination

Parasites	No. inf*/No. examined
Parasites:	
Isospora canis	28/376(7.5%)
Hookworms	30/376(8.0%)
Trichuris vulpis	12/376(3.2%)
Toxocara canis	4/376(1.1%)

nasal swab and sera samples collected from the imported dogs and cats from Thailand. As a result, the import of dogs from Thailand to Taiwan virtually came to a halt. All the parasites found in the imported dogs in the present study were of known species in Taiwan. It has been reported that *Ancylostoma caninum* (34%), *Dipylidium caninum* (34%), *T. canis* (15%), *T. vulpis* (1%) and *Isospora* sp. (1%) were detected from the 83 stray dogs examined in Taipei, Taiwan [3]. In our study, the number of fecal samples positive for parasite eggs or oocysts was greatly reduced than that in the former report [3]. This might be due to the dogs being administered with anthelminthic drugs during the pre-exporting period. Thus, we recommend the administration of anthelmintic drugs before dogs are transported from one country to another. The surveillance of parasitic infection of the animals during quarantine period would also important to prevent the parasitic infection among quarantined dogs and the zoonotic potential for quarantine officers.

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