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A Surveillance of Canine Gastrointestinal Parasites in Fecal Samples from Public Areas of Bangkok, Thailand

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Abstract: The potential role of dogs as reservoirs for zoonotic diseases has been recognized as a significant public health concern worldwide. The surveillance and control of canine parasitic zoonoses in Thailand are considered to be low in priority. The aims of this study were to evaluate the prevalence rate of gastrointestinal parasitic infection of the dogs and to identify the parasite ova in the faeces contaminated in the public areas in Bangkok, Thailand (i.e., the playground at schools, parks and temples). A cross-sectional study was designed to determine baseline data in the areas. A total of 316 faeces were collected randomly from 8 districts during January to June, 2006. The common gastrointestinal parasites observed in this study were hookworm, ascarid, dog tapeworm and coccidia. The overall prevalence rate of gastrointestinal parasites in the areas was 75%. The highest prevalence rate was observed at Khlong Toei district (92.8%) and was significantly different from Patumwan, Yan Nawa and Phra Khanong districts ($p<0.05$). Based on this observation, it was suggested that the possible transmission of these parasites to humans should be a concern. The control of these some possible zoonotic disease and control of dogs living in the public areas is still necessary. The readily available and inexpensive laboratory method used in this study might be applicable and more practical tool for screening and monitoring the diseases in the developing countries.

Key words: Dogs, gastrointestinal parasites, thailand

INTRODUCTION

Soil-borne parasitic infections in animals are widely distributed in tropical and subtropical areas. Various parasites, both helminthes and protozoa, can be found in the canine gastrointestinal tract and a number of them are the main enteropathogens of dogs. Some of these parasites are responsible as well for important zoonotic diseases, including toxocariasis, ancylostomiasis, giadiasis, cryptosporidiosis and echinococcosis. Although dogs act as companion animals and have a close relationship to humans, they also present a potential public health risk. Both owned and stray dogs can play a role in parasitic transmission[1]. A lack of veterinary attention and zoonotic awareness may exacerbate the risks of disease transmission. Natural transmission from dogs to human may occur directly or indirectly via faecal and/or soil contamination. Some studies showed that contaminated soil from gardens and public grounds is a risk for considerable parasitic zoonoses[2]. Moreover, faecal contamination can be an important indicator to determine the prevalence and distribution of parasites in different areas[3].

Because canine gastrointestinal parasites have a worldwide distribution, many studies of these parasites have been reported. Up to date, several surveys have been performed around the world to investigate the prevalence of intestinal parasites among dogs in many regions, such as Europe[4], Africa[5], Southern America[1, 6] and Asia[7]. Even though each of these studies provides baseline knowledge on parasitic infections at a local scale, current information on regional prevalence is essential for development and modification of planning control procedures in animal and human public health for each area. Patent infections caused by gastrointestinal protozoan and helminthes can be simply diagnosed by

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identification of oocysts and eggs in faecal samples. However, the burden of disease caused by such the soil-borne parasitic infection remains enormous in Thailand. Of interest, there are a few reports concerning zoonotic potential parasites contaminated in the public area setting. Therefore, the objectives of the present study are to determine the prevalence rate of the canine gastrointestinal parasites and to provide information on the extent of faecal contamination in the public areas of Bangkok, Thailand.

MATERIALS AND METHODS

Study design and sampling method: A cross-sectional survey was used to determine the prevalence of canine gastrointestinal parasitic infection originated from stray dogs in different public areas (i.e., the playground at schools, parks and temples) in Bangkok, Thailand. A survey was carried out in 8 study sites in the public areas of Bangkok distributed in 8 districts during January to June 2006. The faecal samples of dogs were randomly colleted from the public areas within the community. The health of the majority of the dogs is not controlled and they are spontaneously fed by people in the areas. For this reason, dog populations usually inhabit the open spaces of these areas, with their natural flow of births, deaths and the entry of new animals. Samples were collected according to whether they looked fresh or were situated nearby the dog population. The above mentioned characteristics assure us that the faeces samples collected belong to dogs. Samples were put in plastic bags marked according to area, aspect and date of collection and kept at 4°C until processing, which was carried out within 24 h.

Laboratory examination: Faecal samples were microscopically examined for the presence of helminth ova and protozoan cysts and oocysts using the simple floatation procedure using saturated NaCl (specific gravity = 1.2), following the method described by Wade and Gaafar[8] Faecal egg/oocyst counts were performed using McMaster chamber technique. Briefly, 2 g of the samples and 60 mL of the saturated salt solution were mixed together and the two chambers of the McMaster slide (Weber Scientific International Ltd., England) were filled up with the mixture using a Pasteur pipette. Egg counts were started 10 min after loading the slide. The number of Egg/oocyst Production per Gram faeces (EPG) of gastrointestinal parasite was calculated using the McMaster multiplication factor, which in turn depends on faecal sample dilution and the McMaster slide area (volume) examined as follows:

$$EPG = n\,(d/v)$$

Where n is derived from the total number of eggs/ oocysts counted under the area examined, d is the dilution factor and v is the McMaster slide area (volume) examined. The dilution factor used in this study was 15 and McMaster slide area was 0.15 mL.

Data analysis: Faecal sample was recorded as positive if at least one egg, oocyst, cyst or trophozoite was observed in the faecal smear. The overall prevalence rate of dogs was calculated and expressed as a percentage using the following equation;

Prevalence = (number of positive samples/number of sample tested) x 100

The infection status was classified into 3 groups as follows: no infection, single and multiple infections of parasite species. The prevalence rate of each district was compared using Chi-square test. The mean number of egg/ oocyst count in each area was compared by student't-test. All statistical analysis was performed using commercial statistical software (SigmaStat Version 2.0, Jandel Scientific Software Corporation, CA, 1995). Statistical significant was defined as $p<0.05$.

RESULTS

Three hundred and sixteen faecal samples were collected from the public areas in Bangkok. The number of sample in each district; Phra Khanong, Bang Khen, Phaya Thai, Yan Nawa, Din Daeng, Patumwan, Khlong Toei and Ratchathewi was 65, 51, 51, 38, 32, 29, 28 and 22, respectively Table 1. The highest prevalence rate was observed at Khlong Toei District (92.8%) with the mean EPG±SD of 1 543±1 814. The prevalence rate at Khlong Toei District was significantly different from Patumwan, Yan Nawa and Phra Khanong districts ($p<0.05$). The highest average number of EPG (mean±SD) was also observed at Khlong Toei district (1 543±1 814) and was significantly different from Patumwan and Phra Khanong districts ($p<0.05$). The lowest prevalence rate was observed at Patumwan District (58.6%) with the mean EPG±SD of 544±1,088. The overall prevalence of intestinal parasites observed in this study was up to 75.0% indicating a very high level of infection. The common gastrointestinal parasites found were hookworm (*Ancylostoma* sp.), whipworm (*Trichuris vulpis*), ascarid (*Toxocara canis*), dog tapeworm (*Dipylidium caninum*), threadworm (*Strongyloides stercoralis*) and coccidia (*Isospora* sp.). Regarding the

Table 1: Distribution of environmental contamination of canine gastrointestinal parasite ova in each area of Bangkok

Area (District)	No. of samples examined	No. of positive samples	Prevalence rate (%)	No. of eggs or oocysts per g faeces (EPG)*
Bang Khen	51	41	80.4	1 169±1 887
Phaya Thai	51	38	74.5	1 202±1 872
Ratchathewi	22	21	95.5	ND
Din Daeng	32	26	81.2	1 088±1 561
Patumwan	29	17	58.6[a]	544±1 088[c]
Yan Nawa	38	23	60.5[a]	ND
Phra Khanong	65	45	69.2[b]	382±1 184[c]
Khlong Toei	28	26	92.8	1 543±1 814
Total	316	237	75.0	946±1 644

*Data of the pool results are expressed as mean±SD, ND = Not Determined, EPG; Eggs per gram, a) $p<0.01$ compared with the percentage for Khlong Toei District , b) $p<0.05$ compared with the percentage for Khlong Toei District, c) $p<0.01$ compared with the mean for Khlong Toei District

Table 2: Classification of infection status of gastrointestinal parasites based on faecal examination results from eight study areas in Bangkok

Infection Status	No. of positive sample	Percentage
No infection	79	25.00
Single infection	117	37.03
Ancylostoma sp.	63	19.94
Toxocara canis	47	14.87
Trichuris vulpis	6	1.90
D. caninum	1	0.32
Multiple infections	120	37.97
Toxocara canis-Ancylostoma sp.	22	6.96
Toxocara canis- Ancylostoma sp.-*Trichuris vulpis*	20	6.33
Toxocara canis-Trichuris vulpis	10	3.16
To. canis-Ancylostoma sp.-*Tr. vulpis-D. caninum*	4	1.27
Ancylostoma sp.-*Trichuris vulpis*	62	19.62
Ancylostoma sp.-*S. stercoralis*	1	0.32
Ancylostoma sp.-*Isospora* sp.	1	0.32

classification of gastrointestinal parasitic infection in this study, a single infection of *Ancylostoma* sp., *Toxocara canis*, *Trichuris vulpis* and *D. caninum* was detected in 63 (19.94%), 47 (14.87%), 6 (1.90%) and 1 (0.32%) samples, respectively. The data of observed infection status of gastrointestinal parasites and their egg/oocyst counts are shown in Table 2. Interestingly, the results demonstrated that infection with multiple gastrointestinal parasites was commonly observed in these areas, with 199 dogs (63%) being infected with two or more species of the parasites. Co-infections with *Toxocara canis-Ancylostoma* sp., *Toxocara canis-Ancylostoma* sp.-*Trichuris vulpis*, *Toxocara canis-Trichuris vulpis* and *Toxocara canis-Ancylostoma* sp.-*Trichuris vulpis-D. caninum* were observed in 22 (6.96%), 20 (6.33%), 10 (3.16%) and 4 (1.27%) faecal samples, respectively. In addition, multiple infections with *Ancylostoma* sp.-*Trichuris vulpis*, *Ancylostoma* sp.-*S. stercoralis* and *Ancylostoma* sp.-*Isospora* sp. were found in 62 (19.62%), 1 (0.32%) and 1 (0.32%) samples, respectively.

DISCUSSION

Helminthes and protozoa are worldwide prevalent parasitic diseases that affect both humans and domestic animals. A variety of canine gastrointestinal parasites that can be transmitted to humans include ascarid, hookworm, giadia, cryptosporidium and echinococcus. In the developing countries, animal faeces play an important role in soil contamination which is one of the major modes of transmission of parasitic zoonoses. In Thailand, there are many stray dogs living in urban area, especially Bangkok, the capital of Thailand, where picking up dogs' faeces from public places is not a common habit of people in these areas. Several studies of canine gastrointestinal parasites conducted in various cities showed highly variable prevalence of parasites in samples obtained from dogs' faeces and/or soil from public places such as squares, sidewalks and parks, however, the prevalent surveys of intestinal parasites of dogs are rarely in Thailand.

The overall prevalence of intestinal parasites in stray dogs found in this study was very high (75.0%). It showed higher prevalence than reports found in other developed and developing countries such as on shelter dogs, 34.2% in Belgium[9], in Venezuela[6], 52.4% in Argentina[10] and 5.9% in Finland[11]. The stray dogs in Bangkok have a high prevalence of parasitic infections because they have no disease control and management and they are easier to expose to pathogen than owned dogs. Since Thailand is located in tropical area where the climate is appropriate for parasitic viability in the environment, as well as the characteristics of human populations, both have influences on the epidemiology of parasites.

The prevalence of faecal contamination with canine gastrointestinal parasites in each study area was more than 50%. This result showed that dogs in these parts of

Bangkok could be a source of parasitic infection to animals and people. A large number of parasite species found in this survey was six species. In regard to species classification, we found five helminthes (four nematodes and one cestode) and one protozoa (coccidia). The nematodes were presented in more than 90% of the dogs. *Ancylostoma* sp., *Trichuris vulpis*, *Toxocara canis*, *D. caninum* and *S. stercoralis* and *Isospora* sp. were the most common parasites. The most parasitic prevalences in our study were *Ancylostoma* sp. (19.94%), *Ancylostoma* sp. and *Trichuris vulpis* co-infection (19.62%) and *Toxocara canis* (14.87%). *Ancylostoma* sp. and *Toxocara canis* were usually not only found as single infection, but they were also demonstrated as multiple infections with other nematodes, cestode, or coccidia. Because *Ancylostoma* sp., *Toxocara canis* and *Trichuris vulpis* are soil-transmitted parasites and their eggs hatch in the soil with high humidity and warm temperatures, they are more frequently transmitted than other parasites. *Isospora* sp. and *Dipylidium* sp. have been considered the most frequent protozoa and cestode in dogs, respectively[6]. However, both species were found in a small number in this study when compared to nematodes. The giardiasis prevalence evaluated in animals in different parts of the world ranges between 1 and 39% in faecal samples from dogs[12]. Since fleas (*Ctenocephalides canis*) and lice (*Trichodectes canis*), the intermediate hosts for the canine tapeworm, are common in Thailand where temperature and humidity are suitable for their living, *D. caninum* can complete its life cycle and be easily transmitted to dogs.

Among the parasites found in our survey, *Ancylostoma* sp., *Trichuris vulpis*, *Toxocara canis* and *S. stercoralis* are responsible for important zoonoses, but *D. caninum* can be infected in children by ingesting flea larvae or adult lice. The results showed that faecal contamination with these parasites may be an important source of zoonotic transmission to humans and play a role in public health problem of the country[1]. This study will promote the public health measures to minimize or prevent zoonotic infection of canine origin by suggesting regular faecal examination and providing new information for anthelmintic treatments[13]. From our data, the high prevalence of *Ancylostoma* sp., *Toxocara canis* and *Trichuris vulpis* could be seen at very high level among the dog population, so deworming and defaecation are definitely required. Although a low prevalence of *Dipylidium caninum* was found, its infection can perhaps lead to a potential public health risk for infants and children. Thus, anthelmintic treatments accompanied with flea and lice control are also recommended for the preventive measures. In Thailand, the present study is the new and important information concerning about canine parasitic infections, but data is limited only to some urban areas. Therefore, continuing studies should be performed in different urban and suburban regions. In addition, multidisciplinary procedures should be used to obtain more complete information of the actual situation of parasitic infection in this country.

CONCLUSION

This study showed high prevalence of faecal contamination with canine gastrointestinal parasites in the public areas of urban regions of Bangkok, Thailand. The most common nematodes were hookworm and ascarid. A number of investigated zoonotic parasites included *Ancylostoma* sp., *T. canis*, *S. stercoralis* and *D. caninum*. These results serve as baseline information on the environment-public health link and raising awareness of some zoonotic potential parasites and support the preventive and control strategies in the endemic area. We also demonstrate the readily available and inexpensive model of using a conventional laboratory method to determine and identify faecal contamination with the parasite ova. This might be more applicable and more practical tool for screening and monitoring the diseases in the developing countries.

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