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GIARDIASIS IN DOGS AND CATS IN THE BELGRADE AREA

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Giardia infection is an ongoing problem in Serbia, since 8.0% of the children in the Belgrade area are infected. In the light of the zoonotic potential of Giardia infection, a total of 248 companion animals (167 dogs and 81 cats) were examined for giardiasis in the same urban area. The overall rates of infection in dogs and cats were 14.4% (24/167) and 22.2 % (18/81), respectively. Significantly ($p<0.05$, $p<0.01$) higher infection rates were found in stray (18.7%) and farm (36.4%) dogs than in household pets (7.4%). Furthermore, the rate of infection was significantly ($p<0.01$) higher in domestic cats than in household dogs (22.2% vs. 7.4%). The owners and all 16 of their family members of five out of the six household pet dogs excreting Giardia were Giardia-negative, while both the owner of one dog and the only other family member were Giardia-positive. The data demonstrate that potential animal reservoirs (dogs and cats) exist in urban Serbia and underline the possibility of transmission between dog and man in close contact, thus having important implications for the epidemiology of giardiasis in urban areas.

Key words: Giardia, dogs, cats, urban area

INTRODUCTION

Giardia is one of the most common and well-known, yet poorly understood, intestinal parasites of humans and most other mammals. Cases of giardiasis in man are steadily increasing (Kappus *et al.*, 1994; WHO, 1996). With 6.8% of children in urban Serbia found to be infected, and even 8% in Belgrade (Nikolić *et al.*, 1996), *Giardia* is now the leading intestinal parasite of humans in Serbia.

This has led to an increased interest in the study of different aspects of *Giardia* infection, particularly whether or not giardiasis exists as a zoonosis. As *Giardia* has the widest host range and has been frequently found in many species of animal, both wild and domestic, as well as in household pets, it is commonly assumed that human infection can be acquired from other mammalian hosts and vice versa. Several studies suggested that several water-borne epidemics of

giardiasis in the USA were of zoonotic origin (Dykes *et al.*, 1980; Isaac-Renton *et al.*, 1993).

Despite the potential health risk to humans from enteric parasites harboured by pet dogs and cats and increasing evidence that *Giardia* is a zoonosis, the results of only one survey in Serbia have been published (Nikolić *et al.*, 1993). To assess the role of companion animals in the epidemiology of giardiasis in highly endemic urban areas, we performed a study to determine the prevalence of *Giardia* in dogs and cats in the Belgrade area, and to reveal any possible transmission between animals and man in close contact.

MATERIAL AND METHODS

The study involved a total of 167 dogs and 81 cats. Of the 167 dogs, 81 were household pets attending the Belgrade Veterinary School Clinic for a wide variety of reasons, while 75 were stray dogs admitted to the Belgrade City Pound, and 11 were dogs housed at the Military Dog Farm in Belgrade. Over the last decade, due to poor funding, this latter institution has become a very low level facility. All of the 81 cats sampled were pets, kept by 11 households. Agewise, the series included 23 kittens less than three months old and 58 adolescent and adult cats. None of the sampled dogs and cats showed signs of clinical giardiasis (diarrhoea).

A single stool specimen was collected from each of the 248 animals. All samples were examined by direct saline smear, Lugol stained smear and the zinc sulphate concentration technique, primarily for *Giardia* cysts, but also to detect other parasites. When *Giardia* cysts were found in the faeces of pet dogs, the owners as well as their family members were examined for *Giardia* excretion by the same methods. All stools were examined within 48 hours. If there was a delay of more than three hours after collection, the stools were refrigerated.

Data were analysed using the chi-square test (2x2 contingency tables). The level of statistical significance was less than 5%.

RESULTS AND DISCUSSION

Six of the 81 dogs (7.4%) from urban homes, 14 of the 75 dogs (18.6%) from the pound and four of the 11 dogs (36.4%) from the farm were found to be excreting *Giardia* cysts (Table 1), thus amounting to an overall prevalence of infection in dogs of 14.4% (24/167). Of the examined cats, seven of the 23 kittens (30.4%) and 11 of the 58 adolescent and adult cats (19.0%) were found to excrete cysts, so that the overall prevalence of infection in domestic cats was 22.2% (18/81). These results, however, are likely to be an underestimate, since the excretion of *Giardia* cysts is known to be intermittent in animals and a single sample is unlikely to allow detection of all infected dogs and cats (Hiatt *et al.*, 1995). The prevalence rates in dogs and cats reported in this study are similar to the report of 21% of the dogs and 14% of the cats with *Giardia* in a survey in Perth, Western Australia (Swan and Thompson, 1986).

Significantly higher infection rates were found in stray ($\chi^2=4.43$) and farm ($\chi^2=8.39$) dogs than in household pets ($p<0.05$ and $p<0.01$, respectively). These results are in accordance with Swan and Thompson (1986), who also found that stray dogs harboured *Giardia* more often than pet dogs (30% vs. 9%). On the other

Table 1. Prevalence of *Giardia* in dogs (a) and domestic cats (b) in the Belgrade area.

	No. examined	No. infected (%)
a		
household pet dogs	81	6 (7.4)
stray dogs	75	14 (18.7)*
farm dogs	11	4 (36.4)**
Total dogs	167	24 (14.4)
b		
kittens	23	7 (30.4)
adolescent and adult cats	58	11 (19.0)
Total cats	81	18 (22.2)**

Statistical significance (chi square test -χ^2): *p<0.05, **p<0.01 compared to household pet dogs.

hand, infection was more frequent in farm than in stray dogs. While the stray dogs resided together in the pound for only a few days (1-3) before examination, the longer period of close contact among farm dogs sharing living quarters may have accounted for the higher prevalence of infection in these. Similar observations were recorded by Burnie *et al.* (1983). In their study, the prevalence of infection increased from 4% upon admission to the kennels, to 12% when the dogs were sampled seven days later.

Interestingly, infection in cats was significantly (χ^2=7.04, p<0.01) higher compared to household dogs, although they were both pets. All cats in our series came from households with more than one cat (2 - 21), which could have enabled the spread of *Giardia* among animals in contact and therefore, presumably, to humans. Indeed, Bugg *et al.* (1999) found that dogs from multi-dog households were more commonly infected with *Giardia* than dogs in single-dog households. A suggestive, although not statistically significant association, was found between the prevalence of *Giardia* and the age of cats. A higher rate of infection was detected in kittens (30.4%) than in adolescent and adult cats (19.0%) which may be due to the development of acquired immunity with exposure to *Giardia*, or decreased susceptibility with age.

There was no evidence that *Giardia* was associated with the presence or absence of other intestinal parasites, which confirms the observation of Sykes and Fox (1989). While intestinal parasites, including *Trichuris* (80.2%), *Ancylostoma* (40.7%), *Toxocara* (25.6%), and *Taenia* (10.5%), were detected at an overall rate of 91.9% (79/86) in stray and farm dogs, the distribution of these between *Giardia*-positive (16/18, 88.9%) and *Giardia*-negative dogs (63/68, 92.6%) was uniform (χ^2=0.30, p>0.05). Since none of the dogs in our series received anthelminthic treatment, it is not unexpected that helminthic infections were far more frequent (78%) than either protozoan (2%) or combined protozoan-helminthic infections (20%). In contrast, in both pet dogs and pet cats with regular anthelminthic prophylaxis, protozoa, in particular *Giardia*, were virtually the only parasites present.

The owners and all 16 of their family members of five out of the six pet dogs excreting *Giardia* were negative for *Giardia*, while both the owner of one dog and the only other family member were *Giardia*-positive. Notably, both household members had diarrhoea for some weeks before examination. Following metronidazole treatment of both patients and the dog, all clinical signs and symptoms subsided and repeated examinations of three consecutive stool samples were negative for *Giardia* cysts. This evidence strongly points to close contact between companion animals and man as one of the possible modes of *Giardia* transmission.

This study was the first assessment of the infection rates of *Giardia* in stray dogs and domestic cats in one Serbian urban area. A previous study carried out by our group, involving only household pet dogs, demonstrated a lower prevalence of infection (3.8%) in the same area (Nikolić *et al.*, 1993). The finding of a high rate of infection in stray dogs suggests that they may be a source of environmental contamination by *Giardia* cysts for pet dogs, particularly if dogs are susceptible only to the canine strain of *Giardia* (Woo and Paterson, 1986). Moreover, since it has been suggested that humans may be susceptible to both human and canine strains (Faubert, 1988; Monis *et al.*, 1998), people in close contact with pet dogs may be exposed to *Giardia* cysts of canine origin. Thus, stray dogs may also be responsible for further transmission to man. The current investigation has also demonstrated a high rate of infection in domestic cats, suggesting a role for cats in human infection. In summary, the results of this study confirm that potential animal reservoirs exist in urban Serbia.

The genetic heterogeneity of parasites within the *Giardia* morphological group has been widely recognised for over 10 years. Some of the genotypes appear to have a limited host range, whereas others appear to be infective to a wide range of host species. The application of molecular epidemiology will have a major impact on our understanding of the epidemiology of *Giardia* infections in the future (Thompson, 2000). Thus, work focusing on the genetic structure of *Giardia* populations in pets and their owners may provide further evidence for zoonotic transmission.

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ĐARDIJOZA PASA I MAČAKA U BEOGRADU

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SADRŽAJ

Kako nalaz 8% inficirane dece u Beogradu pokazuje da *Giardia* predstavlja važan zdravstveni problem u Srbiji, a postoje indicije da je đardijoza zoonoza, u cilju provere pretpostavki o mogućoj ulozi pasa i mačaka urbanih sredina kao potencijalnih rezervora infekcije ljudi, u studiji je ispitano 248 ovih životinja (167 pasa i 81 mačaka) sa područja grada Beograda. Ustanovljena je prevalenca infekcije od 14,4% (24/167) kod pasa i 22,2% (18/81) kod mačaka. Značajno su češće ($p<0,05$, $p<0,01$) bili inficirani kako psi lutalice (18,6%) i psi sa vojne farme (36,4%), tako i kućne mačke (14,4%), u odnosu na pse kućne ljubimce (7,4%). Kod šest pasa kućnih ljubimaca koji su bili *Giardia*-pozitivni, pet vlasnika i 16 članova njihovih porodica su bili *Giardia*-negativni, dok je u jednim slučaju ustanovljena istovremena infekcija psa, vlasnika i preostalog člana te porodice.

Rezultati ove studije doprinose boljem razumevanju epidemiologije ove patogene protozoe na našim prostorima, dokazujući postojanje značajnih izvora *Giardia* infekcije kod pasa i mačaka u urbanim uslovima, koji zbog bliskih kontakata kućnih ljubimca i ljudi, mogu biti odgovorni za humanu infekciju.