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Prevalence of *Toxocara canis* in Stray Dogs, Northern Iran

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Abstract: *Toxocara canis* is one of the most common parasites living in the intestine of domestic and stray dogs. A dog eliminates thousands of eggs into the environment that are potential etiological factor for human toxocariasis. The present study was undertaken to determine the prevalence of *T. canis* in stray dogs in Mazandaran, Iran. In this cross-sectional study, during the period from April to September 2007, 50 young and adult stray dogs were collected by shooting from urban areas of Sari city, Northern Iran. They were necropsied and the gastrointestinal tract was opened. Recovered parasites were fixed in alcohol and stained in carmine. Faecal specimens were also examined by the formalin ether concentration method. A total of 27 adult and 23 young dogs were examined with 11 adults (40.7%) and 19 youngs (82.6%) being infected with *T. canis* with an overall prevalence of 60%. There were significant differences in the prevalence of infection between adult and young dogs ($p = 0.003$). There were no significant differences in the prevalence of infection between male and female dogs ($p>0.05$). Considering the high prevalence of this zoonotic parasite and its hygienic significance in causing human toxocariasis, particularly in children, plus the lack of control of stray dog populations, there is a need to improve personal and food hygiene as well controlling stray dogs in these urban areas.

Key words: Epidemiology, *Toxocara canis*, stray dogs

INTRODUCTION

Toxocara canis is one of the most common parasites living in the intestine of domestic and stray dogs (Maizels *et al*., 2006). It has been shown that stray dogs in particular may represent a major source of *Toxocara* eggs due to the high numbers of *Toxocara* worms they harbor presumably due to lack of anthelmintic treatment compared to owned dogs. A dog infected with adult worms of *T. canis* eliminates thousands of undeveloped eggs each day into the environment in its feces but are not infective in this first stage and the eggs require a maturation period (Mizgajska-Wiktor and Uga, 2006). Under optimal conditions (25-35°C and 85% humidity), it takes time between 2 and 6 weeks to evolve from egg to larvae L2/L3. The larva can remain viable during a year inside the egg (Alonso, 2001) and it is then infective if ingested. As this is a zoonotic agent, the presence of *Toxocara* sp. eggs in the environment is a risk for definite and paratenic hosts. *Toxocara* eggs have been recovered from salads and other raw vegetables taken from such gardens. Unlikely that infection will result from fresh droppings due to the length of time required for egg maturation. Eggs washed from the soil surface into deeper layers may remain viable for several years (Mizgajska-Wiktor and Uga, 2006). Children are most commonly infected when they eat food contaminated with eggs or put objects contaminated with eggs into their mouths. Human toxocariasis occurs after ingestion of infective eggs of *T. canis* and the subsequent migration of larvae to liver. In some individuals, the immune system is unable to control larval migration at the liver. In these cases, sever disease with involvement of the lungs, muscles, eyes and brain can occur and cause visceral, ocular and common toxocariasis in humans (Magnaval *et al*., 2001; Dubna *et al*., 2007). Many prevalence studies of *T. canis* in dogs worldwide have assessed infections in dogs (Barutzki and Schaper, 2003; Sager *et al*., 2006; Martinez-Moreno *et al*., 2007).

Moreover, studies from Mazandaran province in Iran show that the percentages of *T. canis* infection in dogs range from 2.8 to 35% and in jackal 10-17% (Sadighian, 1970; Mirzayans *et al*., 1972; Dalimi and Mobedi, 1992). Since, there is old information (related to last decade) about intestinal parasites of dogs in Mazandaran and there is not any new information especially about *T. canis*

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in the present decade, so the aim of this study was to determine the prevalence of infection of *T. canis* in stray dogs in this area.

MATERIALS AND METHODS

Study area: Samples were taken in seven different regions of Sari. This city lies the centre of the Mazandaran Province in Northern Iran with a human population around 196,000 and lies between the parallels 35°58' and 36°50' of the Northern latitude and between 52°56' and 53°59' of the Eastern longitude. The mean yearly relative humidity is 85.83% with rainfall occurrence in all seasons of the year and an average temperature of 17°C.

Collection and examination of dogs: During the period from April to September 2007, with permission from appropriate authorities from the Ethics Committee of Mazandaran University of Medical Sciences, 50 young (<6 months) and adult (≥6 months) stray dogs (male, 21; female, 29) under stray dog control programme were collected by shooting from different parts of urban areas of Sari, Mazandaran province, Iran. Immediately they were carried to the Sari Medical School, where they were necropsied and the gastrointestinal tract was opened along its entire length. The mucosa was scraped with a scalpel. To collect worm from the intestine, the epithelial scrapings and the intestinal contents were passed through 60 and 80 mesh wire sieves. The contents of the sieves were washed with tap water and the helminthes were collected. Recovered parasites were fixed in 10% formalin cleared in lactophenol and stained in formalin alcohol azocarmin lactophenol (Sharif *et al*., 2007). Fecal specimens also were examined by the formalin ether concentration method.

Statistical analysis: Statistical tests were performed using the SPSS 15. Chi-square test was performed to assay the prevalence of *T. canis* relative to host age and gender (Casella and Berger, 1990). In all cases, 95% confidence intervals and $p<0.05$, were set for significant.

RESULTS

By coprological method and also by necropsy, a total of 27 adult and 23 young stray dogs from the whole city were examined with 11 adults (40.7%) and 19 youngs (82.6%) being infected with *T. canis* with an overall prevalence of 60% (Table 1). Moreover, two-third of infected dogs were less than 6 months old. With respect to age, there were significant differences in the prevalence of infection between adult and young dogs ($\chi^2 = 9.07$; df = 1; p = 0.003).

Table 1: Prevalence of *T. canis* in stray dogs related to host age and sex, Sari, Iran

Variable (No.)	No. of positive (%)
Age[a]	
Young (23)	19(82.6)
Adult (27)	11(40.7)
Sex[b]	
Male (21)	13(61.9)
Female (29)	17(58.6)

[a]: $\chi^2 = 9.071$; df = 1; p = 0.003, [b]: $\chi^2 = 0.055$; df = 1; p>0.05

Table 2: Prevalence of *T. canis* in stray dogs in different areas of Sari, Iran

Area (No.)	No. of positive (%)
Divkoti (9)	5 (55.6)
Panbeh choleh (5)	3 (60)
Aboksar (5)	1 (20)
Asram (5)	4 (80)
Abandan sar (10)	7 (70)
Moallem kola (7)	5 (71.4)
Zoghal chal (9)	5 (55.6)
Total (50)	30 (60)

$\chi^2 = 5.11$; df = 6; p>0.05

Eight stray dogs (16%) harbored only *T. canis*. Infection with only one species of parasite was more common (28/50; 56%) than infection with multiple parasite species (12/50; 24%). Among these dogs harboring mixed infections *Hookworm* sp. were the species more frequently found. Moreover, it should be noted that seven animals (14%) were infected with two species and three (6%) and two (4%) animals presented infections by three and four species, respectively.

In regard to gender, there was no significant difference in the overall prevalence between males and females (13/21 = 61.9% versus 17/29 = 58.6%; $\chi^2 = 0.055$; df = 1; p>0.05) (Table 1).

The contamination of stray dogs with *T. canis* in different areas of Sari city is shown in Table 2.

DISCUSSION

Understanding the epidemiology of zoonotic parasitic infections is important for minimization of the risk to humans. Zoonoses involving dog parasites are both common and important, with some causing serious disease, first of all, *Toxocara* sp. are capable of infecting and inducing disease (larva migrans syndromes) in human being who accidentally ingest the infective stages (eggs or larvae, respectively).

Since coprological examinations may not detect the immature parasites, which are unable to lay eggs (Yacob *et al*., 2007), in this study we used also postmortem examination.

The present survey confirms that compared with most localities worldwide the prevalence of *T. canis* infection (60%) in stray dogs in Sari City is high, which can be easily explained, as these animals have no health control measures and, because of their habits, they are

exposed to natural infection more than owned dogs. On the other hand, it suggests that in this area climatic conditions are suitable for the spread and survival of the eggs. There are many stray dogs in the various residential areas of Sari city as well as other cities in Iran. This can significantly contribute to the dissemination of viable *Toxocara* eggs into the environment and a mild temperature climate such as that found in Sari appears to enhance the embryonation of *Toxocara* eggs in the soil and their potential transmission to humans. The authors in a study on *T. canis* in schoolchildren in this area found that 25% of them were seropositive (unpublished data). Although, the exact role of these populations in the transmission of parasites to man is not clearly determined (Eguia-Aguilar *et al*., 2005) they may be an important source of infection for humans and constitute a relevant public health problem. *Toxocara canis* prevalence in this study was greater than those found in some parts of Iran which reported by Sadighian (1970) in Shahsavar (34.7%), Mirzayans *et al*. (1972) in Tehran (19.2%), Eslami and Mohebali (1988) in stray and flock dogs in Tehran (33 and 46%), Dalimi and Mobedi (1992) in Norther Iran (2.8%), Fallah (1995) in Hamadan (51.6%), Haamedi (1997) in Bandar Abbas (5%), Hosseini (1997) in Ardastan (11.5%), Maleki (1999) in Tehran (20%), Fakhar *et al*. (2001) in Kerman (4.5%) and Dalimi *et al*. (2006) in Western Iran (6.02%), but was less than that reported by Ashraf Nohegar *et al*. (2005) in Ghazvin (95%). Recent studies in other countries also show lower prevalence than we have found: 33.8% in Nigeria (Sowemimo, 2009), 12.5% in Japan (Yamamoto *et al*., 2009), 12.8% in Northern Greece (Papazahariadou *et al*., 2007), 17.7% in Spain (Martinez-Moreno *et al*., 2007), 6.5% in Czech Republic (Dubna *et al*., 2007), 21% in Ethiopia (Yacob *et al*., 2007), 3.1% in Finland (Pullola *et al*., 2006), 11.6% in Argentina (Fontanarrosa *et al*., 2006), 0.9% in Korea (Kim and Huh, 2005), 33.6% in Italy (Habluetzel *et al*., 2003). In contrast, its prevalence in this area was lower than those reported by Engbaek *et al*. (1984) in Denmark (79%) and by Haralampidis (1977) in Greece (66.7%).

In this study, prevalence of *T. canis* in stray dogs was higher in pups under 6 months of age (young) than adults. The significantly higher frequency of *T. canis* in young dogs as compared to adults is in consistent with previous studies (Oliveira-Sequeira *et al*., 2002; Le Nobel *et al*., 2004; Fontanarrosa *et al*., 2006). The higher frequency of this nematode in younger dogs could be due to the mode of transmission of the parasite and puppies could be infected transplacentally and transmammary in their first few days of life which increase the occurrence of the parasite at an early age, whereas, adult dogs may develop immunity which decrease the establishment as well as the fecundity of the parasite (Urquhart *et al*., 1996), probably as consequence of one or more exposures.

The overall prevalence between males and females was almost alike (61.9% versus 58.6%). Sowemimo (2009) and Habluetzel *et al*. (2003) have reported that there was no definite pattern of infection with regard to gender. In contrast, different prevalences between sexes have also been detected in previous surveys, indicating a potentially increased susceptibility of adult males to patent infection (Oliveira-Sequeira *et al*., 2002; Rubel *et al*., 2003).

Although, overall prevalences in the 7 areas of Sari city did not show significant differences, Asram area showed the highest rate of contamination. Presence of similar frequencies in different parts of Sari was due to these areas were not different climate zones and we divided this city to 7 parts to get samples from different parts of city.

CONCLUSION

Considering the high prevalence of this zoonotic parasite and its hygienic significance in causing human toxocariasis, particularly in children, plus the lack of control of stray cat populations, there is a need to improve personal and food hygiene as well controlling stray dogs in these urban areas.

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