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ORIGINAL ARTICLE

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Prevalence of canine toxocariasis in Bareilly, Uttar Pradesh, India

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Abstract *Toxocara canis* is one of the most common parasitic helminth worm of dogs and also a causative agent of zoonotic disease in humans. This pilot study was conducted to determine the presence of *T. canis* infection in dog population in and around Bareilly, Uttar Pradesh, India. A total of 558 faecal samples both from stray and owned dogs were screened and overall 24.3 % dogs were found positive for *T. canis*. A comparison between owned and stray dogs suggests that the higher prevalence was observed in the latter group. The age of the dogs had a considerable influence on prevalence, with a much higher proportion of younger dogs being infected. Among the stray dogs, the infection rate is much higher (62.79 %) in pups, as compared to 7.8 % in adult. Similarly, of the owned dogs screened 41.74 % pups were infected while the infection rate in adults was only 3.38 %. The higher rate of prevalence of this parasite in dogs could be the source of soil contamination for transmission of Toxocariasis which is of public health importance in this region.

Keywords *Toxocara canis* · Faecal sample · Bareilly · Prevalence

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Introduction

Toxocariasis is a parasitic zoonosis caused by the ascarid of dog, *Toxocara canis*. Dogs are considered to be the constant source of human infection as they live in close contact with humans (Endrias et al. 2010). Moreover, soil contaminated with faeces of street dogs is everlasting continuous source of worm infection in human population (Oge and Oge 2000). Toxocariasis in dogs has worldwide distribution. Its prevalence is 39.5 % in Pakistan (Chatha 2000), 31.5 % in Spain (Ruiz de ybanez et al. 2001), 4.3 % in China (Naoyuki et al. 2004), 17.4 % in Brazil (Guimaraes et al. 2005), 7.7 % in Turkey (Ozkayhan 2006). In India, several surveys revealed prevalence in dogs ranging from 4.95 to The exact geographical location38.13 % (Traub et al. 2002; Subhash and Tanwar 2007; Khante et al. 2009).

In India studies on the prevalence of human toxocariasis shows that the children who were in the habit of eating raw vegetables were more prone to infection (36.48 %) than those who were not of such (20.31 %) and children with the habit of geophagia were more vulnerable to this infection (36.48 %) (Ahmad et al. 2002). Dar et al. (2008) evaluated that water pretreatment was a significant risk factor for the prevalence of toxocariasis infection. Contact or close association with dogs or presence of pet in house was the high risk for *Toxocara* prevalence and was found significant factor for toxocariasis. Prevalence of *Toxocara* infection was more in people using water from streams, rivers, ponds and wells than those using water from public supply in piped water (Dar et al. 2008).

Viable pathogens in dried and pulverized canine faeces can be spread by wind, vehicular traffic and can be a source of infection through unwrapped food (Poglayen 2006). Children, the elderly and immunocompromised people are

at greatest risk in developing countries, which, in conjunction with the lack of veterinary attention and zoonotic awareness, increases the risks of disease transmission (Traub et al. 2005). Understanding the epidemiology of zoonotic parasitic infections is important for the minimization of risk to humans. Therefore, the aim of this study was to determine the *T. canis* infection among stray and owned dogs in Bareilly (U. P.).

Materials and methods

Study area

The investigation was carried out in and around Bareilly District which is located in the state of Uttar Pradesh in the northern part of India. It is situated on the side of the river Ramganga (a tributary of the river Ganges), 243 km west of Lucknow, the capital city of Uttar Pradesh, and 254 km east of Delhi. The exact geographical location of the Bareilly District is between latitude 28° and longitude 78° and 79°47′ east. The climate is hot, humid subtropical, however, the winters are bit cold, with a temperature ranging from 4 to 15 °C and the annual rainfall is around 500–700 mm.

Study population

This city has a sizeable dog-owning population as well as a growing uncontrolled stray dog population. Stray dogs are named after, which are remained stray in the street/locality without any ownership. Unrestricted population of stray and semi-domesticated dogs in close proximity to increasing densities of human population in small cities like Bareilly is a common feature in developing countries like India.

Owned dogs are classified as those which are kept at home either defined/cross bred or non-descriptive. Dogs of all age groups and both sexes were randomly taken from both owned and stray groups in this study. For simplicity, dogs approximately below 6 months of age group were classified as puppies, while adult dogs were certainly above 1 year of age. Dogs attending the clinics and from the households in the localities, their breeds name were also recorded.

This survey is one cross-sectional study done at Bareilly, Uttar Pradesh. The investigation was carried out from September 2010 to June 2011, in which data was collected and screened for prevalence rate of *T. canis* infection in respect of their age, sex, breed or type of the dogs. Data was collected on the dogs' demographic characteristics (age, gender, breed), purpose of keeping dog (pet or security), and history of deworming. 558 fecal samples from 278 stray and 280 owned dogs in Bareilly area were collected.

Data on the prevalence of *T. canis* infection in dogs was obtained through examination of faeces collected from a random sample of cases presented at Polyclinics, IVRI. Breeds of dog kept were not known to most of participating owners and therefore they were classified as non-descript.

Collection of samples

For sampling, glove, sampling container were used. Faecal samples were collected per rectum by spatula/faecal swabs or from roadside/public parks just after their defecation, using simple random sampling method (Chauhan and Agarwal 2006). For laboratory survey these samples, they were transported to parasitology laboratory of Indian Veterinary Research Institute, Izatnagar. For preserving the samples, 10 % formalin was used until examination.

Processing of faecal samples

In the present survey the processing of samples and identification of *T. canis* eggs was performed according to standard technique as described by Zajac et al. 2002 with the use of zinc sulfate solution as floatation fluid. The parasites eggs were identified by microscopy with reference to Soulsby (1982). The result was considered as positive when at least one parasite egg is present.

Results

A total of 558 faecal samples of dogs comprised of 278 stray dogs and 280 owned dogs were screened for the *T. canis* infection, as shown in Table 1; Fig. 1. The overall prevalence revealed, 24.3 % dogs were infected with *T. canis* (136 out of 558 dogs). Stray dogs with a prevalence of 31.29 % and owned dogs had the prevalence of 17.5 %.

Out of 278 stray dogs examined, 87(31.29 %) dogs were positive for *T. canis* eggs. Among the 86 stray pups screened, 54 were found positive for *T. canis* eggs in their faeces with infection rate 62.79 %. On the contrast, only 7.8 % adult dogs were positive (7 out of 89), unknown dog population showed a prevalence of 25.24(26/103) as shown in Table 2; Fig. 2. In the stray pup population infection rate in male and female is 61.22 and 64.86 % respectively. Whereas, in adult stray dogs 5.88 % male dogs (3 out of 51) and 10.52 % female dogs (4 out of 38) were found infected. In the unknown group of faecal samples where the age and sex of the dog could not be determined and randomly collected from the roadsides/side walks, 25.24 % of such samples were detected for the presence of *T. canis* eggs (26 out of 103 unknown samples).

Of the 280 owned dogs screened, 103 samples from pups and 177 samples from adult dogs were examined and the result is summarized in Table 3; Fig. 3. Among the 103 pups screened, 43(41.74 %) were found positive for

Table 1 Prevalence of *T. canis* in total dog population

	No. examined	No. positive	(%) positive
Stray	278	87	31.29
Owned	280	49	17.5
Total	558	136	24.3

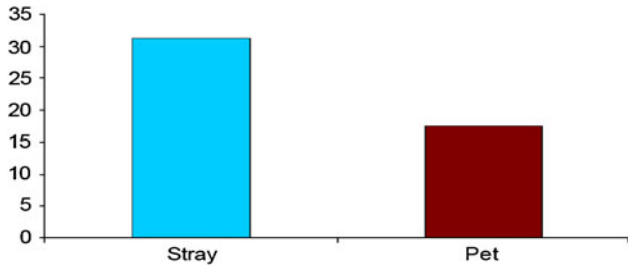

Fig. 1 Overall prevalence of *T. canis* in dogs

Table 2 Prevalence of *T. canis* in stray dogs

	No. examined	No. positive	(%) positive
Pup			
(Male)	49	30	61.22
(Female)	37	24	64.86
(Total)	86	54	62.79
Adult			
(Male)	51	3	5.88
(Female)	38	4	10.52
(Total)	89	7	7.8
Unknown	103	26	25.24
Overall	278	87	31.29

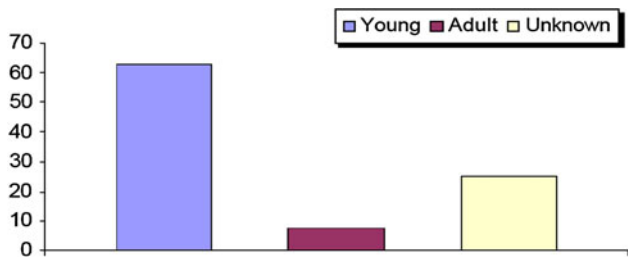

Fig. 2 Prevalence of *T. canis* in stray dogs

T. canis eggs in their faeces. Whereas, out of 177 adult dogs screened, only 6(3.38 %) were found positive for the *T. canis* infection. Among the owned dog population, in the younger dogs, 43.86 % males (25 out of 57) were positive for *T. canis* infection as compared to the 39.13 % in female dogs (18 out of 46). In owned adult dogs female dogs showed higher prevalence than male dogs.

The prevalence of *T. canis* infection in different breeds of dogs in the pet group was studied. Pups in the defined breeds/pedigree dogs were having 35.13 % infection rate (13/37), as compared to non-descripts having 45.45 % infection (30/66). While amongst the adult age groups, the defined breeds/pedigree dogs were having 2.19 % infection rate (2/91) as compared to non-descript with 4.65 % infection rate (4/86) (Table 4).

We also observed mixed infection with eggs of *Ancylostoma caninum* and cestode eggs in addition to *T. canis* eggs. We were more concentrated on the *T. canis* eggs as it is important from the point of view of visceral larvae migrans and as it was part of our research study on the prevalence of *T.canis* eggs only.

Discussion

The findings of the present study are in partial accordance with that of north-eastern India (Traub et al. 2002), Nagpur, India (Khante et al. 2009) and Tabriz, Iran (Garedaghi and Safar 2011). Considering the effect of age on *T. canis* prevalence, it is appropriate to re-examine the comparison of strays and owned dogs. Prevalence rate was found to be very high in younger dogs below 6 months of age in both stray (62.79 %) and owned (41.74 %), (Shukla et al. 2006; Swai et al. 2010). But in older dogs of 1 year of age and above the infection rate are much lesser i.e. 7.8 and 3.38 % in stray and pet dogs, respectively. From the present study, it appeared that age and type of the dog was one of the significant factors in varying prevalence rate of *T. canis.* Higher prevalence in young dogs might be due to prenatal and transmammary transmission of *Toxocara* infection (Hendrix et al. 1996).

In age groups also, stray pups or stray dogs always had higher infection than owned pups/dogs. A comparison between mature pets and strays suggests that the prevalence in the latter group may be higher, which was in accordance with the findings of earlier workers (Samanta and Ghorui 1998). Stray dogs had higher prevalence rate of 31.29 % as compared with owned dogs, where infection rate is only 17.5 % which was in accordance with the finding of Surgan et al. (1980). Obviously stray dogs are associated with free exposure, repeated access to infection, poor health condition, paratenic infection (predatorship/hunting nature, offals). Higher prevalence in stray dogs might be due to their widespread and random distribution, scavenging habit and unrestricted fouling of environment through their excreta causing greater exposure to infection.

No significant difference was found between sex of dogs (61.22 % in male against 64.86 % in female stray pups), in the adult group of stray dogs 5.88 % males were infected against 10.52 % of females infected (Endrias et al. 2010). However, prevalence rate in adult female dogs in both stray and owned group is found slightly higher than male adult

Table 3 Prevalence of *T. canis* in pet dogs

	No. examined	No. positive	(%) positive
Pup			
(Male)	57	25	43.86
(Female)	46	18	39.13
(Total)	103	43	41.74
Adult			
(Male)	102	3	2.94
(Female)	75	3	4.00
(Total)	177	6	3.38
Overall	280	49	17.5

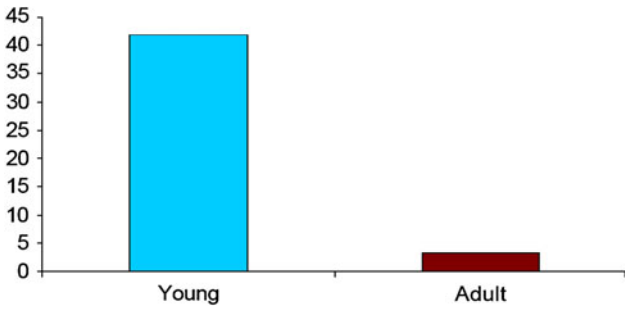

Fig. 3 Prevalence of *T. canis* in pet dogs

Table 4 Prevalence of *T. canis* in defined breeds and non-descriptive breeds among the owned dogs population

Age group	Breed	No. of dogs examined	No. of dogs infected	Infection rate (%)
Pup	Non-descript	66	30	45.45
	Breed	37	13	35.13
Adult	Non-descript	86	4	4.65
	Breed	91	2	2.19

dogs and it can be explained by the stress in altered physiology during gestation period which may decrease the immunity and during this period the dormant larvae in the tissues of the bitch can be reactivated. Although sex did not emerge as a significant factor in this study, females dogs were more infected with helminth parasites than their male counterparts. This may be due to the physiological peculiarities of the female dogs, which usually constitute stress factors thus reducing their immunity to infections (Wakelin 1984).

It was evident from this study that most of owners are not aware of the zoonotic potential of the parasites carried by their dogs, or their mode of transmission to humans. This lack of knowledge seems to be the main reason for the apparent negligence of the owners in deworming their dogs (Katagiri and Oliveira-Sequeira 2008).

The different breeds of dogs examined were found to harbour different levels of *Toxocara* infection that is 35.13 % in pedigree pups and 2.19 % pedigree adult dogs whereas in non-descript dogs the rate was higher i.e. 45.45 % in non descript pups and 4.65 % in non-descript adult dogs. Our data is comparable with the observations of Kutdang et al. (2010), where the infection rate varies from 52.3 % in cross breeds and 91.0 % in Alsatian breeds. Pedigree dogs were found to be slightly less infected with *T. canis* than the non-descript dogs. This may be due to better anthelmintic treatment, nutrition, good management, sanitation/proper disposal of faeces in house-hold pedigree dogs. Although the present study has demonstrated that *T.canis* infection in dogs largely relies on host sex, age, and geographical locations. There are clearly several other mechanisms in the population biology of *T. canis*, i.e. fecundity and intestinal dynamics of repeated infections, which need further evaluations.

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