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Comparative Clinical Epidemiology of Toxocariosis in Dogs and Cats

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Abstract.- Toxocariosis is a parasitic zoonosis and has worldwide distribution affecting dogs and cats. This retrospective study describes the comparative clinical epidemiology of toxocariosis in dogs and cats according to feeding pattern, sex, age and different seasons in and around Lahore. A total of 1874 fecal samples consisting of 1203 dogs (64.19%) and 671 cats (35.80%) were examined through fecal floatation technique. A total of 270 dogs (22.44%) and 198 cats (29.50%) were found positive to *T. canis* and *T. cati*, respectively. The significant incidence of *Toxocara* was recorded in cats (P = 0.0007) as compared to dogs. The study revealed that *Toxocara* incidence is high in uncontrolled fed population (P = 0.0001), more in young puppies (P = 0.000) and kittens (P = 0.014), and sex dependent (P = 0.000) with higher percentage in queens (45.70) and male dogs (49.46). Season wise, a significant difference in both dogs (P = 0.0000) and cats (P = 0. 001) was observed with higher prevalence in summer (32.93%, 40.1%) followed by spring (20.95%, 28%), autumn (23.46%, 23.94%) and winter (15.16%, 21.96%).

Key words: Toxocariosis, zoonosis, floatation technique, *Toxocara* sp.

INTRODUCTION

Toxocariosis is a parasitic zoonosis caused by the ascarids of dog (*Canis familiaris)* and cat *(Felis catus*): *Toxocara canis* and *Toxocara cati,* respectively. Dogs and cats are considered to be the constant source of human infection (Beaver, 1969; Schantz, 1989; Barbabosa-Martinez *et al*., 2003) as both live in close contact with humans. Moreover, soil contaminated with defecation of street dogs and cats is everlasting continuous source of worm infection in human population (Hollan *et al.*, 1991; Oteifa and Moustafa, 1997; Oge and Oge, 2000).

Toxocariosis has worldwide distribution. Its prevalence can vary in different parts of the world depending on climatic zones. Its prevalence is 41.7% in Australia (Boreham and Capon, 1982), 24.4% in Britain (Borg and Woodruff, 1973), 31.5% in Spain (Ruiz de Ybanez *et al*., 2001), 7.7% in Turkey (Ozkayhan, 2006), 30.3% in Egypt (Oteifa and Mustafa, 1997), 12.5% in Mexico (Vazquez *et al.,* 1996), 17.4% in Brazil (Guimaraes *et al*., 2005) and 2.7% in Argentina (Sommerfelt *et al.,* 1992). Among the neighbouring countries of Pakistan, it is found to be 44% in Iran, 6.6% in India (Gunaseelan *et al.*, 1992), and 4.3% in China (Naoyuki *et al*., 2004). Previously reported prevalence of *T. canis* in Lahore, Pakistan is 39.5% (Chatha, 2000).

Human acquires the infection by accidental ingestion of second stage larvae of *Toxocara*. Among all age groups, children are most vulnerable and prone to infection mainly because of their frequent contact with animals (dogs and cats) and contaminated soil (Malloy and Embil, 1978; Barbabosa-Martinez *et al.,* 2003). As humans are not suitable host for this worm, it disperses in different tissues and produces different clinical effects like visceral larvae migrans (VLM), ocular larvae migrans (OLM) (Beaver, 1969; Schantz, 1989; Arango, 1998), and neurological complications like convulsions, epilepsy and eventually leading to death when there is an excess of larvae in the central nervous system (Gould *et al*., 1985; Magnavel *et al*., 1997; Arango, 1998).

In spite of clinical implications of *Toxocara* on human health, there is limited information on comparative clinical epidemiology of *Toxocara* in dogs and cats especially *T. cati*. In this retrospective study, we have described the current status of *Toxocara* and the factors such as age, sex, feeding pattern and season associated with its prevalence in dogs and cats.

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MATERIALS AND METHODS

A total of 1874 fecal samples comprising male and female dogs (n = 741 and n = 462) and cats (n = 278, n = 393) were examined from October, 2007 through September, 2008. These samples were collected from Pet Centre, University of Veterinary and Animal Sciences (UVAS) and other private clinics at Lahore during different seasons of the year. A brief history regarding age, sex, breed, vaccination record, feeding pattern and any previous medication etc. was recorded. Immediately after collection, the samples were processed at the University Diagnostic Laboratory (UDL) using fecal floatation technique described by Soulsby (1982). Nevertheless, in some cases, the individual stool samples were stored in a solution of thiomersal and iodine formaldehyde prepared according to the method of Sapero and Lawless (1953) and maintained at 4°C until examination (maximum 72 h).

Two types of feeding patterns were observed in these animals: controlled (completely fed by their owners) and uncontrolled (partially fed by their owners). Out of these 1874, uncontrolled dog and cat were 14.29% and 54.84%, while controlled were 85.70% and 45.15%, respectively (Table I). The animals were of different ages ranging from two months to four years and were divided into three groups: less than six months, six months to a year and older than one year. In case of season, the year was split into four seasons spring (February, March and April), summer (May, June and July), autumn (August, September and October) and winter (November, December and January). The prevalence of *Toxocara* on the basis of sex, age, and season was analyzed statistically by chi square distribution to test more than two proportions and Z-test through SPSS (Steel *et al.,* 1997). A p value less than 0.05 was considered to be significant.

RESULTS

This retrospective data was reviewed to observe the prevalence of *Toxocara* according to feeding pattern, age, sex, season in dogs and cats in and around Lahore, Pakistan. A total of 1874 (1203 of dogs and 671 of cats) fecal samples were included in the study. The ova were identified under the microscope by their spherical appearance with thin outer shell and slight depression. The prevalence of *Toxocara* was found to be 22.44% in dogs and 29.50% in cats (Table II) showing a significant difference (P = 0.0007) in both species, respectively. As far as sex-wise prevalence is concerned, queens were found more prone to *Toxocara* infection (35.36%) than toms (21.22%). However, the results were opposite in dogs (23.34% male and 20.29% females) (Table II).

The prevalence in uncontrolled fed male dogs and bitches was 49.46% and 39.24% and in controlled fed was 19.59% and 17.23%, whereas in cats, it was 22.44% and 45.70% and 19.84% and 22.09%, respectively (Table III). The incidence of *Toxocara* infection was more in queens (45.70%) and male dogs (49.46%). The prevalence was significant in both sexes of dogs (P = 0.000) and cats (P = 0.000). However, it was significant in uncontrolled dogs and cats (P = 0.0001) but not in controlled (P = 0.3512). The younger age of less than six month in both dogs (P = 0.000) and cats (P = 0.014) were found more prone to *Toxocara* infection as compared to other age groups (Table IV).

Table I.- Distribution of samples according to sex and feeding pattern of animals.

Sex	Dog			Cat		
	Uncontrolled	Controlled	Total	Uncontrolled	Controlled	Total
Male	93	648	741	147	131	278
Female	79	383	462	221	172	393
Total	172	1031	1203	368	303	671

Table II.- Sex wise prevalence of *Toxocara* in dogs and cats.

Species	Sex	No. of feces examined	Infected with Toxocara	%
Dog	Male	741	173	23.34
	Female	462	97	20.99
	Total	**1203**	**270**	**22.44**
Cat	Male	278	59	21.22
	Female	393	139	35.36
	Total	**671**	**198**	**29.50**

Table III.- Prevalence of *Toxocara* on the basis of feeding pattern.

Species	Sex	Self fed	Infected (%)	Owner fed	Infected (%)
Dog	Male	93	46 (49.46)	648	127 (19.59)
	Female	79	31 (39.24)	383	66 (17.23)
	Total	**172**	**97 (56.39)**	**1031**	**193 (18.71)**
Cat	Male	147	33 (22.44)	131	26 (19.84)
	Female	221	101 (45.70)	172	38 (22.09)
	Total	**368**	**134 (36.41)**	**303**	**64 (21.12)**

Table IV.- Age wise prevalence of *Toxocara* infection.

Species	Age	No. of samples examined	Infected with Toxocara	%
Dog	Less than 6months	431	133	30.85
	6 months to one year	378	86	22.75
	Over one year	394	51	12.94
	Total	**1203**	**270**	**22.44**
Cat	Less than 6months	263	92	34.98
	6 months to one year	192	43	22.39
	Over one year	216	63	29.16
	Total	**671**	**198**	**29.50**

The meteorological data of each month was taken from regional meteorological centre, Lahore. The average temperature, humidity and rainfall during spring, summer, autumn and winter season was 21.74°C, 50.60%, and 0.478 mm; 31.39°C, 56.88%, and 2.41mm; 28.05°C, 63.72% and 3.33 mm; 15.56°C, 64.05%, and 0.42 mm (Fig. 1). The prevalence was found to be higher in summer season in both dog (32.93%) and cats (40.1%) followed by spring, autumn and winter (Fig. 2). Season wise, the prevalence was significant within both dogs (P = 0.000) and cats (P = 0.001) with more prevalence in summer compared to other seasons in the country.

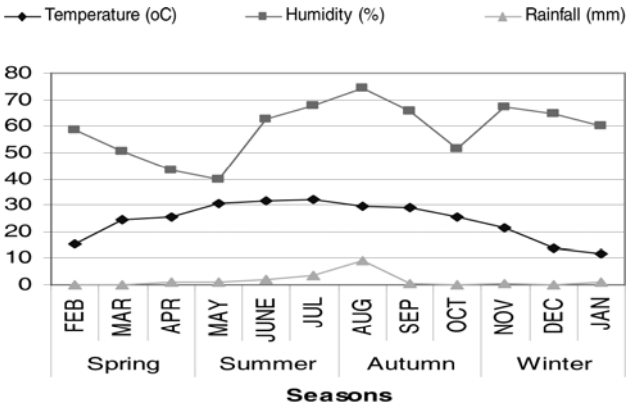

Fig. 1. Average temperature, humidity and rainfall during the whole study period.

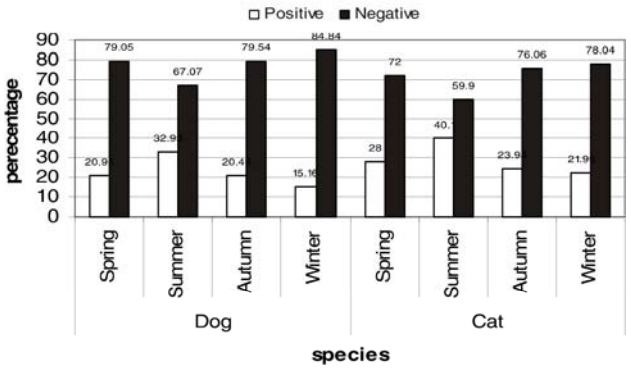

Fig. 2. Season wise prevalence of *Toxocara* spp. in dogs and cats.

DISCUSSION

Little attention has been paid to toxocariosis, especially feline toxocariosis, and its effect on

human health, despite an increase in population of humans and pets in Lahore. The city lies in 31°32′58″ northern and 74°20′36″ eastern latitude with 210 m altitude above sea level and has tropical climate. The average annual temperature, humidity and rainfall are 24.18°C, 55.49% and 1.657 mm. It has over 10 million human population along with 0.3 million dogs and 0.25 million cats. The trend of keeping dogs and cats as pet animal is increasing day by day. In addition, there is a lack of pet registration policy and animal health awareness on the part of pet owners. This may help perpetuate toxocariosis and other infectious diseases of zoonotic importance in dogs and cats.

The results showed significantly (P = 0.0007) higher prevalence in cats (29.50%) compared to dogs (22.44%). This high rate of *Toxocara* infection in cats may be due to the fact that they always tend to defecate in the same feeding place shedding *Toxocara* eggs and when they clean themselves after defecation, they contaminate themselves by swallowing embryonated eggs (Barbabosa-Martinez *et al*., 2003). Likewise, cats like to eat rodents and invertebrates carrying second stage larvae (Soulsby, 1982) are a source of infection but in controlled fed cats, the chances of getting infection may be fewer. On the basis of feeding pattern, the prevalence was more in uncontrolled dogs (56.39%) and cats (36.41%) as compared to controlled dogs (18.71%) and cats (21.12%). The contributing factor may again be predation on paratenic host (rodents) (Soulsby, 1982). Furthermore, Sprent (1956) reported that parasite is well adapted in felidae due to predation on small ruminants, rodents and invertebrates.

The infectivity percentage was higher in puppies (30.85%) and kittens (34.98%) aging less than six month as compared to other age groups (Table IV). It was significant in both dogs (P = 0.000) and cats (P = 0.014). These results are different than those of Barbabosa-Martinez *et al* (2003) who observed no significant difference regarding age. At the same time, there are several studies revealing more frequent infection in younger cats (Schantz, 1989). Furthermore, in another study, Barbabosa *et al* (1998) has reported that incidence of *T. canis* is less frequent in older dogs. Higher incidence at younger age may be due to transmammary route which is a major source of infection in both pups (Stone and Girardeu, 1967) and kittens (Swerczeh *et al*., 1971). Douglas and Baker (1959) have reported that infected bitches may be capable of transmitting infection to puppies for up to 385 days. Moreover, occurrence of eggs in feces shortly after parturition due to weakening of immunity (Douglas and Baker 1959) and the habit of eating the feces of young ones (Sprent, 1961) may be the factor for persistence infection in pups, kittens and their respective mothers. This may be one of the contributing factors for the increased incidence in queens (35.36%).

A significant difference in prevalence was observed in both dogs (P = 0.000) and cats (P = 0.001) with high percentage in summer (32.93% and 40.1%) followed by spring, autumn and winter. These findings correlate with the observations of Emehelu and Fakae (1986) who reported a significant difference in prevalence of *Toxocara* in tropical countries during the different seasons of the year. There have been significant differences in the presence of infective ova in moist and dry classified samples (O'Lorcain, 1994). Likewise, Oteifa and Moustafa (1997) have reported that season does influence the presence of eggs, but variation occurs in the amount of viable eggs. The *Toxocara* infection remained prevalent throughout the year. The reason may be the optimum temperature (24.18°C) and humidity (55.49%) necessary to maintain the infection in the environment. Glickman and Schantz (1981) revealed that high humidity and temperature ranging from 15°C – 35°C favours the development of *Toxocara* infection.

The results confirmed the low prevalence of *Toxocara* spp. in dogs and cats as compared to previously reported 39.50% by Chatha (2000) in Lahore. The decreased prevalence may be due to owner awareness regarding pet health, regular deworming and vaccination schedule. The emphasis should be focused to safeguard the pets from *Toxocara* implications. Moreover, seroepidemiological studies against *Toxocara* in humans need to be undertaken to determine the public health significance.

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