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Gastrointestinal parasites of stray cats in Kashan, Iran

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Abstract. Considering the role of parasites in contamination of human beings and domestic animals and lack of information in the region, the present study was performed to investigate the infection status of helminthes and protozoa of stray cats in central Iran. A cross – sectional study was conducted on 113 stray cats trapped from different geographic regions of Kashan during four seasons and were necropsied. Different organs including: kidney, heart, liver, lungs, gastrointestinal tract and abdominal cavity were inspected for helminthes and protozoa infection. Animal's characters including: genus, weight, and season, location, microscopic and macroscopic findings were recorded in a special form. Data were classified and statistically analyzed with a confidence interval of 95%. Chi- Squire Test was used to show the relationship between different factors and parasitic infection. From a total 113 stray cats examined, 67(59.3%) were male and 46(40.7%) were female. Fifteen species of endoparasite including helminthes and protozoa were detected in intestine and fecal sample of the examined cats. There were six protozoa, five cestodes and four nematodes. All endoparasite were localized in the gastrointestinal tract. Overall 108 cats (95.6%) have been infected with at least one of the endoparasites. Prevalences of parasites found were Nematodea: *Toxocara cati* 13.3%, *Physaloptera preputialis* 39.8%, *Rictularia* 52.2% and *Uncinaria stenocephala* 1.8%; Cestodea: *Mesocestoides lineatus* 7.1%, *Taenia taeniaformis* 15%, *Diplopylidium nolleri* 64.6%, *Dipylidium caninum* 68.1% and *Joyeuxiella echinorhyncoides* 85%; Sporozoea: *Isospora rivolta* 5.3%, *Isospora felis* 5.3%, *Sarcocystis* spp 8%, *Blastocystis* spp 16.8% and Zoomastigophorea: *Giardia felis* 0.9% and *Trichomonas* spp 1.8%. Contamination rate for zoonotic parasites of cat was greater than expected in Kashan region. In this respect, appropriate control measures should be taken and it is recommended to determine the most appropriate preventive methods.

INTRODUCTION

Recently, concerns about the public health dangers of stray cats have increased considerably, and while many potentially zoonotic organisms are associated with cats; enteric pathogens are of particular concern (Hill *et al.*, 2000; McGlade *et al.*, 2003). Stray cats are known to be frequently infected with a host of parasite species. Some cat parasites can infect humans, and can function as the causative agent of zoonosis. In relation to immunocompromised humans, although the origin of zoontic infections is usually unknown, parasites such as *Cryptosporidium*, *Toxoplasma gondii* which can also parasitize cats (Sargent *et al.*, 1998; Spain *et al.*, 2001) have the ability to cause life-threatening infections in these individuals (Crowe, 1992).

In Iran, cats are often reared at homes as a pet and or/ exploited as a predator of rats. However, many of them become stray cats as the result of changes in housing patterns. Theses cats live freely in urban and rural areas, and tend to discharge helminthes eggs, larvae and protozoan cysts into the general environment (Jamshidi *et al.*, 2002; Bahadori *et al.*, 2004; Sharif *et al.*, 2007). Accordingly, stray cats are important as the potential reservoir hosts of a variety of parasites in medical and veterinary point of view (Woon -Mork *et al.*, 2005). There have been few detailed and comprehensive

studies of the prevalence of gastrointestinal parasites in stray cats carried out and there is little information on the level of parasitic infection in stray cats with various helminthes and protozoa. Most surveys of feline gastrointestinal parasites conducted in the past have been limited to feral cats (Okaeme, 1986; Milstein & Goldsmid, 1997; McGlade *et al.*, 2003; Pullola *et al.*, 2006) and have been carried out in order to identify the significance of feral cats as potential reservoirs of infection (Calvete *et al.*, 1997). While previous studies on the prevalence of gastrointestinal parasites in feral cats have yielded important results (Milstein & Goldsmid, 1997), it cannot be assumed these results are indicative of the situation in domestic cats. However, as the potential for zoonotic transmission of gastrointestinal parasites (Schantz, 1994; Overgaauw, 1997) and the human health risks associated with cat ownership (Angulo *et al.*, 1994; Schantz, 1994) are now being realized, it is important that these studies are also conducted on domestic cats in urban areas in order to determine the potential reservoir of infection for humans. Domestic cats are inhabitants near human in rural and urban areas of the world. In Iran, they often live freely out and in human houses. In additional to their natural food, cats feed on garbage discarded around the houses at night, this is important because they discharge some helminthes eggs and protozoan cysts in the environment, that are transmittable to human(Sharif *et al.*, 2007). Due to the close association of cats with human and the fact that children play outdoors on the soil, cats can be an important potential source of transmission of zoonotic parasites such as *Toxoplama* and *Toxocara*. *Toxocara cati* is a common gastrointestinal nematode in cats worldwide, which not only infects young kittens but can also cause human toxocariasis (Dubinsky, 1999). This worm is mostly prevalent throughout tropical, subtropical and temperate regions (Mizgajska-Wiktor & Uga, 2006), where visceral larva migrans is one of the most important parasitic disease of man transmitted by carnivores in Iran (Dalimi & Mobedi,1992). The importance of controlling feline parasites is not only to relieve clinical symptoms in infected cats, but also to minimize the zoonotic potential of larval parasitic infection in human. Since cats constitute a potential source of infection in human (Markel *et al.*, 2006), the aim of the present study is to determine the prevalence and intensity of infection of gastrointestinal parasites in stray cats in rural and urban areas of Kashan, center Iran. Feline gastrointestinal parasite has not been studied in Kashan area despite the growth in the cat population in recent years.

MATERIALS AND METHODS

Study Area

Kashan lies in center of Iran with a human population around 300000, most of them living in urban areas. This area is located at 51° 27' East Longitude and 33° 59 'Latitude with various climate. The mean yearly relative humidity is 15% with rainfall occurrence in winter and an average temperature of 25. This study was carried out in a total area of nearly 2100 km2 in central of Iran.

Collection and examination of animals

This study was performed based on cross – sectional design. One hundred and thirteen stray cats were trapped and collected from different residential areas of Kashan between November 2004 and December 2005 with permission from appropriate authorities from the Iranian Environmental Health Organization and also approved by animal ethics committee of Kashan Medical University. Trapping using baited cage-traps with tinned fish was undertaken in fifteen urban and rural areas of approximately equal distance from each other in the north, south, east, west and in the centre of Kashan.

Based on dental development, maturation of genital structure and body size, the samples were divided into adult (1.5 – 6 kg) and juvenile (<1.4kg) age groups. Animals were anaesthetized by intra muscular injection of high doses of anesthetic drug (Ketamine 10%) and then killed by chloroform. Prior to autopsy, the gender and weight of each cat, also season

and location were recorded in questionnaire. Their carcasses were autopsied not later than 1 hour after killing and examined for the presence of protozoa and helminthes.

After post-mortem examination, the abdominal cavity was opened and the internal organs including stomach, intestine, kidney, liver, heart and lungs were removed.

The small intestine, was opened longitudinally with a pair of scissors in 0.85% saline and washed with the same solution until the supernatant had cleared.

The mucous was scraped between the blades of a forceps and the contents with epithelial scrapings passed and washed with tap water on a 40- and 60- mesh per inch brass sieves. The filtrate retained in the sieve was washed into a glass container and examined carefully for helminthes parasites.

The contents of the gastrointestinal tract were then carefully assessed with the naked eyes as well as under a stereomicroscope.

All helminthes recovered, including nematodes were fixed in 10% formalin cleared in lactophenol and stained with acetocarmine and measured using a micrometer. Male and female worms were identified according to Yamaguti (1961).

Feline fresh fecal samples were examined for cyst and trophozoite of protozoa, egg and larva of helminthes by direct and formalin-ether sedimentation technique followed by microscopy. The form of the feces (formed, semi-formed, diarrhoea) was recorded at the time of collection, and subsequently correlated with parasite status.

In order to determine the status of *Trichinella* larval infections, we minced diaphragm tissues with a mortar and pestle, the material digested, cleared and examined via stereomicroscopy.

Statistical analysis

The prevalence and confidence intervals (C.I) were calculated for each parasite. Associations between parasitism and host characterizes were initially made using the Chi-square test and their 95% confidence intervals. Associations between host factors (age, gender, and weight), season and parasitism was evaluated for all 113 cats. Data was analyzed and statistical comparisons were performed using SPSS 13.0.

RESULTS

Of the hundred and thirteen stray cats included in the investigation, 67(59.3%) were male and 46(40.7) were female. Fifteen species of endoparasite including helminthes and protozoa were detected in visceral and fecal sample of the examined cats. There were six protozoa, five cestodes and four nematodes. All endoparasite were localized in the gastrointestinal tract. Overall 110 cats (97.3%) have been infected with parasites (Table 1).

Prevalence of parasites were: Class Nematodea: *Toxocara cati* 13.3%, *Physaloptera preputialis* 39.8%, *Rictularia* sp. 52.2% and *Uncinaria stenocephala* 1.8%. Class Cestodea: *Mesocestoides lineatus* 7.1%, *Taenia taeniaformis* 15%, *Diplopylidium nolleri* 64.6%, *Dipylidium caninum* 68.1% and *Joyeuxiella echinorhyncoides* 85%; Class Sporozoea: *Isospora rivolta* 5.3%, *Isospora felis* 5.3%, *Sarcocystis* spp 8%, *Blastocystis* spp 16.8%; Class Zoomastigophorea: *Giardia felis* 0.9% and *Trichomonas* spp 1.8% (Table 2, 3). Infection with polyparasitism of gastrointestinal parasite in stray cats is shown in Table 4.

Table 1. Prevalence of gastrointestinal parasite in stray cats in Kashan-Iran

Parasite	Infected animal No (%)	Rang of confidence interval 95%	Adult infected animal	Juvenile infected animal
Nematodes	82 (72.6%)	64.4–80.8	71 (86.6%)	11 (13.4%)
Cestodes	102 (90.3%)	84.9–95.7	91 (89.2%)	11 (10.8%)
Protozoa	36 (31.9%)	23.3–40.5	31 (86.1%)	5 (13.9%)

Table 2. Prevalence and intensity of gastrointestinal helminthes in stray cats in Kashan-Iran according to sex

Helminthes	Male infected animal (NO) %	Female infected animal (NO) %	Total (NO) %	Intensity of infection	
				Mean±Sd	No Worm
Cestodes					
Joyeuxiella echinorhyncoides	56 (58.3)	40 (41.7)	96 (85)	50.4 ± 11.6	5961
Dipylidium caninum	44 (57.1)	33 (42.9)	77 (68.1)	16.9 ± 2.6	1910
Diplopylidium nolleri	40 (54.8)	33 (45.2)	73 (64.6)	20.4 ± 2.8	2301
Taenia taeniaformis	10 (58.8)	7 (41.2)	17 (15)	0.35 ± 0.12	39
Mesocestoides lineatus	5 (62.5)	3 (37.5)	8 (7.1)	0.13 ± 0.2	17
Nemathods					
Rictularia	34 (57.6)	25 (42.4)	59 (52.2)	4.5 ± 0.7	508
Physaloptera preputialis	24 (53.3)	21 (46.7)	45 (39.8)	3.3 ± 0.7	367
Toxocara cati	10 (66.7)	5 (33.3)	15 (13.3)	0.25 ± 0.2	28
Uncinaria stenocephala	1 (50)	1 (50)	2 (1.8)	–	5

Table 3. Prevalence of gastrointestinal protozoa in stray cats in Kashan-Iran according to sex

Protozoa	Male infectd animal (NO) %	Female infected animal (NO) %	Total (NO) %	Mean ± Sd
Blastocystis spp.	11 (57.9)	8 (42.1)	19 (16.8)	16.8 ± 6.9
Sarcocystis spp.	5 (55.5)	4 (44.5)	9 (8)	8 ± 5
Isospora felis	3 (50)	3 (50)	6 (5.3)	5.3 ± 1.4
Isospora revolta	3 (50)	3 (50)	6 (5.3)	5.3 ± 1.4
Trichomonas felis	1 (50)	1 (50)	2 (1.8)	1.8 ± 2.4
Giardia felis	1 (50)	1 (50)	1 (0.9)	0.9 ± 1.7

Table 4. Polyparasitism of gastrointestinal parasite in stray cats in Kashan-Iran

Burden	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Non-infected
No	12	8	10	24	21	18	4	2	1	3
Percent	10.6	7.1	8.8	21.2	18.6	15.9	12.4	1.8	0.9	2.7

Parasitic burden was variable between 1 to 9 parasite and three cat were free of parasitic infection (Table 4).

DISCUSSION

The present study confirms that compared with most localities worldwide the prevalence of gastrointestinal helminthes and protozoan parasites with the exception of *Giardia* and *Trichomonas* in stray cats in Kashan area is high. The high prevalence of intestinal parasites in stray cats in Kashan (97.3%) indicates that the meteorological and conditions are suitable for the spread and survival of the cyst of protozoa. Similar prevalence of helminthic infection of gastrointestinal tract of 98.5% have been recorded in Urban areas in Isfahan, Iran by Jamshidi *et al.* (2002) and 29% in Tehran, Iran by Bahadori *et al.* (2004). The findings confirm a trend in Iran of a increase in the prevalence of helminthes parasites in cats, particularly cestodes and nematodes. It is evident that enteric protozoan parasites are now the dominant parasites affecting domestic cats in Kashan, with prevalence considerably higher than in previous studies.

The most likely reason for the increased prevalence of gastrointestinal helminthes is the poor hygiene and lack of anthelmintics drug used. Enteric protozoa are unaffected by the anthelmintics in common use and it is possible that intestinal protozoa are now occupying the niche vacated by helminthes parasites such as *T. cati*.

Infection of cats with gastrointestinal parasites can occur either through ingestion of infective form or from feeding on rodents containing larvae and cysts in their tissues. Cats usually defecate at night in sandy soils and bury the faeces. Such a habit is favourable for *Toxocara* eggs as it protects them from desiccation. Additionally, some helminthes such as *Toxocara* eggs are resistant to low temperatures and high humidity but desiccation and direct sunlight will decrease infectivity. It is likely that infection can occur at any age, either by ingestion of eggs or tissues containing larvae, although the highest prevalence of infection occurs in kittens and young cats (Sharif *et al.*, 2007). It is suggested that high prevalence of intestinal nematodes in kittens as due to the transmammary route of infection. OLorcain (1994) showed that intra-uterine infection seldom occurs and that *T. cati* infection mostly results from the ingestion of infective eggs, earthworms, cockroaches and/or rodents containing larvae in their tissues. The present study confirms the findings of Jamshidi *et al.* (2002) and Bahadori *et al.* (2004) who reported no difference in the intensity of infection in male and female cats. Sex seemed to have no effect on prevalence of parasitism, and the only effect of neutering was on the occurrence of ascarid infection. The age of the cat was found to be an important risk factor associated with parasitic infection, with cats less than 6 months old being more likely to be parasitized than older cats. These findings are similar to those obtained in previous studies (Visco *et al.*, 1978; Wilson-Hanson & Prescott, 1982; Shaw *et al.*, 1983; Swan & Thompson, 1986; Nolan & Smith, 1995; Hill *et al.*, 2000; Spain *et al.*, 2001). It is probable that infection can occur at any age, either by eggs or tissue containing the larvae, although the highest incidence of infection occurs in kittens and young cats. Sadjjadi *et al.* (2001) in Shiraz, Iran, reported a higher prevalence of *T. cati* in younger cats compared to older animals, but the difference was not significant. However, there are many stray cats in the various residential areas of Kashan city as well as other cities in Iran where the cat population rapidly increasing in these urban sites. This can significantly contribute to the dissemination of viable helminthes eggs into the environment, and a mild, temperate climate appears to enhance the embryonation of helminthes eggs in the soil and their potential transmission to humans.

In this study, prevalence of *Giardia duodenalis* was low, but in a similar study was most prevalent enteric parasite detected in domestic cats (McGlade *et al.*, 2003). The high prevalence of *Giardia* detected by PCR is surprising which has been discussed

previously (McGlade *et al.*, 2003). Traditional methods, such as microscopy, are commonly used by diagnostic facilities for identifying parasite stages in a faecal sample. However, parasites such as *Giardia* can be difficult to detect using conventional microscopy, as was demonstrated in this study. When only one fecal sample is collected, prepatent infections in cats as well as intermittent shedding of parasite stages may lead to the underestimation of the prevalence of parasitic infections (Sherding, 1983). Similarly, a low level of infection may go undetected when using traditional microscopy methods (McGlade *et al.*, 2003).

It is possible that protozoa may not have been detected or were under-diagnosed in earlier studies because the diagnostic techniques used were not sensitive enough to detect low levels of protozoa. This has been shown in previous studies (Collins *et al.*, 1987) as well as in the current study. In a veterinary practice, the importance of PCR must be considered in terms of the practicality and cost effectiveness of using such a technique for routine diagnosis.

Stray cats in all urban and rural areas of Kashan were infected by various gastrointestinal parasites. There was no significant difference in infection rate between male and female animals. However, with regard to age, it seems that older animals are more prone to acquire the infection. It is clear that the worldwide distribution of stray cats would have an impact on sanitation and it is necessary that public health authorities and veterinarians in crowed centres pay more attention to this phenomenon, and that the general public is informed of the hazards and zoonotic aspects of parasites, especially as female worms can lay many eggs per day.

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