

## A survey study on gastrointestinal parasites of stray cats in Azarshahr, (East Azerbaijan province, Iran)

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**Abstract** Gastrointestinal parasites are among the most common parasitic infections found in stray cats, which might act potential helminthic parasites to domestic cats. The objective of this study was to determine the prevalence of gastrointestinal parasites in stray cats in the city of Azarshahr, which is located in East Azerbaijan province, Iran. A cross-sectional study was conducted on 50 necropsied stray cats, trapped and collected from different geographic regions of Azarshahr. From a total 50 stray cats examined, 15 (30 %) were female and 35 (70 %) were male. Overall 47 cats (94 %) were identified as infected with at least one of the endoparasites. The prevalence of parasites found were: *Taenia taeniaeformis* (60 %), *Dipylidium caninum* (58 %), *Taenia hydatigera* (24 %), *Mesocostoides lineatus* (78 %), *Ancylostoma tubaeforme* (14 %), *Toxascaris leonina* (30 %), *Toxocara cati* (78 %), *Physaloptera praeputialis* (10 %), and *Syphacia obvelata* (10 %). Contamination rate for zoonotic parasites of cat was greater than expected in AzarShahr region. Therefore, appropriate control measures should be taken and preventive methods should be applied.

**Keywords** Gastrointestinal · Parasite · Stray cat · AzarShahr

### Introduction

Stray cats play a main role in the epidemiology of gastrointestinal helminthic parasites. In as much as they, harbor a wide variety of parasites which can be detrimental to their and human health (Calvete et al. 1998; Hille et al. 2014; Krecek et al. 2010; Ramos et al. 2013; Scorza et al. 2011; Silaghi et al. 2014), and also represent potential reservoirs of helminthic parasites to domestic cats and human, especially in urban areas (Hille et al. 2014; Polak et al. 2014; Youssef and Uga 2014). Besides, due to their contact with both domestic cats and humans, stray cat may play an important role in the transmission of several pathogenic agents; such as *Toxoplasma gondii* (Can et al. 2014; Lappin 2010; Vilares et al. 2014) and *Cryptosporidium* (Bush et al. 2011; Scorza et al. 2011; Spada et al. 2013; Spain et al. 2001) that have the ability to cause life-threatening infections in individuals (Davoust et al. 2014; Johnson et al. 2013), or *Leishmania infantum* (Chatzis et al. 2014; Hatam et al. 2010; Pennisi et al. 2013; Richter et al. 2014) and *Toxocara* spp. which have been associated with two main clinical syndromes in humans (ocular larva migrans and visceral larva migrans) (Bowman et al. 2010; Fisher 2003; Petithory 2007; Prokopowicz and Sosnowska 1990; Rubinsky-Elefant et al. 2010). Various factors likes influence on the parasitic burden in stray cats; geographical region, season of the year, administration of antiparasitic treatment and factors related to population parameters (age, sex, breed) (Mircean et al. 2010). Previous studies have usually recorded a high prevalence of parasites in stray and feral cats (Adams et al. 2008; Becker

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et al. 2012; Calvete et al. 1998; Canto et al. 2013; Capari et al. 2013; Coman 1972; Duarte et al. 2010; Engbaek et al. 1984; Jittapalpong et al. 2007; Khalafalla 2011; Krecek et al. 2010; Labarthe et al. 2004; Lefkaditis et al. 2014; Millan and Casanova 2009; Ramos et al. 2013; Riggio et al. 2013; Stoichev et al. 1982). In Iran, little is known about the prevalence of gastrointestinal parasites in stray cats. Thus, the main aim the present investigation was to determine the prevalence of gastrointestinal helminthic parasites in stray cats in this part of the country.

## Materials and methods

### Study areas

The study was conducted from March 2013 to October 2013 in Azarshahr (East Azerbaijan province-Iran). This city lies in the northwest of Iran and is located 1468 m above mean sea level between 37°46' North Latitude and 45°85' East Longitude. The studied region has a moderate climate in winters and mild in summers, with an annual rainfall of about 388 mm.

### Sample collection

This study was performed based on cross sectional design. The sample cats including fifty, 15 (30 %) female and 35 (70 %) male stray cats, trapped by baited cage-traps with chicken meat or beef and collected from different areas after permission from the Environment Agency and Bureau veterinary of Azarshahr city, were sent to the Department of Animal Biology, Faculty of Natural Science, Tabriz University. For each cat, some characteristics such as breed, age (based on their teeth condition) sex, weight were registered (Eldredge et al. 2008), they were divided into three age groups (Table 1). The cats were anesthetized by diethylether and euthanized by intra muscular injection of

high doses of the Ketamine 10 % according to the protocol described by Arabali and Hooshyar with some modifications (Arbabi and Hooshyar 2009). Immediately their carcasses were autopsied and examined for the presence of protozoa, helminthes. For this purpose, after opening the abdominal cavity and removing the internal organs including stomach, intestine, kidney, liver, heart and lungs. The small intestine of each cats was detach from the mesenterium, then was cut longitudinally, immersed in phosphate buffered saline (pH 7.2) for 10 min and the mucosa was scraped with the blades of scalpel, thereafter, both the contents of the gut and scraping of the mucosa were washed with tap water in sieve NO. 60 and examined with the naked eyes as well as under a stereomicroscope (Borji et al. 2011; Zibaei et al. 2007). The examination of livers and lungs were done in two steps. First, the samples were sliced in small pieces and examined carefully under stereomicroscope in order to find the mature and immature helminthes or nymph of *linguistula serrata*. In the second step, the minced tissues were put in 50 ml of digestion solution containing 5 g pepsin enzyme (7178, Merck) and 25 ml hydrochloric acid (374, Merck) in 1 liter water (pH=3.5), incubating at 37 °C for 24 h. After that, the suspensions were examined (Haddadzadeh et al. 2010).

### Parasitological procedures

All helminthes parasites recovered were relaxed in water, then fixed in 70 % alcohol and 5 % glycerin (Ash and Orihel 1987), nematodes were mounted and cleared in lactophenol and tapeworms were mounted and stained in acid alum carmine for identification (Ash and Orihel 1987). The identification was carried out following specific keys described by Yamaguti (1961) and Soulsby (1977). The fecal samples were examined for presence of cyst and trophozoite of protozoa, egg and larva of helminthes by direct and flotation methods using saturated sugar solution as described by Soulsby (1977).

**Table 1** Distribution of the helminthic infections among age groups of the studied cats

Parasite (intensity of infection)	Age group (year)			Total n (%)	P value
	≤1 (n = 14)	1–2 (n = 17)	>2 (n = 19)		
<i>Taenia taeniaeformis</i> (1.60)	4 (28.6)	9 (52.9)	17 (89.5)	30 (60)	0.07
<i>Mesocestoides lineatus</i> (0.74)	4 (28.6)	16 (94.1)	19 (100)	39 (78)	0.001
<i>Dipylidium caninum</i> (0.60)	3 (21.4)	14 (82.3)	12 (63.1)	29 (58)	0.003
<i>Taenia hydatigera</i> (0.40)	2 (14.2)	5 (29.4)	5 (26.3)	12 (24)	0.48
<i>Ancylostoma tubaeforme</i> (0.14)	0	0	7 (36.8)	7 (14)	0.001
<i>Toxascaris leonine</i> (0.30)	0	2 (11.8)	13 (68.4)	15 (30)	0.001
<i>Toxocara cati</i> (0.82)	6 (42.8)	16 (94.1)	17 (89.5)	39 (78)	0.059
<i>Physaloptera praeputialis</i> (0.2)	0	1 (5.8)	0	1 (5.8)	0.58
<i>Syphacia abvelata</i> (0.2)	0	1 (5.8)	0	1 (5.8)	0.58

## Statistical analysis

To run statistical analysis, the prevalence with 95 % confidence interval was calculated for each parasitic species. Associations between host factors (age, gender, and weight and parasitism) was evaluated using the Chi square test with SPSS software version 16.2.

## Results

Of the fifty stray cats examined, forty seven (94 %) were positive for at least one of the parasite, 41 (82 %) indicated nematodes and 41 (82 %) cestodes. *Mesocestoides lineatus* (78 %) and *Toxocara cati* (78 %) were the most common parasites. Prevalence and quantity for the rest of parasites were: *Taenia taeniaeformis* (60 %, 80 worms), *Dipylidium caninum* (58 %, 30 worms), *Taenia hydatigera* (24 %, 19 worms), *Ancylostoma tubaeforme* (14 %, 7 worms), *Toxascaris leonina* (30 %, 15 worms), *Physaloptera praeputialis* (10 %, one) and *Syphacia obvelata* (10 %, one) (Table 1). No parasites were found in the respiratory tract, heart, liver and kidney. This study showed that there was no significant difference both in infection rate between male and female cats ( $P > 0.05$ ). However, females had the higher rates of infection than males did. The association between age and prevalence of parasite, with exception of *T. taeniaeformis*, *T. hydatigera*, *Ph. praeputialis*, *S. obvelata* was significant ( $P < 0.05$ ). The frequency of individual parasites in more than 2 year old cats was higher than 1–2 and  $1 \geq$  (Table 2).

## Discussion

Some of the parasites found in our study are zoonotic and play an important action as reservoir and these helminths represent important public health problems (Hille et al.

2014; Krecek et al. 2010; Polak et al. 2014; Youssef and Uga 2014). Therefore these, parasites must be considered as an alert to veterinaries and public health agencies. In the present study, the overall prevalence of parasitic infection (at least with one of the intestinal helminth species in stray cats of 94 % was similar to that reported in previous studies, conducted in other Iranian cities such as Isfahan (98.5 %) (Jamshidi et al. 2002), Shiraz (92.9 %) (Zibaei et al. 2007), Kashan (97.3 %) (Arbabi and Hooshyar 2009), North of Iran (90 %) (Changizi et al. 2007), Mashhad (88.46 %) (Borji et al. 2011), Kashan (95.6 %) (Arbabi and Hooshyar 2009) and in other countries, i.e. Spain (89.7, 100 %) (Calvete et al. 1998; Millan and Casanova 2009), Brazil (98.6 %) (Labarthe et al. 2004), Egypt (91 %) (Khalafalla 2011), Nigeria (80.77 %) (Raji et al. 2013). However, the identified prevalence rate in this study was more than that of the earlier researches, conducted in different contexts such as Italy (35 %) (Riggio et al. 2013), northern Italy (50.4 %) (Spada et al. 2013) Hungary (39.6 %) (Capari et al. 2013), Germany (33.6 %) (Becker et al. 2012), Mexico (53 %) (Canto et al. 2013), Greece (55.8 %) (Lefkaditis et al. 2014), Thailand (11.9 %) (Jitapalapong et al. 2007), Brazil (67.12 %) (Ramos et al. 2013). Moreover, the most common helminth parasites, detected in our study, were *M. lineatus* (78 %) and *T. cati* (78 %). The prevalence of *T. cati* infection was higher than the estimated prevalence previously found in Christmas Island (53.57 %) (Adams et al. 2008), Northern Germany (27.1 %) (Becker et al. 2012), Spain (55.2 %) (Calvete et al. 1998), Mexico (3 %) (Canto et al. 2013), Hungary (17.4 %) (Capari et al. 2013), Thailand (3.5 %) (Jitapalapong et al. 2007), Egypt (9 %) (Khalafalla 2011), India (4 %) (Krecek et al. 2010), Brazil (25.2 %) (Labarthe et al. 2004), Greece (18.14 %) (Lefkaditis et al. 2014), Spain (35 %) (Millan and Casanova 2009), Romania (20.3 %) (Mircean et al. 2010), Australia (3.2 %) (Palmer et al. 2008), Nigeria (16.67 %) (Raji et al. 2013), England (34.8 %) (Nichol et al. 1981), Brazil (4.11 %) (Ramos

**Table 2** Distribution of helminthic infections among sexes in the studied cats

Parasite (intensity of infection)	Sex n (%)		P value
	Male (n = 35)	Female (n = 15)	
<i>Taenia taeniaeformis</i>	20 (57.1)	10 (66.6)	0.78
<i>Mesocestoides lineatus</i>	22 (77.1)	12 (80)	0.83
<i>Dipylidium caninum</i>	21 (60)	8 (53.3)	0.73
<i>Taeniahydatigera</i>	10 (28.6)	2 (13.3)	0.14
<i>Ancylostoma tubaeforme</i>	4 (11.4)	3 (20)	0.42
<i>Toxascaris leonine</i>	9 (52.7)	6 (40)	0.31
<i>Toxocara cati</i>	25 (71.4)	14 (93.3)	0.15
<i>Physaloptera praeputialis</i>	1 (2.8)	0	0.51
<i>Syphacia abvelata</i>	1 (2.8)	0	0.51

et al. 2013), Italy (22.2 %) (Riggio et al. 2013), Argentina (61.2 %) (Sommerfelt et al. 2006), Northern Italy (33.1 %) (Spada et al. 2013), as well as in Iranian contexts including Shiraz (42.6 %) (Zibaei et al. 2007), Northern Iran (44 %) (Sharif et al. 2007), Mashhad (28.84 %) (Borji et al. 2011), North of Iran (8 %) (Changizi et al. 2007), Isfahan (13 %) (Jamshidi et al. 2002), Tehran (42.31 %) (Mirzayans 1973), Kashan (13.3) (Arbabi and Hooshyar 2009), Ahvaz (8.3 %), Tehran (23 %) (Bahadori et al. 2004). However, similar prevalence of *T. cati* infection has been recorded in Denmark (79 %) by Engbaek et al. (1984). The most likely reasons for the increased prevalence of *T. cati* in our studies were the poor hygiene, lack of anthelmintics drug used in stray cats, the presence of high humidity, and moderate temperatures (Arbabi and Hooshyar 2009). All these factors were clearly observed in our research context. However, another invisible factor or reason or the common occurrence of this parasite can be attributed to the role of some intermediary, such as rodents and invertebrates, in the life cycle of *T. cati* and in the diet of stray cats (Adams et al. 2008). *M. lineatus* was the dominant tapeworm reported in our study with a prevalence rate of 79 % which was higher than that reported in Spain (13.8 %) (Calvete et al. 1998), Italy (1.2 %) (Riggio et al. 2013), Iran (13.4 and 8 %) (Arbabi and Hooshyar 2009; Borji et al. 2011). The *T. taeniaeformis* prevalence (60 %) was relatively similar to that found by Coman (1972) in Australia (78 %), Stoichev et al. (1982) in Bulgaria (75.5 %), Abu-Madi et al. (2008) in Qatar (74 %) and Borthakur and Mukharjee (2011) in India (70.4 %) but the prevalence rate of this cestode in our study was higher than that recorded in Spain (8.6 and 22 %) (Calvete et al. 1998; Millan and Casanova 2009), Nile Delta of Egypt (22 %) (Khalafalla 2011), Christmas Island (7.14 %) (Adams et al. 2008), Greece (8.37 %) (Lefkaditis et al. 2014), Mexico (4 %) (Canto et al. 2013), Nigeria (6.67 %) (Raji et al. 2013), Brazil (0.68 %) (Ramos et al. 2013) and Iran (2, 9.6, 15, 12.3 and 9.2 %) (Arbabi and Hooshyar 2009; Borji et al. 2011; Changizi et al. 2007; Jamshidi et al. 2012; Zibaei et al. 2007). Coman attribute the prevalence of this cestode with the importance of rodent in the diet of these cats (Coman 1972). In our study, the prevalence of the *D. caninum* was 58 %, which is compatible with the findings of the previous studies done in Brazil (52.6) (Labarthe et al. 2004) and Iran (68.1 and 49.5 %) (Arbabi and Hooshyar 2009; Zibaei et al. 2007). However, the prevalence of this parasite was higher than the previously recorded rates by other surveys from various countries (Borji et al. 2011; Calvete et al. 1998; Canto et al. 2013; Dalimi and Mobedi 1992; Jittapalapong et al. 2007; Khalafalla 2011; Lefkaditis et al. 2014; Raji et al. 2013; Ramos et al. 2013). High prevalence of this parasite in resent survey could be due to the fact that *D. caninum* requires fleas as intermediary hosts

and cats infected after ingesting infected fleas (Labarthe et al. 2004). *T. hydatigera* prevalence of 24 % found in the current study was higher than that reported by Borji et al. (2011) Furthermore, compared with some previous studies, such as; 5 % in Egypt (Khalafalla 2011), 7.69 and 12.9 % in Iran (Borji et al. 2011; Zibaei et al. 2007), 11.9 % in Brazil (Labarthe et al. 2004), 1 % in Mexico (Canto et al. 2013), 3.33 % in Nigeria (Raji et al. 2013), the prevalence of *T. leonine* was higher (30 %). But Lefkaditis et al. (2014) detected a rate of 93 % in Greece (Lefkaditis et al. 2014). The definitive hosts for *T. leonina* are both feline and canine species (Okulewicz et al. 2012). Cats become infected by ingesting either the eggs or rodents that contain the larvae of *T. leonine* which all can impact the prevalence of *T. leonina*. *Ph. praeputialis* (10 %) and *S. abvelata* (10 %) were the other nematode species found in the present survey. More interestingly, for the first time in the relevant research literature *S. abvelata* was detected in the sample stray cats of our study.

## Conclusion

Findings of this study indicated a high prevalence of endoparasite infections in stay cats in this particular Iranian context. Some of the identified parasites, known as agents of zoonotic diseases, most probably deteriorate the cats' health, and the zoonotic character of some parasites found in this study must serve as an alert to public health agencies, veterinarians and pet owners (Becker et al. 2012).

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