

Current status of intestinal helminths in cats of Istanbul, Türkiye

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ABSTRACT

Domestic cats (*Felis catus*) inhabit diverse environments, from indoor homes to outdoor free-roaming populations, engaging in complex interspecies and intraspecies interactions that influence their health. To determine the prevalence of intestinal helminth infections, this study examined fecal samples from 400 stray cats in Istanbul, Türkiye. Parasitological analysis revealed 165 infected cats; 145 harbored a single species, while 20 had dual infections. Prevalence rates observed were: *Toxocara cati* (37.5%), *Toxascaris leonina* (6.5%), *Joyeuxiella pasqualei* (1.25%), *Ancylostoma tubaeforme* (0.75%), and *Dipylidium caninum* (0.2%). These findings aim to inform veterinary care for stray animals.

Keywords: domestic cat, intestinal helminths, Istanbul.

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Introduction

While owned domestic cats receive comprehensive veterinary care, including vaccinations and antiparasitic treatments, stray cats lack access to these preventive measures, posing a disease risk to other domestic and wild species, and humans. (Gerhold and Jessup, 2013) In Türkiye, pursuant to Law No. 5199 on Animal Protection and other regulations, stray cats are transferred to animal shelters, primarily managed by local governments. Veterinarians at these shelters conduct physical examinations, treatments, antiparasitic medication, and vaccinations. If unadopted, the cats are subsequently released. (IMM, 2024).

The current study included stray domestic cats (*Felis catus*) living from Istanbul and intestinal helminths for which domestic cats serve as definitive hosts. (Zajac et al., 2009; Toparlak and Tüzer, 2012; Taylor et al., 2016; Wulcan et al., 2019; Doğanay et al., 2021)

In Türkiye, there are many studies conducted by faecal examination for the prevalence rates of helminths in owned and/or unowned cats and infection rates at varying levels have been reported (Burgu et al., 1985; Kaplan, 1995; Altaş and Taşan, 1999; Başaran, 2002; Yaman et al., 2006; Öter et al., 2011; Palaz, 2015;

Korkmaz et al., 2016; Tetik Metin, 2016; Karakavuk et al., 2021; Karakuş and Denizhan, 2021; Çetin, 2023). No current study includes a large sample of individuals from all Istanbul districts.

This study investigated the current intestinal helminth infection rate in Istanbul's stray cats, utilizing the largest sample size among similar regional studies.

Materials and Methods

It is reported that the number of stray cats in Istanbul, the target research population, is estimated to be 162,970 (IMM, 2024). The current population size is not known with certainty. In this study, the number of individuals to be included in the sample was determined as 400 (Naing et al., 2006; Serdar et al., 2021). Stray cats admitted to municipal animal shelters were selected as the sample population. Stratified sampling method was preferred for the selection of individuals to be included in the sample from the target population. The districts including the administrative divisions of Istanbul province were used for stratification, and the target population was divided into 39 separate strata. Since there is no precise data on the distribution of the number of individuals in the

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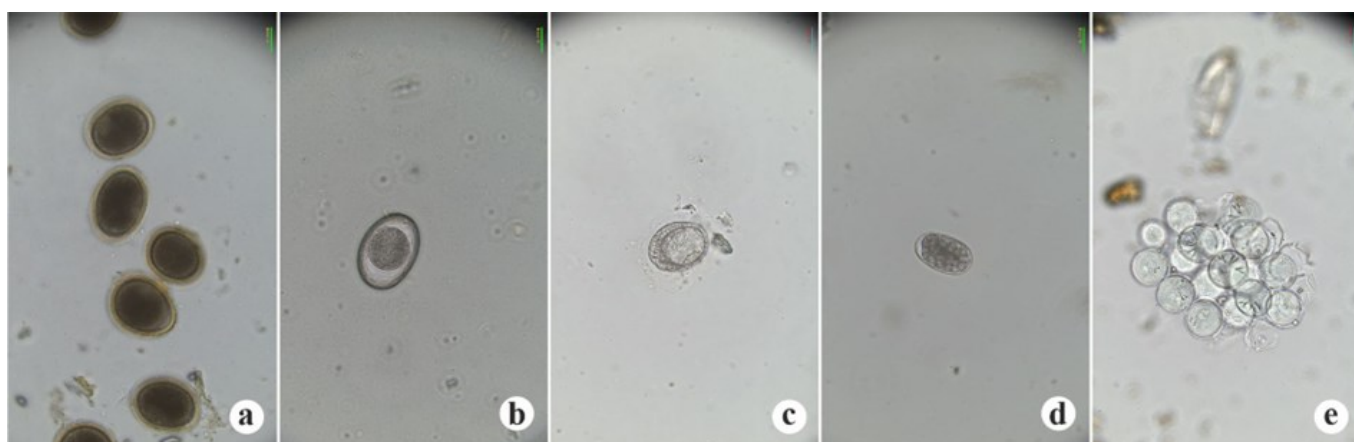


Figure 1. a) *Toxocara cati*, b) *Toxascaris leonina*, c) *Joyeuxiella pasqualei*, d) *Ancylostoma tubaeforme*, e) *Dipylidium caninum*. (Scale Barr : 17.757 micrometers) .

target population in the strata, disproportional sampling was preferred. The individuals to be preferred for the strata were selected by simple random sampling method (Ergin, 1994; Kılıç, 2013). At least 10 cat faecal samples were collected from each of the 39 districts. Faecal samples were collected daily from cats in the individual shelter sections of municipal animal shelters in Istanbul. Since the faeces of the cats in these sections were removed daily, sufficient amount of fresh faeces were taken in polyethylene bags. The faecal samples were transported to the laboratory in transport boxes containing ice batteries and examined on the same day. Laboratory studies were completed between March 2022 and March 2023.

Sample collection for the study did not follow specific research protocols, operating instead within legally regulated rehabilitation processes. The study did not interfere with the animals' transfer or admission to the shelter. Ethics approval (Report 2021/46) was obtained from the Istanbul University-Cerrahpaşa Rectorate Veterinary Faculty Unit Ethics Committee.

Following macroscopic examination, faecal samples

were microscopically analyzed under a light microscope using the Fülleborn Flotation and Simple Sedimentation Tests, enabling diagnoses based on morphological findings (Thienpont et al., 2003; Zajac et al., 2009; Lucio-Forster et al., 2012; Doğanay et al., 2019).

Results

Helminth eggs were detected in the faeces of 165 (41.2%) of the 400 cats examined in the study. Although infection with a single species (n=145) was predominantly found, mixed infections with two species (n=20) were also detected. *Toxocara cati*, whose eggs were detected in the faeces of a total of 150 animals, was the most common parasite species in the study.

In this study, 5 different helminth species were recorded.

Table 1 presents the data on the identified species. The images of helminth eggs detected in the study are shown in Figure 1. In Table 2, epidemiological data including age, sex and fertility status of the animals included in the sample are presented.

Table 1. Distribution of parasites by species in infected animals (n=165).

Infected with	Helminth Species	Number of infected animals	Rate (%)
One species	<i>Toxocara cati</i>	132	87.8
	<i>Toxascaris leonina</i>	11	
	<i>Ancylostoma tubaeforme</i>	1	
	<i>Joyeuxiella pasqualei</i>	1	
Two species	<i>Toxocara cati</i> + <i>Toxascaris leonina</i>	15	12.1
	<i>Toxocara cati</i> + <i>Dipylidium caninum</i>	1	
	<i>Toxocara cati</i> + <i>Joyeuxiella pasqualei</i>	2	
	<i>Ancylostoma tubaeforme</i> + <i>Joyeuxiella pasqualei</i>	2	

Table 2. Epidemiological features of the whole study sample (n=400) and infected animals (n=165)

Epidemiological features		Number of infected animal	Total number
Age	<12 months	54	100
	>12 months	111	300
Sex	Male	80	191
	Female	85	209
Fertility Status	Fertile	84	193
	Infertile	81	207

The distribution of infected animals by district is 68.33% in Indonesia (Rabbani et al, 2020), 95.3% in presented in Table 3. In the city consisting of 39 Nepal (Adhikari et al., 2023), 52.4% in Egypt (Abbas et al., 2022), 60% in Sudan (Mohamed et al., 2021), 45.6% infected with intestinal helminths were detected. in USA (Hoggart et al., 2019), 31.8% in Canada Accordingly, the rate of infected animals was 32.1% (Villeneuve et al., 2015), 8.6% in Australia (McGlade et al., 2003). (n=53) in the Anatolian side and 67.8% (n=112) in the European side.

Discussion

Several studies on the detection of intestinal parasites of domestic cats are reported worldwide. In some studies, only free-living stray domestic cats are included in the study, while in others, owned cats and cats living in shelters are also included. A significant portion of the studies were conducted directly with faecal examination of live animals, and there are also results obtained from intestinal contents obtained by necropsy. Infection rate; 12% in Italy (Sauda et al., 2019), 14.6% in France (Bourgoin et al., 2022), 31.3% in Switzerland (Zottler et al., 2019), 48.6% in Spain (Mateo et al., 2023), 39.43% in India (Sheikh et al., 2020),

In studies with samples including 100 or more individuals in Türkiye; 72% in Ankara (Burgu et al., 1985), 89% in Bursa (Kaplan, 1995), 100% in Elazığ (Altaş and Taşan 1999), 92% in Konya (Palaz, 2015), 47% in Kırıkkale (Korkmaz et al, 2016), 47% in Bitlis (Tetik Metin, 2016), 15.6% in İzmir (Karakavuk et al., 2021), 47.86% in Van (Karakuş and Denizhan 2021), 66.4% in Istanbul (Çetin, 2023). In the present study, the rate of helminth presence in cats was found to be 41.25%, and we think that the reason for the lower rate than the studies in other parts of Türkiye is related to the fact that the number of municipalities providing veterinary services to stray cats is higher in Istanbul than in other cities. The difference with the helminth prevalence rate in another recent study in Istanbul

Table 3. Number of animals examined (n = 400) and number of infected animals (n = 165) by district

District	Number of total animals	Number of infected animals	District	Number of total animals	Number of infected animals	District	Number of total animals	Number of infected animals
Adalar	10	3	Üsküdar	10	5	Esenler	10	5
Ataşehir	10	4	Arnavutköy	11	8	Esenyurt	10	3
Beykoz	10	3	Avcılar	10	4	Eyüpsultan	11	9
Çekmeköy	10	5	Bağcılar	10	4	Fatih	10	4
Kadıköy	10	3	Bahçelievler	10	5	Gaziosmanpaşa	10	6
Kartal	10	1	Bakırköy	10	2	Güngören	10	6
Maltepe	10	2	Başakşehir	10	6	Kâğıthane	10	3
Pendik	10	2	Bayrampaşa	10	4	Küçükçekmece	10	3
Sancaktepe	10	5	Beşiktaş	10	5	Sarıyer	10	7
Sultanbeyli	10	9	Beylikdüzü	10	2	Silivri	11	2
Şile	11	4	Beyoğlu	10	3	Sultangazi	10	6
Tuzla	10	5	Büyükkçekmece	10	0	Şişli	10	4
Ümraniye	10	2	Çatalca	16	8	Zeytinburnu	10	3

(Çetin, 2023) is thought to be due to the fact that the present study was conducted in a larger geographical area of the city and the laboratory method was different.

In species-level diagnostics for nematodes in the Ascaridae family, the prevalence of *Toxocara cati* was 9% in Italy (Sauda et al., 2019), 11.3% in France (Bourgoin et al., 2022), 18.5% in Switzerland (Zottler et al., 2019), 20% in Spain (Mateo et al., 2023), 26.49% in India (Sheikh et al., 2020), 40% in Indonesia (Rabbani et al., 2020), 40.7% in Nepal (Adhikari et al., 2023), 30% in Egypt (Abbas et al., 2022), 1.9% in Brazil (Arruda et al., 2021), 17.5% in the USA (Hoggart et al., 2019), 39% in the USA (Loftin et al., 2019), 16.5% in Canada (Villeneuve et al., 2015) and 0.5% in Australia (McGlade et al., 2003). The spread of *Toxascaris leonina*, which is also in the Ascaridae family; 0.2% in France (Bourgoin et al., 2022), 2.9% in Spain (Mateo et al., 2023), 10.33% in Indonesia (Rabbani et al., 2020), 2.8% in Nepal (Adhikari et al., 2023), 22.4% in Egypt (Abbas et al., 2022) and 2.2% in Australia (McGlade et al., 2003). In the studies reported at species level in Türkiye; *Toxocara cati* distribution was reported as 47% in Ankara (Burgu et al., 1985), 54% in Bursa (Kaplan, 1995), 57% in Elazığ (Altaş and Taşan 1999), 37.31% in Van (Karakuş and Denizhan 2021), 61.2% in Istanbul (Çetin, 2023). *Toxascaris leonina* distribution was reported as 3% in Ankara (Burgu et al., 1985), 7.46% in Van (Karakuş and Denizhan 2021), 9.2% in Istanbul (Çetin, 2023). At the genus level, *Toxocara* spp. prevalence was reported as 48.9% in Kırıkkale (Korkmaz et al., 2016) and 3% in Izmir (Karakavuk et al. 2021). In the present study, the prevalence of *Toxocara cati* was found to be 37.5% and *Toxascaris leonina* was found to be 6.5%. The high prevalence of parasites in the Ascaridae family in the present study is attributed to the fact that the annual averages of relative humidity and temperature values of the study area, Istanbul city (Istanbul Governorship, 2023), are close to the optimal conditions for egg-larval development of parasites in this family (Toparlak and Tüzer, 2012).

In studies conducted in the world for hookworms seen in cats; 2.3% in Italy (Sauda et al., 2019), 1.1% in Switzerland (Zottler et al., 2019), 18.33% in Indonesia (Rabbani et al., 2020), 8.4% in Egypt (Abbas et al., 2022), 7.7% in Brazil (Arruda et al., 2021), 11.7% in the USA (Hoggart et al., 2019), 34% in another study in the USA (Loftin et al., 2019) and 0.2% in Australia (McGlade et al., 2003). In Türkiye, the presence of hookworms was reported as 4.2% in Kırıkkale (Korkmaz et al., 2016) and 11.94% in Van (Karakuş and Denizhan 2021). In the present study, *Ancylostoma tubaeforme* was detected in 3 cats, and the distribution rate of 0.75% is similar to

Switzerland (Zottler et al., 2019). In other studies conducted in the study area of Istanbul (Öter et al., 2011; Çetin, 2023), the presence of hookworms was not reported in contrast to the present study.

The prevalence of *Dipylidium caninum*, which is in the Dilepididae family and known to use some ectoparasites as hosts, is 1.9% in France (Bourgoin et al., 2022), 0.6% in Switzerland (Zottler et al., 2019), 5.7% in Spain (Mateo et al., 2023), 19.39% in India (Sheikh et al., 2020), 1.67% in Indonesia (Rabbani et al., 2020), 2.8% in Nepal (Adhikari et al., 2023), 0.7% in Egypt (Abbas et al., 2022), 12.5% in Brazil (Arruda et al., 2021) and 1.0% in the USA (Hoggart et al., 2019). In Türkiye; 46% in Ankara (Burgu et al., 1985), 65% in Bursa (Kaplan, 1995), 33% in Elazığ (Altaş and Taşan 1999), 28% in Konya (Palaz, 2015), 0.21% in İzmir (Karakavuk et al., 2021), 5.97% in Van (Karakuş and Denizhan 2021), 6.4% in Istanbul (Çetin, 2023). It is seen that the spread of *Dipylidium caninum*, which was detected in only 1 cat (0.2%) in our current study, is similar to the study conducted in Izmir (Karakavuk et al., 2021). In the study conducted in Istanbul (Çetin, 2023), there was no information on ectoparasite control and/or presence of ectoparasites in the stray cats included in the sample, and it is evaluated that the difference in infection rate with our current study may be related to ectoparasite control in the individuals included in the sample.

The distribution of *Joyeuxiella* spp. in Dilepididae family was reported as 20% in Spain (Mateo et al., 2023) and 60% in Sudan (Mohamed et al., 2021). In Türkiye, *Joyeuxiella pasqualei* distribution at genus level was reported as 36% in Ankara (Burgu et al., 1985), 33% in Bursa (Kaplan, 1995), 64% in Elazığ (Altaş and Taşan 1999), 58% in Konya (Palaz, 2015), and *Joyeuxiella* spp. distribution at species level was 4.2% in Kırıkkale (Korkmaz et al., 2016). In the present study, the prevalence of *Joyeuxiella pasqualei* was determined as 1.25%. It is considered that the difference in laboratory method is effective in the low rate of infected animals compared to the studies in Türkiye. In another study conducted in Istanbul with 43 cats (Öter et al., 2011), the prevalence of *Joyeuxiella pasqualei* was reported as 4.65%. The difference between the mentioned study and the current study is attributed to the higher sample size and the inclusion of cats from a larger geographical area.

Conclusion

Examination of faecal samples from 400 stray cats in Istanbul, Türkiye, revealed intestinal helminth eggs in 165 (41.25%) individuals. Five different helminth species, including nematodes and cestodes, were

detected. While the number of parasitic species found was consistent with findings from other parts of Türkiye, the overall infection rate observed in this study was comparatively lower. This rate highlights the critical need for continuous veterinary services for stray cats. Sustained antiparasitic treatments are essential for protecting animal health, reducing the spread of potential zoonoses, and thus safeguarding public health.

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