



## The prevalence of helminths found in cats in Konya/Turkey

Yavuz PALAZ \*<sup>1</sup>

<sup>1</sup> Veterinary Science of Selcuk University, Head Department of Parasitology, Konya, Turkey

### Abstract

The aim of this research is to examine the species and the spread of the helminths in the cats in Konya province. In this research, 70 female and 30 male out of the total 100 cats were collected from the central neighbourhood of Konya in the period from October 2001 to December 2003. These cats were systematically examined from helminthological point of view. First of all, the cats' age and sex were identified and recorded. As a result of fecal examination of the cats helminths species were discovered.

The helminths species collected were taken into the 0,9 percent salt solution, Nematodes were transferred into 70 percent alcohol and Cestodes into ^10 percent formalin. Nematodes were transparenced in lactophenol. Cestodes were stained with carmen borax. Then, these species were identified.

In this study, 92 cats (92 percent) were found infected, for at least one helminth species. It is understood that 83,3 percent of the males and 95,7 percent of the females were infected by helminths. The sample cats which were infected by helminths and their age profile groups are as follows: 95,4 percent of them up to one year old, 100 percent of the two-three years old, 83,3 of the three-four years old, 95 percent of the four-five years old, 88,8 percent of the five- six years old, 92,8 percent of the six-seven years old, 80 percent of the seven-eight years old, 85,7 percent of the eight years old and above. As a result of the observation of the sample cats, it is safe to say, that that in the spread of helminth infections the age and sexuality of the cats were not statistically significant ( $p>0,05$ ).

*Joyeuxiellapasquicelei* in 58 cats, *Dipylidiumcaninum* in 28 cats, *Taeniataeniaeformis* in 10 cats, *Diplopylidiumnolleri* in 5 cats, *Taxocaramystax* in 47 cats, *Physalopterapraeputialis* in 2 cats of 100 cats were found.

In the infected cats, there were 4 Cestodes and 2 Nematodes totalling to the 6 helminth species were detected. The total 6267 helminthes consisted of 6033 Cestodes and 234 Nematodes which were collected and identified from the sample cats. During the macroscopical examination of the faecal samples of the cats, the 4 percent *T. mystax* eggs and the 8 percent segments of *J. pasqualei* were detected.

Since the cat helminths were so widespread in Konya, and some of them were zoonose, this may cause risk for the local people. It is, therefore, necessary that the cats have to be protected against parasites by periodical inspections and by the treatment of the cats for inspected infections.

**Key words:** cat, gastrointestinal helminth, Konya, Turkey

----- \* -----

### Konya ilinde Kedilerde bulunan Helmintlerin görülme sıklığı

#### Özet

Bu araştırma, Konya yöresindeki kedilerde bulunan helmint türlerini ve bunların yayılışlarını belirlemek amacıyla yapılmıştır. Çalışmada, Ekim 2001-Aralık 2003 tarihleri arasında Konya'nın merkez mahallelerinden temin edilen 70 dişi ve 30 erkek olmak üzere toplam 100 kedi sistematik olarak helmintolojik yönden incelenmiştir. Kedilerin önce yaş ve cinsiyetleri belirlenmiş ve kaydedilmiştir.

Dışkıların incelenmesi ile kedilerin taşıdıkları helmint türleri belirlenmeye çalışılmıştır. Nekropside toplanan helmintler %0,9'luk fizyolojik tuzlu suya alınmış, nematodlar %70'lik alkolde, cestodlar ise %10'luk formolde tespit edilmiştir. Nematodlar laktofenolde şeffaflandırılmış, cestodlar borakslı karminle boyanmış, toplanan helmintler mikroskopta incelenmiş ve tür tayinleri yapılmıştır.

\* Corresponding author / Haberleşmeden sorumlu yazar: Tel.: +905052889088; Fax.: +903323553401; E-mail: palaz42@hotmail.com

Araştırmada kullanılan 100 kedinin nekropsisinde 92'sinin (%92,0) değişik helmint türleriyle enfekte oldukları saptanmıştır. Erkek kedilerde %83,3, dişi kedilerde %95,7 oranında enfeksiyon tespit edilmiştir. Bir yaş ve altındaki kedilerin %95,4'ünün, 2-3 yaşındaki kedilerin %100'ünün, 3-4 yaşındaki kedilerin %83,3'ünün, 4-5 yaşındaki kedilerin %95'inin, 5-6 yaşındaki kedilerin %88,8'inin, 6-7 yaşındaki kedilerin %92,8'inin, 7-8 yaşındaki kedilerin %80'inin, 8 yaşındaki ve daha yaşlı kedilerin %85,7'sinin helmintlerle enfekte olduğu belirlenmiştir. Helmint enfeksiyonlarının yayılışında, kedilerin yaş ve cinsiyetlerinin istatistiksel olarak önemli olmadığı gözlenmiştir ( $p>0,05$ ). *Yüz kedinin 58'inde Joyewciella pasqualei, 28'inde Dipylidium caninum, 10'unda Taenia taeniaeformis, 5'inde Diplopylidium nölleri, 47'sinde Toxocara mystax, 2'sinde Physaloptera praeputialis bulunmuştur.* Enfekte kedilerde 4 cestod ve 2 nematod türü olmak üzere toplam 6 tür helmint tesbit edilmiştir. Bu çalışma sonucunda kedilerden 6033 adet cestod, 234 adet nematod elde edilmiş ve toplam 6267 adet helmint toplanmıştır. Dışkıların %4'ünde *T. mystax* yumurtalarına, %8'inde *J. pasqualei* halkalarına rastlanmıştır.

Konya'da kedi helmintlerinin bu kadar yaygın olması ve bu helmintlerin bir kısmının zoonoz olması, insan sağlığı açısından da riskler taşıdığı için, kedilerin periyodik aralıklarla muayenelerinin yapılarak tedavi edilmeleri, parazitlere karşı koruyucu tedbirlerin alınması gerekmektedir.

**Anahtar kelimeler:** kedi, gastrointestinal helminth, Konya, Türkiye

## 1. Introduction

The helminthes constitute a significant part of infectious parasitic diseases. Some of the important zoonose helminthes reservoir are unfortunately cats. The helminthes which settle in various organs and tissues of the cats are pathogenic in varying degrees. But they also infect people and cause serious diseases.

Endoparasites can cause species of parasite and clinical cases depending on the quantity. These can be described as: slight gastrointestinal diseases, lack of appetite, loss of weight, anemia and lack of liquid.

According to the analysis of autopsy and fecal examination in Konya province, there are several studies on the helminthes of dogs. But according to the both autopsy and fecal examination there are few studies on the parasites of cat helminthes.

With the scientific research which made around the world, helminthes were found in stray cats by holding post mortem (Christensen et al. 1946, Ash 1962, Kelly 1975a, Kelly 1975b, Cowper 1978, Hering-Hagembeckve Schuster 1996, Mituch 1968, Umeche ve ima 1988, Baker et al. 19899). Studies were made according to the fecal examination in England (Nichol et al. 1981), in Belgium (Vanparijs et al. 1991), in Netherlands (Overgaauwe Boersema 1998) , in New Jersey (Lillis 1967), in Missouri (Visco et al. 1978) , in Mexico City (Martinez-Barbabosa et al. 2003), in South Australia (Moore and O' Callaghan 1985) , in Iriomete Island (Akuzowave et al. 1987).

In some regions of Turkey, several studies were made on dead cats that reflect helminth fauna. ( Ertürk and Tanzer 1972, Dinçer et al. 1980, Burgu et al. 1985, Umur 1997, Ayaz et al. 2001, Tınar et al. 2001). Also many studies were made on fecal examination (Güralp 1957, Burgu et al. 1985, Ayaz et al. 2001, Başaran 2002).

This study was carried out to determine the species of helminths in cats in Konya province, to detect the helminths thar are closely related to people's health and their way of living and to make people conscious of parasites.

## 2. Materials and methods

During the period from October 2001 to December 2003, a total of 50 (30 males and 70 females) cats were collected from the central neighbourhood of Konya.

The cats who aren't able to heal or half-dead due to multiplication, falling, injury, car accident or poisoning were brought to free veterinary clinics or to the Laboratory of Head Department of Parasitology, Veterinary Science of Selcuk University.

Fiver grams of faecal sample were collected directly from the rectum of the cats and examined with the methods of native consultation, sedimentation and flotation.

All obtained nematodes were collected, counted and then kept in alcohol 70° after being purified with the serum physiologic. Then nematodes were transparenced in lactophenol, taken photographs.

By comparing the results of fecal examination and autopsy, whether there is a relationship between both of them or not, was investigated with the test of  $\chi^2$ . Also whether there is a relationship between infected cats' age, race, gender and helminth infections was investigated with the test of  $\chi^2$ .

## 3. Results

In this research, out of 100 cats sampled, 92 (92%) of the cats were found to be infected with helminths. It was found that 25 of male cats (83,3%) and 67 of female cats (95,7%) were infected. This study revealed tahat 4 cestodes and 2 nematodes were detected in infected cats. the species of detected helminths and the spread of them were shown in

Table 1. According to Table 1, the highest prevalence of helminth infections was related to *Joyeuxiellapasqualei* (58%) (Plate 1) and minimum rate was *Physalopterapraeputialis* (2%) (Plate 2).

Table 1. The species and th prevalence of helminths in cats

Species	Prevalence (%)			Number of helminth	min.- max.
	Female cats	Male cats	Total		
<i>J. pasqualei</i>	39	19	58	4	169
<i>D. carinum</i>	20	8	28	1	144
<i>T. taeniaeformis</i>	6	4	10	1	6
<i>D. nölleri</i>	5	-	5	30	140
<i>T. mystax</i>	34	13	47	2	18
<i>P. praeputialis</i>	2	-	2	-	5

The rate of helminths that can be seen together was shown in Table 2. It was clearly understood from the Table 2 that, of the examined cats, 1 was infected with 4 species, 9 cats with 3, 45 cats with 1 and 37 cats with 2 species.

6033 cestodes and 234 nematodes were collected from infected 92 cats (Table 3). 3927 of these were collected from female cats and 2340 of these helminths were collected from male cats. 3771 of the cestodes were collected from female cats and 2262 of these from male cats. The study confirmed that the predominant cestode was *Joyeuxiellapasqualei* and minimum rate was related to *Diplopylidiumnölleri*. The predominant nematode was *T. mystax*, and minimum rate was related to *P. praeputialis*.

Sex determination of nematodes ws made and it was identified that 109 nematodes of 234 were male and 125 of 234 were female. 120 female and 104 male *Toxocaramyslax* were found. *T. mystax* were detected 48, 5 % in female cats and 43,3% in male cats. 5 female and 5 male *P. praeputialis* were found and all of these helminths were detected in two female cats.

Table 2. The prevalence of mixed helminth infection of infected cats

Infection with	The species of helminth	Positive	Total (%)
Infection with one	<i>D. carinum</i>	5	45 45
	<i>D. nölleri</i>	1	
	<i>J. pasqualei</i>	20	
	<i>T. taeriaeformis</i>	4	
	<i>T. mystca</i>	14	
	<i>P. praeputialis</i>	1	
	Infection with two	<i>D. caninum</i> + <i>J. pasqualei</i>	
<i>D. caninum</i> + <i>T. taeriaeformis</i>		2	
<i>D. caninum</i> + <i>T. mystca</i>		6	
<i>D. nölleri</i> + <i>J. pasqualei</i>		1	
<i>T. taeriaeformis</i> + <i>J. pasqualei</i>		1	
<i>J. pasqualei</i> + <i>T. mystax</i>		17	
<i>T. taeriaeformis</i> + <i>P. praeputialis</i>		1	
Infection with three	<i>D. carinum</i> + <i>J. pasqualei</i> + <i>T. mystca</i>	5	9 9
	<i>D. nölleri</i> + <i>J. pasqualei</i> + <i>T. mystca</i>	2	
	<i>J. pasqualei</i> + <i>T. taeniaeformis</i> + <i>T. mystca</i>	2	
Infection with four	<i>D. caninum</i> + <i>D. nölleri</i> + <i>J. pasqualei</i> + <i>T. mystax</i>	1	1 1

Cats were examined with necropsy, 15% of these cats were infected with nematodes, 43 % with cestodes and 34% were infected with both nematodes and cestodes.

The helminths were collected from stomach and intestine of the cats. *Toxocaramystcix* was collected from duodenum and stomach. Cestodes were found in small intestine and cestode proglottids were detected in large intestine.

Table 3. The percentage of distribution of helminth species by sex in cats

Species	Number of helminth in female cats	Number of helminth in male cats	Total
1 <i>J. pasqualei</i>	2806	1870	4676
2 <i>D. caninum</i>	582	378	960
3 <i>T. taeniaeformis</i>	21	14	35
4 <i>D. nölleri</i>	362	-	362
<b>Total</b>	3771	2262	6033
5 <i>T. mystax</i>	146	78	224
6 <i>P. praeputialis</i>	10	-	10
<b>Total</b>	156	78	234
<b>Grand Total</b>	3927	2340	6267

The distribution of helminth infections in cats according to the age were shown in Table 4. As shown in Table 4, 95,4% of cats who are at one age or under the age of one, 100% of cats at the age of two, 83,3% of cats at the age of three, 95% of cats at the age of four, 88,8% of cats at the age of five, 92,8% of cats at the age of six, 80% of cats at the age of seven and 85,7% of cats at the age of eight were infected with helminths. The distribution of helminth species according to the age were shown in Table 5. As can be seen, the cats who are at the age of 0-1, 4-5, 5-6, 6-7, 8 an older had 5 species helminthes, at the age of 2-3 had four species and 3-4, 7-8 had three species.

Table 4. The prevalence of helminths by age

Age class	Number of cats	Number of infected cats	Prevalance (%)
0-1	22	21	95,4
1 -2	8	8	100
2 -3	6	5	83,3
3 -4	20	19	95
4 -5	18	16	88,8
5 -6	14	13	92,8
6 -7	5	4	80
8-older	7	6	85,7
<b>Total</b>	100	92	92

Table 5. The prevalence of helminth species by age

Species	age 0-1	age 1-2	age 2-3	age 3-4	age 4-5	age 5-6	age 6-7	age 8+
	%	%	%	%	%	%	%	%
<i>J. pasqualei</i>	50	62,5	66,6	40	55,5	71,4	60	71,4
<i>D. caninum</i>	27,3	12,5	-	35	22,2	42,8	40	28,4
<i>T. taeniaeformis</i>	4,5	25	16,6	10	5,5	14,2	-	14,2
<i>D. nölleri</i>	-	-	-	10	11,1	-	-	14,2
<i>T. mystax</i>	59,1	50	49,8	60	55,5	7,1	20	42,8
<i>P.praeputialis</i>	4,5	-	-	-	-	7,1	-	-

Before necropsy faecal samples which taken from rectums of each cat were controlled with the methods of saturated salt water flotation of Fulleborn and sedimentation and helminth eggs were searched. *T. mystax* eggs were found in faecal samples, *J. pasqualei* proglottids were detected macroscopically. It was identified with fecal examination that there were two species of helminth in cats including *J. pasqualei* and *T. mystax*.

With the McMaster method counting of eggs were made on samples infected with helminths and it was found that number of eggs in samples were less than 50.

The study showed that there was statistically significant difference in results of necropsy and fecal examination ( $p < 0,05$ ).

#### 4. Conclusions

Several studies on helminths of cats were conducted together with the results of fecal examination, autopsy and fecal samples or with the results of faecal samples and autopsy until now. Therefore different results were observed.

According to the findings of autopsy, stray cats were found to be infected with helminths. It was found that rates of infection were 66,6% (Mimioğlu 1954) and 87% (Burgu et al. 1985) in Ankara, 88,8% (Dinçer et al. 1980) and 99% (Altaş 1997) in Elazığ, 89% (Durukan 1995) in Bursa, 87,5% (Başaran 2002) in North Marmara province.

According to the results of autopsy in other countries, the rate of infection was 83,3% (Vanparijs et al. 1991) in Belgium, 89,7% (Calvete et al. 1998) in Spain, 65% (Baker et al. 1989) in South Africa, 90,5% (Haslinger et al. 1988) in Egypt, 95,2% (Mituch 1968) in Slovakia, 50% (Cowper 1978) in England, 8,8% (Styles and Evans 1971) in USA, 44,4% in Aruba Island, 90,5% in Curaçao, 58,3% (Rep 1975) in Bonaire.

It was concluded from this research that according to the results of necropsy, helminths were seen in cats with prevalence of 92%. This result revealed that the prevalence of the helminth that detected in cats was higher in Konya province.

Results from fecal examination showed that the rates of helminth infection in stray cats were 35,16% (Güralp 1957) and 72% (Burgu et al. 1985) in Ankara, 36%, 39% (Durukan 1995) in Bursa, 22% (Başaran 2002) in North Marmara province, 78,4% (Ayaz et al. 2001) in Van.

Earlier studies in other countries showed that the rates of helminth infection were 75,6% (Huh et al. 1993) in Korea, 37% (Visko et al. 1978) in The State of Missouri, 24,6% (Kirkpatrick 1988) in The Commonwealth of Pennsylvania.

In this research fecal examination revealed that the rates of helminth in cats were 12%. *Toxocaramystax* eggs were detected in 4% cats, *Joyeuxiellapasqualei* proglottids were detected in 8% cats.

In Turkey, the studies on the helminths of cats revealed that *T. canis*, *O. tenuicollis*, *M. albidus*, *M. yokogawai*, *D. ciureanus*, *M. lineatus*, *D. caninum*, *J. pasqualei*, *T. pisiformis*, *T. taeniaeformis*, *D. nölleri*, *T. elongatum*, *O. tricuspis*, *C. aerophila*, *T. mystax*, *T. leonina*, *P. praeputialis*, *J. echinorhynchoides*, *U. stenocephala*, *Strongyloides sp* were observed in cats (Mimioğlu 1954, Merdivenci 1962, Dinçer et al. 1980, Burgu et al. 1985, Durukan 1995, Umur 1997, Tmar et al. 2001).

The species of *Dipylidiumcaninum*, *Joyeuxiellapasqualei*, *Taeniataeniaeformis*, *Diplopylidiumnölleri*, *Toxocaramystax* and *Physaloptera praeputialis* were found in Konya.

4 species of cestodes and 2 species of nematodes were found in controlled cats and it was identified that the number of species were less than the results of earlier studies. In Turkey and around the world the prevalence of helminth infection high (Mimioğlu 1954, Lengy et al. 1969, Burgu et al. 1985, Akuzowave et al 1987, Yasuda et al. 1993, Durukan 1995,).

Fecal examination results revealed that in this study *Toxocaramystax* was found with prevalence of 35,16% (Güralp 1981) in stray cats of Ankara, 35,29% (Ayaz 2001) in Van. It was concluded from autopsy results that the rates of helminth infection were 47% (Mimioğlu 1954) and 49,3% (Burgu et al. 1985) in stray cats of Ankara, 47,2% (Dinçer et al. 1980) and 57% in stray cats of Elazığ, 27,6% (Merdivenci 1962) in İstanbul, 54% (Durukan 1995) in stray cats of Bursa, 56,2% (Başaran 2002) in North Marmara province.

*Toxocaramystax* was found to be with the prevalence of 28,2% (Cowper 1978) and 39,4% (Niak 1972) in England, 63,6% (Mituch 1968) in Slovakia, 79% (Engbaek 1984) in Denmark, 40% (Lengy et al. 1969) in Israel, 2,1% in Australia and 90,5% (Gregory and Munday 1976, Mcglade et al. 2003) in King Island, Australia. And this parasite was detected to be the parasite seen in cats predominant (Soulsby 1986, Güralp 1981, Kirkpatrick 1988).

In this research, *Toxocaramystax* was found in cats with the prevalence of 47% and it was identified that this parasite was widely observed in Konya province.

Results of autopsy revealed that *Dipylidiumcaninum* was detected in the ratio of 1% (Mimioğlu 1954) and 16% (Burgu et al. 1985) in stray cats of Ankara, 22,2% (Dinçer et al. 1980) and 33% in stray cats of Elazığ, 54% (Durukan 1995) in stray cats of Bursa, 43,7% (Başaran 2002) in North Marmara province. Same parasite was found to be with the prevalence of 0,1-81% (Ash 1962, Ryan 1976, Moore and O'Callaghan 1985, Haslinger et al. 1988, Baker et al. 1989, Calvete et al. 1998) in studies of other countries.

In this research, *Dipylidiumcaninum* was detected with the prevalence of 28%. This parasite was observed widely in Konya.

According to the results of autopsy, *Joyeuxiellapasqualei* was found to be with the prevalence of 56,6% (Mimioğlu 1954) and 36% (Burgu et al. 1985) in stray cats of Ankara, 36,1% (Dinçer et al. 1980) and 64% in stray cats of Elazığ, 33% (Durukan 1995) in stray cats of Bursa, 12,5% (Başaran 2002) in North Marmara province. Same parasite was observed in the ratio of 45-76% (Talbot 1970, Lengy et al. 1969, İsmail et al. 1983, Haslinger et al. 1988, Calvete et al. 1998) in other countries.

In this research 58% of examined cats were found to be infected with *Joyeuxiellapasqualei*. This parasite that widely observed in Turkey, was found to be the helminth that detected predominant in Konya.

*Diplopylidiumnölleri* that was found with the prevalence of 5% in this research, was found 6% (Mimioğlu 1954, Burgu et al. 1985) in Ankara, 12% (Durukan 1995) in Bursa, 19% and 33,3% (Dinçer et al. 1980) in stray cats of

Elazığ. It was declared before that this cestode was rarely observed in Israel (2%) (Lengy et al. 1969). But this cestode was detected in the ratio of 8,6% in Spain (Calvete et al. 1998).

It was found that the rate of nematode *Physalopterapraeputialis* was 3% (Burgu et al. 1985) in Ankara, after detected first time (Dinçer et al. 1976) 8,3% (Dinçer et al. 1980) in Elazığ, 6% and 3% (Durukan 1995) in Bursa, 0,58% (Merdivenci 1962) in İstanbul. Same helminth was detected 40,5% in Australia, %2 in Israel, 5% Kentucky and 23% in Hawaii (Ash 1962, Lengy et al. 1969, Barton and McEvvan 1993, Byronl and Blagburn 2001).

This study revealed that *Physalopterapraeputialis* was detected 2% in Konya province. This rate was observed to be so close to the rates of distribution of Turkey (Burgu et al. 1985, Durukan 1995).

*Taeniataeniaeformis*, according to the results of autopsy, was detected 9,3% (Mimioğlu 1954) and 11% (Burgu et al. 1985) in stray cats of Ankara, 44,4% (Dinçer et al. 1980) and 59% in stray cats of Elazığ, 3% (Durukan 1995) in stray cats of Bursa. This parasite was found to be prevalent 15,2% (Cowper 1978) in Swensea, 1,2% (Nichol et al. 1981) in England, 38,9% (Mituch 1968) in Slovakia, 7% (Christensen et al. 1946) in Denmark, 11% (Engbaek et al. 1984) in Denmark again, 20% (Vanparijs et al. 1991) in Belgium, 78% (Coman 1972) in Victoria, Australia, 3% (Milstein and Goldsmid 1997) in Australia again.

*Taeniataeniaeformis* was detected with the prevalence of 10% in this study and this parasite was determined to be widely in Turkey.

In this survey, *Joyeuxiellapasqualei* had the highest prevalence (58%) of the cestodes that were detected in cats, this prevalence followed by *Dipylidiumcaninum* (%28), *Taeniataeniaeformis* (10%) and *Diplopylidiumnölleri* (5%). *Toxocaramystax* had the highest prevalence (47%) of the nematodes that were observed in cats and this was followed by *Physalopterapraeputialis* (2%).

Some researchers specified that there was significant difference in the results of fecal examination and autopsy (Visko et al. 1978, Burgu et al. 1985, Kirkpatrick 1988, Durukan 1995, Başaran 2002).

According to the results of fecal examination in Konya province, cats were found to be infected with helminths in the ratio of 12% and also the results of necropsy revealed that cats were found to be infected with helminths in the ratio of 92%. The difference in the results of necropsy and fecal examination was determined in cestodes more prominently and cestode eggs were not found with fecal examination. But cestode proglottids were detected in 8 cats' faecal samples. This situation was the same for nematodes. The dissensions between the results of fecal examination and necropsy were found in studies of Turkey and other countries (Lillis 1967, Güralp 1981, Buğu et al. 1985, Moore and O'Callaghan 1985, Durukan 1995) and this difference was statistically important ( $p < 0,05$ ). The reason of this difference was that, nematodes were male or if they were female, not being matured of eggs or pregnant cestode proglottids hatched in intestine. These reasons caused wrong identification.

Başaran (2002) stated that owned female cats were found to be infected with various helminths in the ratio of 22,2% and owned male cats 21,7%. It was detected that sexuality was not significant factor to find out helminth infection and this was same in other countries (Visco et al. 1978, Umeche and Ima 1988, Calvete et al. 1998).

The prevalence of infection was 86,6% in male cats, 94,2% in female cats. No significant difference in the prevalence of helminths was found between male and female cats when the results of both sexes have been combined ( $p > 0,05$ ).

Başaran (2002) identified that 18,2% of adult cats, 29,4% of kittens were infected with helminths and emphasized that age class was important factor to identify helminth infection. In the studies of other countries, it was found that age class was important factor to detect helminth infection and in cats that are under the age of 1 the ratio of infection was higher (Kelly 1975a, İsmail et al. 1983, Kirkpatrick 1988, Calvete et al. 1998, Itoh 2000, Martinez-barbabosa 2003). O'lorcain (1994) stated that *Toxocara* parasite was at the highest degree age in 4-24 weeks. Kirkpatrick (1988) identified that the prevalence of infection was higher in cats under the age of 2 and Baker (1989) stated that the prevalence of helminths like *T. mystax*, *T. canis* ve *A. caninum* were found to be higher in cats under the age of 1. Visco et al. (1978) identified that age class was not significant factor to detect prevalence of helminths.

In this research it was identified with necropsy of cats at different ages that 95,4% of at the age of 1 and younger, 100% of at the 2-3, 83,3% of at the age of 3-4, 95% of at the age of 4-5, 88,8% at the age of 5-6, 92,8% of at the age of 6-7, 80% of at the age of 7-8, 85,7% of at the age of 8 and older were found to be infected with helminths. This study showed that there were not difference in cats with different age classes ( $p > 0,05$ ).

Başaran (2002) reported that 5 of 14 samples were found to be infected with two species. Huh et al. (1993) identified 14,6% mixinfection. However, in this research 45% were found to be infected with one, 37% with two, 9% with three and 1% with four species. Helminth infection in cats was observed mainly with one or two species.

In conclusion, the prevalence of helminth infection in stray cats of Konya was found with the prevalence of 92% and six species of helminths, *Joyeuxiellapasqualei* (58%), *Dipylidiumcaninum* (28%), *Taeniataeniaeformis* (10%), *Diplopylidiumnölleri* (5%), *Toxocaramystax* (47%) and *Physalopterapraeputialis* (2%), were determined.

Helminth infection rate (92%) that detected with necropsy were higher than the rate of fecal examination (12%) and this situation was to be statistically important ( $p < 0,05$ ). Cats' age class end sexuality were not factor at helminth infection's prevalence ( $p > 0,05$ ).

In this research *Dipylidiumcaninum* (28%) ve *Toxocaracali* (47%) which detected in cats is pathogenic yo people and appear to be important risk factor to human healthi If cats carrying dangerous parasites are fed at home,

sanitary controls have to be done and treated. Moreover stray cats have to be fixed by municipal workers. Parasitic diseases can be placed under control partially with information meetings given yo people by press association.

## References

- Akuzowa, M, Mochizuki M, Yasuda N. 1987. Helminthological and parasitological study of the Iriomote cat (*Prionailurus iriomotensis*). *Can J Zool*, 65 (4), 946-949.
- Ash, R.L. 1962. Helminth parasites of dogs and cats in Hawaii. *J Parasitol*, 48 (1), 63-65.
- Ayaz, E., Değer, S., Gül, A., Yüksek, N. 2001. Van kedilerinde helmintlerin yayılışı ve halk sağlığı yönünden önemi. *T Parazitol. Derg.*, 25 (2), 166-169.
- Baker, M.K., Langel Verster, A., Piatt, V.D. 1989. A survey of helminths in domestic cats in the Pretoria area of Transvaal, Republic of South Africa. Part I: The prevalence and comparison of burdens of helminths in adult and juvenile cats. *J S Afr Vet Ass*, 60 (3), 139-142.
- Barton, M.A., Mc Ewan, D.R. 1993. Spirurid nematodes in dogs and cats from central Australia. *Aust Vet J*, 70 (7), 270.
- Başaran, E. 2002. Kuzeydoğu Marmara Bölgesinde Kedi ve Köpeklerin Helminth Enfeksiyonları. Uludağ Ü Sađ. Bil. Enst., Doktora tezi, Bursa.
- Burgu, A., Timar, R., Dođanay, A., Toparlak, M. 1985. Ankara 'da sokak kedilerinin ektoparazitleri üzerinde bir araştırma. *A.Ü. Vet. Fak. Derg.*, 32 (2), 288-300.
- Byron, L., Blagburn, M.S. 2001. Prevalence of canine and feline parasites in the United States, Supplement to compendium on the continuing education for the practicing veterinarian. Bayer Corporation, USA, Kansas, 23 6(A), 5-11.
- Calvete, C., Lucientes, J., Castillo, A.J., Estrada, R., Gracia, M.J., Peribanez, M.A., Ferrer, M. 1998. Gastrointestinal helminth parasites in stray cats from the Mid-Valley, Spain. *Vet Parasitol*, 75, 235-240.
- Christensen, N.O., Olsen, S.J., Roth, H. 1946. Incidence of lungworms and gastrointestinal parasites in Copenhagen cats. *J Parasitol*, 32, 514-515.
- Coman, B.J. 1972. A survey of the gastro-intestinal parasites of the feral cat in Victoria. *Aust Vet J*, 48, 133-136.
- Cowper, S.G. 1978. Helminth parasites of dogs and cats and toxoplasmosis antibodies in cats in Swansea. *South Wales Ann Trop Med Parasitol*, 72 (5), 455-459.
- Diñçer, Ş., Cantoray, R., Taşan, E. 1976. Elazığ sokak kedisinde ilk *Physaloptera praeputialis* Linstown, 1899 bulgusu. *F.Ü. Vet. Fak. Derg.*, 3 (1), 122-127.
- Diñçer, Ş., Cantoray, R., Taşan, E. 1980. Elazığ sokak kedilerinde görülen iç ve dış parazitler ile bunların yayılış oranları üzerinde araştırmalar. *F Ü Vet Fak Derg*, 5 (1), 7-15.
- Durukan, A. 1995. Bursa Yöresi Kedilerinde Helmintholojik Araştırmalar, Uludağ Ü Sađ. Bil. Enst., Doktora Tezi, Bursa.
- Engbaek, K., Madsen, H., Larsen, S.O. 1984. A survey of helminths in stray cats from Copenhagen with ecological aspects. *Z. Parasitenkd*, 70, 87-94.
- Ertürk, E., Tanzer, F. 1972. 1961-1970 periyodunda Ankara ve yöresinde kedilerde görülen hastalıklar. *A.Ü. Vet. Fak. Derg.*, 19 (1-2), 127-131.
- Gregory, G.G., Munday, B.L. 1976. Internal parasites of feral cats from the Tasmanian Midlands and Kings Island. *Aust Vet J*, 52 (7), 317-320.
- Güralp, N. 1957. Köpek ve kedi askaritlerinin tedavisinde piperazineadipate'la yaptığımız deneyler ve aldığımız sonuçlar. *A.Ü. Vet. Fak. Derg.*, 4, 42-51.
- Güralp, N. 1981. Helmintholoji 2. Baskı. A Ü Vet Fak, Yay No 368/266 Ankara Üniv. Basımevi, Ankara.
- Hasslinger, M.A., Omar, H.M., Selim, M.K. 1988. The incidence of helminths in stray cats in Egypt and other Mediterranean countries. *Vet Med Rev*, 59 (1), 76-81.
- Hering-Hagembeck, S., Schuster, R. 1996. A focus of *Opisthorchiasis* in Germany. *Applied Parasitol*, 37, 260-265.
- Huh, S., Sohn, W.M., Chai, J.Y. 1993. Intestinal parasites of cats purchased in Seoul. *Korean J Parasitol*, 31 (4), 371-373.
- Itoh, N. 2000. Survey on *Toxocara cati* in domestic cats. *Kansenshogaku Zasshi*, 74, 824-827.
- Ismail, N.S., Abdel-Hafez, S.K. and Toor, M.A. 1983. Prevalence of gastro intestinal helminths in cats from northern Jordan. *Pakistan Vet J*, 3 (3), 129-132.
- Kelly, J.D. 1975a. Helminth parasites of dogs and cats. II Prevalence in urban environments in Australasia. *Aust Vet Pract*, 1, 133-141.
- Kelly, J.D. 1975b. Anthroponotic helminthiasis in Australasia Part 3- Studies on the prevalence and public health implications of helminth parasites of dogs and cats in urban environments. *Int. J Zoon*, 2, 76-91.
- Kirkpatrick, C.E. 1988. Epizootiology of endoparasitic infections in pet dogs and cats presented to a Veterinary Teaching Hospital. *Vet. Parasitol*, 30 (2), 113-124.
- Lengy, J., Stemain, I., Stemain, Y. 1969. The current helminthofauna of stray dogs and cats in Israel. *J Parasitol*, 55, 1239.
- Lillis, W.G. 1967. Helminth survey of dogs and cats in New Jersey. *J Parasitol*, 53 (5), 1082-1084.

- Martinez-Barbabosa, I., Tsuji, O.V., Cabello, R.R., Cardenas, E.M.G., Chasin, O.A. 2003. The prevalence of *Toxocara cati* in domestic cats in Mexico-City. *Vet Parasitol*, 114, 43-49.
- McGlade, T.R., Robertson, I.D., Elliot, A.D., Read, C., Thompson, R.C. 2003. Gastrointestinal parasites of domestic cats in Perth, Western Australia. *Vet Parasitol*, 117, 251-262.
- Merdivenci, A. 1966. Bir yabani kedi (*Felis sylvestris*)'de *Opisthorchis felineus* (Rivolta 1884) Blanchard, 1895 infeksiyonu olgusu. *A.Ü. Vet Fak Derg*, 8, 455-461.
- Milstein, T.C., Goldsmid J.M. 1997. Parasites of feral cats from southern Tasmania and their potential significance. *Aust. Vet J*, 75 (3), 218-219.
- Mimioglu, M. 1954. Parasitologische Untersuchungen bei Katzen aus Ankara. *Z. Tropenmed Parasitol*. 5, 305-307.
- Mituch, J. 1968. Die helminthenfauna der Hauskatze (*Felis domestica*) in der Slowakei (CSSR). *Folia Veter.*, 12(2), 165-169.
- Moore, E., O' Callaghan, M.G. 1985. Helminths of dogs and cats determined by faecal examinations in Adelaide, South Australia. *Aust Vet J*, 62 (6), 198-199.
- Niak, A. 1972. The prevalence of *Toxocara cati* and other parasites in Liverpool cats. *Vet Rec*, 91, 534-536.
- Nichol, S., Ball, S.J., Snow, K.R. 1981. Prevalence of intestinal parasites in domestic cats from the London area. *Vet Parasitol*, 109, 252-253.
- O'Lorcain, P. 1994. Epidemiology of *Toxocara* spp. in stray dogs and cats in Dublin, Ireland. *J Helminthol* 68, 331-336.
- Overgaauw, P.A.M., Boersema, J.H. 1998. A survey of *Toxocara* infections in cat breeding colonies in the Netherlands. *Vet Quarterly*, 20, 9-11.
- Rep, B.H. 1975. Intestinal helminths in dogs and cats on the Antillean islands Aruba, Curaçao and Bonaire. *Trop Geogr Med*, 27, 317-323.
- Soulsby, E.J.L. 1986. *Helminths, Arthropods and Protozoa*. Tindall and Cassel Ltd, London.
- Styles, T.J. Evans, D.S. 1971. Intestinal parasites of dogs and cats. *NY State J Med*, 71, 2755-2757.
- Talbot, N. 1970. Helminth and arthropod parasites of the domestic cat in Papua and New Guinea. *Aust Vet J*, 46, 370-372.
- Tinar, R., Akyol, V., Çırak, V.Y. 2001. Türkiye kedilerinde ilk *Dexiagonimus ciureami* Witenberg, 1929 (trematoda) bulgusu. *T Parasitol. Derg*, 25, 69-71.
- Umeche N, Ima. A.E. (1988). Intestinal helminthic infections of cats in Calabar, Nigeria. *Folia Parasitol, Praha*, 35 (2), 165-168.
- Umur, Ş. 1997. Türkiye kedilerinde ilk *Metagonimus yokogawai* Katsurada, 1912 (Trematoda, Heterophyidae) Olgusu. *T. Parazitol. Derg.*, 21 (1), 67-70.
- Vanparijs, O., Hermans, L., van der Flaes, L. 1991. Helminth and protozoan parasites in dogs and cats in Belgium. *Vet Parasitol*, 38 (1), 67-73.
- Visco, R.J., Corvin, R.M., Selby, L.A. 1978. Effect of age and sex on the prevalence of intestinal parasitosis in cats. *J Am Vet*, 172 (7), 797-800.
- Yasuda, N., Akuzawa, M., Maruyama, H., Izawa, M., Doi, T. 1993. Helminths of the Tsushima Leopard Cat (*Felis bengalensis ussuriana*). *J Wild Dis*, 29, (1), 153-155.

*(Received for publication 11 August 2014; The date of publication 15 December 2015)*