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RESEARCH ARTICLE

Tapeworm Infections in Stray Dogs and Cats in İstanbul, Turkey

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Summary

This study was performed to determine the tapeworm infections of stray dogs and cats in İstanbul, Turkey. Stool samples were obtained from animals in a temporary animal rehabilitation center in İstanbul. Stools were examined microscopically for tapeworm eggs by saturated salt water flotation and by Teleman's sedimentation (for fatty stools) method and macroscopically for proglottids. Infected animals were treated with praziquantel (Cestacit Injectable Solution® Topkim, Turkey) at a dose of 5.68 active ingredient/kg bw and stools were re-examined daily until no parasite was seen for two consecutive days in terms of proglottids and scolices macroscopically and eggs microscopically. Out of 250 dogs, 26 (10.4%) were found to be infected with tapeworms, 16 (6.4%) with *Dipylidium caninum*, 10 (4%) with *Taenia* spp., and 2 (0.8%) with *Echinococcus granulosus* and, 2 (4.65%) of 43 cats had *Joyeuxiella pasqualei* infection.

Keywords: *Dog, Cat, Tapeworm, Cestode, Istanbul, Turkey*

İstanbul'da Sokak Kedi ve Köpeklerinde Sestod Enfeksiyonları

Özet

Çalışma, İstanbul'da, sokak kedi ve köpeklerinde sestod enfeksiyonlarını belirlemek için yapılmıştır. Dışkı örnekleri İstanbul'da geçici bir hayvan bakım merkezindeki hayvanlardan, ayrı kafeslere konarak bireysel olarak alınmış, makroskobik olarak halka ve mikroskobik olarak sestod yumurtası yönünden doymuş tuzlu su ile flotasyon ve Teleman sedimentasyon (yağlı dışkılarda) yöntemleri ile incelenmiştir. Enfekte bulunan hayvanlar, praziquantel (Cestacit, Enjeksiyonluk Çözelti® Topkim) ile 5,68 mg aktif madde/kg ca dozda tedavi edildikten sonra dışkıları hem makroskobik (halka/skoleks aranarak) ve hem de mikroskobik olarak (yumurta aranarak) arka arkaya iki gün parazit görülmeyinceye kadar incelenmiştir. Çalışmada 250 köpekten 26'sında (%10.4) sestod enfeksiyonu görülmüş, sestod türü itibarıyla 16'sında (%6.4) *Dipylidium caninum*, 10'unda (%4) *Taenia* spp. ve 2'sinde (%0.8) *Echinococcus granulosus* saptanmış; 43 kediden 2'si (%4.65) *Joyeuxiella pasqualei* ile enfekte bulunmuştur.

Anahtar sözcükler: *Kedi, Köpek, Sestod, Şerit, İstanbul, Türkiye*

INTRODUCTION

Cats and dogs may have various tapeworms and some of those such as *Echinococcus* spp are important for public health. The parasites of dogs and cats in Turkey were reviewed by Doğanay [1] in 1992 and existence of 12 and 6 tapeworm species were recorded in dogs and cats, respectively. In the studies [2-13] after this review [1], there is no record of existence of a new tapeworm species in cats or dogs in Turkey *(Table 1)*. Some tapeworms infecting cats and dogs can also infect wild carnivores. The studies [14-20] on the tapeworms of wild canids and felids in Turkey are summarized in *Table 2*.

In the first study [21] of dog tapeworms in İstanbul, in 1928, *Echinococcus granulosus* was found to be present in 3 out of 100 dogs. After approximately 30 years, in İstanbul, Yaşarol [22] detected *E. granulosus* in one (2.44%) dog among 41 dogs which were subject to coprological examination after arecoline administration and also in one (8.33%) dog among 12 dogs which were subject to postmortem examination. Subsequent to these studies, in 1963, Merdivenci [23] found 5 (22.72%) of 22 stray dogs collected from different districts of İstanbul to be infected with *E. granulosus*. These 3 studies have all focused on

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Table 1. *Studies on tapeworms of cats and dogs in Turkey since 1992 (in chronological order)*
Tablo 1. *Türkiye'de 1992'den beri kedi ve köpeklerin sestodları üzerinde yapılmış çalışmalar (kronolojik sıra ile)*

Animal, Locality and Ref.	Year, Method, No of Animals, Cestode Species and (Percentage Frequency)
•Dogs in rural area •Ankara Province •Zeybek et al. (2)	•1992, necropsy •33 dogs; *E. granulosus* (54.5%), *D. caninum* (45.5%), *T. hydatigena* (42.4%), *T. multiceps* (12.1%), *T. psiformis* (3.03%), *Taenia* sp. (6.06%), *M. lineatus* (3.03%) •Flotation with concentrated $ZnCl_2$ solution and saturated salt water •269 dogs; taeniid eggs (24.5%)
•Dogs in rural area •Elmadağ district in Ankara •Çerçi (3)	•1992, Flotation and sedimentation •121 dogs; taeniid eggs (46.28%)
•Stray dogs •Kayseri city •Şahin et al. (4)	•1993, necropsy •50 dogs; *T. hydatigena* (48%), *E. granulosus* (24%), *D. caninum* (8%), *M. lineatus* (8%), *T. multiceps* (4%), *T. psiformis* (4%)
•Dogs •Konya city •Güçlü and Aydenizöz (5)	•1995, Fülleborn's flotation and Benedeck's sedimentation •61 stray and 61 owned, total122 dogs; taeniid eggs (8.19%), *Dipylidium* eggs (1.63%)
•Stray dogs •Sivas city •Ataş et al. (6)	•1997, necropsy •25 dogs; *Taenia spp.* (56%), *D. caninum* (52%), *E. granulosus* (16%), *M. lineatus* (4%)
•Stray dogs •Konya city •Aydenizöz (7)	•1997, necropsy •50 dogs; *D. caninum* (38.33%), *J. pasqualei* (8.33%), *E. granulosus* (28.33%), *T. multiceps* (25%), *T. hydatigena* (21.66%), *M. lineatus* (1.66%)
•Stray dogs •Keçiören district in Ankara •Ayçiçek et al. (8)	•1998, necropsy •106 puppies aged 1-3 months; *Taenia* spp. (14.15%), *D. caninum* (34.9%), *E. granulosus* (0.94%)
•Stray dogs •Kars city •Umur and Özkan (9)	•1998, necropsy •42 dogs; *E. granulosus* (40.5%), *Taenia* sp. (28.6%), *T. psiformis* (11.9%), *T. multiceps* (7.1%), *T. hydeatigena* (4.8%), *M. lineatus* (2.4%) •Flotation and sedimentation •42 dogs; taeniid eggs (9.5%)
•Stray, owned and institution dogs •Van city •Orhun and Ayaz (10)	•2006, Fülleborn's flotation •61 stray dogs; taeniid eggs (9.8%), *Dipylidium* eggs (1.6%) •26 owned dogs; taeniid eggs (34.6%) •28 institution dogs; taeniid eggs (7.1%), *Dipylidium* eggs (10.7%) •Total 115 dogs; taeniid eggs (14.8%), *Dipylidium* eggs (3.5%)
•Stray dogs and cats •Hatay province •Yaman et al. (11)	•2006, necropsy •6 dogs; *D.caninum* in one dog •8 cats; *T. taeniaformis* in 2 cats, *J. pasqualei* in 3 cats, *J. pasqualei+D. caninum* in one cat
•Stray dogs •Afyon and Eskişehir cities •Kozan et al. (12)	•2006, Fülleborn's flotation •Afyonkarahisar: 150 dogs; taeniid eggs (2.9%), *Dipylidium* eggs (2.9%) •Eskişehir: 137 dogs; taeniid eggs (23.9%), *Dipylidium* eggs (4.3%)
•Stray dogs •Aydın city and Kuşadası district •Ünlü and Eren (13)	•2007, Fülleborn's flotation with saturated salt water and $ZnSO_4$ density:1.50 •Aydın shelter: 161 dogs; taeniid eggs (8.07%) •Kuşadası shelter: 39 dogs; taeniid eggs (5.12%) •Total 200 dogs; taeniid eggs (7.5%)

E. granulosus with no consideration of other tapeworms. Although approximately 50 years have passed from the last study [23], no study involving dog and cat tapeworms has been performed in İstanbul.

MATERIAL and METHODS

Animals and Fecal Sample Collection

The present study was performed in the temporary animal rehabilitation center of Kadikoy Municipality in the Asian part of İstanbul metropolitan area, where some stray dogs and cats were also collected from surrounding towns. Animals were placed in individual cages so that individual stools were collected.

Fecal Examination

Stools were examined daily. They were examined microscopically for tapeworm eggs by saturated salt water flotation and by Teleman's sedimentation (for fatty stools) method and were also examined macroscopically for proglottids. Infected animals were treated with

Table 2. *Studies on tapeworms of wild canids and felids in Turkey (necropsy results) (in chronological order)*
Tablo 2. *Türkiye'de yabani köpekgiller ve kedigillerin sestodları üzerinde yapılmış çalışmalar (nekropsi sonuçları) (kronolojik sıra ile)*

Year, locality and ref.	Animal, Tapeworm Species and (Percentage Frequency)
•1963 •Muş, Ankara, Thrace •Merdivenci (14)	•No tapeworms in 1 red fox from Muş Province •*M. lineatus, D.caninum* in 3 red foxes from Ankara Province •*D. caninum* ve *Echinococcus* sp. *(E. multilocularis* ?) in 3 red foxes from Thrace region of Turkey
•1965 •Babaeski district •Merdivenci (15)	•Confirmation of *E. multilocularis* in the red fox from Thrace region mentioned above
•1965 •Ankara province •Mimioğlu et al. (16)	•51 red foxes: *M. lineatus* (78.4%), *Taenia polyacantha* (13.6%), *J. echinorhynchoides* (1.9%) •one jackal: *M. lineatus*, *T. polyacantha*
•1983 •Turkey •Merdivenci (17)	•Red fox: *E. multilocularis*, *M. lineatus*, *M. litteratus*, *T. hydatigena*, *T. psiformis*, *T. crassiceps* •Jackal: *D.caninum*, *J. echinorhynchoides*
•1983 •İstanbul city •Göksu et al. (18)	• In 1980, a pseudophyllid tapeworm was recovered at the necropsy of a lion brought to Gulhane zoo in İstanbul from Adana zoo and pseudophyllid eggs were seen on the microscopic examination of fecal samples of the lion. The parasite was identified as *Diphyllobothrium* sp.
•Erkut Tüzer •İstanbul city •Unpublished data	•Proglottid samples of the pseudophyllid tapeworm mentioned above were sent to British Museum (Natural History) for confirmation. The parasite was identified as *Spirometra erinacei* (Rudolphi, 1819). This case has not been published in a journal.
•2001 •Van province •Ayaz et al. (19)	•Red fox: *M.lineatus* and its larva (tetratridium)
•2009 •Kars province •Gıcık et al. (20)	•20 red foxes: *M. lineatus* (60%), *T. multiceps* (10%), *T. pisiformis* (10%), *T. taenuiformis* (5%), *Taenia* spp. (10%), *E. granulosus* (5%)

praziquantel (Cestacit Injectable Solution® Topkim, Turkey) at a dose of 5.68 active ingredient/kg bw and following treatment, stools were re-examined daily until no parasite was seen for two consecutive days in terms of proglottids and scolices macroscopically and eggs microscopically. The identifications of parasites were based on the morphological characteristics of their eggs, scolices and proglottids [24-26]. Treatment results were previously published [27].

Statistical Analysis

The confidence limits (Confidence Level: 95%, α: 0.05, population size: unknown) of infection frequencies (%) were calculated with an online calculator, Confidence Interval Calculator for a Completion Rate[1*], according to the modified (adjusted) Wald method [28].

RESULTS

In the present study, tapeworms and their infection rates were as follows: Any one or more of tapeworm species in 10.4% of 250 dogs, *Dipylidium caninum* in 6.4%, *Taenia* spp. in 4%, and *Echinococcus granulosus* in 0.8% and, *Joyeuxiella pasqualei* in 4.65% of 43 cats *(Table 3)*.

1 * http://www.measuringusability.com/wald.htm#marg

DISCUSSION

The parasites of the dogs and cats in Turkey were reviewed by Doğanay [1] in 1992 and existence of 12 tapeworm species in dogs (*Echinococcus granulosus*, *Dipylidium caninum*, *D.sexcoronatum*, *Taenia hydatigena*, *T. pisiformis*, *T. multiceps* (Syn. *Multiceps multiceps*), *T. serialis*, *Joyeuxiella pasqualei*, *J. echinorhyncoides*, *Mesocestoides lineatus, M. litteratus*, *Diphyllobothrium latum*) and 6 species in cats (*D. caninum*, *Diplopylidium nölleri*, *J. pasqualei*, *J. echinorhyncoides*, *T. taeniaeformis* (Syn. *Hydatigera taeniaeformis*), *M. lineatus*) had been recorded in this review. Among these species, existence of *Diphyllobothrium latum* [29] and *M. litteratus* [30] in dogs in Turkey were recorded based on only one reference for each. There has been no other reference confirming existence of the two species in dogs in Turkey until now. However, *M. litteratus* in foxes was reported from Turkey [17]. In 1980, a pseudophyllid tapeworm was recovered at the necropsy of a lion brought to Gülhane zoo in İstanbul from Adana zoo and pseudophyllid eggs were seen on the microscopic examination of fecal samples of the lion. The parasite was identified as *Diphyllobothrium* sp.[18] and its proglottid samples were sent to British Museum (Natural History) for confirmation. The parasite was identified as *Spirometra*

Table 3. *Tapeworm infections of stray dogs and cats in İstanbul*
Tablo 3. *İstanbul'da sokak köpek ve kedilerinde sestod enfeksiyonları*

Dogs (n = 250)	No of Infected Dogs					Total No	Infection Frequencies (CI**)
	Sex		Age of Dogs				
	m	f	6 Months	2-4 Years	10 Years		
D. caninum	6	10*	2	14*	-	16*	6.4% (3.91%-10.21%)
Taenia spp	3	7*	-	9*	1	10*	4% (2.09%-7.3%)
E. granulosus	1	1	-	2	-	2	0.8% (0.03%-3.06%)
Any tapeworm	10	16*	2	23*	1	26*	10.4% (7.15%-14.85%)

Cats (n = 43)	No of Infected Cats		Total	Infection Frequencies (CI**)
	8-Months Old Female	1 Year Old Female		
J. pasqualei	1	1	2	4.65% (0.44%-16.3%)

** Two (0.8%) dogs infected with both D.caninum and Taenia spp.*
*** CI = 95% confidence limits according to the modified (adjusted) Wald method*

erinacei (Rudolphi, 1819). This case has not been published in a journal (unpublished data, Erkut Tüzer). There is no other data on pseudophyllid cestodes in animals in Turkey.

In previous studies based on microscopic fecal examination, taeniid eggs [2,3,9,13], taeniid and *Dipylidium* eggs [5,10,12] were found in dogs. There is no study based on fecal examination on the helminth parasites of cats since 1992. In this study based on microscopic and macroscopic fecal examinations, *D. caninum*, *E. granulosus*, and *Taenia* spp. were detected in dogs and *J.pasqualei* was detected in cats.

In the present study, the infection rates of tapeworms in dogs and cats were lower than those in the most of earlier studies based on necropsy [2,4,6,7,9], whereas the rates in earlier studies based on microscopic fecal examination were similar to those in the some studies [5,10,13] or some lower than those in the some other studies [2,12]. The reasons of the lower rates in the present study could be considered as a result of increased municipality performance on the rehabilitation of stray animals and as a result of increased government performances in illegal animal slaughtering. However, individual animal slaughtering still occurs in regions with low socio-economic status, especially during the religious festival known as Eid al Adha (Sacrifice festival) or Kurban Bayramı in Turkish. The use of fecal-based analyses in this study may be another reason of low infection rates. The rates of tapeworm infections in dogs and cats in İstanbul may probably be higher than those found in this study, especially in areas of low socio-economic status.

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