Journal of Helminthology (2006) **80,** 15–18 DOI: 10.1079/JOH2005311

Soil contamination with ascarid eggs in playgrounds in Kirikkale, Turkey

M. Aydenizöz Özkayhan*

Department of Parasitology, Faculty of Veterinary Medicine of Kırıkkale University, 71451 Kırıkkale, Turkey

Abstract

Contamination of soil with feline and canine ascarid eggs in eight playgrounds in Kırıkkale, Turkey was investigated monthly from February 2003 to January 2004. Dog faeces were also collected and all samples were examined using the zinc sulphate centrifugal flotation method. Eggs of *Toxocara* were observed in 5 of 8 (62.5%) of playgrounds examined and in 15.6% of 480 soil samples. The number of eggs varied from 1 to 11. Eggs were observed in soil samples collected in February, March to June, August and November, with embryonated eggs appearing in June and August. Eggs of *Toxascaris leonina* and *Taenia* spp. and oocysts of *Isospora* spp. were also found in 1.5%, 1.0% and 0.2% of soil samples, respectively. Of 26 samples of dog faeces collected, 7.7% were contaminated with *Toxocara* spp. and 11.5% with *Taenia* spp. The presence of *Toxocara* eggs in the city playgrounds and dog populations suggests a potential human health hazard due to toxocariasis.

Introduction

Toxocara canis and *T. cati* are parasites that occur commonly in dogs and cats, respectively (Uga, 1993). Both *T. canis* and *T. cati* are considered to be the causative agents of human toxocariasis (Shimizu, 1993), which is a public health problem (Overgaauw, 1997). *Toxocara* spp. cause visceral, ocular and covert toxocariasis in humans (Güralp, 1981; Aydenizöz, 1999). Visceral larva migrans (VLM) with more severe clinical symptoms is mainly found in children aged 1 to 3 years, primarily due to the close contact of children with contaminated soil in playgrounds and sandpits (Overgaauw, 1997) and the habitual ingestion of non-food substances (pica) (Glickman & Shofer, 1987). Visceral larva migrans is characterized by persistent eosinophilia, leukocytosis and hypergammaglobulinaemia. Clinical symptoms include fever, abdominal pain and wheezing or coughing (Overgaauw, 1997). Ocular larva migrans (OLM) is characterized by complaints of loss of visual acuity, squinting and 'seeing lights'. Covert toxocariasis (CT) is linked with symptoms such as hepatomegaly, cough, sleep disturbances, abdominal pain, headaches and behavioural changes (Overgaauw, 1997). Kindergartens and playgrounds, which are usually unfenced, are important sources of infection particularly for children, as stray dogs, cats and pets can easily visit and contaminate these habitats with eggs of *Toxocara* (Güçlü & Aydenizöz, 1998; Öge & Öge, 2000).

The prevalence of soil contamination by *Toxocara* spp. in various countries varies from 1.2% to 92% (Düwel, 1984; Chiejina & Ekwe, 1986; Ludlam & Platt, 1989; Uga, 1993; Abe & Yasukawa, 1997; Mizgajska, 2001; Ruiz de Ybáñez *et al.*, 2001). In Turkey, the prevalence of *T. canis* was found to be 13.2–40% (Budak *et al.*, 1986; Çerçi, 1992; Doğanay & Öge, 1993; Şahin *et al.*, 1993; Güçlü & Aydenizöz, 1995; Aydenizöz, 1997), with *T. cati* being much lower at 0.5% (Doğanay & Öge, 1993). Güçlü & Aydenizöz (1998) reported 4.2% of parks are contaminated in city of Konya, and the contamination rate of public parks, playgrounds and sandpits with *Toxocara* spp. in Ankara (Öge & Öge, 2000) and İstanbul (Toparlak *et al.*, 2002) were determined as 30.6% and 8.3%, respectively. The present study was undertaken to investigate the level of soil contamination with feline and canine ascarid eggs in playgrounds in Kırıkkale, Turkey, for comparison with other sites in Turkey and elsewhere.

*Fax: +90 318 3573304
E-mail: meralaydenizoz@hotmail.com

Materials and methods

Four hundred and eighty soil samples (30 g) were collected from five different regions of eight playgrounds in Kırıkkale every month from February 2003 to January 2004 and examined as previously described by Kazacos (1983). Twenty six samples of dog faeces were collected and examined at the same time. The specific gravity of the zinc sulphate ($ZnSO_4 \cdot 7H_2O$) used in the centrifuge flotation was 1.20 at 20°C. Soil samples were sifted in a sieve of 4 mm mesh to remove stones, grass and other solid objects and mixed with 60 ml water and 0.5 ml Tween 40 in a 100 ml-bottle. The entire mixture was shaken thoroughly for 5 min and sifted through a coarse sieve of 250 μm pore size mesh. After filtration, 28 ml of filtrate and 20 ml of water were added to a 50-ml centrifuge tube and centrifuged at 1000 to 1500 rpm for 3 min. The supernatant was discarded and the sediment was resuspended in 45–50 ml of water, and the mixture again centrifuged under the same conditions. The sediment was washed three times by centrifugation in water, then suspended in 12 ml of $ZnSO_4$ solution, and transferred to 15-ml centrifuge tubes. Each tube was topped up with zinc sulphate solution until a positive meniscus was formed, then an 18 mm × 18 mm coverslip was placed on top of the tube in contact with the fluid meniscus. The tube was centrifuged for 10 min at 1000 to 1500 rpm, and then the coverslip was removed and examined for parasite egg stages. A second coverslip was added, the tube centrifuged for 5 min and the coverslip examined for eggs. The process was repeated four times, with any remaining eggs being examined after each process. The sediment was suspended before each centrifugation (1000 to 1500 rpm × 10 min).

Results

Seventy five (15.6%) of 480 soil samples and five (62.5%) of eight examined playgrounds were found to be contaminated with *Toxocara* spp. eggs. Forty-three *Toxocara* eggs were counted from playgrounds, in the range of 1–11 eggs (mean of 0.09) with mean numbers in infected soil ranging from 0.3 to 0.6. The highest number of eggs (26) was observed in April 2003. Embryonated eggs were present in soil samples in June and August 2003. Eggs of *Toxascaris leonina* and *Taenia* spp. and oocysts of *Isospora* spp. were also found in 1.5%, 1.0% and 0.2% of soil samples, respectively.

Of 26 samples of dog faeces collected from playgrounds, two (7.7%) were infected with eggs of *Toxocara* spp. and three (11.5%) with eggs of *Taenia* spp. In addition, oocysts of *Isospora* spp. and eggs of *Ancylostoma* spp. were recovered in two and three samples of dog faeces, respectively.

Discussion

It is reported that the prevalence of helminth infections in dogs worldwide range between 67.4 and 100% (Doğanay, 1983; Saygı *et al.*, 1990; Çerçi, 1992; Şahin *et al.*, 1993; Güçlü & Aydenizöz, 1995; Aydenizöz, 1997) and values of 77–97.5% (Vaughan, 1953; Styles, 1967; Kamiya *et al.*, 1973) have been reported in Turkey and other countries.

In dogs in Turkey some helminth species identified were: *Echinococcus granulosus* (16–44%) (Doğanay, 1983; Saygı *et al.*, 1990; Şahin *et al.*, 1993; Aydenizöz, 1997), *T. canis* (13.22–40%) (Doğanay, 1983; Budak *et al.*, 1986; Çerçi, 1992; Doğanay & Öge, 1993; Şahin *et al.*, 1993), *T. cati* (0.54%) (Doğanay & Öge, 1993), hookworms (0.81–18%) (Doğanay, 1983; Çerçi, 1992; Şahin *et al.*, 1993; Güçlü & Aydenizöz, 1995; Aydenizöz, 1997). In other countries helminth infections reported from dogs were: *E. granulosus* (0.8–22.8%) (Kamiya *et al.*, 1973; Pandey *et al.*, 1987), *T. canis* (3–93%) (Vaughan, 1953; Styles, 1967; Kamiya *et al.*, 1973; Pandey *et al.*, 1987), *Ancylostoma caninum* and *Uncinaria stenocephala* (17.5–79%) (Vaughan, 1953; Styles, 1967; Kamiya *et al.*, 1973; Pandey *et al.*, 1987). *Echinococcus granulosus* leads to hydatidosis, while *T. canis*

Table 1. The degree of soil contamination with *Toxocara* spp. eggs in various parts of the world.

Country/city	Prevalence (%)	No. of samples	Reference
Argentina/ Resistencia	1.3	475	Alonso *et al.*, 2001
Germany/ Frankfurt	87	31	Düwel, 1984
India/ Madras	6.6	410	Gunaseelan *et al.*, 1992
Japan/ Mishinomiya, Hyogo	92	13	Uga, 1993
Osaka	75	40	Abe &Yasukawa, 1997
Tokushima	63.3	46	Shimizu, 1993
Jordan/Amman, Irbid, Jerash, Zarqa	15.5	226	Abo-Shehada, 1989
Nigeria/ Enugu, Nsukka	13	100	Chiejina & Ekwe, 1986
Poland/ Ponzań, Lublin, Wroclow, Elblag, Krakow	38–53	1187	Mizgajska, 2001
Spain/ Murcia	1.2	644	Ruiz de Ybáñez *et al.*, 2001
Turkey/ Ankara	30.6	170	Öge & Öge, 2000
İstanbul	8.3	132	Toparlak *et al.*, 2002
Kırıkkale	15.6	480	Present study
Konya	4.2	48	Güçlü & Aydenizoz, 1998
UK/ London	6.3	521	Gillespie *et al.*, 1991
USA/ Baltimore	11	146	Childs, 1985
St Joseph/Benton Harbour, Michigan	19	114	Ludlam & Platt, 1989
Urbana, Galesburg, Charleston	16.3	135	Paul *et al.*, 1988

https://doi.org/10.1079/JOH2005311 Published online by Cambridge University Press

and *T. cati* lead to visceral and ocular larva migrans or to covert toxocariasis. In addition, *A. caninum* and *U. stenocephala* cause cutaneous larva migrans.

In the present study, the presence of eggs of *Toxocara* spp. both in parks (62.5%) and soil samples (15.6%) in Kırıkkale are in agreement with previous studies reported from Turkey and elsewhere. In surveys of parks in Turkey, eggs of *Toxocara* spp. were observed in 25% in Konya (Güçlü & Aydenizöz, 1998), 60.9% in Ankara (Öge & Öge, 2000) and 15.9% in İstanbul (Toparlak *et al.*, 2002). The ratio of eggs in the soil of parks from these cities varied between 4.2% and 30.6% (Güçlü & Aydenizöz, 1998; Öge & Öge, 2000; Toparlak *et al.*, 2002), whereas in other countries the prevalence of *Toxocara* spp. in soil samples from parks ranged between 3.4% and 92% (Düwel, 1984; Paul *et al.*, 1988; Shimizu, 1993; Uga, 1993; Abe & Yasukawa, 1997; Alonso *et al.*, 2001; Ruiz de Ybáñez *et al.*, 2001) and in other areas between 1.2% and 53% (table 1) (Düwel, 1984; Childs, 1985; Chiejina & Ekwe, 1986; Gillespie *et al.*, 1991; Gunaseelan *et al.*, 1992; Mizgajska, 2001; Ruiz de Ybáñez *et al.*, 2001). It should be taken into consideration that many factors influence the results of soil examinations and these include the methods used for the determination of *Toxocara* spp. in soil, sample site selection, number and volume of samples, depth of sampling, season of examination, type of soil examined, preservation of samples and laboratory skills (Mizgajska, 2001).

The highest soil contamination (17 eggs) was observed in one of the largest parks in Kırıkkale city, where people tend to picnic. Moreover, the park is located near a slaughterhouse, and hence visited by many stray dogs. The remaining four parks under investigation were located in the suburbs of Kırıkkale.

The degree of soil contamination with eggs of *Toxocara* spp. in parks and sandpits varies both in Turkey and worldwide. In Turkey, the mean number of eggs of *Toxocara* spp. was 0.067 per 100 g (0.2–1.2) in all parks of İstanbul (Toparlak *et al.*, 2002) and 2.8 per 50 g (1–10) in Ankara (Öge & Öge, 2000). The mean number of eggs per sample was 16.7 ± 20 per 100 g (2–64) in Spain (Ruiz de Ybáñez *et al.*, 2001) and the mean number of viable eggs was 5.5 ± 4.58 per 5 g (1–15) in Jordan (Abo-Shehada, 1989) with viable eggs being found in higher proportions in soil collected from villages compared with cities. In Maryland, USA the number of eggs of *Toxocara* spp. recovered per 2 g sample ranged from 1 to 14 with a mean of 1.5 (Childs, 1985). In Nigeria, only the samples collected from premises of dog kennels were found to be infected, and egg counts for positive soil samples varied from 2 to 30 eggs per 100 g of soil (Chiejina & Ekwe, 1986). *Toxocara* spp. eggs detected were 14.8 per 100 g (3–47) in Frankfurt/M (Düwel, 1984), 1–2300 per 250 g in Jordan (Abo-Shehada, 1989) and 0.73 per 5 g in the USA (Ludlam & Platt, 1989). In the present study, the mean rate of *Toxocara* spp. eggs was 0.09 per 30 g (1–11) in soil samples from parks examined and 0.6 per 30 g in contaminated parks. These results indicate that the soils in playgrounds in Kırıkkale are significantly infected, suggesting that children are at risk of infection.

As the seasonal and climatic conditions are important, the present survey briefly studied the influence of season on the viability of eggs of *Toxocara* spp. in soil. In a previous study by Güçlü & Aydenizöz (1998), *Toxocara* infections were surveyed in July and February, and the highest number of eggs occurred in February. In various countries, infections were observed especially in shady areas in Spain (Ruiz de Ybáñez *et al.*, 2001) in the spring in Poland (Mizgajska, 2001), and the highest egg numbers occurred in the spring, early summer and autumn. In contrast, Shimizu (1993) reported that contamination was lower in the summer and winter in sandpits in Tokushima/Japan. In present study, eggs of *Toxocara* spp. were recovered in February, March, April, May, June, August and November. This is in agreement with the results of other investigations (Shimizu, 1993; Güçlü & Aydenizöz, 1998; Mizgajska, 2001). Of the *Toxocara* eggs recovered from sandpits in Japan, 63% were fully embryonated (Uga, 1993), and the percentage of embryonation was the highest (81%) in September–November, followed by June–August (70%) and then declined to 47% by December–February. In the present study, embryonated eggs were recovered in June and August, but whether this is a seasonal occurrence requires further investigation.

In conclusion, eggs of *Toxocara* spp. were found in 62.5% of the playgrounds examined and 15.6% of the soil samples in Kırıkkale, suggesting that stray and free-ranging dogs and cats defecate in the neighbourhood around the parks. This raises the risk to children of visceral and ocular larva migrans and covert toxocariasis. Preventative measures are needed, including keeping sandpits and playground areas clean of ascarid eggs, controlled management of stray dog and cat populations, fencing of playgrounds and generally educating the public about the zoonotic risk of toxocariasis.

Acknowledgement

The author would like to thank the staff of Parks and Gardens Directorship of Kırıkkale Municipality for help in the collection of soil samples and Dr Şevket Arikan for his reading the manuscript for English language. This work was supported by a grant from the Kırıkkale University Research Fund (Project no: 02/ 09-02-02).

References

Abe, N. & Yasukawa, A. (1997) Prevalence of *Toxocara* spp. eggs in sandpits of parks in Osaka city, Japan, with notes. *Journal of Veterinary Medical Science* **59**, 79–80.

Abo-Shehada, M. N. (1989) Prevalence of *Toxocara* ova in some schools and public grounds in Northern and Central Jordan. *Annals of Tropical Medicine and Parasitology* **83**, 73–75.

Alonso, J.M., Stein, M., Chamorro, M.C. & Bojanich, M.V. (2001) Contamination of soils with eggs of *Toxocara* in a subtropical city in Argentina. *Journal of Helminthology* **75**, 165–168.

Aydenizöz, M. (1997) Konya yöresi köpeklerinde helmintolojik araştırmalar. *Türkiye Parazitololoji Dergisi* **21**, 429–434.

Aydenizöz, M. (1999) Larva migransı. *Türkiye Parazitoloji Dergisi* **23**, 317–322.

https://doi.org/10.1079/JOH2005311 Published online by Cambridge University Press

Budak, S., Sermet, I. & Üner, A. (1986) İzmir ve civarındaki sokak köpeklerinde askarid prevalansı. *Türkiye Parazitololoji Dergisi* **9**, 57–65.

Çerçi, H. (1992) Ankara ili Elmadağ ilçesi kırsal yöre köpeklerinde görülen mide-bağırsak helmintlerinin yayılışı ve insan sağlığı yönünden önemi. *Türkiye Parazitololoji Dergisi* **16**, 59–67.

Chiejina, S.N. & Ekwe, T.O. (1986) Canine toxocariasis and the associated environmental contamination of urban areas in eastern Nigeria. *Veterinary Parasitology* **22**, 157–161.

Childs, J.E. (1985) The prevalence of *Toxocara* species ova in backyards and gardens of Baltimore, Maryland. *American Journal of Public Health* **75**, 1092–1094.

Doğanay, A. (1983) Ankara köpeklerinde görülen helmint türleri, bunların yayılışı ve halk sağlığı yönünden önemi. *Ankara Üniversitesi Veteriner Fakültesi Dergisi* **30**, 550–561.

Doğanay, A. & Öge, S. (1993) The prevalence of ascariasis in stray dogs in Ankara. *Ankara Üniversitesi Veteriner Fakültesi Dergisi* **40**, 552–562.

Düwel, D. (1984) The prevalence of *Toxocara* eggs in the sand in children's playgrounds in Frankfurt/M. *Annals of Tropical Medicine and Parasitology* **78**, 633–636.

Gillespie, S.H., Pereira, M. & Ramsay, A. (1991) The prevalence of *Toxocara canis* ova in soil samples from parks and gardens in London. *Public Health* **105**, 335–339.

Glickman, L.T. & Shofer, F.S. (1987) Zoonotic visceral and ocular larva migrans. *Veterinary Clinics of North America, Small Animal Practice* **17**, 39–53.

Güçlü, F. & Aydenizöz, M. (1995) Konya'da köpeklerde dışkı bakılarına göre parazitlerin yayılışı. *Türkiye Parazitololoji Dergisi* **19**, 550–556.

Güçlü, F. & Aydenizöz, M. (1998) Çocuk parklarındaki kumların köpek ve kedi helminti yumurtaları ile kontaminasyonunun tespiti. *Türkiye Parazitololoji Dergisi* **22**, 194–198.

Gunaseelan, L., Ganesan, P.I., Ramadess, P., Basheer, A. & Raghavan, N. (1992) Incidence of *Toxocara* ova in the environment. *Indian Veterinary Journal* **69**, 308–309.

Güralp, N. (1981) Helmintoloji, 2. Baskı pp. 428–430. A. Ü. Basımevi, Ankara.

Kamiya, H., Ishimoto, T., Araki, J. & Kamiya, M. (1973) Helminths of stray dogs in Sapporo, Hokkaido, Japan. *Japanese Journal of Veterinary Research* **21**, 51–57.

Kazacos, K.R. (1983) Improved method for recovering ascarid and other helminth eggs from soil associated with epizootics and during survey studies. *American Journal of Veterinary Research* **44**, 896–900.

Ludlam, K.E. & Platt, T.R. (1989) The relationship of park maintenance and accessibility to dogs to the presence of *Toxocara* spp. ova in the soil. *American Journal of Public Health* **79**, 633–634.

Mizgajska, H. (2001) Eggs of *Toxocara* spp. in the environment and their public health implications. *Journal of Helminthology* **75**, 147–151.

Öge, S. & Öge, H. (2000) Prevalence of *Toxocara* spp. eggs in the soil of public parks in Ankara, Turkey. *Deutsche Tierärztliche Woschenschrift* **107**, 72–75.

Overgaauw, P.A. (1997) Aspects of *Toxocara* epidemiology: human toxocarosis. *Critical Reviews in Microbiology* **23**, 215–231.

Pandey, V.S., Dakkak, A. & Elmamoune, M. (1987) Parasites of stray dogs in the Rabat region, Morocco. *Annals of Tropical Medicine and Parasitology* **81**, 53–55.

Paul, A.J., Todd, K.S. & Dipietro, J.A. (1988) Environmental contamination by eggs of *Toxocara* species. *Veterinary Parasitology* **26**, 339–342.

Ruiz de Ybáñez, M.R., Garijo, M.M. & Alonso, F.D. (2001) Prevalence and viability of eggs of *Toxocara* spp. and *Toxascaris leonina* in public parks in eastern Spain. *Journal of Helminthology* **75**, 169–173.

Şahin, İ., Ekinci, N., Şen, İ., Özcan, M. & Gödekmerdan, A. (1993) Kayseri yöresi köpeklerinde *Echinococcus granulosus* (Batsch, 1786) ve diğer parazitlerin yayılışı. *Türkiye Parazitololoji Dergisi* **17**, 69–76.

Saygı, G., Özçelik, S. & Temizkan, N. (1990) Sivas sokak köpeklerinin ince barsaklarında bulduğumuz helmintler. *Türkiye Parazitololoji Dergisi* **14**, 81–93.

Shimizu, T. (1993) Prevalence of *Toxocara* eggs in sandpits in Tokushima outskirts. *Journal of Veterinary Medical Science* **55**, 807–811.

Styles, T.J. (1967) Incidence of *Toxocara canis* and other helminth parasites of dogs in Mexico City. *Journal of Parasitology* **53**, 822–823.

Toparlak, M., Gargılı, A., Tüzer, E., Keleş, V., Ulutaş Esatgil, M. & Çetinkaya, H. (2002) Contamination of children's playground sandpits with *Toxocara* eggs in İstanbul, Turkey. *Turkish Journal of Veterinary and Animal Sciences* **26**, 317–320.

Uga, S. (1993) Prevalence of *Toxocara* eggs and number of faecal deposits from dogs and cats in sandpits of public parks in Japan. *Journal of Helminthology* **67**, 78–82.

Vaughan, A.W. (1953) Report on faecal examinations in the dog. *Veterinary Record* **65**, 397–398.

(Accepted 23 June 2005)