

Soil Contamination with *Toxocara* Spp. Eggs in the Public Parks and Primary Schools of Kermanshah, West of Iran

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Abstract

Toxocariasis is a common parasitic infection in the world that is caused by the larvae stage of two members of the family Ascarididae, *Toxocara canis* and *Toxocara cati*. The main source of soil contamination with *Toxocara* eggs is dogs' and cats' faces. The soil, where *Toxocara* eggs become infective, is the natural source of infection. This study was carried out to determine the rate of soil contamination with *Toxocara* spp. eggs in primary schools and public parks in Kermanshah city, Western Iran. This survey was conducted from September 2014 to January 2015 in Kermanshah city, West of Iran. A total of 192 soil samples were collected from different parks and primary schools, 24 parks, and 24 primary schools, of six regions. Soil samples were investigated for the presence of *Toxocara* eggs by flotation technique using sucrose solution and examined under a light microscope using 10X and 40X objectives. Out of 192 soil samples, 56 (29.2%) were found to contain *Toxocara* spp. eggs. *Toxocara* eggs were observed in 21 (87.5%) out of 24 studied parks and 11 (45.8%) out of 24 studied primary schools. Forty-three (44.8%) out of 96 samples from public parks and 13 (13.5%) out of 96 samples from primary schools were found to contain *Toxocara* eggs. Data analysis through the chi-square test revealed that there is a significant relationship in the contamination rate between parks and primary schools ($P < 0.001$). The results of this study illustrate that *Toxocara* spp. are common parasites in the soil in the public parks and primary schools in Kermanshah. Thus, soil contamination with *Toxocara* eggs can be regarded as a potential health problem in this city.

Key words: Soil, *Toxocara*, Iran, Flotation technique.

Introduction

Although intestinal parasites are found worldwide, they are more common in tropical and subtropical areas where there are poor socioeconomic conditions [1,2]. Some of these parasites need a period in the soil to become infective and remain active as long as they infect the next host. One of the main sources of soil contamination with parasites is the feces of infected dogs and cats [3]. So these animals play an important role in the epidemiology of toxocariasis [4].

Toxocariasis is a common parasitic infection in the world that affects animals such as cats and

dogs [5,6]. The agents of this disease are two members of the family Ascarididae, *Toxocara canis*, and *T. cati*. Also *T. leonina*, as another member of the Ascarididae, infects cats and dogs as well [7]. These animals can be regarded as reservoirs for gastrointestinal parasites, which may cause infection in humans. Among these parasites, *Toxocara* spp., in particular, are zoonotic and can infect humans [8]. Infected dogs and cats pass approximately 50000 eggs per gram of feces each day. After three to six weeks, depending on temperature and moisture, the eggs become embryonated in soil and can infect hosts

[9]. The durability of *Toxocara* eggs in the soil is dependent on different factors such as weather conditions, soil moisture, and exposure to sunlight [10]. Accidental ingestion of embryonated eggs in the soil or raw vegetables are the main causes of human infection [11,12]. *Toxocara* infection in humans illustrates four clinical features, including visceral larva migrans (VLM), ocular larva migrant (OLM), covert toxocariasis (CT), and neurological toxocariasis (NLM) [13].

In Iran, infected stray animals are capable of infections with helminths and protozoa [14]. Increased number of stray dogs and cats in urban and rural areas, animal's easy access to public parks, unsuitable waste disposal and discharge, and also increases the human tendency to keep pets raise the probability of contamination of soil with infectious agents and subsequent increase in parasitic infections like toxocariasis [15]. Thus, soil contamination with *Toxocara* spp. eggs appear to be one of the most important risks for the human population, especially children. As a result, several studies were carried out to determine the prevalence of *Toxocara* spp. eggs in parks, playgrounds, beaches, backyard, and other rural and urban areas in the world [16].

The present study aimed to evaluate the soil contamination with *Toxocara* spp. eggs in primary school and public parks in Kermanshah city, West of Iran.

Materials and Methods

Study area

This survey was conducted from September 2014 to January 2015 in Kermanshah city, West of Iran. According to the 2011 census, its population is 851,405. The city has a temperate to mountainous climate and is surrounded by the Zagros Mountains and is rainy in spring and autumn, and cold and snowy in winter. Kermanshah is one of the agricultural centers in the West of Iran that produces grain, vegetables, rice, fruits, and oilseeds.

Design of sources of sample collection

A total of 192 soil samples were collected from 24 public parks and 24 primary schools of

different regions of Kermanshah city. The samples were collected from four different parts of each park and primary school, including northern, eastern, western, and southern, which had loose soil, mainly from the flowerbeds. Approximately 200 grams of soil was collected from an approximate depth of 2-5 cm. All samples were placed in plastic containers, labeled with a number, and dried in the air.

Parasitological procedures

By using 150 and 250-micrometer sieve, two grams of each sample were isolated and transferred into the tubes. Afterward, 10 ml Tween 80 (0.05%) was added to the mixture and shook vigorously. The mixture was centrifuged for five minutes at 1500 rpm. After discarding the supernatants, the test tubes containing the sediments were filled up to approximately 1 cm from the top with sucrose solution (1.2 g/cm³) and then sediments were suspended. In the next step, the tubes were centrifuged for 15 min at 1500 rpm, afterward the tubes were filled to the top with sucrose solution and a cover slip placed on the top of the tube for 30 min and then the cover slip examined under a light microscope using 10X and 40X objective.

Results and Discussion

Out of 192 soil samples, 56 (29.2%) were found to contain *Toxocara* spp. eggs (Table 1). *Toxocara* eggs were observed in 21(87.5%) out of 24 studied parks and 11(45.8%) out of 24 studied primary schools. Forty-three (44.8%) out of 96 samples from public parks, 13(13.5%) out of 96 samples from primary schools were found to harbor *Toxocara* eggs. Data analysis by chi-square test revealed that there was a significant relationship about contamination rate between parks and primary schools ($P < 0.001$).

This study was designed to investigate soil contamination with *Toxocara* spp. eggs in the West of Iran. In the present study, *Toxocara* spp. eggs were recovered from many parts of the studied region, by the floatation method.

Table 1: Soil contamination rates with *Toxocara* spp. eggs among public parks and primary schools of Kermanshah, Iran

Places	Study places no	Study places positive (%)	Samples no	Positive samples (%)
Parks	24	21(87.5)	96	43(44.8)
Primary schools	24	11(45.8)	96	13(13.5)
Total	48	32 (66.7)	192	56 (29.2)

It appears that soil can be a major source of *Toxocara* infections for the human population, especially for children.

Based on the results of the present study, the primary schools in one region of Kermanshah were completely clear about contamination with *Toxocara* spp. eggs, but parks and other primary schools were observed as highly contaminated. On the other hand, it is known that *Toxocara* spp. eggs are resistant to environmental conditions and can remain infective for a year in a favorable condition [17]. Also, some physical properties of the soil such as moisture, oxygen, and compression can affect the survival of eggs, for example, low humidity is lethal to *T. canis* eggs [18]. Since the collection of soil samples for this study was conducted in autumn and winter, which are rainy seasons, a high rate of contamination was expected. Furthermore, because Kermanshah is a mountainous area, the collected sandy soils had high compression and moisture, which these factors could contribute to the survival of *Toxocara* spp. eggs in the environment [19]. Children in contaminated primary schools are at risk of acquiring the infection [20].

Soil contamination with helminths eggs have been reported widely [21] and in the present study contamination with *Toxocara* eggs in Kermanshah (29.2%) was observed higher compared to cities in the other cities in foreign countries such as Aydin (18.91%), Basrah (12.2%), Zarga (15.5%), Michigan (19%), Jerash (15.5%), Illinois (16.3%), but lower than Frankfurt (87.1%), Marche (34%), Havana (42.2%) and Hannover (30.8%) [22-24]. Although, Soil contamination with *Toxocara* eggs in Kermanshah was observed higher than the other cities in Iran including Urmia (7.8%), Shiraz (6.3%), Khorram Abad (22.2%), and Isfahan (28.6%), and the same as Abadan (29.2%) and lower than Ahvaz (30.4%) and Tehran (38.7%) [11, 25-30]. In a study on the

intestinal helminths of dogs in the western part of Iran (West Azerbaijan, Kordestan, and Kermanshah provinces), infection with *T. canis* (6%) and *T. leonina* (32.5%) has been reported [31], which the infection rate is approximately similar to our reported rate of soil contamination with *Toxocara* spp. eggs in Kermanshah.

The results of the present study show that *Toxocara* spp. is of the most common parasites in soils of public parks and primary schools in Kermanshah. Thus the potential possibility of VLM and OLM syndromes among children are predictable. In Iran, VLM syndrome was reported in 10 children cases (6 male and 4 female) that all had a history of contact with the dog [32]. In another study, the seroprevalence of toxocariasis in children aged 1 to 9 years in western Iran was reported 8.8% [33].

Iranian people do not commonly keep dogs and cats in their dwellings. Therefore, it seems that the origin of the contamination is the excreted eggs by stray cats and dogs in public places. Thus, given to the relatively high soil contamination of public parks and, primary schools in the second place, *Toxocara* eggs in Kermanshah should be considered as a health problem in this city. Further studies can be suggested on the prevalence of human toxocariasis in this city, especially among children.

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Footnotes

Authors' Contribution: MAM, MRR, and MRV: Conceptualized the study, developed search strategy; MRV: Collection of samples; MAM, MRR, MF, MGh and ZJ: Execution techniques

and parasitological examination; MAM and MRR: analysis and interpretation of data; All authors reviewed and contributed to the writing of this manuscript.

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References

- Jafari R, Fallah M, Yousofi Darani H, Yousefi HA, Mohaghegh MA, Latifi M, et al. Prevalence of intestinal parasitic infections among rural inhabitants of Hamadan city, Iran, 2012. *Avicenna J Clin Microbiol Infect.* 2014;1(1):e21445.
- Abe EM, Echeta OC, Ombugadu A, Ajah L, Aimankhu PO, Oluwole AS. Helminthiasis among School-Age Children and Hygiene Conditions of Selected Schools in Lafia, Nasarawa State, Nigeria. *Tropical medicine and infectious disease.* 2019;4(3).
- Mandarino-Pereira A, de Souza FS, Lopes CW, Pereira MJ. Prevalence of parasites in soil and dog feces according to diagnostic tests. *Veterinary parasitology.* 2010;170(1-2):176-81.
- Eslahi AV, Badri M, Khorshidi A, Majidiani H, Hooshmand E, Hosseini H, et al. Prevalence of *Toxocara* and *Toxascaris* infection among human and animals in Iran with meta-analysis approach. *BMC infectious diseases.* 2020;20(1).
- MagnaVal JF, Glickman LT, Dorchie P, Morassin B. Highlights of human toxocariasis. *The Korean journal of parasitology.* 2001;39(1):1-11.
- Chen J, Liu Q, Liu GH, Zheng WB, Hong SJ, Sugiyama H, et al. Toxocariasis: a silent threat with a progressive public health impact. *Infectious diseases of poverty.* 2018;7(1):59.
- Antolová D, Reiterová K, Miterpáková M, Stanko M, Dubinský P. Circulation of *Toxocara* spp. in suburban and rural ecosystems in the Slovak Republic. *Veterinary parasitology.* 2004;126(3):317-24.
- Robertson ID, Thompson R. Enteric parasitic zoonoses of domesticated dogs and cats. *Microbes and Infection.* 2002;4(8):867-73.
- Lee AC, Schantz PM, Kazacos KR, Montgomery SP, Bowman DD. Epidemiologic and zoonotic aspects of ascarid infections in dogs and cats. *Trends in parasitology.* 2010;26(4):155-61.
- Pezeshki A, Haniloo A, Alejafar A, Mohammadi Ghalehbin B. Detection of *Toxocara* spp. Eggs in the Soil of Public Places in and Around of Ardabil City, Northwestern Iran. *Iranian journal of parasitology.* 2017;12(1):136-42.
- Zibaei M, Abdollahpour F, Birjandi M, Firoozeh F. Soil contamination with *Toxocara* spp. eggs in the public parks from three areas of Khorram Abad, Iran. *Nepal Med Coll J.* 2010;12(2):63-5.
- Khoshnood S, Pestehchian N, Hejazi SH, Rafiei A, Soleimani A, Ahmadi M, et al. *Toxocara* Seroprevalence and Associated Risk Factors Among Ilam Children, West of Iran. *Arch Pediatr Infect Dis.* 2018;7(1):e81349.
- Congdon P, Lloyd P. *Toxocara* infection in the United States: the relevance of poverty, geography and demography as risk factors, and implications for estimating county prevalence. *International journal of public health.* 2011;56(1):15-24.
- Khademvatan S, Rahim F, Tavalla M, Abdizadeh R, Hashemitabar M. PCR-based molecular characterization of *Toxocara* spp. using feces of stray cats: a study from Southwest Iran. *PloS one.* 2013;8(6):e65293.
- Rezaieianesh MR, Afzalaghaye M, Hamidi S, Eshaghzadeh A, Paydar M, Hejazi SH. Prevalence of toxocariasis and its related risk factors in humans, dogs and cats in northeastern Iran: a population-based study. *Transactions of the Royal Society of Tropical Medicine and Hygiene.* 2019;113(7):399-409.
- Blaszkowska J, Kurnatowski P, Damięcka P. Contamination of the soil by eggs of geohelminths in rural areas of Lodz district (Poland). *Helminthologia.* 2011;48(2):67-76.
- Fisher M. *Toxocara cati*: an underestimated zoonotic agent. *Trends Parasitol.* 2003;19(4):167-70.
- Mizgajska H. The role of some environmental factors in the contamination of soil with *Toxocara* spp. and other geohelminth eggs. *Parasitology International.* 1997;46(1):67-72.
- Slifko TR, Smith HV, Rose JB. Emerging parasite zoonoses associated with water and food. *International journal for parasitology.* 2000;30(12):1379-93.
- Grama DF, Lescano SZ, Pereira Mota KC, dos Anjos Pultz B, Miranda JS, Silva Segundo GR, et al. Seroprevalence of *Toxocara* spp. in children with atopy. *Transactions of the Royal Society of Tropical Medicine and Hygiene.* 2014;108(12):797-803.
- MagnaVal J-F, Glickman LT, Dorchie P, Morassin B. Highlights of human toxocariasis. *The Korean journal of parasitology.* 2001;39(1):1-11.
- Tavassoli M, Hadian M, Charesaz S, Javadi S. *Toxocara* Spp. Eggs in Public Parks of Urmia City, West Azer -bajjan Province Iran. *Iranian journal of parasitology.* 2008;3(3):24-9.
- Dumenigo B, Galvez D. Soil contamination in Ciudad de La Habana province with *Toxocara canis* eggs. *Revista cubana de medicina tropical.* 1994;47(3):178-80.
- Gürel FS, Ertuğ S, Okyay P. Prevalence of *Toxocara* spp. eggs in public parks of the city of Aydin, Turkey. *Acta parasitologica Turcica/Turkish Society for Parasitology.* 2004;29(3):177-9.
- Maraghi S, Mazhab Jafari K, Sadjjadi SM, Latifi SM, Zibaei M. Study on the contamination of Abadan public parks soil with *Toxocara* spp. eggs. *Journal of environmental health science & engineering.* 2014;12(1):86.
- Tavalla M, Oormazdi H, Akhlaghi L, Razmjou E, Lakeh MM, Shojaee S, et al. Prevalence of parasites in soil samples in Tehran public places. *African Journal of Biotechnology.* 2014;11(20):4575-8.
- Motazedian H, Mehrabani D, Tabatabaee S, Pakniat A, Tavalali M. Prevalence of helminth ova in soil samples from

public places in Shiraz. Eastern Mediterranean health journal. 2006;12(5):562.

28. Khademvatan S, Abdizadeh R, Tavalla M. Molecular characterization of *Toxocara* spp. from soil of public areas in Ahvaz southwestern Iran. Acta tropica. 2014;135:50-4.

29. Ghomashlooyan M, Falahati M, Mohaghegh MA, Jafari R, Mirzaei F, Kalani H, et al. Soil contamination with *Toxocara* spp. eggs in the public parks of Isfahan City, Central Iran. Asian Pacific Journal of Tropical Disease. 2015;5(S1):S93-S5.

30. Zibaei M, Sadjjadi SM. Prevalence of helminth ova in soil samples from public places in Shiraz. Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit. 2010;16(5):580.

31. Dalimi A, Sattari A, Motamedi G. A study on intestinal helminthes of dogs, foxes and jackals in the western part of Iran. Veterinary parasitology. 2006;142(1-2):129-33.

32. Rokni M, Massoud J, Mowlavi G. Report of 10 cases of Visceral larva migrans in Iran. Iranian Journal of Public Health. 2000;29(1-4):61-6.

33. Fallah M, Azimi A, Taherkhani H. Seroprevalence of toxocariasis in children aged 1-9 years in western Islamic Republic of Iran, 2003. Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit. 2007;13(5):1073-7.