

Soil Contamination of Public Places with *Toxocara* spp. Egg in Kermanshah, Iran, in 2014

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Abstract

Background: Toxocariasis is considered as an important neglected tropical disease. Although, the prevalence of *Toxocara* eggs in soil has previously been reported in different parts of Iran, the extent of this condition is not precisely known in Kermanshah city, west of Iran.

Materials and Methods: A total of 126 soil samples were collected from different zones of Kermanshah public places during April-June 2014. The samples were examined for *Toxocara* spp. eggs via modified floatation method using sodium nitrate (NaNO₃) and the data was analyzed using Data Analysis and Statistical Software (STATA Ver.13.1).

Results: *Toxocara* spp. eggs were found in 17 (13.5%) out of 126 samples collected from the studied areas. There was a significant difference between contamination rate in the areas with low levels of health status and that in the areas with high levels ($p=0.003$).

Conclusion: According to the results obtained in the present study public parks, streets, and squares of Kermanshah are contaminated with eggs of *Toxocara* spp. Considering these findings, establishment of a wisely planned health program for controlling helminthes in the soil and the population of the stray dogs and cats in order to reduce the distribution of parasitosis is strongly recommended.

Keywords: *Toxocara* spp. eggs, soil contamination, public parks, public streets and squares, Kermanshah, Iran

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Introduction

Toxocariasis is an important neglected tropical disease mostly caused by the larvae of the dog roundworm *Toxocara canis* or the cat roundworm *Toxocara cati*. Ingestion of the embryonated eggs of *Toxocara* initiates infection in both the definitive and aberrant hosts. The children accidentally come into contact with these eggs when they play in sandboxes and on playgrounds

contaminated with *Toxocara* eggs. This situation has its roots in indiscriminate defecation on these sites by cats and dogs that harbor the adult worms^{1,2}.

The degree of host damage and the concomitant elicitation of signs and symptoms varies with regard to the tissue invaded; liver, lungs, and central nervous system (CNS), including the eyes, appear to be the most sensitive tissues. In addition, the number of migrating juveniles and the age of the hosts are two additional factors important as to whether a given

individual's condition will clinically be elevated³⁻⁷. The most important factors in preventing contamination of soil are removing cat and dog feces in places immediately adjacent to houses and children's playground, regular washing of hands after handling soil and before eating, and teaching children not to put dirty objects into their mouths⁸. Geographic distribution of toxocariasis is worldwide and its seroprevalence can vary widely in different regions, as in Iran, where there are locales with 21.6% and other countries such as Turkey, up to 64.28%^{9,10}.

Although the presence of *Toxocara* eggs in soils have previously been reported in other parts of Iran, the condition of soil contamination in Kermanshah is not precisely known. Thus, the present study was carried out in order to determine the prevalence of *Toxocara* eggs in the soil of public places in Kermanshah, Iran.

Methods

Study area: Kermanshah is the largest city in the western zone of Iran with one-million inhabitants (www.amar.org.ir). This area is humid with a mean rainfall of 490 mm/year and the mean yearly temperature of 14°C (www.kermanshahmet.ir). The current study was conducted between April-June 2014. Fourteen public parks and fifty-six public streets and squares in the residential areas were randomly selected and soil samples were collected. The selection of collecting areas was confined to the seven divisions defined by Kermanshah municipally (www.kermanshahcity.ir).

In the present study, public streets and squares are defined as a planned spaces, usually outdoors, or sidewalk public streets and squares near the streets. Also, public parks are defined as public garden open spaces. The low level of health status in these areas can be seen from various perspectives including high density in population, low income, keeping domestic animals, like sheep and goats, and thus necessarily dogs as the sheep dogs, and stray dogs and cats, as well as poor access to health services, which mean that individuals are unable to properly manage their own health.

Sampling: A total of 126 soil samples were collected from the seven zones of Kermanshah public places. Each sample contained 500 grams of soil dug from

the 3 cm ground depth (north, south, west, east, and central). The samples were collected in individually identified sterile plastic bags, and then sent to the Parasitological Laboratory of Shahid Beheshti University of Medical Science, Tehran, and were kept in refrigerator (4°C) for processing.

Recovery of parasites: The samples were examined for recovery of parasites using Mizgajska-Wiktor et al. method, with some modifications¹¹. Briefly, each soil sample was dissolved in a bucket of water and to help the eggs separate from debris soil, a few drops of detergent were added. Then, the mixed soil was dissolved in water and filtered by three layers of mesh No. 25, 50 and 75 (Damavand Alak, Iran). This solution was put in a fixed position for two hours until the egg worms deposited. Then, supernatants discarded and the sediments centrifuged at 3000 RPM (Sigma 3-18K, Germany) for 5 minutes. Next, sediments were completely resuspended in saturated sodium nitrate (NaNO₃) with specific gravity 1.20, and then the coverslips were placed in the tube in touch with the sodium nitrate for 20 minutes. Later, it was examined under the light microscope at 100 and 400 magnifications.

Data analysis: The chi-square was used to determine the relationship between infection and the studied areas. Statistical significance was set at $p < 0.05$.

Results

Toxocara canis eggs are sub globular, with thick, finely pitted shells, and the size about 90-75µm and in the *Toxocara cati* the egg shell is pitted similarly to the egg of *T.canis* and the diameter of the egg is 75-65µm¹². Those were found in 17 (13.5%) samples of the total 126 samples (Table 1, Figure 1). There was a significant difference between contamination rate in the zone with low levels of health status (zones 3 and 7) and that of the areas with high levels of health status (zones 1, 2, 4, 5) ($p=0.003$) (Table 2).

Discussion

Toxocariasis is considered as an important neglected tropical disease in Iran. Human toxocariasis develops by ingestion of infective eggs in soil or through contaminated hands or fomites. All individuals are susceptible to contamination, but children playing in

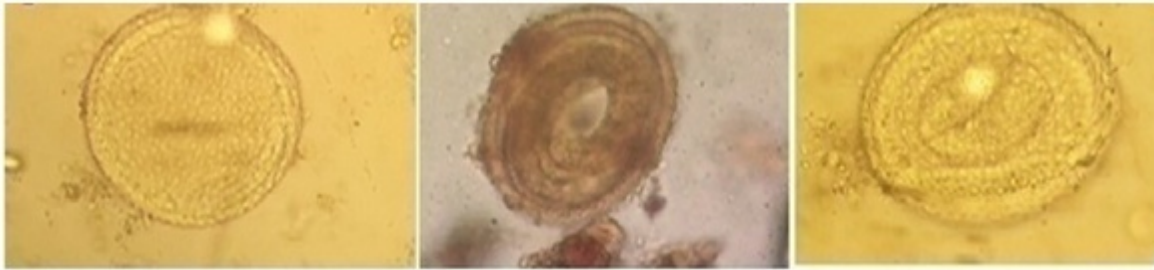


Figure 1. Eggs of *Toxocara* species isolated from the soil of Kermanshah public parks, public streets and squares, in 2014 ($\times 400$)

Table 1: Contamination rate of *Toxocara* eggs at public parks, public streets and squares in Kermanshah city, in 2014.

Location of sampling	Positive samples (%)	Negative samples (%)	Total (%)
Public parks	12 (17.14)	58 (82.86)	70 (100)
Public streets and squares	5 (8.93)	51 (91.07)	56 (100)
Total	17 (13.5)	109 (86.5)	126 (100)

Public streets and squares: A planned space, usually outdoors, sidewalk public streets and squares near the streets

Public parks: Public open spaces or municipal public streets and squares

the parks are more prone to infection compared with adults.

The risk of contamination from soil is more than direct contact with cats or dogs. This is because eggs need a period of time to be incubated in soil to be infective¹³.

Our data showed that the occurrence of *Toxocara* spp. eggs was 13.5% in the soil of public places in Kermanshah. The contamination found in our studies is lower than that in many cities in the world such as, Tehran (38.7%), Khorramabad (22.2%), Abadan (29.2%) in Iran, Frankfurt, Germany (87.1%), Tokushima, Japan (63.3%), Sao Paulo, Brazil (60%), Petaling Jaya, Malaysia (54.5%), Havana, Cuba (42%), Ankara, Turkey (30.6%), Kansas, the USA (20.6%), Aydin, Turkey (18.9%)¹⁴⁻²⁴. Also, the rate of contamination observed in the present study was higher than those reported in Shiraz, Iran (6.3%), Tehran, Iran (10%), Urmia, Iran (3.9%), Tabriz (9.3%), Basrah, Iraq (15.5%), London, the UK

(6.3%), Ireland (5.6%), and Spain (1.2%)²⁵⁻³². The reason for the discrepancy in the rate of contamination in the previous studies can be explained from the viewpoint of several factors, such as socio-cultural variables, geographical parameters, differences between the temperatures, raining properties, and the study methods^{16,29,31}.

The reasons mentioned above can partly explain the difference between the prevalence in two studies conducted by Tavalla at el.²³ and Khazan at el.³¹ in Tehran. These studies were carried out almost at the same time and at same place in 2008-2009. It seems that the most important factors leading to the difference between the findings of these studies are the difference in sampling and implemented techniques. Our results also showed a significant difference between the contamination rates in the area with low levels of health status and those with high levels of health literacy.

A relatively higher number of stray cats and dogs in

Table 2: Contamination rate of *Toxocara* eggs at public park, public streets and squares in different areas of Kermanshah city based on the statues levels, in 2014.

Studied zone	Positive sample (%)	Negative samples (%)	Total (%)
Zone with High level of health status	7 (8)	83 (92)	90 (100)
Zone with low level of health status	10 (28)	26 (72)	36 (100)
Total	17 (13.5)	109 (86.5)	126 (100)

Zone 3, 7: high levels of health status

Zone 1, 2, 4, 5, 6: low levels of health status

the area with low levels of health status could explain this observation. On the other hand, the public places, were not surrounded by fences, which invited the animals to freely live there²². Furthermore, these zones are densely populated and seriously affected in terms of economy and public health status, which adds to the problem.

Conclusion

Relatively high occurrence of *Toxocara* spp. eggs in the soil of public places in Kermanshah merit further attention by health authorities, physicians, and parasitologists. The findings of the current study support the need for the establishment of a health programme for the controlling the helminths in the soil. In addition, controlling the population of animals, such as stray dogs and cats, is necessary to reduce the distribution of parasites.

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Conflict of Interest

The authors declare no conflict of interest.

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