Tehran University of Medical Sciences Publication
http://tums.ac.ir

Iran J Parasitol

Open access Journal at
http://ijpa.tums.ac.ir

Iranian Society of Parasitology
http://isp.tums.ac.ir

Original Article

Epidemiological Study of *Toxocara* Eggs in the Soil of Public Parks in Iran with an Emphasis on Climatic and Seasonal Diversity

Mahsa Shahbakhsh [1], *Soheila Akhzari [2]

1. *Department of Pathobiology, Faculty of Veterinary Medicine, Garmsar Branch, Islamic Azad University, Garmsar, Iran*
2. *Department of Animal Science, Faculty of Agriculture, University of Kurdistan, Sanandaj, Kurdistan, Iran*

Received 10 Jul 2025
Accepted 25 Oct 2025

Keywords:
Toxocara;
Soil;
Public parks;
Iran;
Climate

***Correspondence Emails:**
S.akhzari@uok.ac.ir

Abstract

Background: Toxocariasis is a globally important zoonotic infection acquired through contact with soil contaminated by *Toxocara* eggs. Despite its relevance, comprehensive data on environmental contamination across Iran's climatic zones are lacking. We assessed the presence of *Toxocara* eggs in public park soils with emphasis on climatic and seasonal variation.

Methods: A cross-sectional survey was conducted from summer 2024 to spring 2025 in three climatic zones of Iran (Mountain, humid, and hot–dry). A total of 1,445 soil samples were randomly collected from a depth of 4–5 cm. Samples were examined using sucrose flotation and direct smear techniques. Microscopic identification of eggs was performed at 400× magnification.

Results: *Toxocara* eggs were detected in all regions studied. The humid zone showed the highest contamination rate, reaching 51% in summer. In the mountain zone, prevalence peaked in spring (44%) and was lowest in winter (12%). In the hot–dry zone, the highest contamination occurred in autumn (32%) and the lowest in summer (14%). These differences indicate the influence of climatic and seasonal conditions on egg survival.

Conclusion: The widespread detection of *Toxocara* eggs in public park soils highlights a considerable risk for human exposure, particularly among children. Improved environmental hygiene, responsible pet management, and public education are required. Future studies should incorporate molecular confirmation and longitudinal monitoring within a One Health framework to support targeted interventions.

Introduction

Toxocariasis is a zoonotic parasitic disease with global prevalence (1). It is caused by the larval stages of the nematodes *Toxocara canis* and *T. cati*. Human infection primarily occurs through direct contact with dogs or cats, or through exposure to contaminated sources of parasite eggs, such as soil in public areas and contaminated vegetables.

The eggs excreted by definitive hosts have the potential to infect humans and other accidental hosts (2).

According to some researchers, the risk of transmission to humans through direct physical contact with infected animals is relatively low (3). This is because the eggs excreted in the feces of dogs and cats require at least two weeks to embryonate and become infectious in the environment. As a result, soil serves as a major environmental reservoir for *Toxocara* eggs, playing a central role in the spread of the disease (4).

In human toxocariasis, children under the age of 10 are considered the most susceptible group due to their frequent soil-ingestion habits. The most common transmission route is the ingestion of eggs present in contaminated soil or vegetables, and contamination may also occur through polluted water sources. Given the zoonotic importance of this parasite, its prevalence has been studied in multiple countries. In Iran, the seroprevalence in the general population has been reported at 9.3% (5), while contamination among children in Mahidasht County, Kermanshah, was 8.46% (6).

Several studies in Iran have reported varying levels of soil contamination with *Toxocara* eggs, including 93.7% in Kermanshah, 2.61% in Abadan, 15% in Shiraz, and 8% in Piranshahr (7–10). Furthermore, the average infection rates in dogs and cats in Iran have been reported at 24.2% and 32.6%, respectively (5). The increasing presence of stray animals in public spaces and the growing trend of pet ownership appear to be contributing factors to the rising contamination levels (11).

The development and survival of *Toxocara* eggs depend on several environmental factors, including soil type, pH, light exposure, temperature, and humidity (12). Although many studies have explored these factors at local scales, a significant research gap remains. To date, no comprehensive study has systematically examined the prevalence of *Toxocara* eggs in public parks across all major climatic zones of Iran—mountain, humid, and hot/dry—over all four seasons.

Understanding how climatic and seasonal variations influence egg survival and distribution is essential for designing effective public health strategies. Therefore, this study aimed to address this gap by conducting a cross-sectional analysis of soil contamination with *Toxocara* eggs across Iran's principal climatic regions and seasons.

Materials and Methods

Study Design and Sample Collection

This cross-sectional study was conducted to investigate the prevalence of *Toxocara* eggs in the soil of public parks and green spaces across Iran's major climate zones—mountain, humid, and hot and dry—from the beginning of summer 2024 to the end of spring 2025 (Fig. 1). The study period spanned all four seasons of the year to account for seasonal variations in parasite survival and prevalence.

A total of 1,445 soil samples were collected from the surface of these parks and public areas. To ensure a representative sample, between 10 and 23 sampling locations were randomly selected within each park, depending on its size. Each sample consisted of 100 grams of soil, collected from a depth of 4 to 5 centimeters using a sterile trowel. The samples were immediately placed into labeled plastic bags and transported to the laboratory for analysis.

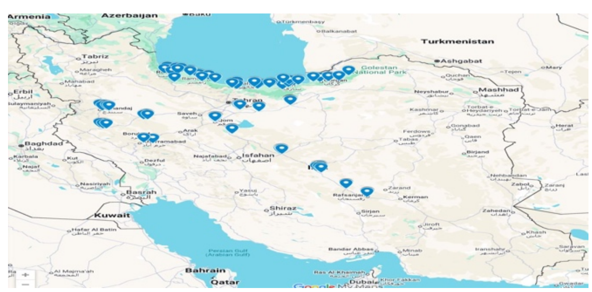

Fig. 1: Map of sampling locations

Laboratory Analysis

Upon arrival at the laboratory, the samples were processed for the detection of *Toxocara* eggs. First, large soil particles were removed using a standard sieve. The remaining soil was then sieved through a 150-micron mesh to separate fine particles. The filtered samples were then analyzed using two primary parasitological techniques: Flotation with Sucrose Solution. This method, which exploits the specific gravity difference between parasite eggs and the solution, was used to concentrate any present eggs. Three grams of each sample were separated and mixed thoroughly with 42 ml of water. Then it was filtered through a 100-micrometer sieve. 15 ml of each mixture was poured into tubes and centrifuged for 3 minutes at 1500 rpm. The supernatant was discarded. 15 ml of a saturated sucrose solution was added to the tubes. A coverslip was placed on each tube. In the next step, the samples were centrifuged for 15 minutes at 1500 rpm. Then the coverslips were examined using a light microscope. Direct Smear: A small portion of the processed sample was also examined directly on a slide to identify any eggs that might not have been concentrated by the flotation method. Finally, each slide was examined under a light microscope at a magnification of 400x to identify and count any *Toxocara* eggs present.

Statistical Analysis

The effects of climate (mountain, humid, and hot and dry) and season (Spring, Summer, Autumn, and Winter) on the infection rate were analyzed using a Generalized Linear Model (GLM) with a binomial distribution and logit link function. The number of samples was used as the response variable. The main effects of climate and season, as well as their interaction, were tested using analysis of deviance.

Results

The results of this study, conducted across various climate zones and seasons in Iran, are summarized in Table 1. A total of 1,445 soil samples were analyzed for the presence of *Toxocara* eggs (Fig. 2)

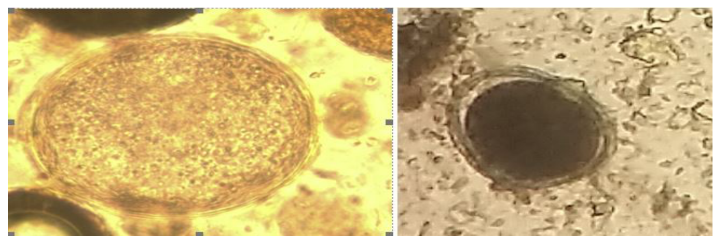

Fig. 2: *Toxocara* spp. eggs in soil samples (Original)

Table 1: Prevalence of *Toxocara* eggs in soil samples by climate and season

Climate	season	Total sample	Number of positive samples	Number of eggs seen in 5 microscope slides	Infection rate (%)
Mountain	Summer	120	42	38	35
	Autumn	100	27	28	27
	Winter	110	14	17	12
	Spring	130	58	62	44
Humi1d	Summer	135	70	80	51
	Autumn	120	43	67	35
	Winter	150	51	65	34
	Spring	140	62	78	44
Hot and Dry	Summer	120	17	23	14
	Autumn	120	39	53	32
	Winter	100	22	49	22
	Spring	100	29	38	29

Prevalence by Climate Zone

The humid climate zone exhibited the highest overall infection rates. The highest prevalence in this zone was observed in summer, with an infection rate of 51% from 70 positive samples out of 135. The lowest rate in this zone was 34% in winter, from 51 positive samples out of 150. In the Mountain climate zone, the highest prevalence was recorded in spring at 44% (58 positive samples out of 130), followed by summer at 35% (42 positive samples out of 120). The lowest infection rate was found in winter, at 12% (14 positive samples out of 110). The Hot and Dry climate zone had the lowest overall prevalence compared to the other two zones. The highest infection rate occurred in autumn at 32% (39 positive samples out of 120), followed by spring at 29% (29 positive samples out of 100). The lowest infection rate was observed in summer, with a rate of 14% (17 positive samples out of 120) (Fig. 3).

Seasonal Variations

Seasonal analysis revealed distinct patterns across the climate zones. In the mountain and humid regions, the highest infection rates were observed in spring (44%) and summer (51%), respectively. This trend suggests that the warmer, post-winter months are conducive to the survival and development of *Toxocara* eggs in these regions. Conversely, in the Hot and Dry zone, the highest prevalence was found in autumn (32%), possibly indicating that the slightly cooler and more humid conditions of this season are more favorable for egg survival than the extremely hot summer months. The lowest infection rates in all three climate zones were consistently found in winter or summer, depending on the specific climate, suggesting that extreme temperatures—whether cold or hot—are a primary limiting factor for parasite survival (Fig. 3). According to the GLM analysis, neither climate (*P*=0.11) nor season (*P*=0.45) had a statistically significant effect on the infection rate, and the interaction between these factors was also not significant (*P*=0.68). Although no significant differences were observed, descriptively, the infection rate was highest in humid climates during summer (51%) and lowest in mountainous regions during winter (12%) (Table 2).

Table 2: Analysis of deviance (GLM) showing the effects of climate, season, and their interaction on infection rate

Effect	df	Deviance	Resid. df	Resid. Deviance	*P*-value
Climate	2	4.89	9	21.45	0.11
Season	3	2.21	6	19.24	0.45
Climate × Season	6	3.02	0	16.22	0.68

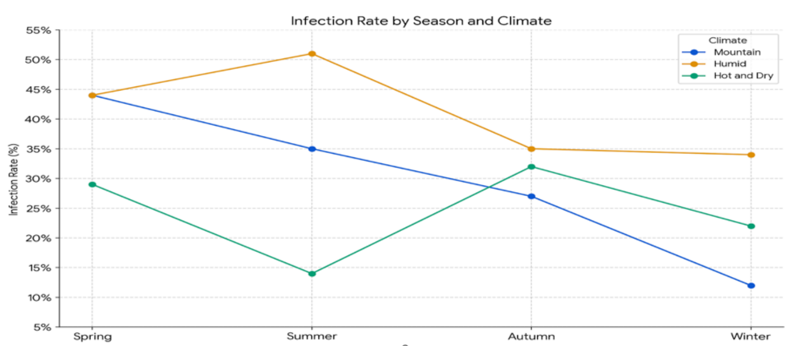

Fig. 3: This chart illustrates the trend of infection rates for each climate type across the different seasons

Discussion

The findings of this study, which comprehensively investigated the prevalence of *Toxocara* eggs in the soil of public parks across Iran's major climate zones and seasons, contribute significantly to our understanding of this neglected zoonotic disease. As highlighted in the literature, developing countries are more susceptible to parasitic infections due to socioeconomic factors, climate, and sanitation challenges (13). Our results align with this context, reinforcing the notion that Iran remains a region where parasitic infections pose a considerable public health concern (14).

The overall high prevalence of *Toxocara* eggs detected in park soils across all three climate zones underscores the widespread environmental contamination in urban green spaces. This is consistent with previous investigations reporting high contamination rates in various parks in Iran (15), as well as in other countries. For instance, similar studies have documented substantial soil contamination in public areas in Warsaw, Poland (16), and in parks and playgrounds in Oklahoma City, USA (17). Comparable findings from Chiclayo, Peru (18), and beach sand in Kuşadası, Turkey (19), further confirm that environmental contamination is not restricted to specific climates or regions.

Berenji et al. examined 304 soil samples from 39 parks in northeastern Iran and reported contamination levels ranging from 9.2% to 11.3% (20). Our study's findings—showing the highest rates in the humid climate zone—are consistent with diverse results reported across Iranian cities. For example, contamination rates of 80% in Piranshahr (10), 77.77% in Zanjan (21), 76.7% and 14.7% in Tabriz (22,23), 75% in Isfahan (24), 61.2% in Abadan (8), 50% in Ilam (25), 36.4% in Karaj (26), 34.1% in Ardabil (27), 31.25% in Larestan (28), 26.66% in Arak (29), 23.2% in Tehran (11), 22.2% in Khorramabad (30), 15% in Shiraz (9), and 3.9% in Urmia (31) have been reported. These variations likely reflect differences in geographic and climatic conditions, methodologies, and stray-animal control measures (11).

A key outcome of this research is the significant seasonal fluctuation in *Toxocara* egg prevalence. In the humid and mountain climate zones, the highest infection rates were recorded in spring and summer (51% and 44%, respectively), with the lowest rates in winter (34% and 12%). These trends indicate that moderate temperatures and higher moisture levels create favorable conditions for egg embryonation. In contrast, in the hot–dry climate zone, the highest prevalence occurred in autumn (32%), while the lowest was observed in summer (14%). This inverse pattern likely results from extreme summer temperatures and low humidity, which hinder egg survival. Thus, local climatic conditions play a critical role in shaping the parasite's environmental distribution.

The detection of high numbers of *Toxocara* eggs in soils of public parks indicates a significant potential source of infection for humans. This is especially concerning for children, who are more likely to ingest contaminated soil. The comprehensive dataset obtained across all major climatic zones and seasons provides a strong foundation for future targeted research. The findings emphasize the urgent need for robust strategies to reduce environmental contamination, including improved management of dog feces, enhanced public education, and strengthened hygiene practices.

The high environmental burden also points to the need for integrated One Health approaches that link veterinary care, environmental management, and public awareness. Priority actions include responsible pet-ownership education, season-specific park sanitation (especially in humid and mountain zones during spring and summer), enhanced hand-hygiene promotion in parks, and improved playground design to reduce exposure. Although human cases were not assessed in this study, the level of environmental contamination supports the need for coordinated interventions across animal, environmental, and community health sectors.

Conclusion

Toxocara eggs are widely present in the soils of public parks across all major climate zones in Iran, with significantly higher contamination in humid regions and during warmer seasons. These findings highlight the strong influence of climate and season on environmental persistence of the parasite.

Acknowledgements

No financial support was received for this study.

Conflict of Interest

The authors declare that there is no conflict of interests.

References

1. Magnaval JF, Glickman LT, Dorchies P, Morassin B. Highlights of human toxocariasis. Korean J Parasitol. 2001;39(1):1–11.
2. Macpherson CN. The epidemiology and public health importance of toxocariasis: a zoonosis of global importance. Int J Parasitol. 2013;43(12–13):999–1008.
3. Overgaauw PA, Van Knapen F. Aspects of *Toxocara* epidemiology: human toxocariasis. Crit Rev Microbiol. 1997;23(3):215–31.
4. Glickman LT, Schantz PM. Epidemiology and pathogenesis of zoonotic toxocariasis. Epidemiol Rev. 1981;3:230–50.
5. Vafae Eslahi A, Badri M, Khorshidi A, et al. Prevalence of *Toxocara* and *Toxascaris* infection among humans and animals in Iran: a meta-analysis. BMC Infect Dis. 2020;20:20.
6. Akhlaghi L, Oormazdi H, Sarrafnia A, Vaziri S, et al. Survey of seroepidemiology of toxocariasis in children aged 2–12 years in Mahidasht region, Kermanshah, Iran. Iran Univ Med Sci J. 2005;13(52):41–48. (In Persian)
7. Rezaei F, Karimi Dehkordi M, et al. Frequency of *Toxocara* egg contamination in public parks of Kermanshah city. Iran Vet J. 2022;18(4):39–49.
8. Maraghi S, Jafari KM, Sadjjadi SM, et al. Contamination of Abadan public parks soil with *Toxocara* spp. eggs. J Environ Health Sci Eng. 2014;12(1):86.
9. Ghorbani Ranjbary A, Shafie A, Anamipor A, et al. Frequency of *Toxocara* Egg in Public Parks Shiraz/Iran. J Kerman Univ Med Sci. 2014;21(2):174–179.
10. Yakhchali M, Ebn-Adamnezhad A. *Toxocara canis* infection in dogs and soil of public parks in Piranshahr, Iran. Vet Res. 2014;69(4):355–362.
11. Khazan H, Khazaei M, Tabaee SS, et al. Prevalence of *Toxocara* spp. eggs in public parks of Tehran, Iran. Iran J Parasitol. 2012;7(3):38–42.
12. Liravizadeh S, Abdolahi Khabisi S, Salimi Khorashad A, et al. Molecular determination of *Toxocara* spp. eggs isolated from public parks and playgrounds in Zahedan, Southeast Iran. J Parasitol Res. 2024;2024:2132696.
13. Wakid MH, Azhar EI, Zafar TA. Intestinal parasitic infection among food handlers in Makkah during Hajj season 1428 H. J King Abdulaziz Univ Med Sci. 2009;16:39–52.
14. Sharifi Sarasiabi K, Madani A, Zare S. Prevalence of intestinal parasites among primary school children in Bandar Abbas. Hormozgan Univ Med Sci J. 2002;4(5):25–30.
15. Maraghi S, Rafiei A, Hajihossein R, et al. Seroprevalence of toxocariasis in hypereosinophilic individuals in Ahvaz, Iran. J Helminthol. 2012;86(2):241–4.
16. Dzido M, Michalski K. Risk factors associated with soil-transmitted helminths in dog feces contaminating public areas in Warsaw, Poland. Animals. Animals (Basel). 2024;14(3):450.
17. Stone SD, Smith SM, Johnson DC. Parasites in the park: *Toxocara* species in Oklahoma City parks and playgrounds. J Parasitol. 2018;104(4):434–439.
18. Cárdenas P, Alva S, García V. *Toxocara* spp. eggs contamination in public parks of Chiclayo, Peru. Egyptian Journal of Veterinary Sciences. 2025;56(8): 1939-1943.
19. Aydenizöz-Özkay S, Göz Y. Presence of *Toxocara* spp. in beach sand: Kuşadası case. Turkiye Parazitol Derg. 2017;41(3):136–141.
20. Berenji F, Movahedi Rudy AG, et al. Soil contamination with *Toxocara* spp. eggs in public parks of Mashhad and Khaf. Iran J Parasitol. 2015;10(2):286–9.
21. Jafari S, Norouzi R, Barabadi B. Contamination of public parks with *Toxocara* eggs in Zanjan city: a short report. JRUMS. 2019;17(12):1181–1188.

22. Garedaghi Y, Shabestari-Asl S. Contamination of Tabriz public parks with *Toxocara* spp. eggs: a short report. J Rafsanjan Univ Med Sci. 2012;11(2):173–178.
23. Nematollahi A, Shahbazi P, Nasrollahi N. Soil contamination of public parks with *Toxocara* spp. eggs and its relation to human toxocariasis in Tabriz. J Zoonotic Dis. 2017;2(1):14–18.
24. Ghomashlooyan M, Falahati M, Mohaghegh MA, et al. Soil contamination with *Toxocara* spp. eggs in Isfahan public parks. Asian Pacific Journal of Tropical Disease. 2015;5(S1):S93–S95.
25. Viesy S, Abdi J, Rezaei Z, Karimian M. Prevalence of *Toxocara* spp. eggs in soil samples from Ilam public parks. J Clin Diagn Res. 2020;14(7):DC23–DC25.
26. Zibaei M, Bahadory S, Cardillo N, et al. Soil contamination with *Toxocara* spp. eggs in public parks of Karaj, Iran. Int J Enteric Pathog. 2017;5(2):45–48.
27. Pezeshki A, Haniloo A, Alejafar A, et al. Detection of *Toxocara* spp. eggs in public places of Ardabil, Iran. Iran J Parasitol. 2017;12(1):136–142.
28. Ebrahimizadeh F, Kiani Z, Sahranavard F, et al. Prevalence of *Toxocara* eggs in public parks of Larestan, Iran. Med J Mashhad Univ Med Sci. 2018;61(5):1257–1263.
29. Mohamadi S, Eslamirad Z, Hajihossein R, et al. Soil contamination with *Toxocara* eggs in public parks of Arak. J Arak Univ Med Sci. 2016;18(12):67–73.
30. Zibaei M, Abdollahpour F, Birjandi M, et al. Soil contamination with *Toxocara* spp. eggs in Khorramabad public parks. Nepal Med Coll J. 2010;12(2):63–5.
31. Tavassoli M, Hadian M, Charesaz S, et al. *Toxocara* spp. eggs in public parks of Urmia, Iran. Iran J Parasitol. 2008;3(3):24–29.