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Review Article

An Updated Systematic Review and Meta-Analysis of the Prevalence of *Toxocara* spp. Eggs in the Soil of Public Areas in Iran

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Abstract

Human toxocariasis (HT), caused by the larvae of *Toxocara canis* and *Toxocara cati*, is a globally prevalent parasitic disease with significant public health implications. Although soil is a primary route for the transmission of *Toxocara* spp., data on soil contamination in Iran remain limited. To address this gap, the present study expands upon a systematic review published in 2018, which analyzed studies conducted between January 2000 and November 2016. Using recent data to guide control strategies, the study provides an updated estimate of the prevalence of *Toxocara* spp. eggs in the soil of public areas in Iran. Accordingly, a comprehensive literature review was performed in accordance with PRISMA guidelines, covering studies published between January 2000 and April 2025. A random-effects meta-analysis was performed to pool prevalence rates. In addition, associations with geographic and environmental factors were examined through meta-regression and sensitivity analyses. Overall, 28 studies (31 datasets) were included, comprising 6,264 soil samples collected from 25 provinces of Iran. The pooled prevalence of *Toxocara* spp. eggs was 16% (95% confidence interval: 12–21%), with high heterogeneity ($I^2 = 94.4\%$, $P < 0.001$). This high heterogeneity across studies may be attributed to differences in sampling methods, climatic conditions, study quality, and regional variations in stray animal density. The prevalence of this species varied by region and climate, with the highest rates reported in the central region (23%) and in hot desert climates (20%). The sample size, year of publication, or environmental variables had no statistically significant effects. These findings underscore significant environmental contamination by *Toxocara* spp. eggs throughout Iran. Further, this contamination indicates an ongoing risk of human infection. In general, the results highlight the need for geographically targeted interventions, public education, and integrated One Health strategies to inform health policies and prevent HT.

Keywords: *Toxocara* spp., Soil contamination, Prevalence, Systematic review, Meta-analysis, Iran

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Introduction

Human toxocariasis (HT) is a globally prevalent neglected parasitic infection that is primarily caused by the larvae of *Toxocara canis* and *Toxocara cati*, nematodes commonly found in the gastrointestinal tracts of dogs and cats (1,2). The Centers for Disease Control and Prevention has recently recognized toxocariasis among the five parasitic infections that demand urgent public health attention. Moreover, HT could be incorporated into the preventive chemotherapy programs of the World Health Organization, given its responsiveness to anthelmintic drugs, such as albendazole (3-5). The findings of the National Health and Nutrition Examination Survey demonstrate that HT remains prevalent and continues to be overlooked as a public health issue. Therefore, a comprehensive understanding of its disease burden, both in the US and globally, requires more advanced and sensitive serological diagnostic methods (6). The adult nematodes of *T. canis* and *T. cati* complete their reproductive cycle in the intestines of their definitive hosts, dogs and cats, producing approximately 200,000 eggs each day. These eggs are then excreted into the environment through the hosts' feces (7). In addition, infected hosts shed eggs in their feces, which contaminate the environment, including soil, water, and various surfaces. Humans are mainly infected by accidentally ingesting these embryonated eggs from contaminated soil, food, hands, or through close contact with infected animals (1). Further, *Toxocara* eggs can stick to the fur of pets, providing another route of transmission to humans (8). Furthermore, humans may become infected by eating undercooked or raw meat from paratenic hosts, such as cattle, sheep, or poultry. Upon entering the human body, these eggs hatch within the small intestine, allowing larvae to breach the intestinal lining and access the circulatory system. Then, the larvae travel through the bloodstream to infect various organs, including the liver, lungs, heart, muscles, eyes, and occasionally the brain (1,9). The host immune system responds with local inflammation, an increase in eosinophils, and the production of targeted antibodies and pro-inflammatory cytokines (1,10).

The clinical spectrum of HT is broad, ranging from asymptomatic cases to severe organ damage. The infection can manifest in different forms, including visceral larva migrans, ocular larva migrans, and both common and covert toxocariasis. In addition, it may cause neurological, psychiatric, and cardiac complications, as well as allergic skin conditions and asthma (9,11-14). Children infected with *Toxocara* spp. were significantly more likely to come from lower socioeconomic backgrounds than their uninfected peers. However, differences in cognitive and academic performance remained even after accounting for socioeconomic status (15-18). This indicates that, similar to other neglected tropical diseases, HT may play a role in perpetuating the cycle of poverty and deepening health and educational disparities in endemic areas. Some researchers have even hypothesized that HT could partly account for the academic achievement gap observed among economically disadvantaged students (1,19-21). On a global scale, recent epidemiological data indicate that approximately 19% of the population demonstrates serological evidence of exposure to *Toxocara* spp., while environmental contamination, primarily through soil, has been reported in about 21% of surveyed areas (4,20). The infection burden remains substantial, and HT continues to be overlooked as a public health concern in many countries. In Iran, meta-analyses have estimated the prevalence of *Toxocara* spp. infection to be 24.2%, 32.6%, and 9.3% in dogs, cats, and humans, respectively (22). High-risk groups, including children and pregnant women, show even higher rates of infection (30% and 20.8%, respectively) (23,24). Environmental contamination is also notable, with approximately 16% of park soils across the country contaminated with *Toxocara* eggs, varying by region, including Tehran and Qazvin provinces (25). Diagnosis in animals primarily depends on the microscopic identification of eggs in feces using flotation or sedimentation methods. In humans, more advanced techniques, such as enzyme-linked immunosorbent assay, polymerase chain reaction, and Western blot, are employed to enhance diagnostic accuracy (26-28). The One Health framework emphasizes the intrinsic link between human, animal, and environmental health, advocating for interdisciplinary collaboration to tackle global health challenges. Although repeated human exposure to *Toxocara* spp. has been documented, more comprehensive research is needed to fully assess its public health implications. The One Health approach is increasingly recognized as an essential strategy for addressing the multifaceted nature of HT globally (29-31). *Toxocara* spp. represents an important public health concern, although data on soil contamination as a transmission route in Iran are scarce. Therefore, an updated systematic review and meta-analysis was performed, extending the previous 2016 review. This work includes studies from 2000 to 2025 and seeks to provide a comprehensive estimate of the prevalence of *Toxocara* spp. in soil, guiding future public health measures and control strategies. Given the widespread environmental contamination, diverse climatic regions, and socio-economic variability across Iran, an updated systematic review is particularly warranted to accurately evaluate the prevalence of *Toxocara* spp. in soil and thus guide region-specific public health interventions. Soil contamination with *Toxocara* spp. eggs represents a direct risk for human infection, as the ingestion of contaminated soil or soil-contacted hands can lead to larval migration and the development of toxocariasis, significantly contributing to the disease burden.

Materials and Methods

Search Strategy

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure transparent and reproducible methods in selecting studies, extracting data, performing analyses, and interpreting results (32). A PRISMA flowchart was created to illustrate the steps of identification, screening, eligibility evaluation, and inclusion of studies. A thorough literature search was conducted in major English-language databases, including PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar (for identifying additional studies), as well as Persian databases, such as the Scientific Information Database and Magiran, covering publications from January 2000 to April 2025. The search strategy involved Medical Subject Headings terms, such as "*Toxocara* spp.", "Iran", "Epidemiology", and "Prevalence", used both individually and in combination with "OR" and "AND" operators. Moreover, the bibliographies of the selected full-text articles were manually reviewed to identify additional relevant studies that might have been missed in database searches (25).

Selection Criteria

Only original peer-reviewed studies, such as cross-sectional investigations and short reports, that utilized parasitological or molecular techniques to detect the prevalence of *Toxocara* spp. eggs in soil were included in this investigation. It should be noted that studies published from January 1, 2000, to April 30, 2025, were taken into consideration. On the other hand, the exclusion criteria comprised reviews, systematic reviews, editorials, letters to the editor, books, reports from workshops, seminar proceedings, and studies that were not aligned with the aims of this research (32).

Data Collection and Evaluation of Study Quality

The studies identified through database searches were initially sorted and archived according to their subjects or abstract content. An initial screening was then performed to identify articles with potential relevance, which were subsequently retrieved in full text. Moreover, the eligibility of these studies was independently reviewed by trained researchers by applying the established inclusion criteria. In addition, the reference lists of relevant studies and reviews were carefully screened to capture any additional literature that might have been missed in the initial database search. This manual review was independently conducted by two reviewers, and any disagreements were resolved through discussion to reach consensus, ensuring completeness and minimizing selection bias. The main features of each eligible study were documented and organized using Excel software (32). The extracted data encompassed the first author's name, publication year, diagnostic approach, geographical region within Iran, sample size (n), number of positive samples (n), prevalence rate (%), humidity level (%), and climate classification, as well as the latitude and longitude. The methodological quality of the selected studies was evaluated using the Newcastle–Ottawa Scale, specifically adapted for cross-sectional research (33). In brief, each criterion was awarded a maximum of one star, with a total possible score of 10 marks. Additionally, studies were classified according to their quality as poor (0–4 marks), satisfactory (5–6 marks), good (7–8 marks), or very good (9–10 marks). Based on these marks, the researchers decided which studies to include in this review.

Synthesis of Data and Statistical Methods

The overall prevalence estimate of *Toxocara* spp. eggs in soil samples, along with their 95% confidence intervals (CIs), was estimated by integrating individual study results via a random-effects meta-analysis model. In addition, study heterogeneity was quantified using Cochran's Q test and I^2 statistics, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively (34). Further, subgroup analyses stratified prevalence estimates according to publication year, sample size, humidity (%), geographical region, climate zone, latitude, and longitude. Furthermore, meta-regression was conducted to explore potential relationships between prevalence and covariates, including publication year, sample size, humidity, latitude, and longitude. To assess publication bias, funnel plots were generated and examined using Egger's regression test. Moreover, the one-study-removed approach was employed for sensitivity analyses in order to evaluate the robustness of the pooled estimates. All analyses were performed using STATA, version 16 (STATA Corporation, College Station, TX, USA), with P values < 0.05 considered statistically significant.

Results

The pooled global prevalence of *Toxocara* spp. eggs in the soils of public places in Iran, as reported in 28 studies (31 datasets), was 16% (95% CI, 12–21%), with significant evidence of heterogeneity among studies (I^2 = 94.4%, P < .0001, Figure 1). An initial search of the literature yielded 2,470 articles. Following a title and abstract screening, 2,429 articles were excluded from the analysis. Of the remaining 41 articles deemed potentially relevant, 13 were excluded based on predefined exclusion criteria. Ultimately, 28 studies (31 datasets) (35-62) comprising a total of 6,264 soil samples were deemed eligible and included in the meta-analysis (Figure 2, Table 1).

The majority of studies employed flotation techniques to detect *Toxocara* spp. eggs, and one study used the polymerase chain reaction method. The included studies represented 25 different provinces or cities across various geographical areas of Iran (Table 1), including central (0.23%; 95% CI: 16–33%), southwest (18%; 95% CI: 10–30%), west (18%; 95% CI: 13–23%), north (16%; 95% CI: 2–63%), northwest (12%; 95% CI: 6–24%), northeast (10%; 95% CI: 7–14%), and south (5%; 95% CI: 3–9%) regions (Figure S1, Table 2).

According to the analysis by geographical latitude, the prevalence rates reached their peak and lowest values within the ranges of 31–35° (20%; 95% CI: 15–26%) and 25–30° (11%; 95% CI: 6–19%), respectively (Supplementary file 1, Figure S2). When considering geographical longitude, the highest and lowest prevalence rates were recorded at 40–49° (18%; 95% CI: 14–24%) and 50–59° (12%; 95% CI: 7–20%), respectively (Figure S3). In terms of humidity, prevalence rates were the highest when humidity exceeded 50% (16%; 95% CI: 10–24%) compared to levels below 50%, where it was slightly lower (15%; 95% CI: 11–21%) (Figure S4). The subgroup analysis based on publication year indicated that the highest prevalence occurred during 2020–2025, reaching 19% (95% CI: 11–32). For earlier periods, the prevalence was 15% (95% CI: 10–22) from 2014 to 2019 and 13% (95% CI: 7–13) from 2006 to 2013 (Figure S5, Table 2). As regards sample size, studies with

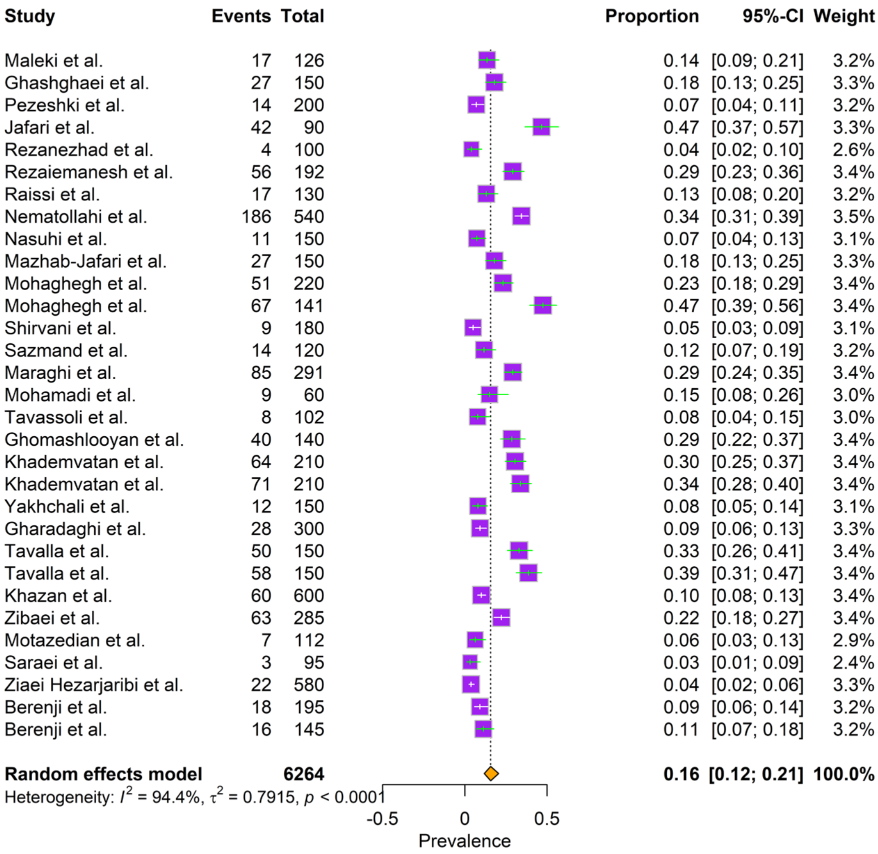

Figure 1. Forest Plots of Pooled *Toxocara* spp. Egg Prevalence in the Public Soil of Iran

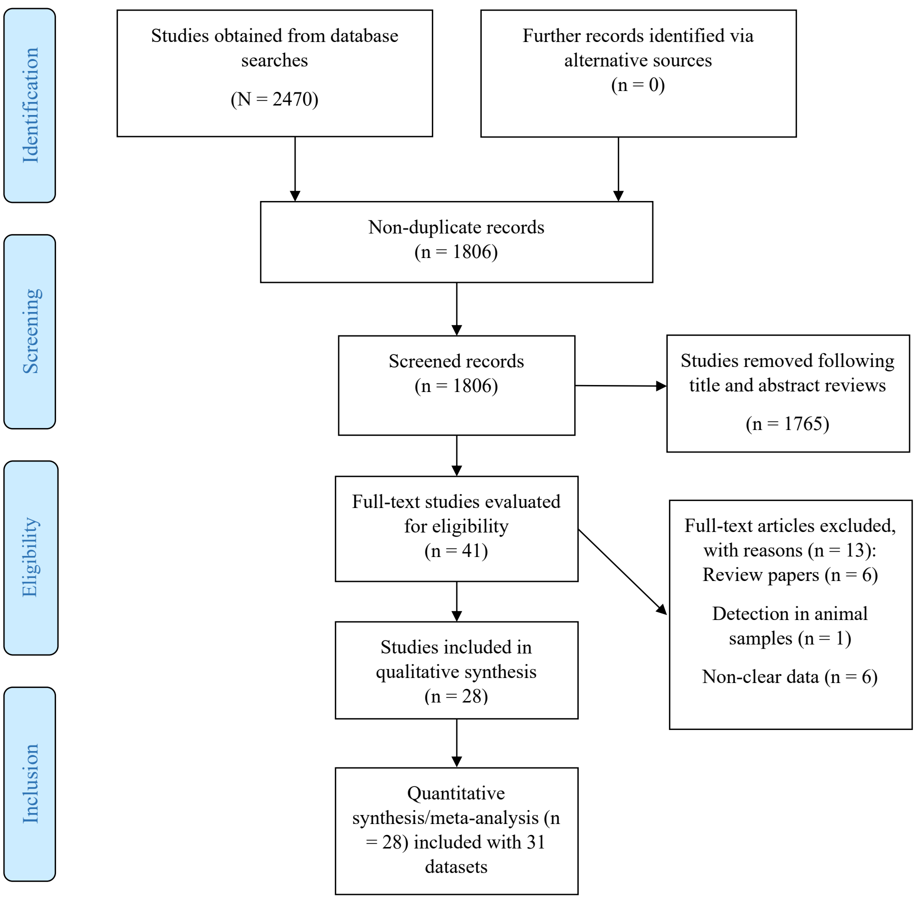

Figure 2. PRISMA Chart Describing the Study Design Process. *Note*. PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Table 1. Key Study Parameters of 28 Studies (31 Datasets) Reporting the Prevalence of *Toxocara* spp. Eggs in the Soil of Public Areas in Iran

Author's Name/References	Publication Year	Sample Size (n)	Positive Samples (n)	Prevalence (%)	Technique	Province/City
Maleki et al (42)	2016	126	17	13.5	Flotation (sodium nitrate)	Kermanshah
Ghashghaei et al (37)	2016	150	27	18	Flotation (sodium nitrate)	Kermanshah
Pezeshki et al (51)	2017	200	14	7	Flotation (sodium nitrate)	Ardabil
Jafari et al (39)	2018	90	42	46.6	Flotation (zinc sulfate)	Zanjan
Rezanezhad et al (54)	2017	100	4	4	Flotation (saturated sucrose)	Jahrom
Rezaiemanesh et al (53)	2021	192	56	29.2	Flotation (saturated sucrose)	Kermanshah
Raissi et al (52)	2020	130	17	13.08	Flotation (sodium nitrate)	Ilam
Nematollahi et al (50)	2016	540	186	34.44	Flotation (zinc sulfate)	Tabriz
Nasuhi et al (49)	2024	150	11	7.33	Flotation (saturated sucrose)	Yasuj
Mazhab-Jafari et al (44)	2019	150	27	18	Flotation (saturated sucrose)	Khorramshahr
Mohaghegh et al (45)	2020	220	51	23.2	Flotation (saturated sucrose)	Yazd
Mohaghegh et al (46)	2021	141	67	47.5	Flotation (saturated sucrose)	Sari
Shirvani et al (57)	2019	180	9	5	Flotation (saturated sucrose)	Chaharmahal and Bakhtiari
Sazmand et al (56)	2020	120	14	11.67	Flotation (saturated sucrose)	Hamadan
Maraghi et al (43)	2014	291	85	29.2	Flotation (saturated sucrose)	Abadan
Mohamadi et al (47)	2016	60	9	15	Flotation (saturated sucrose)	Arak
Tavassoli et al (59)	2008	102	8	7.8	Flotation (saturated salt)	Urmia
Ghomashlooyan et al (38)	2015	140	40	28.6	Flotation (saturated sucrose)	Isfahan
Khademvatan et al (40)	2014	210	64	30.5	Flotation (sodium nitrate)	Ahvaz
Khademvatan et al (40)	2014	210	71	33.8	PCR	Ahvaz
Yakhchali et al (60)	2014	150	12	8	Flotation (zinc sulfate)	Piranshahr
Gharadaghi et al (36)	2011	300	28	9.3	Flotation (saturated salt)	Tabriz
Tavalla et al (58)	2012	150	48	33	Flotation (saturated sucrose)	Tehran
Tavalla et al (58)	2012	150	58	38.7	Flotation (sodium nitrate)	Tehran
Khazan et al (41)	2012	600	60	10	Flotation (saturated salt), Petri dish methods	Tehran
Zibaei et al (62)	2010	285	63	22.2	Flotation (saturated sucrose)	Khorram Abad
Motazedian et al (48)	2006	112	7	6.3	Flotation (zinc sulfate)	Shiraz
Saraei et al (55)	2012	95	3	3.15	Flotation (saturated sucrose)	Qazvin
Ziaei Hezarjaribi et al (61)	2016	580	22	3.73	Flotation (saturated sucrose)	Sari
Berenji et al (35)	2015	195	18	9.2	Flotation (saturated sucrose)	Mashhad
Berenji et al (35)	2015	145	16	11.3	Flotation (saturated sucrose)	Khaf

Note. PCR: Polymerase chain reaction.

150–300 participants recorded the highest prevalence at 17% (95% CI: 11–26), whereas studies enrolling more than 300 participants showed the lowest prevalence at 12% (95% CI: 4–31) (Figure S6). Based on the obtained data, different climate zones in Iran included hot desert (20%), hot semi-arid and cold semi-arid (17%), Caspian humid (16%), and cold mountainous (7%) (Figure S7). Meta-regression analysis demonstrated that factors such as sample size, year of publication, geographic coordinates (longitude and latitude), and humidity did not have a statistically significant impact. The quality assessment revealed that 3 (11%), 6 (21%), and 19 (68%) studies were of satisfactory, good, and very good quality, respectively. The sensitivity analysis represented that removing each study one at a time had minimal impact on the overall estimated prevalence of human infection, which varied between 15.02% and 16.48% (Figure S8). While Egger's test confirmed significant publication bias. This finding should be considered with caution because of the high heterogeneity (I^2 = 94.4%) that might contribute to the funnel plot asymmetry (Figure 3). In general, these results highlight substantial environmental contamination by *Toxocara* spp. eggs across Iran, indicating a persistent risk of human infection and underscoring the need for targeted public health interventions and awareness programs.

Discussion

Toxocara spp. are nematode parasites with a global distribution and are among the most common intestinal parasites of cats and dogs, with significant zoonotic potential (1,2). The eggs are excreted in the feces of infected animals and can remain infectious in soil for

Table 2. Subgroup Analyses Provided Pooled Estimates of the Global Prevalence of *Toxocara* spp. Eggs in Soil, Stratified by Region, Humidity, Climate Zone, Latitude, Longitude, Year of Publication, and Sample Size

Categories and Subgroups	Included Studies	Positive Findings/ Sample Size	Pooled Prevalence	Heterogeneity			Meta-Analytic Regression
				χ^2	I^2 (%)	*P* Value	Beta (95% CI)
Region							
Western	6	194/1003	0.18 (0.13-0.23)	0.1252	78.4%	<0.0003	
Northwestern	7	293/1477	0.12 (0.6-0.24)	1.1219	96.2%	<0.0001	
Southern	2	11/212	0.05 (0.03-0.09)	0	0%	<0.4645	
Southwestern	6	267/1191	0.18 (0.10-0.30)	0.7092	92.7	<0.0001	-
Central	6	268/1320	0.23 (0.16-0.33)	0.3383	94.2	<0.0001	
Northern	2	89/721	0.16 (0.02-0.63)	99.2	2.4497	<0.0001	
Northeastern	2	34/340	0.10 (0.07-0.14)	0	0	0.5839	
Humidity							
<50	16	495/2890	0.15 (0.11-0.21)	0.5539	91.3%	<0.0001	Regression coefficient= (-0.0130, *P*= 0.320)
>50	15	661/3374	0.16 (0.10-0.24)	1.0535	95.9%	<0.0001	
Climate zone							
Cold semi-arid	16	654/3315	0.17 (0.12-0.23)	0.6568	94.2	<0.0001	
Cold	4	48/650	0.07 (0.06-0.10)	0.0028	34.6	0.2044	
Mountainous	5	186/772	0.17 (0.07-0.33)	1.0108	90.8	<0.0001	-
Hot semi-arid hot desert	4	179/806	0.20 (0.14-0.28)	0.1511	84.5	<0.0002	
Caspian humid	2	89/721	0.16 (0.02-0.63)	2.4497	99.2	<0.0001	
Latitude							
31-35	15	606/2923	0.20 (0.15-0.26)	0.3947	91.2	<0.0001	
36-40	10	400/2393	0.12 (0.06-0.23)	1.3136	97.1	<0.0001	Regression coefficient= (-0.0032, *P*= 0.947)
25-30	6	150/948	0.11 (0.06-0.19)	0.5317	91.5	<0.0001	
Longitude							
40-49	17	740/3306	0.18 (0.14-0.24)	0.4751	92	<0.0001	Regression coefficient= (-0.0651, *P*= 0.192)
50-59	14	416/2958	0.12 (0.07-0.20)	1.1190	95.8	<0.0001	
Publication year							
2006-2013	8	277/1794	0.13 (0.07-0.23)	0.8375	94.7	<0.0001	
2014-2019	17	663/3517	0.15 (0.10-0.22)	0.8144	94.8	<0.0001	Regression coefficient= (0.0259, *P*= 0.513)
2020-2025	6	216/953	0.19 (0.11-0.32)	0.6142	93.6	<0.0001	
Sample size							
0-150	18	429/2261	0.15 (0.10-0.22)	0.8355	92.6	<0.0001	
150-300	10	459/2283	0.17 (0.11-0.26)	0.5879	93	<0.0001	Regression coefficient= (-0.0004, *P*= 0.736)
>300	3	268/1720	0.12 (0.04-0.31)	1.1237	98.9	<0.0001	

extended periods (7). Humans mainly get infected by accidentally ingesting *Toxocara* eggs from contaminated environments, contact with infected animals, or consuming undercooked meat from paratenic hosts (1,8). The clinical manifestations of HT vary widely, ranging from asymptomatic cases to severe organ involvement, including ocular larva migrans, visceral larva migrans, and covert toxocariasis. Moreover, the infection can lead to neurological, psychiatric, and cardiac complications and allergic conditions, such as asthma. This wide clinical spectrum underscores the complexity of the disease and the need for heightened awareness among clinicians and public health professionals (11,13). Public areas, such as beaches, parks, and children's playgrounds, where stray or pet animals and people frequently gather and pass through, play a crucial role in the transmission of *Toxocara* infection. This updated systematic review and meta-analysis revealed a 16% prevalence of *Toxocara* spp. eggs in soil samples collected from public spaces across Iran. The estimate was based on 28 studies (31 datasets) conducted in 25 provinces, comprising a total of 6,264 soil samples. This prevalence is consistent with the data of the 2018 systematic review (covering data up to 2016), indicating stable levels of environmental contamination over time (25). An estimated one in six public recreational areas in Iran is contaminated with *Toxocara* spp. eggs, based on pooled data from 28 studies (31 datasets). This environmental contamination is primarily attributed to the continuous presence of infected cats and dogs in public areas, shedding significant numbers of *Toxocara* eggs into the environment (63,64). Children are particularly at risk due to behaviors such as geophagia, nail-biting, hand-to-

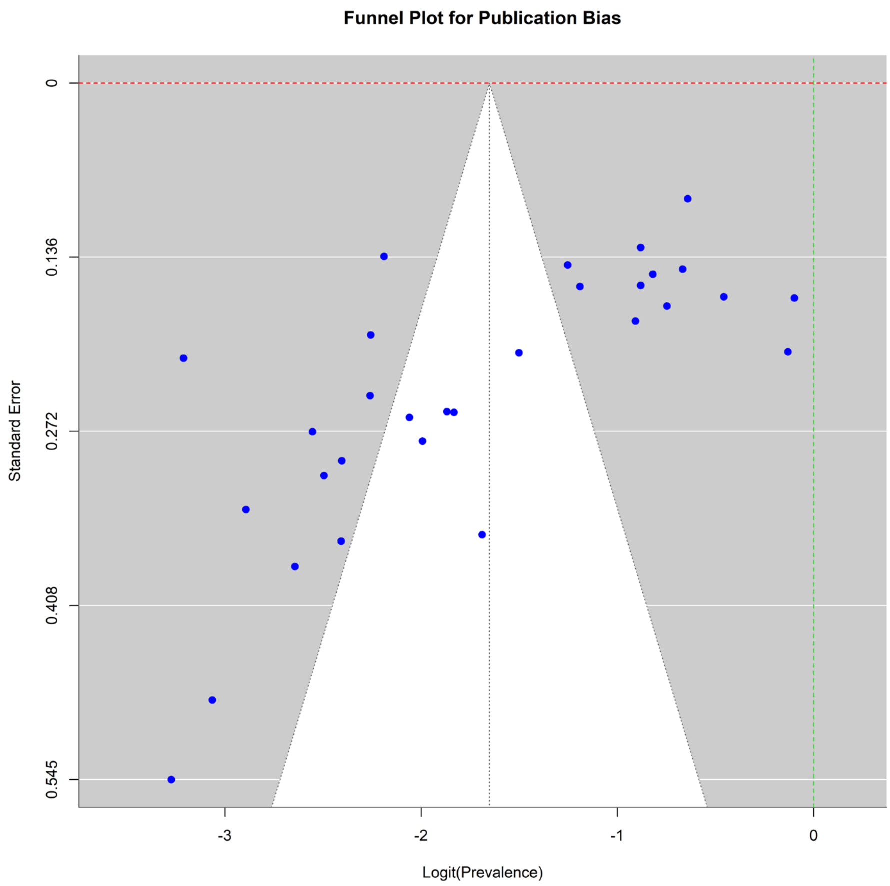

Figure 3. Funnel Plot for Publication Bias

mouth activity, and frequent contact with contaminated soil in playgrounds and parks (65,66). In addition to direct fecal contamination, mechanical transmission through contaminated shoes and animal paws may contribute to dispersing *Toxocara* eggs, especially in environments visited by dewormed animals (67). The regional subgroup analysis demonstrated notable heterogeneity, with prevalence ranging from 23% in central regions to 5% in the south. These differences may be attributed to several factors, such as climate, animal population density, and local sanitation practices. Notably, desert and semi-arid zones showed contamination rates of *Toxocara* spp. eggs as high as 20%, while colder mountainous areas represented lower rates (around 7%). Geospatial analysis further supported these trends, with higher prevalence found in regions with latitudes of 31–35° and longitudes of 40–49°, likely due to favorable environmental conditions for egg persistence. Based on multiple systematic reviews and meta-analyses, the higher *Toxocara* infection rates observed at specific latitudes and longitudes were likely influenced by different factors, including favorable climatic conditions (higher temperature, humidity, and tropical/subtropical zones) and environmental contamination. The other influential issues were stray or outdoor dog/cat density and socioeconomic factors (e.g., lower income and sanitation levels), which aligns with global patterns reported in studies from Iran, North America, South America, Europe, and Asia (4,20,63,64,68-70). In Iran, humidity did not show a significant effect on the persistence of *Toxocara* eggs in soil, likely due to the relatively uniform climatic conditions across the studied regions, which contradicts the findings of global research, reporting higher contamination in areas with elevated humidity (20). Therefore, environmental factors influencing *Toxocara* egg survival in Iran may differ from global patterns, highlighting the importance of considering local climatic and ecological conditions when assessing contamination risk. Time-based analysis indicated a slight upward trend in prevalence, with the highest rate recorded at 19% between 2020 and 2024. Although a slight increase in prevalence was observed during 2020–2024 in our data, no global temporal trend was reported in the study by Fakhri et al (20), as their analysis did not evaluate changes over time. Accordingly, our observation should be considered a hypothesis, potentially reflecting improved diagnostic methods, urban expansion, increased environmental contamination, or other unmeasured factors. This trend may be influenced by improved detection methods, urban expansion, or other unmeasured variables. The subgroup analysis based on sample size demonstrated a higher prevalence in studies with 150–300 samples. However, meta-regression analysis revealed no statistically significant association between prevalence and sample size, publication year, or environmental variables. These findings suggest that other factors (e.g., the control of stray animals, public awareness, and sanitation infrastructure) may be more influential in determining contamination levels. Most of the included studies were rated as being of good to very good quality, and sensitivity analyses confirmed the robustness of the prevalence estimates. Overall, the findings highlight that *Toxocara* spp. contamination remains a moderate but persistent public health concern in Iran. The persistence of *Toxocara* eggs in the environment poses an ongoing risk of toxocariasis, particularly for children. Thu, preventive strategies should include regular deworming of pets, public education on hygiene practices, and improved sanitation in public areas. In addition, further research using standardized and sensitive detection methods (e.g., molecular diagnostics) is needed to enhance surveillance and guide control efforts. The One Health approach, which integrates human, animal, and environmental health, is especially relevant for controlling toxocariasis due to its zoonotic nature and environmental transmission routes. Coordinated efforts across veterinary medicine, environmental management, and human healthcare are essential to reduce infection risks, improve diagnosis, and implement effective prevention strategies. In addition to molecular diagnostic approaches, future research should prioritize longitudinal studies to capture temporal dynamics and assess changes in prevalence over time. Moreover, the investigation of pet-related transmission, particularly the role of domestic dogs and cats as reservoirs, is crucial to understanding the epidemiological cycle. Finally, the evaluation of the effectiveness of interventions, including deworming programs, public education campaigns, and sanitation improvements, will provide valuable evidence to guide policy and practice. Overall, these findings emphasize the need for region-specific public health interventions, including targeted hygiene education, regular deworming of pets, and improved sanitation in public spaces, to effectively reduce the risk of HT in Iran.

Conclusion

This updated systematic review and meta-analysis confirms the widespread and ongoing presence of *Toxocara* spp. eggs in soil across Iran, with a 16% overall prevalence. Public spaces, especially in central and arid regions, remain key sources of exposure, posing a continued risk to public health, particularly for children. Other vulnerable groups, such as pregnant women and immunocompromised individuals, should also be considered in public health interventions if relevant data are available. Despite regional differences, the stable prevalence over time reflects the persistent nature of this hazard. The lack of significant links between prevalence and factors such as sample size or environmental conditions suggests that broader issues (e.g., stray animal control, hygiene awareness, and sanitation) play a more crucial role. Eventually, targeted interventions, including regular pet deworming, hygiene education, and improved public sanitation, are essential as well.

Limitations of the Study

This review faced several limitations, including variability in study methods and diagnostic techniques, limited geographic representation, and reliance on conventional (non-molecular) detection methods, which may have underestimated prevalence. In addition, the absence of standardized data on environmental or socioeconomic factors, potential publication bias, and the lack of direct human exposure or health outcome data have limited the generalizability and public health interpretation of the findings. Hence, it is recommended that future studies employ standardized protocols, broaden geographic coverage, and include direct human health outcomes to address current gaps.

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Competing Interests

We declare no competing interests.

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Supplementary Files

Supplementary file 1 contains Figures S1-S8.

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