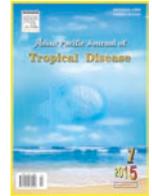


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Soil contamination with *Toxocara* spp. eggs in the public parks of Isfahan City, Central Iran

Mohsen Ghomashlooyan¹, Mohammad Falahati¹, Mohammad Ali Mohaghegh^{1*}, Rasool Jafari¹, Farzaneh Mirzaei¹, Hamed Kalani¹, Ghodrattollah Salehi Sangani², Mehdi Azami³

¹Department of Parasitology and Mycology, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

²Department of Parasitology and Mycology, School of Public Health, Tehran University of Medical Science, Tehran, Iran

³Skin Diseases and Leishmaniasis Research Center, Isfahan University of Medical Sciences, Isfahan, Iran

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ABSTRACT

Objective: To evaluate the contamination rate of the public parks of Isfahan city with *Toxocara* spp. eggs.

Methods: A total of 140 soil samples were collected from 28 public parks of Isfahan City, Central Iran, during the summer of 2014. Soil samples were investigated for the presence of *Toxocara* eggs by flotation method using sucrose solution. The prepared wet mount slides were examined under light microscope using 10× and 40× objectives.

Results: *Toxocara* spp. eggs were found in 21 (75%) out of 28 studied public parks. Also *Toxocara* spp. eggs were observed in 40 (28.6%) out of 140 collected soil samples.

Conclusions: Contamination rate with *Toxocara* spp. eggs in Isfahan is fairly high. Isfahan is a city that has lots of parks and gardens. The stray dogs and cats that roam around the parks contaminate the soil. Therefore preventive measures, especially for children, should be implemented.

1. Introduction

Human toxocariasis is a zoonotic disease caused by the larvae of *Toxocara canis* and *Toxocara cati*. These two species are considered as the most common round worms that live in the intestines of puppies, kittens and adult dogs and cats[1]. In addition, parasites can be found in birds and many species of mammals, including humans. Dogs and cats, which harbor adult worms, are able to spread the eggs by defecating into the environment. After the maturation of the eggs, ingestion of these eggs can cause infection.

Children are the most common afflicted age group that can be infected by swallowing the eggs by contaminated food stuff or objects in their mouth[2]. The larvae hatch in the human intestine

after swallowing and then migrate into different organs, including liver, lung and kidney. It can also migrate to central nervous system and cause visceral larva migrans syndrome[3,4]. According to the different symptoms of the disease, three syndromes are recognized: visceral larva migrans, ocular larva migrans and covert toxocariasis[5]. To date, the highest frequency of anti-*Toxocara* antibodies in affected children, have been reported by different studies[6-10]. Interestingly, eggs of the parasites which are excreted in the feces of dogs and cats, need a period of about two weeks to become infective[11,12].

According to the previous epidemiological study on dogs in Tehran, Iran, the prevalence rate of *Toxocara* spp. infection has been estimated at 10.7%-18.7%[13]. Also there are several reports from different soil samples showing the widespread contamination of the environment, parks and playgrounds with the eggs of *Toxocara* spp[13-16]. Because the parks and playgrounds are the main source of exposure for children, this study was carried out to determine the rate of contamination with *Toxocara* spp. eggs in

*Corresponding author: Mohammad Ali Mohaghegh, Department of Parasitology and Mycology, School of Medicine, Isfahan, Iran.

Tel: +989159661580

E-mail: mohaghegh1982@yahoo.com

public parks of Isfahan city.

2. Materials and methods

2.1. Survey area

Isfahan is located in the main north–south and east–west routes crossing Iran, and is one of the largest cities of Iran. Isfahan Province covers an area of approximately 107 027 km² and is situated in the center of Iran. The province has a dry, semi-dry and temperate climate. The average temperature has been estimated at 16.3 °C with average annual rainfall of 122.7 mm[17].

2.2. Design of study/sources of sample collection

A total of 140 soil samples from 28 public parks of 14 regions of Isfahan City were collected during the summer of 2014. Two main parks of each area were chosen and included in the study. The samples were randomly collected from 5 different flowerbeds of each park, including northern, eastern, western, southern and central regions, where there is loose soil. An eight-centimeter polyvinyl chloride pipe was used to collect the soil samples, because *Toxocara* spp. eggs are more abundant in the top (0 ± 8) cm than in deeper layers of the ground[18].

2.3. Parasitological procedures

By using 150 and 250 micrometer sieve, 2 g of each sample was isolated and transferred into the tubes, and then 10 mL NaOH 5% was added to the mixture and shaken vigorously. The mixture was left sedentary for 1 h in order to separate eggs from the soil. The mixture was homogenized by using vortex for 20 min. Centrifuged tubes were completely filled with the mixture and centrifuged for 3 min at 1500 r/min. The supernatants were discarded and the residue was washed with distilled water for three times. The sucrose solution (1.2 g/cm³) was added to the half of the tube and the sediment was suspended. In the next step, the tubes were centrifuged for 10 min at 1500 r/min, then the tubes were filled to the top with sucrose solution; and a cover slip was placed on each tube for 30 min and then the cover slips were examined under light microscope using 10× and 40× objectives.

3. Results

Toxocara spp. eggs were found in 21 (75%) out of 28 public parks and it showed a contamination rate of 28.6% among total of 140 soil samples. Region No. 2 was found to be highly contaminated comparing to the other examined sites. Regions No. 7, 8, 9, 10 and 12 stand for the second highly contaminated regions. The lowest rate of contamination was observed in region No. 5 (Table 1). The contamination rate in the parks which were

more than 10000 m² and less than 10000 m² area were 11 (73.3%) out of 15 and 10 (76.9%) out of 13 parks, respectively. There was no significant relationship between contamination rate of soil samples with parks area size ($P = 0.827$).

Table 1

Abundance of *Toxocara* spp. eggs in soil samples of the public parks of Isfahan City.

Region	Number of the parks	Number of the samples	Positive [n (%)]
1	2	10	3 (30%)
2	2	10	5 (50%)
3	2	10	1 (10%)
4	2	10	2 (2%)
5	2	10	0 (0%)
6	2	10	3 (30%)
7	2	10	4 (40%)
8	2	10	4 (40%)
9	2	10	4 (40%)
10	2	10	4 (40%)
11	2	10	1 (10%)
12	2	10	4 (40%)
13	2	10	2 (20%)
14	2	10	3 (30%)
Total	28	140	40 (28.6%)

4. Discussion

Soil contamination with *Toxocara* eggs and zoonotic helminthes is a matter of concern for public health in the world, especially in developing countries[19]. In recent years, the number of pet owners has increased in Isfahan. In addition, there are an increasing number of stray dogs and cats and all of these animals defecate in parks as well as other public regions[20]. The rate of infection with *Toxocara* spp. in dogs was reported from 10% to 51.6% and in cats from 13% to 52.7%[21-24]. Many studies show that lots of helminthes which can cause disease in human are soil-transmitted. *Toxocara* is one of these helminthes that its' ova need a period in soil to become infective[12].

In the recent similar studies in Iran, soil contamination rates have been reported in cities such as Khorram Abad (22.2%), Urmia (7.8%), Shiraz (6.3%), Tehran (38.7%) and Abadan (29.2%)[2,6,13,14,25]. In other countries, contamination ranges are highly variable from 1.2% in Spain to 97.5% in Greece[26,27]. Contamination of soil with *Toxocara* spp. eggs in the neighboring countries of Iran ranges from 15.5% in Iraq to 30.6% in Turkey[28,29].

According to the studies carried out in different regions of Iran and the world[2,6,25,26,30], contamination rate of soil with *Toxocara* spp. eggs in Isfahan (28.6%) is fairly high. Although no statistically significant relationship was observed between contamination rate of soil samples and the parks' size, but 21 out of 28 parks were found to be contaminated by *Toxocara* eggs among 13 municipal regions in Isfahan. The green areas in parks are the main places where children play. Furthermore, these places are suitable for the defecation of dogs and cats, which creates an ideal condition for the transmission of *Toxocara* eggs to the humans, especially to

the children. Isfahan is one of the cities that have lots of parks and gardens and the number of stray dogs and cats, which can freely roam round in there and contaminate the soil.

In conclusion, contamination rate with *Toxocara* spp. eggs in Isfahan is fairly high. Therefore, preventive measures, especially for the children, should be implemented. Also, it could be suggested to limit the access of cats and dogs to the parks by fencing them and meanwhile, public health education may be helpful to prevent or reduce soil-transmitted human toxocarosis.

Conflict of interest statement

We declare that we have no conflict of interest.

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References

- [1] Despommier D. Toxocarosis: clinical aspects, epidemiology, medical ecology, and molecular aspects. *Clin Microbiol Rev* 2003; **16**(2): 265-72.
- [2] 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.
- [3] Coelho LM, Dini CY, Milman MH, Oliveira SM. *Toxocara* spp. eggs in public squares of Sorocaba, São Paulo State, Brazil. *Rev Inst Med Trop Sao Paulo* 2001; **43**(4): 189-91.
- [4] Glickman LT, Schantz PM. Epidemiology and pathogenesis of zoonotic toxocarosis. *Epidemiol Rev* 1981; **3**(1): 230-50.
- [5] Dubná S, Langrová I, Jankovská I, Vadlejch J, Pekár S, Nápravník J, et al. Contamination of soil with *Toxocara* eggs in urban (Prague) and rural areas in the Czech Republic. *Vet Parasitol* 2007; **144**(1-2): 81-6.
- [6] Tavassoli M, Hadian M, Charesaz S, Javadi S. *Toxocara* spp. eggs in public parks of Urmia City, West Azerbaijan Province Iran. *Iran J Parasitol* 2008; **3**(3): 24-9.
- [7] Fallah M, Azimi A, Taherkhani H. Seroprevalence of toxocarosis in children aged 1-9 years in western Islamic Republic of Iran, 2003. *East Mediterr Health J* 2007; **13**(5): 1073-7.
- [8] Dogan N, Dinleyici EÇ, Bor Ö, Töz SÖ, Özbek Y. Seroprevalence survey for *Toxocara canis* infection in the northwestern part of Turkey. *Turkiye Parazitol Derg* 2007; **31**(4): 288-91.
- [9] De Almeida Carvalho EA, Rocha RL. Visceral larva migrans syndromes associated with toxocarosis: epidemiology, clinical and laboratory aspects of human toxocarosis. *Curr Trop Med Rep* 2014; **1**(1): 74-9.
- [10] Fragoso RP, Monteiro MBM, Lemos EM, Pereira FEL. Anti-*Toxocara* antibodies detected in children attending elementary school in Vitoria, State of Espírito Santo, Brazil: prevalence and associated factors. *Rev Soc Bras Med Trop* 2011; **44**(4): 461-6.
- [11] Chieffi PP, Ueda M, Camargo ED, de Souza AM, Leopoldo e Silva C, Villa Nova A, et al. Domiciliary and occupational contact with dogs as risk factors to human infection with *Toxocara* larvae. *Rev Inst Med Trop Sao Paulo* 1988; **30**(5): 379-82.
- [12] Overgaauw PA. Aspects of *Toxocara* epidemiology: human toxocarosis. *Crit Rev Microbiol* 1997; **23**(3): 215-31.
- [13] Tavalla M, Oormazdi H, Akhlaghi L, Razmjou E, Lakeh MM, Shojae S, et al. Prevalence of parasites in soil samples in Tehran public places. *Afr J Biotechnol* 2012; **11**(20): 4575-8.
- [14] Maraghi S, Mazhab Jafari K, Sadjjadi SM, Latifi SM, Zibaei M. Study on the contamination of Abadan public parks soil with *Toxocara* spp. eggs. *J Environ Health Sci Eng* 2014; **12**: 86.
- [15] Manini MP, Marchioro AA, Colli CM, Nishi L, Falavigna-Guilherme AL. Association between contamination of public squares and seropositivity for *Toxocara* spp. in children. *Vet Parasitol* 2012; **188**(1-2): 48-52.
- [16] Khazan H, Khazaei M, Tabaei SS, Mehrabi A. Prevalence of *Toxocara* spp. eggs in public parks in Tehran City, Iran. *Iran J Parasitol* 2012; **7**(3): 38-42.
- [17] Soltani M, Khoshakhlagh F, Zawar-Reza P, Miller STK, Molanejad M, SaadatAbadi Ranjbar A. Probable maximum precipitation estimation using statistical and physical methods over Esfahan Province of Iran. *Res J Forest Environ Prot* 2014; **1**(1): 38-55.
- [18] Uga S, Matsumura T, Aoki N, Kataoka N. Prevalence of *Toxocara* species eggs in the sandpits of public parks in Hyogo Prefecture, Japan. *Jpn J Parasitol* 1989; **38**(5): 280-4.
- [19] Alonso JM, Stein M, Chamorro M, Bojanich M. Contamination of soils with eggs of *Toxocara* in a subtropical city in Argentina. *J Helminthol* 2001; **75**(2): 165-8.
- [20] Abdi G. Study of cestodes in stray dogs in isfahan and its hygienic importance [dissertation]. Isfahan: Isfahan University of Medical Sciences; 2003.
- [21] Sadjjadi SM, Oryan A, Jalai AR, Mehrabani D. Prevalence and intensity of infestation with *Toxocara cati* in stray cats in Shiraz, Iran. *Vet Arch* 2001; **71**(3): 149-57.
- [22] Mehrabani D, Sadjjadi SM, Oryan A. Prevalence of gastrointestinal nematode parasites in stray dogs in Shiraz, Southern Iran. *J Appl Anim Res* 2002; **22**(1): 157-60.
- [23] Zibaei M, Sadjjadi SM, Sarkari B. Prevalence of *Toxocara cati* and other intestinal helminths in stray cats in Shiraz, Iran. *Trop Biomed* 2007; **24**(2): 39-43.
- [24] Mohsen A, Hossein H. Gastrointestinal parasites of stray cats in Kashan, Iran. *Trop Biomed* 2009; **26**(1): 16-22.
- [25] Motazedian H, Mehrabani D, Tabatabaee SHR, Pakniat A, Tavalali M. Prevalence of helminth ova in soil samples from public places in Shiraz. *East Mediterr Health J* 2006; **12**(5): 562-5.
- [26] Himons C, Antoniadou-Sotiriadou K, Frydas S. Research survey on the prevalence of *Toxocara* ova in the soil of public parks in Thessaloniki. *Helliniki Tatraki* 1992; **58**(5): 333-9.
- [27] Ruiz de Ybckáñez MR, Garijo MM, Alonso FD. Prevalence and viability of eggs of *Toxocara* spp. and toxascaris leonina in public parks in eastern Spain. *J Helminthol* 2001; **75**(2): 169-73.
- [28] Mahdi NK, Ali HA. *Toxocara* eggs in the soil of public places and schools in Basrah, Iraq. *Ann Trop Med Parasitol* 1993; **87**(2): 201-5.
- [29] Oge S, Oge H. Prevalence of *Toxocara* spp. eggs in the soil of public parks in Ankara, Turkey. *Dtsch Tierarztl Wochenschr* 2000; **107**(2): 72-5.
- [30] Gillespie SH, Pereira M, Ramsay A. The prevalence of *Toxocara canis* ova in soil samples from parks and gardens in the London area. *Public Health* 1991; **105**(4): 335-9.