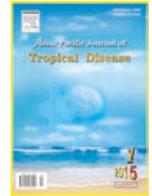


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Soil contamination with *Toxocara* spp. eggs in the public parks of Isfahan City, Central Iran

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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

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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 km<sup>2</sup> 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/cm<sup>3</sup>) 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 m<sup>2</sup> and less than 10000 m<sup>2</sup> 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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