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Prevalence of *Toxocara* species in park soils of Ahvaz City, southwest of IranForough Kazemi^{1,2}, Reza Arjmand^{2,3}, Mehdi Tavalla^{2,4*}¹Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran²Department of Parasitology, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran³Golestan Hospital Clinical Research Development Unit, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran⁴Health Research Institute, Infectious and Tropical Diseases Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

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ABSTRACT

Objective: To evaluate the prevalence of *Toxocara* species in park soils of Ahvaz City, southwest of Iran.**Methods:** A descriptive cross-sectional study was designed. Initially, 260 soil specimens were randomly collected from five regions (center, north, south, west and east) of the Ahvaz City (southwest of Iran) covering public parks. Then, the zinc sulfate (ZnSO₄) flotation method was carefully carried out for the detection of *Toxocara* species egg from contaminated soils. Eventually, the samples were microscopically examined at a magnification of 40× and 100×.**Results:** Out of 260 collected specimens, 196 samples were observed positive for presence of parasitic contaminations, and 76 cases were positive for *Toxocara* species, 67, 68, 14 and 42 cases were found positive for *Eimeria*, mite, yeast and free-living nematode larvae, respectively.**Conclusions:** Our findings indicated a relatively high prevalence of *Toxocara* species in the park soils of Ahvaz City. Since *Toxocara* species can cause the various complications, the health authorities should pay more attention to the management of the park soils of the city.

1. Introduction

Human toxocariasis is one of the most important zoonotic diseases worldwide[1]. The infection is caused by the larval stages of *Toxocara cati* (cat roundworm) and *Toxocara canis* (dog roundworm). Toxocariasis is considered as a helminthic sapro-zoonotic disease[2,3]. The infection can be caused by the ingestion of infected paratenic hosts and/or by the ingestion of contaminated food, raw vegetables, undercooked meat and geophagia[4,5]. Based on the localization of the larvae and the response of host immunity, the infection has four clinical types

including ocular larva migrans (OLM), neurological toxocariasis (NT), visceral larva migrans (VLM), and covert toxocariasis (CT) [1,6]. The prevalence of *Toxocara* species egg in public parks in some countries was estimated to be 0.55%, 6.73%, 9.75%, 11.57%, 11.87%, 14.03% and 28.31% in Middle East, Latin America, North America, Asia, Turkey, Australia and Europe, respectively[1,7,8].

Dogs are final hosts of the parasites that play a significant role in the infection with *Toxocara* species, in particular in the subtropical and tropical areas[6]. It is established that different factors such as the number of animals carrying the parasite including cat and dog as well as environmental conditions (climate, health of public parks) are involved in toxocariasis[9]. The parasite eggs remain in the soil for a long time depending on several factors including humidity of the soil, climatic conditions, and exposure to sunlight[3]. Frequently, the infections are

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acquired, especially in children, by playing in public areas such as parks that are contaminated with *Toxocara* species egg. The increasing population of dogs and cats infected with the parasites in public areas such as public parks and their easy access to the parks have caused increasing prevalence rate of the infection among children[10]. Therefore, the aim of the study was to evaluate the prevalence of *Toxocara* species in park soils of Ahvaz City, southwest of Iran.

2. Materials and methods

2.1. Ethical statement

The current study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (code No. OG-96120).

2.2. Study area

Ahvaz is a city in the center of Khuzestan Province in southwest of Iran. The city occupies an area of 375 km² and its population has been reported to be 1 425 891 until 2006. The city has a desert climate with temperature above 50 °C, which is one of the hottest cities in the world. The average annual rainfall is about 230 mm[11].

2.3. Collection and recovery of soil samples

A descriptive cross-sectional study was designed and the study was conducted from March 2017 to July 2017 in Ahvaz City. Initially, 260 soil specimens were randomly collected from five regions (center, north, south, west and east) of the Ahvaz City (southwest of Iran) covering public parks. For sampling, each sample (about 250 g soil) collected from 3 cm depth of soil was carefully placed in labeled polyethylene bags[1].

2.4. Flotation technique and microscopic observation

After drying, the collected soil specimens were precisely sieved by a 0.5 mm mesh. Then, the zinc sulfate (ZnSO₄) flotation method was carefully carried out for the detection of *Toxocara* species egg from contaminated soils. By using floatation technique, 10 g collected sample was mixed with 50 mL of 0.1% Tween 80 for 30 min. The supernatant (free of eggs) was discarded, and in the next stage, a saturated flotation solution (ZnSO₄) was added to the remaining sediment in the tubes. After centrifuging, the solution was added to form a meniscus and a cover slip was overlaid. Finally, the cover slip was transferred to a glass slide and microscopically examined at a magnification of

100× and 40× for the detection of *Toxocara* species egg, according to morphological features such as presence of larva inside the pitted eggs. In addition, unembryonated eggs were incubated in 0.5% formalin at the temperature of 25 °C for more than 60 days[1]. On the other hand, yeast and other parasites were detected based on morphological features and comparison with positive control slides.

3. Results

Table 1 shows the prevalence of parasitic and microbial contaminations in the park soils of Ahvaz City, southwest of Iran by microscopic observation. Out of 260 collected specimens, 196 samples were observed positive for presence of 267 parasitic and microbial contaminations, and 76 (28.4%) cases were positive for *Toxocara* species. In addition, 67 (25.0%), 68 (25.4%), 14 (5.2%) and 42 (15.7%) cases were found positive for *Eimeria*, mite, yeast and free-living nematode larvae, respectively.

Table 1

The prevalence and identification of parasitic and microbial contaminations in the park soils of Ahvaz city, southwest of Iran.

| Parasite and microbial species | Frequency (n) | Percentage (%) |
|--------------------------------|---------------|----------------|
| <i>Toxocara</i> | 76 | 28.4 |
| <i>Eimeria</i> | 67 | 25.0 |
| Mite | 68 | 25.4 |
| Yeast | 14 | 5.2 |
| Free-living nematode larvae | 42 | 15.7 |
| Total | 267 | 100.0 |

4. Discussion

Contamination of public areas such as parks with *Toxocara* species egg has been a worldwide health concern. Toxocariasis is one of the emerging zoonotic diseases and an endemic infection in most areas of Iran as well as in Ahvaz City. Frequently, the infections are acquired, especially in children, by playing in public areas such as parks contaminated with *Toxocara* species egg. Therefore, the present study was performed to evaluate the prevalence of *Toxocara* species in park soils of Ahvaz City, southwest of Iran, using the flotation method and microscopic observation.

The results of the study indicated that out of 260 collected specimens, 196 samples were observed positive for presence of 267 parasitic and microbial contaminations, and 76 (28.4%) cases were positive for *Toxocara* species. This prevalence was similar to that of the study by Ozlati *et al.*[1] in Tabriz (northwest of Iran) in 2016 which used zinc sulfate flotation method and reported 57 (31.6%) cases of 180 soil specimens contaminated with the parasite egg. Moreover, Khademvatan *et al.*[3] in Ahvaz City in 2014 using the nitrate flotation method showed that 30.4% of soil

samples of public parks were contaminated with *Toxocara* eggs. This prevalence was higher than those of other studies conducted in various areas of Iran. Epidemiological investigations conducted in the country indicate the contamination prevalence of park soils as 10%, 6.3% and 3.9% in Tehran (center), Shiraz (south), and Urmia (northwest) cities, respectively[12-14].

Differences in the findings of studies may be due to sample size, different diagnostic techniques, geographical parameters, socioeconomic status, climatological variables, poor sanitation and the number of stray cats and dogs. In addition, we collected the soil specimens from unfenced parks of Ahvaz City, and the stray infected dogs and cats have easy access to these parks, and the higher prevalence of the parasite in the soil of unfenced public parks than fenced parks has been reported[8]. The prevalence rate of human toxocariasis is associated with the degree of soil contamination with the parasite eggs, because the eggs are resistant to environmental conditions[3,15]. Therefore, the management of stray dogs and cats, enforcement of hygiene programs in public parks and increasing public awareness by urban government can reduce the outbreak rate of toxocariasis. In conclusion, our findings showed a relatively high prevalence of *Toxocara* species in the park soils of Ahvaz City, southwest of Iran. Since *Toxocara* species can cause the various complications, the health authorities should pay more attention to the management of the park soils of the city.

Conflict of interest statement

We declare that we have no conflict of interests.

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