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Soil contamination with Toxocara spp. ova in public parks, elementary schools and kindergartens in Jahrom City, Southern Iran

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Abstract

Introduction:
Visceral larvae migrant syndrome is a zoonotic disease which is transmitted to human through invasion of animal nematode larvae, mainly Toxocara spp., to intestine and their migration to other tissues. Little information has been published in this regard. The present study aimed to investigate the soil contamination with Toxocara spp. ova in public parks, elementary schools and kindergartens of Jahrom city.

Material and Method:
A total of 100 soil samples were collected from 20 parks and public places, 16 soil samples from kindergartens and 55 samples from elementary schools. Samples were investigated for Toxocara spp. ova by Sheather's flotation technique. The probable correlations between rate of contamination and environmental factors were analyzed using statistical methods.

Results:
Toxocara ova were observed in 4% of the samples taken from parks. However, no samples from kindergartens and elementary schools were contaminated. Moreover, no positive correlation was detected between rate of contamination and environmental variables (P>0.05)

Conclusion:
The presence of Toxocara spp ova in the Jahrom's public parks, the large number of people mainly kids using these places, lack of public awareness about the risks of contact with contaminated soils and more importantly, the roaming of stray dogs and cats are known as alarming factors for authorities to take appropriate measures to reduce contamination in these places.

Keywords: Toxocara, Soil, Park, Kindergarten, School, Jahrom

Introduction

VLM syndrome is a zoonotic disease caused by the intestinal invasion of nematode larvae mainly Toxocara and their migration to other tissues (1). Toxocara canis and Toxocara cati are mature gastrointestinal worms in the body of dogs and cats, whose eggs are scattered in the environment through animal excretion. The pathogenicity of Toxocara eggs relies on soil, which plays a key role in transmitting

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the disease to humans once it is contaminated with the eggs of these parasites (2). Large numbers of eggs are laid by these parasites, reaching as high as 15000 per gram of dog feces (3). Given the high number of stray dogs and cats in public places and parks in many Iranian cities, the potential contamination of these places is not unexpected (3-4).

Mature eggs containing parasitic larvae can cause human infection by entering the mouth and the gastrointestinal tract through eating contaminated vegetables and food as well as contacting soil. The parasitic larvae leave the eggs in human intestine, penetrate the intestinal tissue and migrate to other organs, including the liver and the lung, and cause VLM (5). The larvae may also invade the eye and cause ocular larva migrans, with symptoms ranging from visual impairment, retinal detachment to blindness (6-7). The symptoms and complications of VLM vary depending on the tissue and the organ involved, including fever, cough, nausea, hepatomegaly, brain involvement coupled with seizure symptoms and meningitis and in severe cases death.

The risk of human infection is far greater through contact with soil than direct contact with dogs and cats, since Toxocara eggs need to remain in soil for 4-6 weeks to become embryonated and infectious (8). Given that the parasite eggs acquire resistance in soil, parks and public places in urban areas constitute a major source of human contamination, especially in children (9). Research suggests that direct contact with soil is responsible for 50% of VLM cases (10). Laboratory and clinical symptoms are used to diagnose VLM in human. Serologic methods are useful for evaluating antibodies and imaging methods for diagnosing tissue lesions (11).

Despite the different positive results ranging from 1% to 20% obtained by studying people's serum levels for identifying anti-Toxocara antibodies, all these findings confirm high contamination in children (12). A study conducted to determine the serum levels of anti-Toxocara antibodies in primary school children in Shiraz, Iran, found over 25% of the cases to be positive (13).

Given the difficult diagnosis of this complication and the lack of information, providing accurate statistics of the disease cases and distribution is impossible in Iran (14).

The presence of dogs and cats in public areas has currently turned into a normal routine, highlighting the widespread scattering of Toxocara eggs in these places. The increased probability of children's contact with soil, caused by their regular presence in parks and kindergartens and their use of toys in these places, increases the risk of child infection with Toxocara eggs. Given the lack of accurate data on the distribution of Toxocara eggs in public areas of Jahrom, the present study was performed to investigate soil contamination of public places such as schools, kindergartens and parks in this city with the eggs of Toxocara species.

Materials and Methods

The present cross-sectional descriptive study was conducted in all schools,

kindergartens and parks in Jahrom, Iran. From May to August 2016, one hundred soil samples were randomly collected from 20 public places and parks, 16 from kindergarten yards and 55 from primary school yards in Jahrom. In fact, a single sample was collected from each school and kindergarten, while 5 samples were obtained from park soils in the north, south, west, east and center of the town. These 200-g soil samples were removed at a depth of 3 cm. Data associated with the sampling setting were obtained upon sampling, including the presence of dogs and cats and their feces and the availability of proper fences. To dehydrate the samples, they were left at room temperature for 24 hours in the Parasitology Laboratory of the School of Medicine in Jahrom. To detect Toxocara eggs in soil, the technique proposed by Maraghi et al. was utilized (15). According to this method, soil samples were first crushed, ground and passed through 200-300-micron sieves. The screened soil was then poured into a proper volume of distilled water, passed through three gas layers and transferred to test tubes. The tubes were centrifuged at 2000 rpm for five minutes and the supernatant and its suspended materials were then discarded. The sediment was remixed with the saline solution and the supernatant was separated using a centrifuge. Flotation was carried out by adding 1.2 g/cm^3 of saturated sucrose solution to the sediment and centrifuging them at 1500 rpm for 15 minutes. Tubes containing the suspension were then filled with additional sucrose solution. After placing coverslips on the tubes and letting them have a full contact with the tube content, the tubes were fixed in place for 45 minutes in the laboratory. The coverslips were then removed and placed on slides and tested for Toxocara eggs using optical microscopes (Olympios 320) at the magnifications of 100× and 400×.

The data collected were analyzed in SPSS-19 and the potential relationship between the degree of contamination and environmental factors was assessed using the Chi-squared test. $P<0.05$ was also set as the level of statistical significance.

Results

Toxocara eggs were detected and isolated from 3 (15%) of a total of 20 public places and parks with green spaces. These eggs contained larvae and their walls were corrugated (Figure 1). Five samples were collected from each place and a total of 100 samples were ultimately analyzed. The results revealed that 4 (4%) of the samples were contaminated with Toxocara eggs, including 2 samples collected from a single park and 2 samples collected from other 2 parks. No cases of contamination were, however, observed in the soil samples of the kindergartens and schools (Table 1). The results suggested no statistically significant relationships between the degree of contamination in a place and environmental factors such as fence availability, the traffic of dogs and cats and their feces being observed (Table 1).

Figure 1: The eggs of Toxocara species isolated from soil in Jahrom, Iran (×400)

Table 1: Soil contamination of public places with the eggs of Toxocara species in Jahrom

	Number of Samples	Positive cases of contamination	Existence of feces of dog or cat (%)	Existence of proper fence
Parks	100	4 (4)	100 (100)	0 (0)
Kindergartens	16	0 (0)	2 (12.5)	11 (68.75)
Schools	55	0 (0)	23 (41.81)	31 (53.36)

Discussion

The transmission of parasitic worms from soil to the human body is considered a major global health problem even in developed countries (16). Soil poses a greater risk of developing Toxocariasis compared to physical contact with dogs and cats, since the eggs of these parasites require to remain in soil to become infectious (17).

Despite the current emphasis placed on the risk of developing parasitic diseases acquired from dogs and cats in Iran, the increasing number of these stray animals in different urban places and holding them as pets have caused soil contamination with Toxocara and VLM syndrome, especially in children.

Different studies conducted in Iran suggest a relatively high prevalence of Toxocara in dogs and cats (18-19). Toxocariasis in human, also known as VLM, has also been addressed in literature. Rokni et al. reported 10 cases of contamination with VLM (20). Seroepidemiologic studies conducted on man revealed a prevalence of 25.6% in Shiraz, Iran, and 5.3% in the west of the country (13 & 21).

In Jahrom, gardens and farmland located in the suburb and even downtown, sometimes with no fences, have turned these areas into a haven for dogs and cats, which tend to appear in public places. The present study detected 4% of the samples collected from 15% of the parks across Jahrom to be contaminated with Toxocara species; nevertheless, different studies conducted in Iran and worldwide reported different values for the frequency of Toxocara eggs.

Although the degree of contamination reported in the present study is similar to those found in Argentina (7.2%), London (6.3%) and Ireland (5.6%) (22-24), these

values are far less than the soil contamination reported in countries such as Turkey (63%), Spain (67%), Brazil (53%), Japan (92%), Germany (87.1%), Cuba (42.2%) and the US, Kansas (20.6%) (25-30).

Comparing the results of the present study with the others obtained in Iran also suggests that the level of soil contamination of public places in Jahrom with Toxocara eggs is close to in areas such as Shiraz (6.3%), Urmia (7.8%), Kermanshah (13.2%) and Tehran (10%) (31-34), whereas the contamination reported was significantly higher in Khorramabad (63.3%), Isfahan (28.6%) and Abadan (61.2%) (15, 35-36). These differences can be explained by various factors, including the contamination level and population of dogs and cats in the area, climatic conditions, soil type, humidity, temperature, public places having proper conditions for dogs and cats, such as open agricultural spaces and parks without fences in the city, sampling season and the quality of testing. Cultural differences between Iran and other countries in terms of keeping dogs and cats as pets can also justify the difference in the results (33).

Given that this contamination poses a risk to children, the present study examined the yard soil in schools and kindergartens, suggesting no cases of contamination. Most of the school yards were found to have fences, thus limiting the entry of cats. Avoiding the disposal of garbage containing food residues in the streets, which may attract cats, can also lower the contamination rate of yards. Not allowing dogs to enter these enclosed areas can also play a key role in reducing contamination levels.

Conclusion

The relatively high contamination of public parks in Jahrom with Toxocara eggs and the associated complications constitute a major health problem which should be addressed by the authorities and proper measures be taken to control it. Although notifying people of the complications caused by soil contamination and completely clearing public parks from food remains on a daily basis are useful, clearing cities from dogs and cats and properly enclosing parks to prevent them from entering these places appear the most effective solution. More comprehensive studies are recommended to be conducted, especially seroepidemiologic investigations of Toxocariasis, to clearly specify the disease status in the study region.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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