

## Original Article

# Seroprevalence of *Toxocara* infection among healthy individuals referred to the medical center laboratories in Tehran City, Capital of Iran

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Received: 22 February, 2017; Accepted: 5 January, 2018

## Abstract

**Background:** Toxocarosis is a zoonotic disease with worldwide distribution. Humans' infection occurred by incidental ingestion of eggs shed in feces of dogs or cats. Studies on general population are rare in Iran. In this cross-sectional study, we investigated seroprevalence, and risk factors associated with toxocariasis among the healthy individuals in Tehran, capital of Iran.

**Materials and Methods:** In total, 374 sera samples were investigated for the presence of anti-Toxocara IgG. We applied ELISA as screening test using available commercial kit. In addition, demographic data were obtained from participant's questionnaires. Data analysis was performed using SPSS<sub>16</sub>.

**Results:** The overall seroprevalence of toxocariasis was found 5.6% (21/374). Regarding the socio-demographic variables, age ( $P < 0.001$ ) and eating unwashed vegetables ( $P = 0.049$ ) were significantly associated to toxocariasis in univariate analysis. In the logistic regression analysis, only age ( $P < 0.001$ ) was identified as potential risk factor associated with Toxocara infection.

**Conclusion:** This study revealed that seroprevalence of toxocariasis is relatively low in the healthy individuals in Tehran. We suggest carrying out further studies in the different part of Iran and investigate on the prevalence of toxocariasis in high-risk groups such as asthma, hyper-eosinophilic, epilepsy, rheumatism and schizophrenia patients.

**Keywords:** Toxocariasis, Seroprevalence, Tehran, Iran

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Please cite this article as: Baghani Z, Khazan H, Sohrabi MR, Rostami A. Seroprevalence of *Toxocara* infection among healthy individuals referred to the medical center laboratories in Tehran City, Capital of Iran. Novel Biomed. 2018;6(2):68-73.

## Introduction

*Toxocara cati* and *Toxocara canis* parasites cause a zoonotic disease known as toxocariasis with a worldwide distribution, particularly in communities with low levels of sanitation and hygiene<sup>1</sup>. Both of the causative agents belong to nematodes and inhabit in the intestine of their definitive hosts, including

dogs and cats<sup>2</sup>. It was estimated that 2 billion people are at risk of the infection, and because of the global warming, along with human and animals' immigration, the geographical distribution of toxocariasis is expanding<sup>3</sup>. Humans are the accidental host of the *Toxocara* spp., and ingestion of embryonated ova-contaminated soil/water and vegetables or raw infected larvae-contaminated animal

tissue are main routes of infection<sup>4-6</sup>. The risk of infection is higher in the first decade of life, due to more geophagic behaviors in children<sup>7</sup>.

Most of the infected humans are asymptomatic and probably its morbidity depends on parasite burden and immune response of the host<sup>8</sup>. Symptomatic toxocariasis is classified into three main forms, including visceral larva migrans (VLM), ocular larva migrans (OLM), and neurological toxocariasis (NT). The occurrence of any form depends on organs affected. It should be mentioned that some other helminth larvae can migrate in the human body and result in VLM<sup>9-11</sup>. The common clinical manifestations of toxocariasis may include dyspnea, cough, chest discomfort asthma, skin itching, or gastrointestinal disorders<sup>12</sup>.

The adult stage of the *Toxocara* spp. is not present in the human body, so microscopic examination of stool for ova is not possible. Biopsy is the gold standard for diagnosis of human toxocariasis, although it is an extremely difficult method, so serological methods such as enzyme-linked immunosorbent assay (ELISA) and indirect fluorescent antibody test (IFAT) are the most common<sup>13</sup>.

A number of seroprevalence studies on toxocariasis were conducted in Iran, mostly focused on high-risk groups like children<sup>14</sup>. Tehran is the biggest and most populous city in Iran. To the best of our knowledge, none of the previous studies have been carried out to evaluate the epidemiology of toxocariasis in Tehran city. In addition, since many stray dogs and cats are widely distributed in around of city and public parks, Tehran can be a neglected endemic area for toxocariasis. The objectives of the present study were a better understanding of prevalence of *Toxocara* spp. infection and determination of toxocariasis associated potential risk factors in this area.

## Methods

**Study area and study population:** This cross-sectional study was conducted at the Department of Medical Parasitology, Shahid Beheshti University of Medical sciences (SBMU), Tehran, Iran. The Ethics Committee of the SBMU (grant No 1394-263), approved this research. The Study involved subjects were healthy individuals referred to medical laboratories for routine health checkup in the Tehran

city. This area (35°41'46"N and 51°25'23"E) is located meanly 1700 meters above the sea level and has a cold semi-arid climate (with an average annual temperature of 16.4°C and about 429 mm rain receives annually).

**Sampling strategy:** The subjects were obtained from six hospitals between January 2014 and September 2015. A previously designed questionnaire was used to record potential risk factors associated with toxocariasis include: sex, age, educational level (illiterate, primary education, high school, and college graduated education and above), occupation, eating unwashed vegetables, and contact with dog, cat and contaminated soils. Objectives and protocol of the study were explained to all the enrolled participants. The written consents were signed by participants or their parents. Medical laboratory specialist collected blood samples after receiving consent forms and questionnaires.

**Laboratory tests:** A total of 374 participants were enrolled in this study. About 3-5 mL of whole blood samples were taken from each participant using venipuncture. The samples were allowed to clot and centrifuged at 1000 g for 3 minutes in order to the separation of sera. The collected sera were transported in ice to the Helminthology Laboratory of Shahid Beheshti University of Medical Science, where the sera were stored at -20°C until the examination. Sera samples were screened for anti-*Toxocara* IgG antibodies using ELISA kit (Nova Tec, Germany) as its instruction. The kit has sensitivity and specificity of >95%.

**Statistical analysis:** The SPSS statics software, version 21 (IBM, NY, USA), was used for analysis of results. Frequency was used for the description of characteristics of participants and prevalence of the parasite, and risk factors. Associations between seropositivity for toxocariasis and the potential risk factors were evaluated by Pearson's chi-square test.

## Results

Population sample comprised 192 (51.4 %) females and 182 (48.6%) males, aged from 1 to 81 years with a mean age (standard deviation; SD) of 28.6 (18.2) years. Most of the participants were aged ≥61 years (23.8%). The majority of women (105/192; 54.7%) were housewife. Concerning education level, only 16 (4.2%) were unable to read and write. One hundred

**Table 1:** Seroprevalence of *Toxocara* infection among healthy individuals referred to the medical centers Tehran city, according to sociodemographic characteristics (n=374).

Characteristic	No. Persons (%)	% seropositive	P value in $\chi^2$ test	P value in Logistic regression
<b>Age (yr)</b>			<0.001	0.001
≤9	64 (17.1)	0 (0.0)		
10-19	72 (19.3)	1 (1.38)		
20-29	75 (20)	3 (4)		
30-39	74 (19.8)	2 (2.7)		
≥61	89 (23.8)	15 (16.8)		
<b>Sex</b>			>0.05	0.1
Male	182 (48.6)	13 (7.1)		
Female	192 (51.4)	8 (4.1)		
<b>Education</b>			0.16	0.2
College and above	97 (26)	4 (4.1)		
High school	200 (53.5)	12 (6)		
Primary school	61 (16.3)	4 (6.5)		
Illiterate	16 (4.2)	1 (6.2)		
<b>Occupation</b>			0.09	0.1
Gov't employer & Other	194 (51.9)	13 (6.7)		
Student	73 (19.5)	0 (0.0)		
Housewife	105 (28.1)	8 (7.6)		
Farmer & shepherd	2 (0.5)	0 (0.0)		
<b>Eating not sterile raw vegetables</b>			0.046	0.06
Yes	177 (47.3)	15 (8.5)		
No	197 (52.7)	6 (3.04)		
<b>Contact with dog and cat</b>			0.08	0.1
Yes	118 (31.5)	11 (9.3)		
No	256 (68.5)	10 (3.9)		
<b>Contact to soil</b>			0.23	0.3
Yes	67 (17.9)	2 (2.98)		
No	307 (82.1)	19 (6.1)		
<b>Eosinophilia</b>			0.47	0.6
Yes	11 (2.9)	1		
No	363 (97.1)	20		

and eighteen (31.5%) and 67 (17.9%) participants reported a frequent contact with domestic animals (dog and cat) and soil, respectively. More socio-demographic characteristics are presented in Table 1. Out of 374 participants, the overall prevalence of anti-*Toxocara* antibodies was 5.6% (21/374). The seropositivity rate among males (13/182 cases; 7.1%) was slightly lower than in females (8/192; 4.1%). There was no significant difference in the prevalence among males and females ( $P>0.05$ ) in chi-square test. Results by the chi-square test showed that *Toxocara* seropositivity was associated with age ( $P<0.001$ ) and eating unwashed vegetables ( $P=0.046$ ). In logistic regression only age was as potential risk factor ( $P<0.001$ ). Further data are presented in Table 1.

## Discussion

In spite of the importance of toxocariasis for the human health, the infection is classified as a neglected disease by World Health Organization<sup>22</sup>, and is taken little attention as an important health problem, in the developing countries like Iran<sup>23</sup>. However, few studies have been conducted to determine the seroprevalence of toxocariasis among potentially at-risk groups in Iran<sup>14-16</sup>.

Seroprevalence of *Toxocara* spp. infection was reported 3-86% in deferent studies from different parts of the world, and from 5 to 29% in different parts of Iran<sup>12,24</sup>. In our study, the overall seroprevalence of 5.6% was found to *Toxocara* spp. infection in the Tehran city that is significantly lower than previously reported mean (15.8%) seroprevalence of the infection in the Iran<sup>14</sup>. To compare of our results with other

**Table 2:** Seroprevalence of *Toxocara* spp. reported by previous studies in the different parts of Iran.

First author/Ref	Study province	Study population	Sample size	Infected (%)
Sharif/ <sup>33</sup>	Mazandaran/Sari	School-children	1210	297 (25)
Nourian/ <sup>34</sup>	Zanjan	School-children	810	22 (2.7)
Maraghi/ <sup>35</sup>	Khuzestan/Ahwaz	Hypereosinophilic patients	100	19 (19)
		Healthy controls	100	1 (1)
Sajjadi/ <sup>15</sup>	Fars/Shiraz	School-children	519	133 (25.6)
Fallah/ <sup>16</sup>	Hamadan	School-children	544	29 (5.3)
Hosseini-Safa/ <sup>36</sup>	Isfahan	Children	427	6 (1.39)
Shahraki/ <sup>37</sup>	Sistan-Baluchestan	Children	364	14 (3.8)
Alavi/ <sup>38</sup>	Khuzestan/Ahwaz	Children with chronic cough	115	16 (13.9)

reports in different part of Iran, we have summarized previously performed studies in Table 2. Moreover, the seroprevalence of toxocariasis in the present study is lower than the 44.92% of seroprevalence reported Peru<sup>17</sup>, 51.6% in Brazil<sup>18</sup>, 13.9% in United States<sup>19</sup>, 51.2% in South Korea<sup>20</sup>, 23.5% in Serbia<sup>21</sup> and 22.1% in Roma population of Slovakia<sup>22</sup>. Furthermore, seroprevalence rate in our study is lower than their reported from Turkey (16.97%) in neighboring Iran<sup>23</sup>. On the other hand, the seroprevalence in this study higher than results of the study from Denmark (2.4%)<sup>24</sup> and approximately in consistent with results from studies in Egypt (7.7%) and Austria (6.3%)<sup>25,26</sup>.

Considering to risk factors for *Toxocara* infection results from this study demonstrated that age and unwashed vegetable were potential risk factors to the acquisition of infection. In our study rate of infection was elevated with increase in age. These results are in agreement with those reported by Won *et al.* in the USA<sup>19</sup> and Lee *et al.* in South Korea<sup>20</sup> and other studies in the different part of world<sup>21,22</sup>. The possible explanation for this would be an enhanced exposure to *Toxocara* eggs by means contaminated soil and raw vegetables or undercooked meat. Moreover, it should be noticed that anti-*Toxocara* antibodies remain for a long time, and the increment of the seroprevalence with age is associated with life-time exposure. Given that unwashed vegetables, it should be mentioned that many previous studies in Iran have reported moderate contamination of vegetables with *Toxocara* eggs<sup>5,6,27</sup>. Therefore, raw vegetables could be a potential risk factor, especially if they are washed inappropriately.

In our study we observed not statistically significant

association of *Toxocara* infection seropositivity with the gender, education, occupation, contact with dog or cat and contact with soil. In consistent with our results, Gabrielli *et al.* in Serbia, Lötsch *et al.* in Gabon and Espinoza *et al.* in Peru have reported that contact with dog or cat could not be a risk factor for *Toxocara* infection<sup>21,28,29</sup>. Interestingly, Rubinsky-Elefant *et al.* have found cat as protective factor in their study<sup>30</sup>. However, unlike to our study in some studies, contacts with dogs have described as important risk factors for the infection<sup>19,31,32</sup>. In contrast with our study, Won *et al.* have found that low level of education is significantly associated *Toxocara* seropositivity<sup>19</sup>. They mentioned that lower education levels are often associated with lower socioeconomic status, employing in occupations involving more soil exposure, live in areas with high environmental contamination, in which all of these could be associated with increased rate of *Toxocara* infection in the overall population<sup>19</sup>. Although our results showed that male were more infected than women, but statistically significant association was not observed. The different findings may be due to difference in sample size, time the study was done, type of studies population in different studies.

Our study had some limitations. First, financial issue and time limits did not allow us to include wider area and more participants in our study. Another limitation of our study is the use of only ELISA method. It would have been ideal to use of western blot to confirmation of seropositive individuals.

## Conclusion

The relatively low seroprevalence of *Toxocara* infection in our study can be caused by environmental

and socio-cultural conditions, moderate or high standards of hygiene, in Tehran city. We suggest carrying out further studies on the prevalence of toxocariasis in at-risk groups (such as asthma, hyper-eosinophilic, epilepsy, rheumatism and schizophrenia patients). In addition, to decrease *Toxocara* spp. infections, knowledge of people regarding toxocariasis and its risk factors must be increased.

## Acknowledgment

We would like to thank the administrators, authorities and personnel of the Loghman, Mahdieh, Imam Hussein, Mofid, Modares and Taleghani hospitals for their kind cooperation during the sample collection. Most importantly, the authors would like to thank all the participants for giving their permission to collect samples and for their participation in this study. We are thankful to the Helminthology Unit of the Shahid Beheshti University of Medical Sciences for the provision of materials.

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