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Original Article

Seroprevalence of Toxocariasis Among Children in the Urban and Rural Areas in North Iran

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Abstract

Background: *Toxocara* spp. can cause different clinical syndromes, including visceral larva migrans and ocular larva migrans. Apparently, children up to the age of 12 are the main population group susceptible to toxocariasis. Consequently, this study aimed to assess the seroprevalence of *Toxocara* infection and the associated risk factors in children aged 12 years and younger living in Guilan province, northern Iran.

Methods: A total of 267 blood samples were collected from children in the Roudbar, Manjil, and Rostamabad districts in Guilan province. Anti-*Toxocara* IgG antibodies were evaluated using a *T. canis* IgG ELISA. This study investigated basic demographic data and risk factors, including contact with dogs.

Results: Overall, 12 (4.5%) children exhibited IgG antibodies against *Toxocara*. The overall seroprevalence in females and males was 4.7% (6/ 129) and 4.3% (6/138), respectively. Urban and rural children demonstrated seropositivity rates of 2.9% (5/172) and 7.4% (7/94), respectively. No notable correlation was found between toxocariasis and factors such as gender, age, dog contact, or location.

Conclusion: Based on our findings, the rate of *Toxocara* infection is low among the children of the study area; however, preventive measures, including hygiene education, raising awareness about zoonotic infections, and providing treatment for pregnant dogs, are recommended whenever possible.

Keywords: *Toxocara*, Seroprevalence, ELISA, Guilan, Iran

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Introduction

Toxocara canis and, to some extent, *Toxocara cati* are the causative agents of human toxocariasis. Dogs and cats are definitive hosts of *T. canis* and *T. cati*, respectively. Humans are infected by ingesting the parasite eggs or, sometimes, by consuming chicken or cow liver. The clinical signs of toxocariasis have variations from asymptomatic to systemic cases. *Toxocara* spp. can cause visceral larva migrans and ocular larva migrans, which may have a role in the development of epilepsy (1,2). Children under the age of 12 years are the leading population group at risk for toxocariasis because of inadequate hygiene and interaction with dogs (3,4). In humans, the parasitological method does not help diagnose toxocariasis, but serological diagnoses of toxocariasis, such as antigen-based ELISA, are helpful (1,3). The seroprevalence of toxocariasis in children across various countries has been reported to vary from 4% to 86 % (1,5,6). Based on the findings of a meta-analysis, 9.3% of human toxocariasis cases were reported from Iran (7). Several seroepidemiological studies reported toxocariasis among children in northern (2.8%), northwestern (2.3%), western (5.3%), southeastern (1.3%) and southern (25.6%) parts of the country (8-12).

No reports on the seroprevalence of toxocariasis in Guilan province, north of Iran, are available. Therefore, the status of toxocariasis among the people remains unknown, especially among the children who live in this area. In the present study, we aimed to determine the frequency of toxocariasis among children up to 12 years old living in Guilan province using the ELISA method.

Methods

Geography of the study area

Guilan has a humid climate with a mean annual rainfall of 1359 mm. This province is situated on the southwest coast of the Caspian Sea in northern Iran (between 36° 36′ and 38° 27′ N and between 48° 43′ and 50° 34′ E). The study area, including Roudbar, Manjil, and Rostamabad

districts, is located in the southern part of Guilan province.

Questionnaire distribution and design

This descriptive cross-sectional study was conducted on children referred to public health centers in the study region's urban and rural areas. Permissions were obtained from the parents, and the basic demographic information, including age, gender, location and accommodation, was collected during the interview. The children were categorized into three age groups: Group 1: < 7 years; group 2: 7–9 years; and group 3: 9–12 years. The number of children in the three age groups was 75, 79, and 109, respectively. Of the 267 children enrolled in the study, 129 and 138 were female and male, respectively (Table 1).

Serologic detection of toxocariasis

Blood samples were taken from 267 children by trained public health nurses and transferred to the parasitology department of Guilan University of Medical Sciences. Serum samples were obtained through centrifugation at 5000 rpm for 5 minutes and stored at -20 °C. Anti-*Toxocara canis* antibodies were identified using an ELISA kit (Novotech, Germany) following the manufacturer's instructions. A value exceeding 11 NTU indicated a positive result, while a negative result was defined as a value below b 9 NTU.

Statistical analysis

Statistical analyses were conducted using the chi-square test with SPSS (version 23; SPSS Inc., Chicago, USA), and a *P* value of ≤ 0.05 was deemed statistically significant.

Results

A total of 12 (4.5%) out of 267 children exhibited *Toxocara* IgG antibodies. In the present study, the overall seroprevalence in females and males was 4.7% (6/129) and 4.3% (6/138), respectively. There was no significant association between gender and *Toxocara* seropositivity (*P* value = 1) (Table 1). The seroprevalence rates in the three age groups, including < 7, 7–9, and 9–12 years, were 3.5%, 3.4%, and 5.6%, respectively. Most of the seropositive cases were detected in the 9–12 age group (5.6%), and no significant association was found between the age group and *Toxocara* seropositivity (*P* value = 0.76) (Table 1, Figure 1). While the seropositivity rate in rural areas (7.4 %) was higher than in urban areas (2.9%), the difference was not statistically significant (*P* value = 0.12). The analysis of risk factors revealed that the seropositive rate was 7.4% among children who had a history of contact with dogs; there was no notable correlation with seropositivity for *T. canis* antibody (*P* value = 0.12) (Table 1).

Table 1. Demographic and risk factor analysis of *Toxocara canis* infection among children in north Iran

Variables	N	%	OR (95% CI)	*P* value
Gender				1
Male (n = 138)	6	4.3	Reference	
Female (n = 129)	6	4.7	1.07 (0.33–3.4)	
Age groups				0.76
< 7 years old (n = 85)	3	3.5	0.61 (0.14–2.53)	
7–9 years old (n = 75)	3	3.4	0.70 (0.17–2.89)	
9–12 years old (n = 107)	6	5.6	Reference	
Location				0.12
Urban (n = 172)	5	2.9	Reference	
Rural (n = 94)	7	7.4	2.68 (0.82–8.71)	
Contact with dogs				0.12
Yes (n = 94)	7	7.4	Reference	
No (n = 173)	5	2.9	0.37 (0.11–1.2)	

Discussion

Children, compared to adults, are more susceptible to toxocariasis; thus, they represent an excellent target group for studying the transmission of toxocariasis (1). The climate of the Guilan province is humid and tropical; therefore, its geographical situation may justify the survival of some parasites, such as *T. canis*, and the high prevalence of toxocariasis. Additional factors, such as the presence of stray dogs and cats in public parks, working dogs in rural areas, and domestic dogs and cats as pet animals, all play a role in the spread of *Toxocara* (6,13). The reported seroprevalence of toxocariasis varies among children of different countries (1,5,13-15). In the present study, 4.5% of children exhibited *Toxocara* IgG antibodies. It has been reported that 25.6% of children aged 6–13 years in Shiraz (10), 22% of children in Ilam (13) and 29.46% of children in East Azerbaijan (14) had IgG antibodies against *Toxocara.*

The seroprevalence of toxocariasis has been reported to be 12% among children in Bushehr (16) and 5.3% in Hamadan (9). In the reports mentioned above, the seroprevalence rate was higher than the results found in the current study (4.5%). Lower seroprevalence of toxocariasis has been reported among children in the rural and urban areas of Zanjan (2.7%), Jolfa (2.3%), Isfahan (1.39%), and Zahedan (1.3%) (11,12,17,18). The climate of the Guilan province is humid and tropical; therefore, its geographical situation may justify the survival of some parasites, such as *T. canis* and the high prevalence of toxocariasis. The humidity in the study area (Roudbar, Manjil, and Rostamabad) of the Guilan is much lower than that observed in the plain landforms of the province, which may explain the low prevalence of the infection in this area of Guilan.

Multiple factors affect the occurrence of *Toxocara* in humans, such as climate, health status, and demographic variations. These factors are also linked to the levels of *Toxocara* infection observed in local canine and feline populations. Furthermore, the absence of standardized

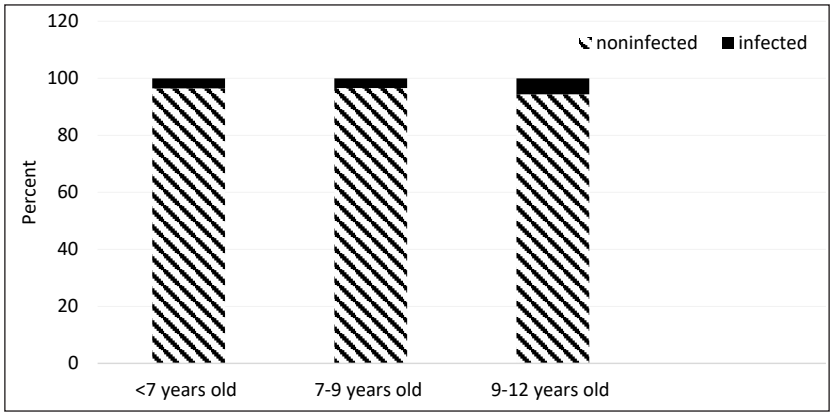

Figure 1. The seroprevalence rates of toxocariasis in the three age groups of children in north Iran

protocols, the use of different antigen preparations, and the application of varying cut-off titers can lead to variability in seroepidemiological studies (19).

The present study's overall seroprevalence in females and males was 4.7% and 4.3%, respectively. Our study failed to show a significant correlation between gender and seropositivity for the *T. canis* antibody. In line with the results of our study, several other studies have also been unable to find any relationship between gender and toxocariasis (20-24). At the same time, Gabrielli and colleagues reported that toxocariasis is significantly more frequent in women who practice onychophagy (25). The study found that approximately twice as many females were *Toxocara* seropositive (26).

In the current study, most seropositive individuals were identified within the age range of 9 to 12 (5.6%), but there is no significant association between seropositivity and age groups. This funding aligns with findings from other studies conducted in Iran, Nigeria, Spain, and the Republic of the Marshall Islands (1,6,10,27). Martínez et al mentioned that younger children are considered at risk for toxocariasis because they tend to have lower hygiene standards and often play with dogs and in the soil (28). This differs from findings in other studies, which report the highest prevalence in the oldest age groups (15,29).

Contact with animals is a critical risk factor for toxocariasis (3,7). The current study's results, similar to those of the study conducted in the Republic of the Marshall Islands (1), indicated that the frequency of toxocariasis in children who had a history of contact with dogs was higher than in children with no contact; however, the difference was insignificant (Table 1).

Urban and rural children demonstrated seropositivity rates of 2.9% (5/172) and 7.4% (7/94), respectively, so the difference was not significant (Table 1). In contrast, in the studies conducted in Babol (northern Iran) (30) and Ilam (13), the prevalence of toxocariasis was significantly higher in rural children.

Conclusion

This research showed that toxocariasis is low among the children in the study area. Preventive measures such as providing hygiene education, raising awareness about zoonotic infections, and treating pregnant dogs whenever possible are recommended. To increase our knowledge about the prevalence of toxocariasis in Guilan province, we suggest larger-scale studies on children and adults of different areas in Guilan province, focusing on whether the participants are symptomatic or asymptomatic and evaluating their eosinophilia levels.

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Competing Interests

The authors declared that there is no conflict of interest.

Ethical Approval

This study was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1399.300).

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