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# First Report of *Toxocara canis* Seroprevalence in Military Personnel and Their Families with Eosinophilia Referred to a Military Hospital in Tehran, Iran, 2015 - 2016

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## Abstract

**Background:** Humans may be accidently infected by larva stage of *Toxocara canis* and *Toxocara cati* nematodes through consumption of contaminated vegetables and food by embryonated eggs and geophagia. They cause visceral, ocular, and neurological syndromes detected through serological methods. Parasitic contamination and infectious diseases are the main cause of eosinophilia.
**Objectives:** The current study aimed at investigating *Toxocara canis* seroprevalence in military personnel and their families with eosinophilia referred to a military hospital in Tehran, Iran, from 2015 to 2016.
**Methods:** In the current cross sectional study, 179 patients (military personnel and their families) referred to a military hospital with eosinophilia > 5% in a two-year period (2015 - 2016) were selected and after obtaining informed consent and filling out the questionnaires, anti-*Toxocara canis* IgG was detected in their sera using the enzyme-linked immunosorbent assay (ELISA) technique.
**Results:** Seroprevalence of *Toxocara canis* infection was 11.7%. Males were the most infected individuals. After statistical analysis, a significant relationship between the level of education (P = 0.01) and history of pet contact (P = 0.02), and anti-*T. canis* IgG was found; nevertheless, it had no relationship with age, gender, occupation, and place of residence (P > 0.05).
**Conclusions:** Prevalence of *Toxocara* antibody was relatively high, which can indicate susceptibility to *Toxocara* infection in military personnel due to military operations. Due to lack of clinical manifestations in some patients, survey of *Toxocara* infection in eosinophilia cases is recommended.

*Keywords:* Toxocariasis, Military Personnel, Eosinophilia, Iran

## 1. Background

Toxocariasis as a helminthic infectious disease is caused by *Toxocara canis* and *Toxocara cati* nematodes (1) inhabited in canine and feline small intestine as definitive hosts, respectively (2).

Humans may be accidentally infected by larva stage of parasite through consumption of embryonated eggs with vegetables, food, geophagia (3), and chicken or cow livers (4).

Since parasite cannot be maturated in humans, after hatching egg in the intestine, larva migrates to organs and tissues (5). Clinical manifestation of human toxocariasis is usually asymptomatic (2, 4). Nevertheless, visceral larva migrants (VLM) and ocular larva migrants (OLM) as two major syndromes of toxocariasis in human can be detected (6, 7). VLM signs are recognized by fever, hepatomegaly, splenomegaly, respiratory symptoms, muscle pain, hypergammaglobulinemia, and eosinophilia (2, 7, 8). Toxocariasis caused by latent or long-standing exposure to infective larvae may also lead to central nervous system involvement, such as seizure, myelitis, and encephalopathy (9, 10).

It is unlikely that *Toxocara* can be diagnosed by biopsy in the contaminated organs; therefore, its diagnosis is based on immunological tests such as the enzyme-linked immunosorbent assay (ELISA) and Western blot (8, 11). Due to high sensitivity and specificity of ELISA (2), this technique is commonly used to detect *Toxocara* antibodies in human blood (6, 12).

This zoonotic disease is global (13) and its prevalence is higher in tropical and developing countries (8, 14). Sero-

prevalence of toxocariasis is reported 2.3% - 86% in different parts of the world (7), which is 15.8% in Iranian population (13).

Moreover, toxocariasis is known as a parasitic disease, which can cause eosinophilia (15). Different studies are performed to evaluate anti-*Toxocara* antibody in patients with eosinophilia, and prevalence of toxocariasis in patients with eosinophilia was highly reported in Iran and world (15-20).

Due to high level of anti-*T. canis* in different communities of the world and existence of *Toxocara* spp. egg in public park soil in different parts of Iran that indicates potential source for human infection (21-23), and due to the lack of information about the outbreak in military personnel and their families, the current study was designed.

## 2. Objectives

The current study aimed at investigating the anti-*T. canis* IgG in military personnel and their families with eosinophilia referred to a military hospital in Tehran, Iran, from 2015 to 2016.

## 3. Methods

### 3.1. Serological Assay

In the current cross sectional study, among individuals (military personnel and their families) referred to a military hospital in a two-year period (2015 - 2016) for any medical problems, 179 patients with eosinophilia > 5 % in complete blood count (CBC) test, using automatic blood cell counter, were selected for anti-*T. canis* IgG testing.

After obtaining informed consent and filling out the questionnaire including demographic characteristics (age, gender, place of residence, occupation, education, history of contact with pets), anti-*T. canis* IgG was detected in their sera using ELISA technique with commercially ELISA kit (IBL, German company) according to the manufacturer's instructions. Values < 9U were interpreted as negative, 9 - 11 U as equivocal, and > 11 U as positive. Data were analyzed using chi-square test with SPSS version 18. P value < 0.05 was considered as significant.

### 3.2. Ethical Considerations

Informed consent was obtained from all participants after obtaining a written permission from head of the laboratory in Baqiyatallah hospital and explaining the study objectives to participants.

## 4. Results

The total seroprevalence of *T. canis* infection was 11.7%. Out of 179 patients, 58.6% were male (M/F ratio = 1.4) and males were the most infected individuals (71.4%) compared with females.

Mean age of patients was 51.32 ± 17.79 years; ranged 24 to 87.

Majority of seropositive patients (60%) were undereducated and 58% of them were living in rural areas. Demographic characteristics of *T. canis* infection among patients with eosinophilia are shown in Table 1.

**Table 1.** Demographic Characteristics of *Toxocara canis* Infection in Patients with Eosinophilia

| Variable | Number | Seropositive Rate[a] | p-value |
|---|---|---|---|
| **Gender** | 105 | 15 (71.43) | 0.2 |
| Males | 74 | 6 (28.6) | |
| Females | | | |
| **Contact with pet** | 179 | 19 (1.05) | 0.02 |
| **Residency** | | | 0.3 |
| Urban | 75 | 7 (9.34) | |
| Rural | 104 | 14 (13.4) | |

[a]Values are expressed as No. (%).

After statistical analysis, a relationship was observed between the level of education (P = 0.01) and history of pet contact (P = 0.02), and anti-*T. canis* IgG. There was no significant relationship between *Toxocara* seroprevalence and age, gender, occupation, and place of residence (P > 0.05).

## 5. Discussion

To the authors' best knowledge, it was the first study conducted on military personnel and their families in which 11.7% of the patients with eosinophilia were also positive for anti-*T. canis* IgG. There was significant relationship between pet contact and level of education, and anti-*T. canis* IgG.

Among parasitic diseases, Toxocariasis may be the most common reason for eosinophilia, especially in the developing countries (15, 24, 25).

Numerous researches were performed to investigate *Toxocara* seroprevalence among different communities worldwide, which reported distinct seroprevalence. Due to geophagia habit in young children and poor hygiene, most studies were conducted to evaluate *Toxocara* infection in schoolchildren with different results due to the geographic location of studies (1, 4, 6, 26-28); in other words,

their incorrect habit caused susceptibility to *Toxocara* infection and high seroprevalence in this age group.

In researches, positive correlation was observed between anti-*Toxocara* IgG Ab and urticaria in children (29) and adults (30, 31).

In researches conducted on patients' sera with eosinophilia in Korea from 2001 to 2005, blood donors in Brazil, Turkey, and a number of cities in Iran such as Babol, Mashhad, Ahvaz ,and Arak, 68%, 46.3%, 32.2%, 23%, 22.5%, 19%, and 16% of the subjects were positive for anti-*T. canis* IgG, respectively, (17, 18, 20, 21, 24, 32, 33) that were inconsistent with the current study results (11.7%). The variation of results may be due to climate differences since *Toxocara* eggs need humid and warm weather for maturation.

In dissimilar studies conducted in different parts of Korea, high prevalence of anti- *Toxocara* IgG Ab in individuals with (65.2%) and without eosinophilia (51.2%) was reported, which indicated possibility of toxoxcariasis in eosinophilic cases. Also, the *Toxocara* seroprevalences differed a lot from the current study results, which indicate weather differences (16, 34).

About 72% of seropositive patients in the current study were male that was in concordance with most studies (3, 5, 8, 15, 16, 35, 36). Naturally, the military males are more tending to infection compared to females.

In the current study, there was a significant relationship between pet contact and level of education, and anti-*T. canis* IgG antibody, which was consistent with the results of studies performed in Netherlands, Mashhad, and Arak (11, 21, 33). This can be due to unawareness of undereducated individuals of transmission ways such as contact with pets, which can contaminate humans. However, pet raising was not related to *Toxocara* seropositivity in a study on the prevalence of toxocariasis in asymptomatic Korean adults (34).

Almost 13% of seropositive individuals were living in rural areas and there was no association between place of residence and *Toxocara* seropositivity. This result was in discordance with the results of studies in Korea and Babol (20, 34), but unlike the study performed in Korea on patients with eosinophilia of unknown origin (16).

Armed forces are more susceptible to *Toxocara* infection due to battlefield and operational environment and the current study also confirmed it. Drinking contaminated river water and lack of access to clean water and soap for hand washing during and after operations in some situations are risk factors for *Toxocara* infection. Despite the relatively high *Toxocara* seroprevalence in the studied individuals, there are less than the average prevalence reported by other studies in Iran since the current study population was almost from urban military personnel and their families referred to a military hospital for any medical problems with almost the same access to health facilities. Based on these outcomes, seroprevalence of toxocariais was remarkable in military personnel, which reflects the importance of studying *Toxocara* infection in such groups due to occupational exposures to infectious agents. Since toxocariasis can be considered as a probable cause of eosinophilia, anti-*T. canis* antibody test is recommended in eosinophilic cases. Increasing military personnel awareness about *Toxocara* transmission ways and training to wash hands after contact with soil and avoid drinking contaminated water are strategic, which could lead to reduction of the infection.

It is the first report on the prevalence of *Toxocara canis* in military personnel and their families with eosinophilia.

The limitations and weak points were that the patients referred to this hospital were sometimes nonmilitary persons; the results of the current study cannot be generalized to all military families.

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## References

1. Hosseini-Safa A, Mousavi SM, Bahadoran Bagh Badorani M, Ghatreh Samani M, Mostafaei S, Yousofi Darani H. Seroepidemiology of Toxocariasis in Children (5-15 yr Old) Referred to the Pediatric Clinic of Imam Hossein Hospital, Isfahan, Iran. *Iran J Parasitol*. 2015;**10**(4):632–7. [PubMed: 26811731]. [PubMed Central: PMC4724841].
2. Anaruma Filho F, Chieffi PP, Correa CR, Camargo ED, Silveira EP, Aranha JJ, et al. Human toxocariasis: a seroepidemiological survey in the municipality of Campinas (SP), Brazil. *Rev Inst Med Trop Sao Paulo*. 2002;**44**(6):303–7. [PubMed: 12532212].
3. Stensvold CR, Skov J, Moller LN, Jensen PM, Kapel CM, Petersen E, et al. Seroprevalence of human toxocariasis in Denmark. *Clin Vaccine Immunol*. 2009;**16**(9):1372–3. doi: 10.1128/CVI.00234-09. [PubMed: 19641098]. [PubMed Central: PMC2745020].
4. Fu CJ, Chuang TW, Lin HS, Wu CH, Liu YC, Langinlur MK, et al. Seroepidemiology of Toxocara canis infection among primary schoolchildren in the capital area of the Republic of the Marshall Islands. *BMC Infect Dis*. 2014;**14**:261. doi: 10.1186/1471-2334-14-261. [PubMed: 24886153]. [PubMed Central: PMC4024650].

5. Kaplan M, Kalkan A, Kuk S, Demirdag K, Ozden M, Kilic SS. Toxocara seroprevalence in schizophrenic patients in Turkey. *Yonsei Med J*. 2008;**49**(2):224–9. doi: 10.3349/ymj.2008.49.2.224. [PubMed: 18452258]. [PubMed Central: PMC2615325].
6. Fan CK, Hung CC, Du WY, Liao CW, Su KE. Seroepidemiology of Toxocara canis infection among mountain aboriginal schoolchildren living in contaminated districts in eastern Taiwan. *Trop Med Int Health*. 2004;**9**(12):1312–8. doi: 10.1111/j.1365-3156.2004.01332.x. [PubMed: 15598263].
7. Dar ZA, Tanveer S, Yattoo GN, Sofi BA, Wani SA, Dar PA. Seroprevalence of toxocariasis in children in Kashmir, J&K State, India. *Iran J Parasitol*. 2008;**3**(4):45–50.
8. Roldan WH, Cavero YA, Espinoza YA, Jimenez S, Gutierrez CA. Human toxocariasis: a seroepidemiological survey in the Amazonian city of Yurimaguas, Peru. *Rev Inst Med Trop Sao Paulo*. 2010;**52**(1):37–42. [PubMed: 20305953].
9. Lee JY, Kim BJ, Lee SP, Jeung YJ, Oh MJ, Park MS, et al. Toxocariasis might be an important cause of atopic myelitis in Korea. *J Korean Med Sci*. 2009;**24**(6):1024–30. doi: 10.3346/jkms.2009.24.6.1024. [PubMed: 19949655]. [PubMed Central: PMC2775847].
10. Caldera F, Burlone ME, Genchi C, Pirisi M, Bartoli E. Toxocara encephalitis presenting with autonomous nervous system involvement. *Infection*. 2013;**41**(3):691–4. doi: 10.1007/s15010-012-0342-6. [PubMed: 22996385].
11. Mughini-Gras L, Harms M, van Pelt W, Pinelli E, Kortbeek T. Seroepidemiology of human Toxocara and Ascaris infections in the Netherlands. *Parasitol Res*. 2016;**115**(10):3779–94. doi: 10.1007/s00436-016-5139-6. [PubMed: 27234034].
12. Dogan N, Dinleyici EC, Bor O, Toz SO, Ozbel Y. Seroepidemiological survey for Toxocara canis infection in the northwestern part of Turkey. *Turkiye Parazitol Derg*. 2007;**31**(4):288–91. [PubMed: 18224618].
13. Abdi J, Darabi M, Sayehmiri K. Epidemiological situation of toxocariasis in Iran: meta-analysis and systematic review. *Pak J Biol Sci*. 2012;**15**(22):1052–5. [PubMed: 24261119].
14. Alderete JM, Jacob CM, Pastorino AC, Elefant GR, Castro AP, Fomin AB, et al. Prevalence of Toxocara infection in schoolchildren from the Butanta region, Sao Paulo, Brazil. *Mem Inst Oswaldo Cruz*. 2003;**98**(5):593–7. [PubMed: 12973524].
15. Karadam SY, Ertug S, Ertabaklar H, Okyay P. The comparision of IgG antibodies specific to Toxocara spp. among eosinophilic and non-eosinophilic groups. *New Microbiol*. 2008;**31**(1):113–6. [PubMed: 18437849].
16. Kim HB, Seo JW, Lee JH, Choi BS, Park SG. Evaluation of the prevalence and clinical impact of toxocariasis in patients with eosinophilia of unknown origin. *Korean J Intern Med*. 2017;**32**(3):523–9. doi: 10.3904/kjim.2014.270. [PubMed: 28352060]. [PubMed Central: PMC5432784].
17. Kwon NH, Oh MJ, Lee SP, Lee BJ, Choi DC. The prevalence and diagnostic value of toxocariasis in unknown eosinophilia. *Ann Hematol*. 2006;**85**(4):233–8. doi: 10.1007/s00277-005-0069-x. [PubMed: 16463154].
18. Artinyan E, Uysal HK, Akgul O, Altiparmak S, Oner YA. Research on Toxocara canis antibodies obtained from patients with eosinophilia. *Indian J Med Microbiol*. 2014;**32**(4):383–6. doi: 10.4103/0255-0857.142239. [PubMed: 25297021].
19. Berenji F, Haghani M, Fati A, Mahmoodi M, Salehi M. Seroprevalence of Toxocara Infection among hypereosinophilic patients Referred to hospitals of mashhad university of medical science. *Med J Mashhad Uni Med Sci*. 2015;**58**(1):1–6.
20. EbrahimiFard SF, Fakhar M, Sharif M, Shirvani N, Davood S. Seroprevalence of Toxocara infection among adult individuals with eosinophilia in Babol, 2013. *J Mazandaran Univ Med Sci*. 2015;**24**(121):355–62.
21. Berenji F, Movahedi Rudy AG, Fata A, Tavassoli M, Mousavi Bazaz M, Salehi Sangani G. Soil Contamination with Toxocara Spp. Eggs in Public Parks of Mashhad and Khaf, North East of Iran. *Iran J Parasitol*. 2015;**10**(2):286–9. [PubMed: 26246828]. [PubMed Central: PMC4522306].
22. Garedaghi Y, Shabestari SA. [Prevalence of toxocara eggs in public parks of tabriz city, center of East Azerbaijan provice, Iran]. *J Islamic Azad Uni Tabriz*. 2012;**5**(4):1357–61. Persian.
23. Ghorbani Ranjbary A, Shafie A, Anamipor A. Frequency of Toxocara egg in public parks Shiraz/Iran. *J Kerman Univ Med Sci*. 2014;**21**(2):174–9.
24. Dattoli VC, Freire SM, Mendonca LR, Santos PC, Meyer R, Alcantara-Neves NM. Toxocara canis infection is associated with eosinophilia and total IgE in blood donors from a large Brazilian centre. *Trop Med Int Health*. 2011;**16**(4):514–7. doi: 10.1111/j.1365-3156.2010.02719.x. [PubMed: 21410848].
25. Kim YH, Huh S, Chung YB. Seroprevalence of toxocariasis among healthy people with eosinophilia. *Korean J Parasitol*. 2008;**46**(1):29–32. doi: 10.3347/kjp.2008.46.1.29. [PubMed: 18344674]. [PubMed Central: PMC2526293].
26. Iddawela DR, Kumarasiri PV, de Wijesundera MS. A seroepidemiological study of toxocariasis and risk factors for infection in children in Sri Lanka. *Southeast Asian J Trop Med Public Health*. 2003;**34**(1):7–15. [PubMed: 12971508].
27. Ghaffar Naqnehi HA, Khalili B, Kheiri S. [Seroepidemiology of Toxocara canis infection in 2-14 years old children referred to Health Care Centers of Chaharmahal and Bakhtiari Province by ELISA method in 2014]. *J Shahrekord Univ Med Sci*. 2016;**17**(6):121–9. Persian.
28. Akhlaghi L, Ourmazdi H, Sarafnia A, Vaziri S, Jadidian K, Leghaii Z. An Investigation on the Toxocariasis Seroprevalence in Children (2-12 Years Old) from Mahidasht Area of Kermanshah Province (2003-2004). *Razi J Med Sci*. 2006;**13**(52):41–8.
29. Matos Fialho PM, Correa CRS, Lescano SZ. Seroprevalence of Toxocariasis in Children with Urticaria: A Population-based Study. *J Trop Pediatr*. 2017;**63**(5):352–7. doi: 10.1093/tropej/fmw094. [PubMed: 28077610].
30. Burak Selek M, Baylan O, Kutlu A, Ozyurt M. Toxocara Canis IgG Seropositivity in Patients with Chronic Urticaria. *Iran J Allergy Asthma Immunol*. 2015;**14**(4):450–6. [PubMed: 26547714].
31. Joob B, Wiwanitkit V. Toxocara Canis and Chronic Urticaria. *Iran J Allergy Asthma Immunol*. 2016;**15**(2):667. [PubMed: 27090371].
32. Maraghi S, Mazhab Jafari K, Sadjjadi SM, Latifi SM, Zibaei M. Study on the contamination of Abadan public parks soil with Toxocara spp. eggs. *J Environ Health Sci Eng*. 2014;**12**:86. doi: 10.1186/2052-336X-12-86. [PubMed: 24872887]. [PubMed Central: PMC4036808].
33. Mosayebi M, Hajihossein R, Didehdar M, Eslamirad Z, Ejtehadifar M, Hamzelo Z. The role of Toxocara larva migransin hypereosinophilia with unknown origin in patients referred to laboratories. *J Kermanshah Univ Med Sci*. 2014;**18**(3):173–80.
34. Lee JY, Yang MH, Hwang JH, Kang M, Paeng JW, Yune S, et al. The Prevalence of Toxocariasis and Diagnostic Value of Serologic Tests in Asymptomatic Korean Adults. *Allergy Asthma Immunol Res*. 2015;**7**(5):467–75. doi: 10.4168/aair.2015.7.5.467. [PubMed: 26122506]. [PubMed Central: PMC4509659].
35. Romano N, Nor Azah M, Rahmah N, Lim Y, Rohela M. Seroprevalence of toxocariasis among Orang Asli (Indigenous people) in Malaysia using two immunoassays. *Trop Biomed*. 2010;**27**(3):585–94.
36. Chiodo P, Basualdo J, Ciarmela L, Pezzani B, Apezteguia M, Minvielle M. Related factors to human toxocariasis in a rural community of Argentina. *Mem Inst Oswaldo Cruz*. 2006;**101**(4):397–400. [PubMed: 16951810].