



**Brief Report**

# A Retrospective Study on the Seroprevalence of Anti-*Toxocara canis* Antibodies in the Human Population of a Romanian City

Iasmina Luca<sup>1\*</sup>, Cătălin Bogdan Sîrbu<sup>1</sup>, Beatrice Jitea Sîrbu<sup>1</sup>, Alex Cireșan<sup>1</sup>, Gheorghe Dărăbuș<sup>1</sup>

<sup>1</sup>Department of Parasitology and Parasitic Diseases, Faculty of Veterinary Medicine, University of Life Sciences "King Michael I" from Timișoara, Romania

## Abstract

Ascariasis is frequently diagnosed in the dog population, and *Toxocara canis* is the main agent that causes larva migrans syndrome in humans. In big cities, the number of pets is constantly increasing, especially canids. In Romania, in addition to dogs with owners, a large number of dogs without owners are found in public green spaces. Timisoara is one of the largest cities in Romania, with a population of approximately 306.462 people. In the present study, the seroprevalence of anti-*T. canis* antibodies was investigated in different age groups using the ELISA method. The samples were taken and analyzed in a private laboratory. The results indicated a major deficiency in the control of ascariasis in animals. The overall seroprevalence recorded in 371 individuals who were referred to the laboratory during 2017-2020 was 22.64%. The elderly were the most affected (39.39%) and children were the least affected (7.4%) groups.

**Keywords:** Human, Seroprevalence, Larva migrans

**Received:** December 15, 2021, **Accepted:** December 24, 2021, **ePublished:** June 30, 2022

## Introduction

Toxocariasis is a zoonosis frequently reported among the human population. Toxocariasis in humans is mainly caused by the larvae of *Toxocara* spp. which do not complete their maturation in the human body. They cause several characteristic syndromes such as LMO, LMV, and neurotoxocarosis (1-3). There are numerous sources of infestation; however, the soil is the main source, especially in children (geophagy). Additionally, poor hygiene, the consumption of contaminated vegetables and insufficiently cooked meat, along with the consumption of organs from different paratenic hosts, can be important sources. The liver is a frequently consumed organ from species such as large (4,5) and small ruminants (6), pigs (7), and chickens (8).

In the human body, the larvae are noticed by the immune system and initially produce an inflammatory process, followed by eosinophilia and the massive production of cytokines and immunoglobulins (3,9). Serological tests provide a definite diagnosis in the case of human toxocariasis. ELISA is a commonly used laboratory method. Various commercial kits that are used in immunology today mostly use *Toxocara* excretory-secretory (TES) antigens to detect IgG class antibodies. A major disadvantage of using TES antigens is the

inaccuracy of the results generated by them, which is related to potential cross-reactivity with other parasites (10-12). Moreover, the detection of IgG antibodies may indicate a previous infection or exposure of the body to the parasite and not an ongoing infection. Therefore, the diagnosis of toxocariasis in humans is based on the combination of clinical symptoms and positive serological results (13).

The purpose of the present study was to identify positive cases of human toxocariasis in the municipality of Timisoara (Timis county), using the ELISA technique. The results obtained can be correlated with the prevalence of ascariasis in dogs with or without an owner, as well as the prevalence of parasitic elements in public spaces. Therefore, veterinarians can help in breaking the epidemiological chain, and the human population can be informed about the concrete epidemiological situation and the possible locations and sources of infestation.

## Materials and Methods

During 2017-2020, 371 blood samples were taken from 237 women and 134 men. The investigated persons were divided into 4 age groups: children aged 0-14 years old (n=108), young people aged 15-24 years old (n=33), adults aged 25-64 years old (n=197), and seniors



\*Corresponding Author: Iasmina Luca, Email: [iasmina.luca@usab-tm.ro](mailto:iasmina.luca@usab-tm.ro)

aged >65 years old (n=33). From each individual, 1 mL of blood was collected in Kima vacutainers, with a yellow cap and a capacity of 5 mL. The obtained serum samples were analyzed using the ELISA technique in a private laboratory in the city of Timisoara, Romania. The kit used in this study was NovaLisa *Toxocara canis* IgG (NovaTec Immundiagnostica GmbH). Samples with an absorbance value greater than 10% were considered positive, and those with a value less than 10% were considered negative. Then, the obtained results were statistically analyzed using GraphPad Prism. *P*-value was obtained using Fisher's exact test, 2x2 contingency table. The results were compared in terms of gender and age.

## Results and Discussion

The seroprevalence of anti-*T. canis* antibodies was found to be 22.64% (84/371) during 2017-2020 in Timisoara, Romania, which is higher compared to other studies conducted in Europe during the same period. In Sicily, the seroprevalence among the human population was only 8% (14), and it was 3.6% in the Czech Republic (15). The values close to those obtained in Romania were reported in Asian countries including Iran during 2017-2018. The seroprevalence was reported to be 17.99% in Brazil (16).

The most affected age group was >65 years old, with a seroprevalence of 39.39% (13/33). High percentages were also recorded in the age groups of 25-64 years (28.93%) and 15-24 years (18.18%). Children were the least affected group; in other words, the seroprevalence in the 0-14 age group was 7.4% (8/108). The results obtained are contrary to those obtained by other researchers in the studies carried out on the African continent. In Ghana, the prevalence was high in the age group of 0-15 years (53.5%) (17). Extremely high percentages were identified in primary school children in Nigeria. The prevalence was 86.1% using the Western blot method (18). These differences are due to the poor standard of living and hygiene in African countries. Another explanation for the low seroprevalence in Romania can be the constant vigilance and supervision of children by their mothers in playgrounds and public parks. Many of the parks in the city of Timisoara have public fountains, where children can frequently wash their hands. Additionally, many parks are covered with rubber material, thus eliminating the soil as the main source of infection. In an extensive study, Gheorghe et al investigated the prevalence of parasitic elements in public parks with or without dog pens, children's playgrounds, and dog pens in Timisoara. Fecal samples, as well as soil and sand samples from sandpits (from playgrounds and dog paddocks), were collected and processed. The eggs of *Toxocara* spp. were present with a percentage of 0.57% in fecal samples and 1.15%-3.46% in soil samples. These eggs were not identified in sandpits (19,20). Therefore, parks are

among the sources of human infection, and the parasitic elements come from both stray and owned dogs which are not properly dewormed. In the present study, the high seroprevalence among the human population, especially among the elderly, may be due to close contact between them and pets. A major source of infestation can be the hair of dogs and cats. Generally, elderly people adopt an animal to avoid loneliness. They choose to spend most of their time with a dog or a cat. They eat or even sleep with their pets. Unfortunately, not all animal owners are responsible, and many choose not to deworm their animals. Therefore, they represent a danger to their health through the irresponsibility they show.

In the present study, extremely significant differences were recorded between the age groups of 0-14 and 25-64 years ( $P=0.0002$ ) and significant differences between the age groups of 0-14 and >65 years ( $P=0.0011$ ). Although women were more affected compared to men (23.20% versus 21.64%), the statistical differences between the two genders were insignificant ( $P=0.8026$ ).

## Conclusion

Considering the results recorded by other authors globally (15), the seroprevalence obtained in the present study is high. Therefore, it is necessary to adopt additional measures to prevent infestation, starting from the elimination of parasitic elements from the external environment (soil, sandpits, etc.) and finishing with deworming and frequent examination of the feces of dogs with and without owners using coproscopic techniques.

## Authors' Contribution

**Conceptualization:** Iasmina Luca, Gheorghe Dărbăuș.

**Data curation:** Iasmina Luca, Beatrice Jitea (Sîrbu).

**Formal analysis:** Iasmina Luca, Cătălin Bogdan Sîrbu, Gheorghe Dărbăuș.

**Investigation:** Iasmina Luca, Cătălin Bogdan Sîrbu, Beatrice Jitea (Sîrbu), Alex Cireșan, Gheorghe Dărbăuș.

**Methodology:** Iasmina Luca, Gheorghe Dărbăuș.

**Project administration:** Alex Cireșan, Beatrice Jitea (Sîrbu).

**Resources:** Iasmina Luca, Gheorghe Dărbăuș.

**Software:** Cătălin Bogdan Sîrbu, Alex Cireșan.

**Supervision:** Iasmina Luca, Gheorghe Dărbăuș.

**Validation:** Iasmina Luca, Cătălin Bogdan Sîrbu, Beatrice Jitea (Sîrbu), Alex Cireșan, Gheorghe Dărbăuș.

**Visualization:** Iasmina Luca, Cătălin Bogdan Sîrbu, Beatrice Jitea (Sîrbu), Alex Cireșan, Gheorghe Dărbăuș.

**Writing—original draft:** Iasmina Luca, Gheorghe Dărbăuș.

**Writing—review & editing:** Iasmina Luca, Gheorghe Dărbăuș.

## Competing Interests

The authors declare that they have no conflict of interest.

## Ethical Approval

Not applicable.

## Funding

Not applicable.

## References

- Finsterer J, Auer H. Neurotoxocarosis. Rev Inst Med Trop Sao Paulo. 2007;49(5):279-87. doi: [10.1590/s0036-46652007000500002](https://doi.org/10.1590/s0036-46652007000500002).
- Pivetti-Pezzi P. Ocular toxocariasis. Int J Med Sci. 2009;6(3):129-30. doi: [10.7150/ijms.6.129](https://doi.org/10.7150/ijms.6.129).
- Taylor MR, Keane CT, O'Connor P, Mulvihill E, Holland C. The expanded spectrum of toxocaral disease. Lancet. 1988;1(8587):692-5. doi: [10.1016/s0140-6736\(88\)91486-9](https://doi.org/10.1016/s0140-6736(88)91486-9).
- Chang S, Lim JH, Choi D, Park CK, Kwon NH, Cho SY, et al. Hepatic visceral larva migrans of *Toxocara canis*: CT and sonographic findings. AJR Am J Roentgenol. 2006;187(6):W622-9. doi: [10.2214/ajr.05.1416](https://doi.org/10.2214/ajr.05.1416).
- 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](https://doi.org/10.1007/s00277-005-0069-x).
- Salem G, Schantz P. Toxocaral visceral larva migrans after ingestion of raw lamb liver. Clin Infect Dis. 1992;15(4):743-4. doi: [10.1093/clind/15.4.743](https://doi.org/10.1093/clind/15.4.743).
- Fan CK, Lan HS, Hung CC, Chung WC, Liao CW, Du WY, et al. Seroepidemiology of *Toxocara canis* infection among mountain aboriginal adults in Taiwan. Am J Trop Med Hyg. 2004;71(2):216-21.
- Morimatsu Y, Akao N, Akiyoshi H, Kawazu T, Okabe Y, Aizawa H. A familial case of visceral larva migrans after ingestion of raw chicken livers: appearance of specific antibody in bronchoalveolar lavage fluid of the patients. Am J Trop Med Hyg. 2006;75(2):303-6.
- Beaver PC, Snyder CH, Carrera GM, Dent JH, Lafferty JW. Chronic eosinophilia due to visceral larva migrans; report of three cases. Pediatrics. 1952;9(1):7-19.
- Altcheh J, Nallar M, Conca M, Biancardi M, Freilij H. [Toxocariasis: clinical and laboratory features in 54 patients]. An Pediatr (Barc). 2003;58(5):425-31. doi: [10.1016/s1695-4033\(03\)78088-6](https://doi.org/10.1016/s1695-4033(03)78088-6). [Spanish].
- Mohamad S, Azmi NC, Noordin R. Development and evaluation of a sensitive and specific assay for diagnosis of human toxocariasis by use of three recombinant antigens (TES-26, TES-30USM, and TES-120). J Clin Microbiol. 2009;47(6):1712-7. doi: [10.1128/jcm.00001-09](https://doi.org/10.1128/jcm.00001-09).
- Smith H, Holland C, Taylor M, Magnaval JF, Schantz P, Maizels R. How common is human toxocariasis? Towards standardizing our knowledge. Trends Parasitol. 2009;25(4):182-8. doi: [10.1016/j.pt.2009.01.006](https://doi.org/10.1016/j.pt.2009.01.006).
- Roldán WH, Espinoza YA. Evaluation of an enzyme-linked immunoelectrotransfer blot test for the confirmatory serodiagnosis of human toxocariasis. Mem Inst Oswaldo Cruz. 2009;104(3):411-8. doi: [10.1590/s0074-02762009000300003](https://doi.org/10.1590/s0074-02762009000300003).
- Nicoletti A, Cicero CE, Mantella A, Giuliano L, Rascunà C, Paradisi V, et al. Seroprevalence of *Toxocara canis* in the city of Catania, Italy. Mediterr J Hematol Infect Dis. 2019;11(1):e2019031. doi: [10.4084/mjhid.2019.031](https://doi.org/10.4084/mjhid.2019.031).
- Skulinova K, Novak J, Kasny M, Kolarova L. Seroprevalence of larval toxocarosis in the Czech Republic. Acta Parasitol. 2020;65(1):68-76. doi: [10.2478/s11686-019-00121-0](https://doi.org/10.2478/s11686-019-00121-0).
- Raissi V, Sohrabi Z, Getso M, Raiesi O, Hashemi Hafshejani S, Shabandoust H, et al. Risk factors and prevalence of toxocariasis in pregnant women and diabetic patients compared to healthy adults in Ilam province, western Iran. EXCLI J. 2018;17:983-8. doi: [10.17179/excli2018-1630](https://doi.org/10.17179/excli2018-1630).
- Kyei G, Ayi I, Boampong JN, Turkson PK. Sero-epidemiology of *Toxocara canis* infection in children attending four selected health facilities in the central region of Ghana. Ghana Med J. 2015;49(2):77-83. doi: [10.4314/gmj.v49i2.3](https://doi.org/10.4314/gmj.v49i2.3).
- Gyang PV, Akinwale OP, Lee YL, Chuang TW, Orok AB, Ajibaye O, et al. Seroprevalence, disease awareness, and risk factors for *Toxocara canis* infection among primary schoolchildren in Makoko, an urban slum community in Nigeria. Acta Trop. 2015;146:135-40. doi: [10.1016/j.actatropica.2015.03.018](https://doi.org/10.1016/j.actatropica.2015.03.018).
- Garedaghi Y. Seroprevalence of toxocariasis in children in East-Azerbaijan province, Iran. Cukurova Med J. 2013;38(4):581-6.
- Gheorghe D, Iasmina L, Ion O, Sorin M, Narcisa M, Marius I, et al. Pollution with parasitic elements of green areas in Timișoara. Sci Parasitol. 2018;19(1-2):62-5.

© 2022 The Author(s); This is an open-access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.