

Seroepidemiological Survey for *Toxocara canis* Infection in the Northwestern Part of Turkey

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SUMMARY: In this study, an ELISA with *Toxocara canis* antigen was used for the determination of sero-epidemiological survey of *Toxocara canis* infection in urban and rural areas of northwestern part of Turkey. *Toxocara* seroprevalance was detected among randomly selected 430 children in the rural areas and 141 children in the urban areas. Total seroprevalence rate of *Toxocara* antibodies was found as 12.95% in both groups. While significant levels of anti-*Toxocara* antibodies were detected in 73 out of 430 (16.97%) children from rural area while only one children (0.71%) had positive level of anti-*Toxocara* antibodies from urban area ($p<0.001$). In rural areas, anti-*Toxocara* antibodies were significantly higher in children who have a dog in their house than the children who have no dogs (53 vs. 20 children; $p<0.01$). Seropositivity rate of *Toxocara* antibodies were similar between age groups and genders ($p>0.05$). Based on these results, however total seroprevalence rate is lower than other countries, we have proposed that public health programs especially for children, may be effective for protecting from *Toxocara* infection.

Key Words: *Toxocara canis*, toxocariasis, Turkey, children

Türkiyenin Kuzey Batı Bölümünde *Toxocara canis* İnfeksiyonu Seroepidemiolojisi

ÖZET: Bu çalışmada Türkiye'nin kuzey-batısında hem kentsel hem de kırsal alanda, *Toxocara canis* infeksiyonu seroepidemiolojisinin ELISA yöntemi ile çalışılması planlanmıştır. Bu amaçla; kırsal bölgede yaşayan 430 çocukta ve kentte yaşayan 141 çocukta *Toxocara canis* seroprevalansı değerlendirilmiştir. Tüm çalışma grubunun *Toxocara canis* seropozitifliği %12,95 olarak saptanmıştır. Kırsal alanda yaşayan çocuklarda anti-*Toxocara* antikorları 430 çocuktan 73'ünde (%16,97) pozitif olarak saptanırken, kentte yaşayan çocuklardan yalnızca birinde (%0,71) seropozitiflik saptanmıştır ($p<0.001$). Kırsal alanda anti-*Toxocara* antikorları, evinde kopek besleyen çocuklarda, beslemeyenlere göre anlamlı derecede yüksek olarak saptanmıştır (53'e 20 çocuk; $p<0.01$). Seropozitiflik oranı için yaş ve cinsiyete göre farklılık saptanmadı ($p>0.05$). Bu bilgiler ışığında, ülkemizde *Toxocara* seroprevalansı diğer ülkelere göre düşük olmakla birlikte, çocukluk çağında uygulanacak halk sağlığı eğitim programlarının *Toxocara* enfeksiyonundan korunmada etkili olabileceği vurgulanmıştır.

Anahtar Sözcükler: *Toxocara canis*, toxocariasis, Türkiye, çocuk

GİRİŞ

Human toxocariasis is an important emerging zoonotic disease and due to the high prevalence of infection, and its potential complications, it should be considered as a serious public health problem (5). Toxocariasis is an infection predominantly caused by migration of the roundworm *Toxocara (T.) canis* larvae to organs and tissues of man. The major clinical consequences of prolonged migration of *T. canis* larvae in humans are visceral larva migrans and ocular toxocariasis (9). There is a strong correlation between frequency of *Toxocara*

infection, life style, and infection risk. Toxocariasis is present worldwide but people living in areas, with sanitary deficiencies are considered at the highest risk of infection (5). Young children up to the age of 12 years are the main population supposedly more susceptible to *T. canis* infection due to dirt pica, poor hygiene, or frequent contact with dogs (9). A big part of the infected patient is asymptomatic and most of the clinical symptoms are not specific (1). The routine diagnosis of toxocariasis has been relied therefore upon immunological tests. Detection of an antibody response to *T. canis* antigen in serum samples is sensitive and specific for the diagnosis and serological surveys (17). *T. canis* larval excretory-secretory (TcES) antigen-based enzyme-linked immunosorbent assay (ELISA), which reportedly shows 78% sensitivity and 92% specificity (9).

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Contradictory results were reported about the seroepidemiology of toxocara infection, possibly due to selected population from different countries. The seroprevalence of toxocariasis among children in different countries has been reported to be within a range of 4.0–86% using the TcES-ELISA (1, 3, 4, 6, 7, 12, 13). Limited study about *Toxocara* seroprevalance, including small population or specific conditions were reported from Turkey. In the present study, an ELISA with *Toxocara canis* larval excretory-secretory (TcES) antigen was used for the determination of seroepidemiological survey of *T. canis* infection in urban and rural areas of northwestern part of Turkey.

MATERIALS AND METHODS

In the four major provinces, located in Northwestern part of Turkey, including Eskisehir, Bilecik, Kutahya and Afyon, a total of 430 children in rural areas and a total of 141 children in urban areas were randomly selected for the study. Informed consent forms were obtained from the parents of all children included the study. Detailed physical examinations were performed by pediatricians and demographic data were also recorded. A short, self-administered questionnaire was then used to collect relevant information from each subject, including data about keeping of dogs.

Blood samples were tested using an enzyme linked immunosorbent assay (ELISA) technique for the detection of IgG-specific antibodies to *T. canis* excretory-secretory antigens (Cypress Diagnostics®). Statistical analysis was performed with SPSS 15.0 package software. Chi-Square test was performed for comparisons.

RESULTS

A total of 430 children in rural areas and a total of 141 children in urban areas were screened for *Toxocara* infections. Total seroprevalence rate for *Toxocara* infections was 12.95% in all study group. While significant levels of anti-*Toxocara* antibodies were detected in 73 samples out of 430 children from rural area (16.97%), only one children (0.71%) has positive levels of anti-*Toxocara* antibodies from urban area ($p<0.001$). In rural area, anti-*Toxocara* antibodies were significantly higher in children who have a dog in their house than the children who have no dogs (53 vs. 20 children; $p<0.01$). Seropositivity rate of *Toxocara* antibodies were similar between age groups and according to gender ($p>0.05$) (Table 1).

DISCUSSION

Human toxocariasis is an important and common zoonotic disease from worldwide (5). The diseases frequently seen in young children, usually does not cause severe problems, although it persist for months to more than a year. Demographic and socioeconomic factors may lead to increase in *Toxocara* seroprevalance and widely recognized as zoonotic infections throughout the world and may be much more common than

previously thought. Serological tests are of considerable importance in the detection of infection by *T. canis*, as the clinical symptoms of toxocariasis are of limited value in the differential diagnosis (19).

Table 1. Demographical findings and seropositivity rate of study population.

	Rural area	Urban area	Total
Patients	430	141	571
Girls/Boys	204/226	69/72	273/298
Age (months)	76.8 ± 13.4	81.2 ± 12.8	77.8 ± 13.1
Have a dog	53*	20	73
Seropositive case	73**	1	74
Seropositivity rate (%)	16.97	0.71	12.95

* $p<0.01$, rural vs. urban area; ** $p<0.001$, rural vs. urban area

Toxocara infections are generally asymptomatic, and the seroprevalence varies from 3% to 86% in different countries (1). Total seroprevalence rate of *Toxocara* antibodies was 12.9% in our study group and was lower than other reported countries. Fan et al. (6) conducted a seroepidemiological study of *Toxocara canis* infection among mountain aboriginal school-children aged between 7 and 12 years living in Taiwan and overall seroprevalence was 76.6%. Muradian et al. (17) reported, a 26.9% out of the 338 serum samples from children ages between 1 and 15 years were positive with ELISA for antibodies to *Toxocara canis* in Brazil. Iddawela et al. (11) conducted a seroepidemiological study including 1,020 children aged between 1 and 12 years in Sri Lanka and toxocariasis seroprevalence was reported as 43%. Theodoridis et al. (20) reported that a remarkably high percentage (12.5%) reacted positively with ELISA for the detection of specific IgG and IgM antibodies against *T. canis* antigen in 511 serum samples from children aged between 6 months and 15 years old. Uhlíkova and Hubner (21) reported that the seropositivity ranged from 5.8% to 36.0% in various districts in Czech Republic. The geographical conditions and socio-economic status play an important role in the seropositivity of the population.

Seroepidemiological studies from our countries consist small population or in a specific population such as epilepsy or mental retardation (2, 13-16). Korkmaz et al. (15) reported that 37.34% of 391 serum samples were positive with using the TcES-ELISA. Oguzturk et al. (18) reported 32.3% of 186 school-children were seropositive for *Toxocara* infection. While significant levels of anti-*Toxocara* antibodies were detected in 73 samples of 430 children from rural area (16.9%), only one child (0.71%) has positive levels of anti-*Toxocara* antibodies from urban area. Buyukbaba et al. (2) reported that the seropositivity rate was 42.2% in the rural area and 11.9% in the urban area of Istanbul province. In the present study, in the rural area, anti-*Toxocara* antibodies were

significantly higher in children who have a dog in their house than the children who have no dogs. However, routine veterinary controls of dogs have been strictly performed in urban and rural areas, seroprevalance rate of toxocariasis is considerably common in our country.

Figueiredo et al. (7) reported that *T.canis* infection must be considered in at-risk children, such as those with puppies at home, who have had contact with soil. *Toxocara* spp. was found in the soil samples from 21 out of 22 playgrounds (95.5%) in Italy (8). Muradian et al. (12) reported that 29.7% of soil samples were positive for the presence of *Toxocara* spp. Eggs. Gurel et al. (10) also showed that 18.9% of 111 soil samples were contaminated with *Toxocara* spp. eggs in Aydın province and they highlighted the high toxocariasis risk. Fan et al. (6) also reported those children who admitted living in a household where dogs were kept or playing in soil appeared at increased risk of seropositivity for *Toxocara* infection. Iddawela et al. (11) reported that dog ownership, especially puppies, and geophagia-pica, were significant risk factors. Coelho et al. (4) conducted a seroepidemiological survey for toxocariasis, among 180 schoolchildren of the public schools in Brazil; the infection risk was higher among the children living in the city outskirts where the socioeconomic conditions were worse than in the central region of the city.

We could not demonstrate any relationship between the seropositivity rate and gender difference and age groups. Fan et al. (6) reported that neither age nor gender seemed to be important factors related to a positive serology like our studies. However Theodoridis et al. (20) reported that females were significantly more infected than males. Seropositivity rate was highest in children over the age of 10.

Kaplan et al. (13) reported that, in Turkey; the frequency of *Toxocara* infection was found significantly higher in mental retarded cases. There was no significant difference between mental retarded children and the controls for age, age groups, gender, owning dogs, socio-economic level and behavioral factors, and personal hygiene. Alderete et al. (1) reported that among infected children, the mean age was 9.4 years, with a similar distribution between genders. A significant association was observed with the presence of onychophagia, residence with a dirty backyard, living in a slum, previous wheezing episodes, school attended, and family income. Chan et al. (3) reported higher *Toxocara* seropositivity in children with asthma than that of the non-asthmatic controls in Malaysia.

Seropositivity rate of *Toxocara canis* is common in healthy children living in rural areas than the children living in urban areas. Based on these results, we propose an effective organization for public health programs for prevention strategies against toxocariasis. The high environmental contamination frequency found underlines the hygiene education of the population to increase awareness of potential zoonotic infections.

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