Low *Toxocara* Seroprevalence in People in Rural Durango, Mexico

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The epidemiology of *Toxocara* infection in rural Mexico is largely unknown. Therefore, we sought to determine the seroprevalence of *Toxocara* infection in rural people in a northern Mexican state. We performed a cross-sectional serosurvey of 641 people living in rural Durango State including 282 subjects of the general population, 214 subjects of Huichol ethnicity, and 145 subjects of Mennonite ethnicity. Sera of participants were analyzed for the presence of anti-*Toxocara* immunoglobulin G (IgG) antibodies using a commercially available enzyme immunoassay. Three (0.5%) of the 641 subjects tested were positive for anti-*Toxocara* IgG antibodies. Of the 3 *Toxocara* seropositive subjects, two were females, aged 19 and 39 years, and one was male, aged 59 years. They had contacted with dogs, cleaned cat excrement, consumed unwashed raw fruits, contacted soil, or lived in a house with soil floors. Seroprevalence of *Toxocara* infection was similar among the 3 groups of population studied: 0.4% for the general population, 0.9% for Huicholes, and 0.0% for Mennonites. In conclusion, the *Toxocara* seroprevalence found in subjects in rural Durango is low as compared with those reported in people from rural areas in other countries.

**Keywords:** cross-sectional study, epidemiology, rural, ethnic groups, seroprevalence, toxocariasis

**Introduction**

The parasite *Toxocara* is the most ubiquitous intestinal nematode in dogs and cats [1]. This parasite is a zoonotic pathogen that causes toxocariasis and associated complications including allergic and neurological disorders [2]. Toxocariasis is one of the most commonly reported zoonotic helminth infections in the world [3]. Transmission to humans occurs by accidental infection of eggs present in, for instance, contaminated fruits or vegetables [4]. Toxocariasis is a neglected disease reaching high prevalence independently of the economic conditions [5]. Most human infections are asymptomatic [6]. Patients with toxocariasis may present fever, respiratory symptoms, gastrointestinal features [7], decreased visual acuity, eyestrain, headache, paleness [8], paresthesias, nervousness, and lipothythic states [9]. Ocular toxocariasis may lead to blindness [10]. Cardiac involvement is a rare but potentially life-threatening complication in *Toxocara* infection [11].

Living in rural areas is considered a risk factor for *Toxocara* infection as demonstrated in studies in several countries including Iran [12], Gabon [13], Korea [14, 15], Egypt [16], and Poland [17]. Knowledge about the seroepidemiology of *Toxocara* infection in rural Mexico is quite limited; however, we are aware of only one study about the seroepidemiology of *Toxocara* infection in rural Mexico. In a serosurvey of 126 Tepehuanos (an indigenous ethnic group) in rural Durango State, a 26.2% seroprevalence of *Toxocara* infection was found [18]. In the present study, we attempted to determine the seroprevalence of *Toxocara* infection and its association with the sociodemographic, clinical, and behavioral characteristics of the general population in the rural communities in the northern Mexican state of Durango.

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**Materials and Methods**

**Study Design.** We performed a cross-sectional serosurvey using serum samples from previous *Toxoplasma gondii* seroepidemiology studies [19–21]. The aims of the original studies were to determine the seroprevalence of and risk factors for *Toxoplasma gondii* infection in the studied population groups.

**Study Population.** We studied 641 people living in rural Durango State including 282 subjects of the general population, 214 subjects of Huichol ethnicity, and 145 subjects of Mennonite ethnicity. Inclusion criteria for enrollment were as follows: (1) living in rural Durango State, (2) aged 14 years and older, and (3) who accepted to participate in the survey. The socioeconomic status, gender, and educational level of the subjects were not restrictive criteria for enrollment. Concerning the 282 subjects of the general population, they were sampled in three communities: San Dimas, Villa Montemorelos, and Santa Clara, whereas Huicholes were sampled in the community of Huazamota. For its part, Mennonites were sampled in the community of Nuevo Ideal. In total, the tested subjects included 408 females and 233 males, aged 14–91 years (mean 40.30 ± 16.69 years).

**Socio-Demographic, Clinical, and Behavioral Characteristics of the Subjects.** We obtained the sociodemographic, clinical, and behavioral characteristics of the study population from archival Microsoft Excel files recorded in the original studies [19–21]. Sociodemographic data included age, gender, birthplace, occupation, socioeconomic status, educational level, and type of flooring at home. Clinical data included history of blood transfusion or solid organ transplantation. Behavioral data included animal contacts (cats, dogs, farm animals, and others), traveling (national or international trips), type of meat consumed (beef, pork, chicken, turkey, and others), degree of meat cooking (raw, undercooked, or well done), consumption of unpasteurized products.

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milk, untreated water, unwashed raw fruits or vegetables, eating in restaurants or fast food outlets, and soil contact.

Detection of Anti-Toxocara IgG Antibodies. Anti-Toxocara immunoglobulin G (IgG) antibodies were detected in the sera of subjects using a commercially available enzyme immunosassay “Toxocara” kit (Diagnostic Automation, Inc. Calabasas, CA, USA). All assays were performed following the manufacturer’s instructions. We included in each assay the negative and positive controls provided in the kit. Seropositivity was considered when an absorbance reading ≥0.3 optical density units was obtained.

Statistical Analysis. We performed the statistical analysis using the software Microsoft Excel, Epi Info version 7, and SPSS version 20. We calculated the sample size using the following parameters: a population size of 500,000, a reference seroprevalence of 26.2% [18] as the expected frequency of exposure, 4% of confidence limits, and a 95% confidence level. The result of the sample size calculation was 464 subjects. We used the two-tailed Fisher’s exact test to assess the association of Toxocara seropositivity and the sociodemographic, clinical, and behavioral characteristics of the subjects studied. A P value <0.05 was considered statistically significant.

Ethical Aspects. In the present study, we analyzed only archival serum samples and data obtained in the previous studies. The original surveys were approved by Institutional Ethics Committees [19–21].

Results

Three (0.5%) of the 641 subjects tested were positive for anti-Toxocara IgG antibodies. Of the 3 Toxocara seropositive subjects, 2 were females, aged 19 and 39 years, and one was male, aged 59 years. The occupations of these 3 seropositive subjects were as follows: a student, a housewife, and an agriculturist. They had contacted with dogs, cleaned cat excrement, consumed unwashed raw fruits, and contact with soil. However, the lack of associations between Toxocara seroreactivity and the characteristics of the study population found in this study was probably due to the very low number of Toxocara seropositive individuals found. This low rate of Toxocara seropositivity was a limitation of the survey. Additional studies with large sample sizes to determine risk factors associated with Toxocara exposure in rural Durango are needed.

In summary, we demonstrate a low rate of Toxocara exposure among people living in rural Durango. The seroprevalence found is lower than those reported in people living in rural setting in other countries. Risk factors associated with Toxocara exposure in rural Mexico remain to be determined.

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Authors’ Contributions

CAE designed the study protocol, performed the laboratory tests and data analysis, and wrote the manuscript. AOF and GAAF performed the data analysis and reviewed the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

References