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

Cosme Alvarado-Esquível\(^1\), Ángel Osvaldo Alvarado-Félix\(^2\) and Gustavo Alexis Alvarado-Félix\(^2\)

\(^1\)Biomedical Research Laboratory, Faculty of Medicine and Nutrition, Juárez University of Durango State, Avenida Universidad S/N, 34000 Durango, Mexico

\(^2\)Colegio Anglo-Español Durango, Avenida Real del Mezquital 92, 34199, Durango, Mexico

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 seroprevalence study 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 \((P = 0.41)\). 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
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 immunoassay “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 agro-culturist. 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 (*P* > 0.41). The *Toxocara* seropositivity rate did not vary (*P* > 0.05) with respect to sociodemographic characteristics of the study population including age, gender, birthplace, occupation, socioeconomic status, educational level, and type of flooring at home. Concerning clinical characteristics, none of the *Toxocara* seropositive individuals had a history of blood transfusion or solid organ transplantation. None of the behavioral characteristics analyzed including animal contacts, traveling, type of meat consumed, degree of meat cooking, consumption of unpasteurized milk, untreated water, unwashed raw fruits or vegetables, eating in restaurants or fast food outlets, and soil contact was associated with *Toxocara* seropositivity rate (*P* > 0.05).

**Discussion**

The seroepidemiology of *Toxocara* infection in rural Mexico has been sparsely studied so far. Therefore, in the current study, we sought to determine the seroprevalence of *Toxocara* infection in several communities in rural Durango State, Mexico. We found a low (0.5%) seroprevalence of *Toxocara* infection in people living in rural areas of Durango State. This finding was unexpected since living in rural areas is considered as a risk factor for *Toxocara* exposure in several countries in Asia [12, 14, 15, 17], Africa [13, 16], and Europe [17]. The *Toxocara* seroprevalence found in our study is lower than those reported in rural populations in Brazil (71.8%) [22], Gabon (59.9%) [13], Argentina (23%–31.6%) [23, 24], Poland (56.2%) [17], Korea (5%) [25], India (6.4%) [26], Bolivia (34%) [27], the Slovak Republic (17.09%) [28], and Venezuela (25.6%) [29]. In addition, the seroprevalence found in our study is lower than the 26.2% *Toxocara* seroprevalence reported in Tepexuanos in rural Durango, Mexico [18]. In fact, the seroprevalence found in our study is the lowest ever reported in rural communities. It is not clear why the seroprevalence in rural communities in Durango found in this study is lower than those reported in similar populations elsewhere. It is possible that the rate of *Toxocara* infection in dogs and cats and soil contamination with *Toxocara* in the rural communities explored was low. We cannot rule out previous deworming in cats and dogs to reduce parasite transmission in the communities studied. However, we did not obtain information about deworming in animals in the communities studied. We looked for socioeconomic, clinical, and behavioral factors associated with *Toxocara* infection in people in rural Durango; however, statistical analysis showed that none of the characteristics studied was associated with *Toxocara* infection. The three *Toxocara* seropositive individuals found in the current study had factors associated with *Toxocara* infection including contact with dogs, cleaning cat excrement, consumption of unwashed raw fruits, and soil contact. 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 certainly a limitation of the survey. Additional studies with large sample sizes to determine risk factors associated with *Toxocara* exposure of people in rural Durango are needed.

In summary, we demonstrate a low rate of *Toxocara* exposure among people living in rural Durango State. 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**


