Toxocara infection in gardeners: a case control seroprevalence study

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ABSTRACT

**Objective:** To determine the association of Toxocara infection and gardening occupation.

**Methods:** Through a case–control seroprevalence study, 168 gardeners and 168 age- and gender-matched control subjects without gardening occupation were compared for the presence of anti-Toxocara IgG antibodies in Durango City, Mexico. Socio-demographic, clinical, and behavioral characteristics of participants associated with toxocariasis were also investigated.

**Results:** A total of 3 (1.8%) of the 168 gardeners, and 3 (1.8%) of the 168 controls were positive for anti-Toxocara IgG antibodies (odds ratio=1.00; 95% confidence interval: 0.01–50.40; P=1.00). Gardeners seropositive for Toxocara were males aged 21, 28 and 35 years old. Seropositivity to Toxocara in gardeners was not associated with age, gender, educational level and type of flooring at home. The frequency of Toxocara—seropositivity was similar in gardeners regardless their seniority in the activity, frequency of contact with soil, habitual use of safety practices (use of hand gloves and face masks), history of splashes at face with water or mud, injuries with sharp material at work, eating when working, washing hands before eating, contact with cats or dogs, and cleaning feces. Of the clinical data, all 3 Toxocara-seropositive gardeners were healthy and did not have visual impairment.

**Conclusions:** We conclude that gardeners do not have a higher risk for Toxocara infection than subjects of the general population in Durango City, Mexico. However, further studies with larger sample sizes are needed to elucidate the association of toxocariasis with gardening occupation.

1. Introduction

Infections with the parasite Toxocara occur widely around the world[1,2]. Dogs and cats infected with Toxocara shed parasite eggs contaminating the soil[3,4]. Ingestion of embryonated Toxocara eggs by humans leads to larval hatch and bloodstream dissemination towards eyes, lungs, liver, muscles, and central nervous system[1,5]. Other possible route of Toxocara transmission in humans is ingestion of Toxocara larvae from undercooked giblets[6,7]. Most infections with Toxocara in humans are asymptomatic, but a severe disease may occur in some individuals[1,2,8]. After infection, a systemic disease caused by larval migration through major organs or a disease limited to eyes and optic nerves may occur[1]. Ocular toxocariasis may lead to permanent blindness[8,10].

To the best of our knowledge, there is a lack of information about Toxocara infection in gardeners. The close contact to soil in gardeners raises the question whether these workers have a higher frequency of Toxocara infection than people of the general population. Therefore, through a case–control seroprevalence study we sought to determine whether Toxocara infection is associated with gardening occupation in Durango City, Mexico.

2. Materials and methods

2.1. Study populations

We performed a case–control study using serum samples from recent Toxoplasma gondii serosurveys[11,12]. A total of 168 gardeners and 168 control subjects were compared for the presence of anti-Toxocara IgG antibodies.

Inclusion criteria for the gardeners were: 1) to have been currently working in gardening for at least 6 months; 2) aged 16 years and older; and 3) who accepted to participate in the study. Gender, socio-economic status, educational level and place of work (private or public) were not restrictive criteria for enrollment. As a strategy for recruiting gardeners we visited them at their work places at streets, boulevards, parks and work offices. Gardeners included 15 females and 153 males aged 16–73 years old [mean age of (37.89±13.91) years.
old]. Controls were subjects without gardening occupation drawn from the general population in the same Durango City. Controls were matched with cases by age and gender. Control subjects consisted of 15 females and 153 males aged 16–73 years old [mean age of (37.13±14.49) years old]. Age was comparable between cases and controls (P≥0.51).

2.2. Socio-demographic, work and clinical characteristics of gardeners

We used a standardized questionnaire to record the characteristics of the gardeners. Socio-demographic data including gender, age, educational level, and type of flooring at home were obtained. Work data as seniority in the activity, frequency of work contact with soil (up to 3 d a week or 4–7 d a week), habitual use of safety practices (use of hand gloves and face mask), history of splashes at face with water or mud, injuries with sharp material at work, eating when working, contact with cats or dogs, and cleaning feces were also registered. Clinical data explored included current suffering from any disease and presence of visual impairment.

2.3. Laboratory tests

Serum samples from cases and controls were kept frozen at −20 °C until analyzed. Serum samples were analyzed for anti-Toxocara IgG antibodies with a commercially available enzyme immunoassay “Toxocara” kit (Diagnostic Automation, Inc. Calabasas, CA, USA). Absorbance reading equal to or greater than 0.3 optical density units was considered as a cut off for seropositivity. All tests were performed following the instructions of the manufacturer. Negative and positive controls were included in each assay.

2.4. Statistical analysis

Results were analyzed with the aid of Epi Info version 7, and SPSS version 15.0 (SPSS Inc. Chicago, Illinois). For calculation of the sample size, we used a 95% confidence level, a power of 80%, a 1:1 proportion of cases and controls, a reference seroprevalence of 13%[13] as the expected frequency of exposure in controls, and an odds ratio (OR) of 2.5. The result of the sample size calculation was 138 cases and 138 controls. Age values among the groups were compared by the paired student’s t-test. For comparison of the frequencies of seropositivity to Toxocara between cases and controls, the McNemar’s test was used[14]. OR and 95% confidence interval (CI) were calculated by the Mantel–Haenszel analysis. The Pearson’s Chi-squared test and the two-tailed Fisher’s exact test (when values were less than 5) were used to assess the association of Toxoplasma gondii seropositivity and the socio-demographic, work and clinical characteristics of the gardeners studied. When a cell in the 2x2 contingency table had a zero value, the OR was calculated by adding 0.5 to all table cells. A P value less than 0.05 was considered statistically significant.

2.5. Ethical aspects

In this study only archival serum samples and questionnaires from previous surveys were used[11,12]. In such surveys, the purpose and procedures of the studies were explained to all participants and written informed consent was obtained from all of them and from the next of kin of minor participants. Both previous surveys were approved by Institutional Ethical Committees.

3. Results

A total of 3 (1.8%) of the 168 gardeners, and 3 (1.8%) of the 168 controls were positive for anti-Toxocara IgG antibodies (OR=1.00; 95% CI: 0.01–50.40; P=1.00). Gardeners seropositive for Toxocara were males aged 21, 28 and 35 years old. Stratification by age showed that Toxocara seroprevalence was similar (P=0.24) in gardeners aged ≤35 years old (3/83: 3.6%) than controls of the same age (0/81: 0%). While stratification by gender showed that Toxocara seroprevalence was similar (P=1.0) in male gardeners (3/153: 2%) than in male controls (3/153: 2%). None of the other socio-demographic characteristics including educational level and type of flooring at home were associated with Toxocara infection in gardeners (P>0.05). In addition, the frequency of Toxocara–seropositivity was similar in gardeners regardless their seniority in the activity, frequency of contact with soil, habitual use of safety practices (use of hand gloves and face mask), history of splashes at face with water or mud, injuries with sharp material at work, eating when working, washing hand before eating, contact with cats or dogs, and cleaning feces (P>0.05). Of the clinical data, all 3 Toxocara-seropositive gardeners were healthy and did not have visual impairment.

4. Discussion

There is no information about the seroepidemiology of Toxocara infection in workers occupationally exposed to soil, i.e., gardeners. The present study was performed to investigate whether Toxocara infection was associated with gardening occupation. The similar frequency of Toxocara exposure in gardeners and subjects of the general population in this age– and gender–matched seroprevalence study suggests that gardeners do not represent a risk group for Toxocara infection. Results of the current study are unexpected since a large number of stray dogs and cats exist in Durango City and they may contaminate the soil with their feces daily. A number of studies have demonstrated Toxocara contamination in soil of gardens and parks in several countries i.e., in Italy[15], Spain[16], Poland[17], and Brazil[18]. Toxocara eggs have also been found in parks and gardens in Mexico. In a large study in public parks, public flower beds, and home gardens in Mexico City, researchers found that 12.5% of the sampled sites were contaminated with Toxocara eggs and 90% of eggs were embryonated or larvated[19]. In a study in a university campus in Mexico City, researchers found that 12.9% of 15 gardens sampled had Toxocara contamination and 65.5% of eggs were viable[20]. We are not aware of any study about Toxocara contamination of soil in Durango City or in other northern Mexican city. It is not clear why gardeners in Durango City have a low frequency of Toxocara exposure. It is likely that the frequency of infection with Toxocara in dogs and cats in Durango City is very low. Therefore, soil contamination with Toxocara in public gardens or parks might also be low. However, there is no information about the presence of Toxocara infection in animals in Durango City. It is of interest to test cats and...
dogs for *Toxocara* infection in the region. It is also possible that cats and dogs shed their feces in places other than soil so that gardeners take no direct contact with such feces. A number of surveyed gardeners cleaned animal feces in the city gardens and parks, and we even observed feces in the work place of gardeners during the sampling. However, there was no difference in *Toxocara* exposure between gardeners who cleaned animal faces than those without such activity. It is also possible that a considerable number of pet dogs visiting public parks and gardens had underwent deworming. Therefore, soil contamination with *Toxocara* by pet dogs in public parks and gardens might be low. Also unexpectedly, *Toxocara* infection in gardeners was not associated with any of the safety and hygiene practices including the use of hand gloves and face masks and washing hands before eating. These results suggest that other routes of *Toxocara* infection might be more important than soil contact in gardeners. Nevertheless, only few *Toxocara* seropositive participants were found in the present study. The low frequency of *Toxocara* exposure was a limitation of the study and did not allow us to find *Toxocara* prevalence association with the gardeners’ characteristics. Further research with a larger sample size should be conducted to investigate the association of toxocariasis with socio-demographic, clinical and behavioral characteristics of gardeners.

To the best of our knowledge, there are not further studies of toxocariasis in gardeners and we cannot compare our results. However, in a local context, the *Toxocara* seroprevalence found in gardeners is lower than the 13% and 4.7% seroprevalences found in waste pickers[12] and psychiatric patients[11] in Durango City, respectively. In addition, the *Toxocara* prevalence in gardeners is lower than the 26.2% seroprevalence of *Toxocara* exposure in subjects of Tepehuanos ethnicity[22] in rural Durango, Mexico. Differences in sanitation and hygiene practices might explain the differences in seroprevalences among the population groups studied in Durango, with likely poorer practices in rural and urban Tepehuanas.

We conclude that gardeners do not have a higher risk for *Toxocara* infection than subjects of the general population in Durango City, Mexico. However, this is the first report of toxocariasis in gardeners and further studies with a larger sample size may confirm or challenge our results on the lack of association of *Toxocara* exposure and gardening occupation.

**Conflict of interest statement**

We declare that we have no conflict of interest.

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**References**


