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Ocurrence of *Toxocara canis* in Students of Veterinary and Graphic Design in a Mexican University

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ABSTRACT

***Background*:** Human toxocariosis is a parasitic zoonosis caused by larval forms of the genus Toxocara. The eggs hatch after being ingested, penetrate the intestinal wall and migrate via the blood stream through to the liver, hence spread to other organs. Erratic larval migration by the different soft tissues in humans, generates four syndromes, Visceral Larva Migrans, Ocular Larva Migrans, neurotoxocariosis and covert toxocariosis. A seroprevalence study of *Toxocara canis* among students from Veterinary Medicine and Graphic Design in Mexico City was conducted, as the Veterinary student has regular contact with animals was compared with students who have no contact with animals in their study program.
***Materials, Methods & Results*:** In both groups of students blood samples were collected and centrifuged to obtain the serum was evaluated by *Toxocara* serology ELISA (enzyme-linked immunosorbent assay). All participants completed a questionnaire supplying personal data and specifics regarding dog ownership and hygiene practices. Serology data and results from the questionnaire were analyzed using the Fisher´s exact test, Chi-square and odds ratio (OR) test. The frequency of *Toxocara* infection tended to be greater ($P = 0.11$) in veterinary students than in those from graphic design (13 % and 7.0 % respectively). Some of the risk factors that were considered were: do not wash your hands after eating, frequent contact with dogs, has dog at home, eating on the street and dewormed your dog, neither factor was associated nor were risk factors for *Toxocara* antibodies present.
***Discussion*:** The fact that almost twice as many veterinary students were seropositive indicates a higher risk of *Toxocara canis* infection in those individuals, which may be due to veterinary students having greater contact with sources of infection (animals, feces, soil, hair, and farms), regardless of the ownership of dogs. In a study in Canada researchers found no differences among veterinarians and other professionals in anti-*Toxocara* antibodies, finding similar values (8.8% and 9.6% respectively) in both, and also found no association between dog ownership and anti-*Toxocara* antibodies a study in Austria found that veterinarians were the second occupational groups that had more antibodies (27%) compared to the control group (2%) and the main source of infection was identified as cats and dogs. Many studies have shown that risk factors are very important in the epidemiology of toxocariosis, primarily the presence of dogs and cats living together with people. It has been reported higher infection in individuals who were in contact with dogs. In several cities of Mexico, highest percentages of dogs infested with *Toxocara* were reported, with a mean of 35.5% and a range from 19.0 to 63.36%. It has been reported up to 100% of stray puppies can be contaminated with *Toxocara* in samples collected from dorsal and perianal hair which constitutes a great potential of infection considered that 94% of the *Toxocara* eggs were embrionated. Other studies show less contamination of hair with eggs of *T. canis* (40.9%) but still shows the importance as a potential source of infection for humans. Eating in the street or poor hygiene before eating were not factors related to the disease. Although no association was found with the lack hand washing and *Toxocara*, other researchers have identified this problem as a risk factor associated with *Toxocara*. It can be assumed that depending on the degree of contamination by *Toxocara* exposed to each individual, the hygiene practices may have different impact on the presence of the parasite. The results indicate that veterinary students are more prone to infection with *Toxocara*.

Keywords: Veterinary, *Toxocara*, risk factors, ocurrence, Mexico.

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INTRODUCTION

Toxocariosis can be caused by accidental ingestion of larvated eggs of nematodes from genus *Toxocara* [18] which includes more than 30 species of *Toxocara* of which *Toxocara canis* causes the most problems [26,29] with a dose of 500 infective eggs being sufficient to cause human clinical manifestations [20] however, one of the most serious complications is associated to *T. cati* with ocular toxocariasis [17,19] while species found in rodents and other wild animals (*T. tanuki*, *T. alienate* and *T. mackerrasae*) have not been associated with disease in humans or domestic animals [11]. The diagnosis of toxocariasis in humans is problematic because the larval stage of *T. canis* cannot be detected directly, except for by histological studies that are performed *post mortem*. Moreover, as in humans the larvae do not complete their cycle, avoiding the egg laying, this makes direct diagnosis impossible. The only possible method is indirect, detecting antibodies in blood or other biological [26].

Contact with dogs and cats, as well as feces and hair of these, have been associated with a high prevalence of infection in humans [12]. Some professions and jobs are risk factors for contracting the parasite zoonoses, particularly those working with soil and animals. Studies report that veterinarians and people who take care of pets had higher anti-*Toxocara* antibodies [8]. The risk of toxocariasis to veterinarian students may start before beginning their professional practice; however this has not been documented, so the objective of this research was to compare the ocurrence of *Toxocara canis* in two groups of undergraduate students, veterinary medicine and graphic design students, the latter without contact with animals during their educational activities.

MATERIALS AND METHODS

The study was conducted between October 2008 and September 2010 at the Universidad Autónona Metropolitana, Campus Xochimilco, which is located in the south of Mexico City, at an altitude of 2260 m, with a subtropical highland climate due to its tropical location and high elevation. The average annual temperature varies from 12 to 16°C with an annual precipitation of 820 millimeters concentrated from June through October.

Sampling

This study was carried out after being approved by the Committee for Social Services of the Biological Division Science of the campus with a total of 200 students, half of each program. All participants completed a questionnaire supplying personal data with their consent. After that, a survey form was filled out by the students with information about dog ownership and hygiene practices. The range of ages was 21 to 25 years. Three ml of venous blood were taken under sterile conditions from each subject in both groups. Serum was separated and stored at –20oC until studied.

Analysis of sera

Specific anti-*Toxocara* antibodies were determined by ELISA Kit[1] (enzyme-linked immunosorbent assay). This test has 93.3% sensitivity and 87.5% specificity and the procedure was performed following the manufacturer's protocol. The students' sera were diluted 1:64 with buffer solution. In order to determine whether the sera were positive or negative the controls provided by the manufacturer were used, using an optical density at 450 nm. An absorbance equal or greater than 0.3 units was considered positive.

Statistical analysis

The Fisher´s exact test was performed in order to compare differences between groups [10]. Chi-square test and odds ratio (OR) were performed to analyze the data from the survey as risk factors and to evaluate the association with *Toxocara canis* [22].

RESULTS

From the 200 serum samples analyzed, 20 were seropositive and the frequency of *Toxocara* infection tended to be higher ($P = 0.11$) in veterinary students than graphic design students (13% and 7.0% respectively). In Table 1 can be observed the factors that were considered potentially hazardous, but no factor was associated with *Toxocara* serology and none showed a significant odds ratio. In Tables 2 and 3 are presented the same factors by group of students, showing the same results.

DISCUSSION

Toxocariosis is recognized as a problem of children and young people [26]. The fact that almost twice as many veterinary students were seropositive indicates a higher risk of *Toxocara canis* infection in those individuals, which may be due to veterinary students having greater contact with sources of infection (animals, feces, soil, hair, and farms), regardless of the ownership of dogs.

Table 1. Some risk factors associated with toxocariosis serology for students in both programs.

Risk factor	Anti-*Toxocara* antibodies				Bivariate analyses		
	Seropositives		Seronegatives		Chi^2	*P* value	OR (95% CI)*
	(n = 20)	%	(n = 180)	%			
Not washing hands before eating	18	90	149	82.7	0.68	0.40	1.872 (0.413-8.486)
Frequent contact with dogs	14	70	106	58.8	0.92	0.33	1.628 (0.598-4.434)
Ownership of dogs	15	75	138	76.6	0.02	0.86	0.913 (0.313-2.66)
Eat in the Street	18	90	168	93.3	0.30	0.57	0.643 (0.133-3.102)
Dog is dewormed	8	40	56	31.1	0.65	0.41	0.470 (0.116-0.883)

*OR, odds ratio; 95% CI; 95% confidence intervals.

Table 2. Some risk factors related to serology for toxocariosis in Graphic Design students.

Risk factor	Anti-*Toxocara* antibodies				Bivariate analyses		
	Seropositives		Seronegatives		Chi^2	*P* value	OR (95% CI)*
	(n = 7)	%	(n = 93)	%			
Frequent contact with dogs	4	57.1	52	55.9	0.004	0.94	1.051 (0.222-4.962)
Not washing hands before eating	6	85.7	80	86	0.001	0.94	0.975 (0.108-8.769)
Ownership of dogs	4	57.1	65	69.8	0.49	0.48	0.574 (0.120-2.73)
Dog is dewormed	3	42.8	57	61.2	0.92	0.33	0.473 (0.100-2.240)

*OR, odds ratio; 95% CI; 95% confidence intervals.

Table 3. Some risk factors related to serology for toxocariosis in Veterinary students.

Risk factor	Anti-*Toxocara* antibodies				Bivariate analyses		
	Seropositives		Seronegatives		Chi^2	*P* value	OR (95% CI)*
	(n = 13)	%	(n = 87)	%			
Not washing hands before eating	12	92.3	69	79.3	1.24	0.26	3.130 (0.381-25.68)
Frequent contact with dogs	10	76.9	54	62	1.08	0.29	2.037 (0.522-7.944)
Ownership of dogs	11	84.6	73	83.9	0.004	0.94	1.054 (0.210-5.284)
Dog is dewormed	9	69.2	67	77	0.37	0.54	0.671 (0.186-2.413)

*OR, odds ratio; 95% CI; 95% confidence intervals.

In a study in Canada researchers found no differences among veterinarians (n = 113) and other professionals (n = 114) in anti-*Toxocara* antibodies, finding similar values (8.8% and 9.6% respectively) in both, and also found no association between dog ownership and anti-*Toxocara* antibodies [30]. In contrast, in a study in Austria found that veterinarians were the second occupational groups that had more antibodies (27%) compared to the control group (2%) and the main source of infection was identified as cats and dogs that have not been dewormed [8].

The prevalence of anti-*Toxocara* antibodies in this study was lower than some reported in other countries, for example in Peru, in a random sample of 301 individuals a prevalence of 46.5% was found [5] whereas in Argentina, 37.9% was reported in a sample of 206 individuals [3]. The values of the students are slightly higher than those found in children at the province of Salamanca in Spain, where the seroprevalence of toxocariosis was 8.5% and 4.6% in urban and rural areas, respectively [7]. Other studies in Mexico report similar prevalence in children (n = 288) with a seroprevalence of 10.6%, where the deworming of dogs was not associated [28].

Many studies have shown that risk factors are very important in the epidemiology of toxocariosis, primarily the presence of dogs and cats living together with people. It has been reported higher infection in individuals who were in contact with dogs [27]. Other studies show that the use of public places and geophagia exhibited a significant association with the seropositivity of *Toxocara* [22].

In several cities of Mexico, highest percentages of dogs infested with *Toxocara* were reported, with a mean of 35.5% and a range from 19.0 to 63.36% [15,16,23-25] indicating that dogs are a major source of pollution to the environment and human infection. It has been shown that pharmacological control of parasites reduces the risk of environmental contamination and the risk factor for contracting toxocariosis in humans. It has been reported an efficiency of 97.3% in the treatment of dogs positive for *Toxocara* using ivernmectin and levamisole [2].

Eating in the street or poor hygiene before eating were not factors related to the disease. The question of eating in the street was incorporated because in undeveloped countries many facilities do not have adequate hygiene controls in food preparation and the consumption of raw vegetables grown in contaminated gardens may result in chronic low-dose infections of *Toxocara* sp. [14].

Although no relationship was found with contact and possession of dogs, some studies have demonstrated this association with the presence of antibodies to *Toxocara canis* [6,13] and others have shown that contact with dogs is a significant risk factor where 91% of seropositive individuals had contact with canines [4]. It has been reported up to 100% of stray puppies can be contaminated with *Toxocara* in samples collected from dorsal and perianal hair which constitutes a great potential of infection considered that 94% of the *Toxocara* eggs were embrionated [21]. Other studies show less contamination of hair with eggs of *T. canis* (40.9%) [9] but still shows the importance as a potential source of infection for humans.

Although no association was found with the lack hand washing and *Toxocara*, other researchers [1] have identified this problem as a risk factor associated with *Toxocara*. It can be assumed that depending on the degree of contamination by *Toxocara* exposed to each individual, the hygiene practices may have different impact on the presence of the parasite.

This study found that veterinary students are more likely to toxocariosis, although the results on risk factors are not conclusive; it is suggested to inform the public that during his training take preventive measures.

SOURCES AND MANUFACTURERS

[1]Enzyme-linked immunosorbent assay, Toxocara microwell, Scimedx, USA.

***Declaration of interest*.** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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