Revista da Sociedade Brasileira de Medicina Tropical
32(5):483-488, set-out, 1999.

Presence of anti-*Toxoplasma* antibodies in humans and their cats in the urban zone of Guadalajara

Presencia de anticuerpos anti-*toxoplasma* en humanos y sus gatos, en la zona urbana de Guadalajara

María de la Luz Galván Ramírez, Guillermo Sánchez Vargas, Marcos Vielma Sandoval and Juan Luis Soto Mancilla

Abstract *Cats are the definitive hosts of* Toxoplasma gondii*. Infected cats excrete oocysts in their feces, infecting humans and other animals. The objective of the present study was to determine the presence of anti-*Toxoplasma *antibodies in cat owners and their pets, and determine if there was a relationship between* Toxoplasma *infection and humans who live with infected cats. IgG anti-*Toxoplasma *antibodies in sera of 59 cat owners were determined by enzyme-linked immunosorbent assay (ELISA), in 24 sera from their cats, IgG, IgM, and IgA antibodies were found using Burney's ELISA. Thirty-eight (64%) of 59 cat owners were positive to IgG anti-*Toxoplasma*. Seropositivity for cats was 70.8% IgG, 8.3% IgM, and 62.5% IgA. Cohabitation with cats infected by* T. gondii*, feeding with leftovers or raw viscera, and lack of control over how their feces were handled are risk factors conducive for humans to become infected by* T. gondii.

Key-words*: Toxoplasmosis. Antibodies. Humans. Cats. Elisa.*

Resumen *Los felinos son huéspedes definitivos de* Toxoplasma gondii. *Los gatos infectados excretan ooquistes en sus heces, infectando a humanos y a otros animales. El propósito de este estudio fue determinar anticuerpos anti-*Toxoplasma *en dueños de gatos y sus mascotas y conocer si existía relación entre la infección por* Toxoplasma *en humanos que conviven con gatos infectados. Se determinaron anticuerpos anti-Toxoplasma IgG en 59 sueros de dueños de gatos por el método de ELISA (Sigma), y en 24 sueros de sus gatos anticuerpos IgG, IgM e IgA por ELISA de Burney. Los dueños de gatos fueron positivos a IgG anti-Toxoplasma 38/59 64%. La seropositividad de gatos fue de 70.8% IgG, 8.3% a IgM y 62.5% IgA. Cohabitar con gatos infectados por* T. gondii *dentro del hogar, alimentarlos con desechos de mesa o vísceras crudas y la falta de control de sus heces son factores de riesgo para adquirir infección por* T. gondii *en el humano.*

Palabras-claves: *Toxoplasmosis. Anticuerpos. Humanos. Gatos. Elisa.*

Toxoplasmosis is a disease caused by an obligate intracellular parasite called *Toxoplasma gondii* whose definitive hosts are cats; warm-blooded animals, including man, are its intermediate hosts[18]. Infected cats' oocysts in feces, create a risk factor for the infection of other animals and human beings, encouraging the development of toxoplasmosis[5 7 8 14]. The seroprevalence in humans varies, depending on the geographic area and alimentary habits, it ranges from 7% to 90%[17]; and in Mexico has been reported to range from 15% to 50% in an open population[9 13 16].

This work's aim is to determine the presence of anti-*Toxoplasma gondii* antibodies in humans and their cats, and to study the relationship between Toxoplasmosis and humans living with cats.

Center for Tropical Disease Research of the University of Guadalajara, Guadalajara, Jalisco, México.
Address to: Dr. María de la Luz Galván Ramírez. Lago Camécuaro 2398 Col. Lagos del Country C.P. 44281, Apartado Postal 2-816. Guadalajara, Jalisco, Mexico.
Tel: (523) 618-8527; Fax: (523) 618-14-24.
E-mail: mgalvan@irsp.dsp.udg.mx
Recebido para publicação em 9/6/97.

MATERIAL AND METHODS

This is a cross-sectional, random study of a cohort, performed from April to June 1995, choosing 59 subjects living with cats. The study group was made up of adult subjects from metropolitan Guadalajara, Jalisco, Mexico, living in 20 randomly chosen city blocks.

Criteria for being included. **Humans**. Subjects between 15 and 81 years old who had lived with cats for a minimum period of 6 months, and who agreed to participate in the study, were chosen.

Cats. Twenty-four cats that were donated by their owners, all of them seropositive to IgG anti-*Toxoplasma* antibodies, were included.

Variables. **Humans**. Age, sex, IgG antibodies.

Cats. Habitat (living indoors at owner's home or outdoors), method of handling feces (with or without control), type of food (viscera, table leftovers, and dry food), and IgG, IgM, and IgA anti-*Toxoplasma* antibodies.

Enzyme-linked Immunosorbent assay (ELISA). The presence of IgG anti-*Toxoplasma* antibodies in the blood samples of these patients was assayed using the ELISA (Sigma Diagnostic, PO Box 14508 St Louis, MO 63178 USA). The absorbency values for seropositivity considered were: < 0.21-0.33 low positive; 0.34-0.64 medium positive, and < 0.65 high positive.

Cats. Twenty-four serum samples of the cats of seropositive patients were studied. IgG, IgM, and IgA anti-*Toxoplasma* antibodies were identified using ELISA, as described by Burney and Lappin[4]**.**

Statistical analysis. Averages and standard deviations of the variables are presented; seropositive and seronegative humans were compared regarding the variable of living with a cat and the rest of the variables analyzed, rejecting the null hypothesis with an alfa significance of 0.05. Analyses were performed through quadruple tables by the chi-square test and Fisher's exact probability, using the statistical computer program EPI 6 of the CDC of Atlanta, Georgia.

RESULTS

Humans. The ages of the 59 subjects included in the study ranged from 15 to 81 with an average of 44.9 ± 17.3 years; 22 (37.38%) were male and 37 (62.72%) females. It was found that 38 (64.4%) were seropositive to IgG anti-*Toxoplasma* antibodies. The majority of the positives showed high levels of I gG anti-*Toxoplasma* antibodies; their distribution according the level of antibodies is shown in Figure 1.

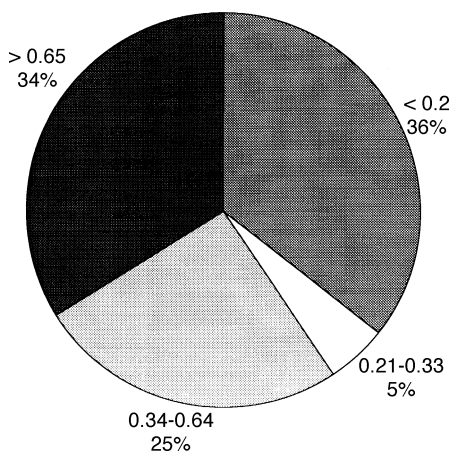

*Figure 1 - Levels of anti-*Toxoplasma *antibodies in samples of sera of humans who own cats, using ELISA (Sigma). Negative value of SIA < 0.20; 0.21-0.33 Low positive; 0.34-0.64 Medium positive; > 0.65 High positive.*

Among humans living with their cats, it was found that 45 kept them within the home and 14 outdoors; of the former, 32/45 (71%) were seropositive and 13/45 (28.9%) seronegative; out of those who kept their cat outdoors, 6/14 (42.8%) were seropositive and 8/14 (57.2%) seronegative.

When comparing these results it was found that p = 0.05 (Figure 2).

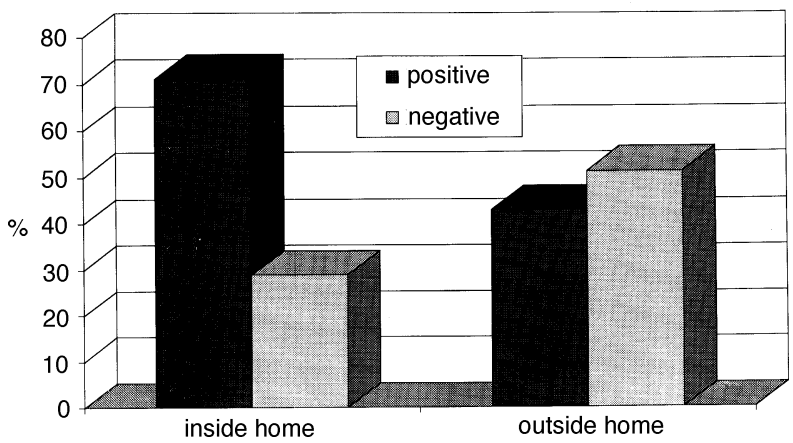

*Figure 2 - IgG anti-*Toxoplasma *antibodies (ELISA) in humans related to the habitat of their cats; positives* vs *negatives living inside or outside the home (Fisher's test p = 0.05).*

Regarding the handling of cat feces, we found that only 7 owners had control over them and that 52 had no control. Among the former, 3/7 (42.8%) were seropositive and 4/7 (57.1%) seronegative; among those who had no control over feces, 35/52 (67.3%) were seropositive and 17/52 (32.7%) seronegative. When we compared seropositive and seronegative with or without feces control by Fisher's exact test, we found a value of p = 0.1963 which was not significant (Figure 3).

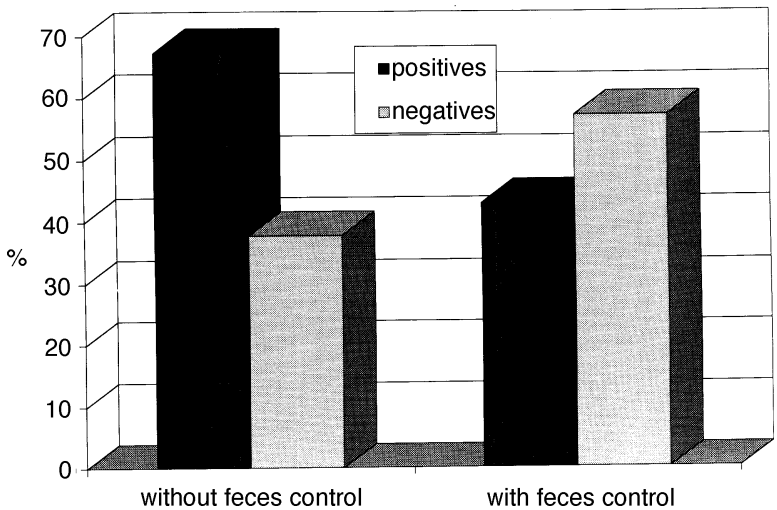

*Figure 3 - IgG anti-*Toxoplasma *antibodies in humans in relation to the control of their cat's feces. Fisher's test, without feces control* vs *with feces control p = 0.1963 (NS).*

Cats. In another part of the study, using serum from 24 cats from seropositive subjects, we found IgM anti-*Toxoplasma* antibodies in only 2 (8.3%), IgA in 15 (62.5%), and IgG in 17 (70.8%). The titers for anti-*Toxoplasma* antibodies are shown in Table 1.

*Table 1 - Titers of anti-*Toxoplasma *antibodies in cats using ELISA.*

Case	IgM	IgG	IgA
6	-	-	-
13	-	128	128
14	-	64	-
17	-	256	256
18	256	2048	512
22	-	512	128
24	-	256	128
31	-	512	128
32	2048	-	-
35	-	-	-
42	-	512	512
45	-	256	128
47	-	-	-
49	-	-	-
50	-	-	-
51	-	512	256
57	-	2048	1024
58	-	-	-
58	-	64	64
59	-	256	128
59	-	64	64
59	-	64	64
59	-	64	-
59	-	64	128

Case 58 with two cats; case 59 with five cats; (-) negative; IgM = immunoglobulin M; IgG = immunoglobulin G; IgA = immunoglobulin A; significant titers for IgM, IgG and IgA • 1:64.

In the study of the correlation between the kind of food given and IgG seropositivity in cats, we found that among those fed table leftovers 13/17 (76.5%) were seropositive, those fed dry food 2/6 (66.6%) were seropositive, and those fed viscera 2/4 (50%) were seropositive; no statistically significant differences were found between these groups (Figure 4).

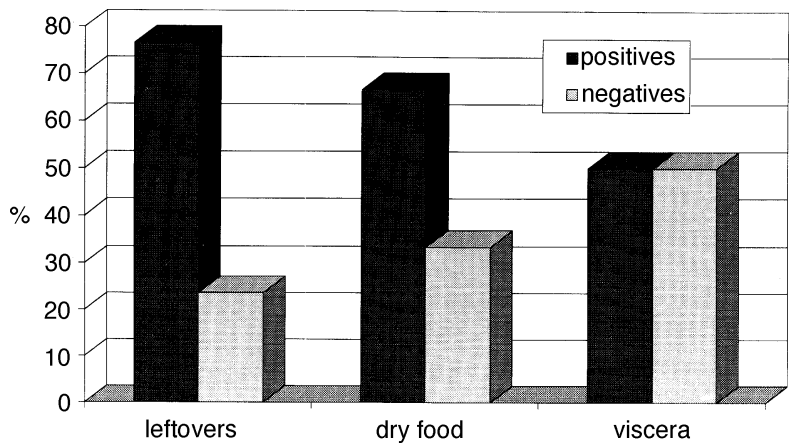

*Figure 4 - IgG anti-*Toxoplasma *antibodies in humans related to the type of food eaten by their cats. Fisher's test, leftovers* vs *viscera, p = 0.3157, leftovers* vs *dry food p = 0.6008, and dry food* vs *viscera p = 0.6245.*

DISCUSSION

We consider that for humans, to live with cats infected by *T. gondii* is a factor condusive to infection by *Toxoplasma*, since the proportion of seropositivity found in cat owners (0.64) is higher than in Jalisco's general population by IFI of 1:16 (.50) and 1:128 (.36) and in the Metropolitan Zone of Guadalajara (0.38) it is much lower; these results are similar to those obtained from studies done in other Mexican states[2 17].

Among the risk factors for acquiring the infection, one is the type of living conditions that humans share with their cats that is, whether the infected animals are inside the home or not, since the former presented greater seropositivity, as already previously noted[1 2 6 17].These results give greater consistency to the previous affirmation.

The seropositivity to antibodies did not increase proportionally to the age of the patients, since it was higher in those more than 50 years old; however, since 50% were over 50 years old, we cannot infer from this study that the presence of antibodies increases with age, as shown in other populations[17].

Regarding gender, the majority of the patients were females. This result differed from those of other investigations in which there were no differences in terms of sex[15].

The elimination of oocysts in the feces of cats infected with *T. gondii* has been shown to be a transmission mechanism[5]; however, when comparing subjects who had or not, control over their cat's feces, there were no significant differences between seropositive and seronegative individuals, possibly because most of the cats were experiencing chronic infections in which oocysts are not eliminated in the feces so that this was not a decisive factor for transmission.

Primary infections shown by seropositives cats were scarce, since only two cases had IgM antibodies, the largest number (12), was positive for IgA antibodies, and 11 showed titers for IgG antibodies greater than 1:256; possibly these were more recent infections, as also shown by other researchers[9]; however, this cannot be clinically affirmed.

In Mexico there is no serological diagnostic practice to determine *Toxoplasma* infection in cats; therefore, it would be important to develop diagnostic methods to identify its antibodies in serum and aqueous humor of cats, making it possible to diminish infections in humans contaminated by their cats. It is essential to educate the population regarding handling of cats, including habitat, type of food and feces control; these factors should be controlled to reduce the infection in humans who share living quarters live with cats.

REFERENCES

1. Alluja AS, Aguilar P. Estudio sobre la frecuencia del ooquiste de *Toxoplasma gondii* en el gato doméstico del Distrito Federal. Gaceta Médica de México 113:455-459, 1977.
2. Armas BM, Alvarez RM, Acosta AG. Presencia de ooquistes de *Toxoplasma gondii* en heces de gatos y su correlación con la sroprevalencia de sus dueños procedentes de 4 municipios del valle de Morelia-Queréndaro, Michoacán, México. Resumen de XIII Congreso Nacional de Parasitología CONAPAR'98 Zacatecas, México p. 63, 1998.
3. Blood DC, Henderson JA, Radostits OM. Medicina Veterinaria. Editora Interameriana México,DF. 6th edition, p. 973-976, 1987.
4. Burney, Lappin MR, Cooper CM, Spilker MM. Demostration of *Toxoplasma* specific immunoglobulina A in the serum of cats. Americal Journal Veterinary Researchs 56:769-773, 1995.
5. DiGiacomo RF, Harris NV, Huber NI, Cooney MK. Animal exposures and antibodies to *Toxoplasma gondii* in a university population American Journal Epidemology 131:129-133, 1990.
6. Dubey JP. Toxoplasmosis. Journal American Veterinary Medicine Association 205:1593-1598,1994.
7. Frenkel J. Toxoplasmosis parasite life cycle pathology and immunology. *In:* Hammond DM, Long LPL. The Coccidea: Eimeira, Isospora, *Toxoplasma*, and Related Genera. Baltimore University Park Press p.343-410, 1973.
8. Frenkel JK, Ruiz A, Chinchilla M. Soil survival of *Toxoplasma* oocysts in Kansas and Costa Rica. The American Journal Tropical Medicine and Hygiene 24:439-443, 1975.
9. Galván RML, Soto MJL, Velasco CO, Perez MR. Incidence of Anti-*Toxoplasma* antibodies in women with high risk pregnancy and habitual abortions. Revista da Sociedade Brasileira de Medicina Tropical 28:333-337, 1995.
10. Lappin MR, Greene CE, Prestwod AK Donal L, Dawe, Tarleton R. Enzyme-Liked immunosorbent assay for the detection of circuating antigens of *Toxoplasma gondii* in the serum of cats. American Journal Veterinary Research 9:1586-1590, 1989.

11. Lappin M, Greene C, Winston S, Toll SL, Epstei ME. Clinical Feline Toxoplasmosis. Jorunal of Veterinary Internal Medicine 3: 139-143, 1989.
12. Lappin MR, Roberts S, Davison M, Powell C, Reif J. Enzyme' liked immunosorbent assays for the detection of *Toxoplasma gondii* specific antibodies and antigens in the aqueous humor of cats. Journal American Medical Association 201:1010-1016, 1992.
13. Roch E, Varela G. Diversos aspectos de la investigación sobre la toxoplasmosis en México. Resultados de 29.883 reacciones de Sabin y Feldman efectuados de 1953 a 1965. Revista de Salud Pública de México 26:31-49, 1966.
14. Swartzberg JE, Remington JS. Transmission of *Toxoplasma*. American Journal Diseases Children 29:777-779, 1975.
15. Tenter AM, Vietmeyer C, Johnson AM, Janitseck K, Rommeln M. ELISA's based on recombinant antigens for seroepidemiological studies on *Toxoplasma gondii* in cats. Veterinary Immunology Immunopathology 33:29-36, 1993.
16. Varela G, Molina PC, Sánchez BJ, Aluja AS. Toxoplasmosis: estudios de sueros humanos en los últimos 4 años. Comparación entre la serología de la toxoplasmosis y de la infección por sarcoides en bovinos. Revista de Investigación en Salud Pública de México 32:138, 1972.
17. Velasco O, Salvatierra IB, Valdespino JL, Sedano LA, Galindo VS, Magos C, Llausas A, Tapia R, Gutierrez G, Sepulveda J. Seroepidemología de la toxoplasmosis en México. Salud Pública de México 34:222-229, 1992.
18. Wong SY, Remington JS. Biology of *Toxoplasma gondii*. AIDS 7:299-316, 1993.