

## INCIDENCE OF ANTI-TOXOPLASMA ANTIBODIES IN WOMEN WITH HIGH-RISK PREGNANCY AND HABITUAL ABORTIONS

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*Toxoplasmosis is a zoonosis caused by Toxoplasma gondii, an obligate intracellular parasite. In pregnant women on the worldwide scale, there are seroprevalences from 7% to 51.3% and in women with abnormal pregnancies and abortions the seroprevalences vary from 17.5% to 52.3%. In Mexico, seropositivity has been found to vary from 18.2% to 44.8% in women with abnormal deliveries or abortions. This study's aim was to determine the incidence of IgG and IgM anti-Toxoplasma antibodies in women at the Gineco-Obstetrics Hospital of the Western Medical Center of the Mexican Social Security Institute. Three hundred and fifty women with high-risk pregnancies were studied, and 122 (34.9%) were found to be IgG seropositive and 76 (20.7%) were IgM positive. In one group of women with habitual abortions there were 48 (44.9%) with the presence of IgG antibodies and 33 (33.3%) were IgM seropositive. Seropositivity was analyzed according to age, occupation, socio-economic level, eating raw or poorly cooked meat, and living with cats.*

*Key-words: Toxoplasmosis. High-risk pregnancy. Habitual abortion.*

Toxoplasmosis is a zoonosis caused by *Toxoplasma gondii*, an obligate intracellular parasite that infects all the cells and tissues in the vertebrae except the erythrocytes<sup>26 30</sup>. There are five different ways, humans can contract the infection: ingesting oocysts in foods contaminated by cat feces; ingesting cysts in tissues of poorly cooked meat, transplacental blood transfusions and organ transplants<sup>3 28 30</sup>. The sub-clinical infection in humans is very common although there are great differences depending on the geographic areas, as indicated by the prevalence of antibodies that range from 1% in Alaska to 90% in Paris<sup>4 9 11 12</sup>. In Mexico rates from 22% to 47% have been found through the positivity of Sabin and Feldman positivity test, and by intradermoreaction. It was confirmed that between 15% to 65% of the population has been exposed to *T. gondii*. In 1966 Roch

reported 30%<sup>24</sup>; in 1992 Velasco, using indirect immunofluorescence with 1:128 dilution, found that out of 29,935 cases in the general population there was an average of 50% seropositivity. These rates varied according to geographic area, from 17.1% in the southern part of the state of Baja California, located in the northern zone of Mexico, to 67.5% in the state of Tabasco in the southern zone, and in the state of Jalisco 36.2%<sup>27</sup>. On the worldwide scale, there are seroprevalences in pregnant women that range from 7% to 51.3%, and in women who have had abortions, they range from 17.5% to 52.3%<sup>1 2 3 7 8 9 10 11 13 17 18 20 30</sup>. In Mexico seropositivities of 18.2%, 19% and 30% have been reported in women with abnormal deliveries or abortions, and, out of these, 34.5% of the children have been affected at birth<sup>5 11 15 19 23 25 27</sup>. However, the most recent research in the state of Yucatán indicates figures of 44.8% for habitual abortions and 49.01% for spontaneous abortions<sup>27 31</sup>. In the state of Jalisco, the incidence of IgG and IgM anti-*Toxoplasma* antibodies in women with high-risk pregnancies and habitual abortion was unknown. For this reason, this study's aim was to determine the incidence of anti-*T. gondii* antibodies in this group of women at the Gynecology-Obstetrics Hospital of the Western Medical Center of the Mexican Social Security

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Institute, as well as finding out the relation seropositivity with age, occupation, socio-economic level, and some risk factors such as eating raw or poorly cooked meat and living with cats.

## MATERIALS AND METHODS

**Groups.** Five hundred and five blood sera were included in the study, of which 350 belonged to women with high-risk pregnancies (HR), 105 with habitual abortion (HA), and as a control (C), 50 sera were included from healthy women who were not pregnant or had not had abortions. An immunoenzymatic assay, IgG and IgM Toxonóstika ELISA from the Organón Teknika Company determined the presence of anti-Toxoplasma antibodies<sup>29</sup>.

**Questionnaire.** The following factors were taken into account: age, occupation, socio-economic and educational levels, eating raw or poorly cooked meat, living with cats.

**Statistical analysis.** The mean, the standard deviation, and the correlation of the variables studied associated with sero-positivity were estimated.

## RESULTS

By using the ELISA method to detect anti-Toxoplasma antibodies on the 505 women studied, the following results were obtained: in the HR group, 122/350 (34.9%) were found IgG positive and 76/350 (20.7%) were IgM positive. In the HA group, 48/105 (44.9%) were IgG positive and 35/105 (33.3%) were IgM positive; in the C group, 13/50 (26.01%) were IgG positive and 1/50 (1.9%) were IgM positive. There was a significant difference ( $p < 0.05$ ) between the HA group and the other two groups. In regard to the trimesters of pregnancy, for the HR group during the first trimester of pregnancy there were 12/350 3.42% IgG seropositive, 4/350 (1.14%) IgM positive; in the second trimester 34/350 (9.7%) were IgG positive and 25/350 (7.1%) were IgM positive; in the third trimester of pregnancy 75/350 (21.4%) were IgG positive and 41/350 (11.7%) were IgM positive. In the HA group, there were 51 pregnant women: in the first trimester of pregnancy 1/56 (1.7%) were IgG positive and equal number were IgM positive; in the second trimester 9/56 (16.0%) were IgG positive and 8/56 (14.2%) were IgM positive,

and during the third trimester of pregnancy 10/56 (17.8%) were IgG positive and 8/56 (14.2%) were IgM positive.

Table 1 - Seroprevalence of anti-Toxoplasma gondii antibodies by age.

| Age     | Num | High risk |      | Num | Hab abortion |      | Num  |      | Control |   |
|---------|-----|-----------|------|-----|--------------|------|------|------|---------|---|
|         |     | %IgG      | %IgM |     | %IgG         | %IgM | %IgG | %IgM |         |   |
| < 20    | 49  | 32.7      | 10.2 | 3   | 33.3         | 33.3 | 0    | 0    | 0       | 0 |
| 20 - 30 | 197 | 34.5      | 23.4 | 40  | 37.5         | 20.0 | 20   | 9.5  | 0       | 0 |
| >30     | 104 | 36.5      | 21.2 | 62  | 41.9         | 38.8 | 30   | 43.7 | 3.1     | 0 |
| Total   | 350 |           |      | 105 |              |      | 50   |      |         |   |

The average age for these groups was: HR,  $26.4 \pm 6.0$ ; HA,  $32.3 \pm 7$  and C,  $31.7 \pm 7.1$ . The seropositivity results increased in the three groups, except for women in the HA group from 20 to 30 years old (Table 1). The occupations of the women in the study groups showed the following distribution: in the HR group 70% were housewives, 4% were workers, 18.5% employees, 6.6% professionals; in the HA group 81.9% were housewives, 4.7% were workers, 7.5% employees, and 6.6% professionals; in group C 1.9% were housewives, 69% were employees, and 28.3% were professionals. The presence of anti-Toxoplasma antibodies in relation to each occupation is shown in Table 2. In regard to socio-economic status in the HR group: 6.6% belonged to the high economic level, 46.1% to the middle economic level, and 47.3% to the lower economic level; in the HA group 6.6% belonged to the high level, 48.1% to the middle level, and 45.2% to the low level; in the C group 9.4% belonged to the high level and 90.6% to the middle level. The only significant difference found between high and low classes was for IgG antibodies. The distribution of the presence of anti-Toxoplasma antibodies is shown in Table 3. The average educational level according to years of study was  $6.04 \pm 4.0$  in the HR group; in the HA group,  $6.0 \pm 3.9$  and in the C group  $8.2 \pm 0.7$ . The seropositivity of the groups studied is shown in Table 4. Of the three groups, there were 11% of the women in the HR group who admitted the habit of eating raw or insufficiently cooked meat, 22% in the HA group, and 15.8% in the C group; and there were 33.5%, 43.4%, and 18.9%, respectively, who informed to live with cats (Table 5).

Table 2 - Seroprevalence of anti-Toxoplasma gondii antibodies by occupation.

| Occupation    | Num | High risk |      | Num | Hab abortion |      | Num | Control |      |
|---------------|-----|-----------|------|-----|--------------|------|-----|---------|------|
|               |     | %IgG      | %IgM |     | %IgG         | %IgM |     | %IgG    | %IgM |
| Housewives    | 251 | 37.4      | 21.1 | 86  | 43.2         | 29.1 | 1   | 100     | 0    |
| Workers       | 14  | 21.4      | 14.2 | 5   | 20.0         | 0    | 0   | 0       | 0    |
| Employees     | 64  | 32.8      | 19.0 | 7   | 28.5         | 42.8 | 36  | 37.8    | 5.4  |
| Professionals | 21  | 19.0      | 38.0 | 7   | 28.5         | 57.2 | 13  | 40.0    | 0    |
| Total         | 350 |           |      | 105 |              |      | 50  |         |      |

Table 3 - Seroprevalence of anti-Toxoplasma gondii antibodies by socio-economic level.

| Level  | Num | High risk |      | Num | Hab abortion |      | Num | Control |      |
|--------|-----|-----------|------|-----|--------------|------|-----|---------|------|
|        |     | %IgG      | %IgM |     | %IgG         | %IgM |     | %IgG    | %IgM |
| Low    | 170 | 40.5      | 20.0 | 46  | 37.0         | 28.2 | 0   | 0       | 0    |
| Middle | 157 | 31.8      | 21.6 | 52  | 42.3         | 26.9 | 45  | 29.7    | 2.1  |
| High   | 23  | 13.0      | 21.7 | 7   | 42.9         | 71.4 | 5   | 40.0    | 0    |
| Total  | 350 |           |      | 105 |              |      | 50  |         |      |

Table 4 - Seroprevalence of anti-Toxoplasma gondii antibodies by educational level.

| Years of study | Num | High risk |      | Num | Hab abortion |      | Num | Control |      |
|----------------|-----|-----------|------|-----|--------------|------|-----|---------|------|
|                |     | %IgG      | %IgM |     | %IgG         | %IgM |     | %IgG    | %IgM |
| < 6            | 185 | 38.4      | 21.6 | 72  | 43.0         | 70.9 | 0   | 0       | 0    |
| 7 - 9          | 110 | 38.2      | 20.0 | 17  | 29.4         | 17.6 | 23  | 39.1    | 0    |
| 10 - 12        | 31  | 22.5      | 29.0 | 12  | 41.6         | 41.6 | 13  | 38.4    | 0    |
| > 12           | 24  | 8.3       | 8.3  | 4   | 25.0         | 75.0 | 14  | 18.7    | 0    |
| Total          | 350 |           |      | 105 |              |      | 50  |         |      |

Table 5 - Seroprevalence of anti-Toxoplasma gondii antibodies and risk factors.

| Factors                | Num | High risk |      | Num | Hab abortion |      | Num | Control |      |
|------------------------|-----|-----------|------|-----|--------------|------|-----|---------|------|
|                        |     | %IgG      | %IgM |     | %IgG         | %IgM |     | %IgG    | %IgM |
| Living with cats (yes) | 119 | 21.8      | 21.8 | 48  | 45.8         | 27.0 | 10  | 10.0    | 0    |
| Living with cats (no)  | 231 | 32.4      | 20.8 | 57  | 35.1         | 33.3 | 40  | 34.8    | 0    |
| Eating Raw meat (yes)  | 49  | 40.8      | 24.5 | 20  | 55.0         | 15.0 | 8   | 37.5    | 0    |
| Eating Raw meat (no)   | 301 | 28.8      | 20.2 | 85  | 36.5         | 34.0 | 42  | 28.8    | 0    |

## DISCUSSION

The results obtained showed that in the group of women with high-risk pregnancies, 34.9% had been exposed to *T. gondii* and 20.7% showed recent infection. The results are almost the same as those found in the general population in the state of Jalisco 36.2%<sup>28</sup> and greater than the figures reported for Mexico City of 18.2% and 19%<sup>5, 23</sup>. In the habitual abortion group there was a greater number of women 44.9% who had been exposed to *T. gondii*, and 33.3% with recent infection. These results are similar to those reported in the state of Yucatán, which confirms ours in the state of

Jalisco, located in the coastal zone of Mexico; the prevalence is greater than in other states in open population. Like other authors<sup>1, 16, 18, 31</sup> we believe there is a close relationship between abortion and toxoplasmosis.

The greatest incidence of IgG antibodies was found in the third trimester of pregnancy in the HR group with 21.4% and 11.7% with active infections, which shows a high risk of congenital infections that is perhaps greater than the 5.6% previously found<sup>1, 3, 15</sup>.

In the three groups, the seropositivity of IgG antibodies increased with age, indicating that the number of people who have been exposed to *T. gondii* increases in direct relation to the population's age<sup>11, 28</sup> however, the number of IgM antibodies was 33.3% greater in those younger than 20. When analysing profession, seropositivity for IgG anti-Toxoplasma antibodies was more frequent in women who were housewives, and the active infections were more common in laborers, although we cannot pinpoint its origin.

The low socio-economic level showed a higher incidence of IgG antibodies 40.5% for the HR group alone. These results support previous findings in this region of Mexico, where no differences were found between socio-economic level and seropositivity for IgG antibodies<sup>28</sup>; however, the HA group (42.9%) and group C (40.0%) had a higher incidence of active infections in the high class; the reason for these findings could not be determined due to the limited number of women belonging to the high class. Educational and socio-economic levels are interrelated variables; their behavior turned out to be similar.

In the HR group there was a higher incidence of seropositivity in women with the habit of eating raw or poorly cooked meat 40.8%, 24.5%. The AH group had more active infections (34.0%). These results could be due to the fact that these women do not eat raw meat, but they perhaps consume vegetables irrigated with sewage water, which has also been found to be a transmission mechanism<sup>3, 26, 28</sup>; however, this phenomenon could not be taken into account since this study did not include it as a variable.

The presence of IgG anti-Toxoplasma antibodies was 45.8% and 33.3% greater for

recent infections in members of the HA group, and 34.8% in group C. The previous results may be accounted, not only by the fact of living with a cat, but also by the way in which the cat lives with the guest, which has been fully discussed by other authors<sup>2 14 26 28</sup>.

Due to the fact that the majority of Mexico's population consists of young people, particularly in Jalisco, where there is a greater female population, we believe that carrying out anti-Toxoplasma tests on women before and during pregnancy is of utmost importance, in order to avoid or curb serious outbreaks of congenital toxoplasmosis.

## RESUMEN

La toxoplasmosis es una zoonosis causada por *Toxoplasma gondii*, parásito intracelular obligado, en mujeres embarazadas a nivel mundial existen seroprevalencias del 7% al 51.3% y mujeres con embarazos anormales y aborto varían desde 17.5% al 52.3%. En México se ha referido seropositividad del 18.2% al 44.8% en mujeres con partos anormales ó abortos. El propósito de este trabajo consistió en determinar la frecuencia de anticuerpos antitoxoplasma IgG e IgM en mujeres del Hospital de Gineco Obstetricia del Centro Médico de Occidente del Instituto Mexicano del Seguro Social. Se estudiaron 350 mujeres con embarazo de alto riesgo encontrando 122 (34.9%) seropositivas a IgG y 76 (20.7%) a IgM, y en un grupo de 105 mujeres con aborto habitual resultando 48 (44.9%) con presencia de anticuerpos IgG y 33 (33.3%) a IgM. Se analizó la seropositividad con la edad, ocupación, nivel socioeconómico, ingesta de carne cruda ó mal cocida y convivencia con gatos.

Palabras-claves: Toxoplasmosis. Embarazo de alto riesgo. Aborto habitual.

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## REFERENCES

1. Abdel-Hafez SK, Shbeed I, Ismail NS, Abdel-Raham F. Serodiagnosis of *Toxoplasma gondii* in habitual aborting women and other adults from North Jordan. Folia Parasitology (Praha) 33:7-13, 1986.
2. Aline S, Aluja AP. Estudio sobre la frecuencia del oocisto de *Toxoplasma gondii* en el gato doméstico del Distrito Federal. Gaceta Médica de México 113:455-459, 1977.
3. Al-Meshari AA, Chowdhury MNH, Chattopadhyay SK, De Silva SK. Screening for toxoplasmosis in pregnancy. International Journal of Gynecology and Obstetric 29:39-45, 1989.
4. Biagi F. Datos actuales sobre biología y epidemiología de la toxoplasmosis. Gaceta Médica de México 111:165-167, 1976.
5. Biagi F, Islas PM, González C. Frecuencia de la toxoplasmosis en relación al parto. Gaceta Médica de México 108:127-130, 1974.
6. Clayton L, Miles HB. Toxoplasmosis and pregnancy. Australian and New Zealand Journal of Obstetrics and Gynecology 30:32-33, 1990.
7. Daffos F, Forestier F, Capella P, Thulliez P, Aufrant CH, Valenti D, Cox W. Prenatal management of 746 pregnancies at risk for congenital toxoplasmosis. New England Journal of Medicine 318:271-75, 1988.
8. Decavalas G, Papapetropoulou M, Ginnoulaki E, Tzigounis V, Kondakis XG. Prevalence of *Toxoplasma gondii* antibodies in gravidas and recently aborted women: a study of risk factors. European Journal of Epidemiology 6:223-226, 1990.
9. Desmonts G, Courver S. Toxoplasmosis in pregnancy and its transmission to the fetus. Bulletin of New York Academy of Medicine 50:146-159, 1974.
10. Desmonts G, Courver S, Peupion JC. Un diagnóstico precoce de la toxoplasmosis. Presse Medicale 1:339-341, 1972.
11. Díaz O, Vaca M. Evolución y epidemiología de la toxoplasmosis. Revista Mexicana de Infectología 6:146-152, 1985.
12. Feldman HA. Epidemiology of *Toxoplasma*. Epidemiology 4:204-214, 1982.
13. Forsgren M, Gille E, Ljungstrom I, Nokes DJ. *Toxoplasma gondii* antibodies in pregnant women in Stockholm in 1969, 1979, and 1987. Lancet 337:1413-1413, 1991.
14. Frenkel JK. *Toxoplasma* in and around us. Bioscience 23:43, 1973.
15. Galván ML, Garzón M. Estudio serológico en niños con toxoplasmosis. Revista Latinoamericana de Microbiología 31:267-270, 1989.
16. Johnson AM, Roberts H, Wetherall B, McDonald PJ, Need JA. Relationship between spontaneous abortion and presence of antibody to

- Toxoplasma gondii*. Medical Journal of Australia 1:579-580,1979.
17. Langer H. Repeat congenital infection with *Toxoplasma gondii*. Obstetric and Gynecology 21:318,1965.
  18. Meylan J. Toxoplasmosis as a cause of repeated abortion. Toxoplasmosis. Hans Huber Publisher, Vienna, 1971.
  19. Molina PC, Ontiveros C, Uribe R. Investigación de anticuerpos contra el *Toxoplasma gondii* por medio de la inmunofluorescencia en mujeres con embarazos anormales. Salud Pública de México 31:27-39,1971.
  20. Nakib AW, Ibrahim ME, Hathout H, Moussa MA, Deverajan LV, Thoruburn H, Yousof AM. Seroepidemiology of viral and *Toxoplasma* infections during pregnancy among arab women of child bearing age in Kuwait. International Journal of Epidemiology 12:220-223,1983.
  21. Remington JS, Desmots G. Toxoplasmosis. In: Remington JS, Klein JO (eds) Infectious disease of the fetus and newborn infant. WB Saunders, Philadelphia 191:332,1976.
  22. Remington JS, Miller MJ, Brownlee I. IgM antibodies in acute toxoplasmosis. II. Prevalence and significance in acquired cases. Journal of Laboratory and Clinical Medicine 71:855-866, 1968.
  23. Roch E, Bravo BM. Incidencia de toxoplasmosis congénita en una muestra de 2,186 recién nacidos vivos en la ciudad de México. Revista del Instituto de Salud Pública y Enfermedades Tropicales de México 22:221,1962.
  24. Roch E, Varela G. Diversos aspectos de la investigación sobre toxoplasmosis en México, resultados de 29, 883 reacciones de Sabin y Feldman de 1953. Salud Pública de México 26:31, 1966.
  25. Roch Ubiria E. La Toxoplasmosis Congénita, Problema Médico-Social. Salud Pública de México 18: 871-874, 1976.
  26. Swarzber JE, Remington J. Transmission of *Toxoplasma*. American Journal Disease Children 129:777-779, 1975.
  27. Varela G, Roch E, Zavala J. Estudio sobre toxoplasmosis en México. Salud Pública de México 3:451-454, 1961.
  28. Velasco O, Salvatierra J, Valdespino JL, Sedano AM, Galindo VS, Llausas A, Tapia CR, Gutiérrez G, Sepúlveda J. Seroepidemiología de la toxoplasmosis en México. Salud Pública de México 34:222-229, 1991.
  29. Verhofsted C, Van Renterghem JP. Comparison of six commercial enzyme linked immunosorbent assays for detecting IgM antibodies against *Toxoplasma gondii*. Journal of Clinical Pathology 42 1285-1290, 1989.
  30. Wong SY, Remington JS. Biology of *Toxoplasma gondii*. AIDS 7:299-316,1993.
  31. Zavala VJ, Guzmán ME, Becerra PM, Rodríguez ME. Toxoplasmosis y aborto en pacientes del Hospital O'Horan de Mérida Yucatán. Salud Pública de México 31:664-668, 1989.