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# Seroprevalence study of IgG antibodies to toxoplasma, and risk factors for *toxoplasma* infestation among pregnant women in Alkhoms state, Libya

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## ABSTRACT

Background: *Toxoplasma gondii* is an obligate intracellular protozoan that is distributed worldwide. Objective of the study: Seroprevalence study of IgG antibodies to toxoplasma, and risk factors for *toxoplasma* infestation among pregnant women in Alkhoms state, Libya. Results and conclusion: The study was conducted in Al-Khoms city, Libya from February 2013 to September 2013. Serum specimens were subjected to *Toxoplasma* IgG ELISA test. Out of 361 pregnant women investigated, 142(39.3%) were positive for IgG ELISA. The risk of toxoplasmosis among pregnant women was significantly greater among women in the older age group. There was **no** significant differences between working women and house wife women concerning seropositivity to toxoplasma. However there was a significant differences between those living in rural areas and those living in urban areas. Also there was a significant differences between women consuming sheep and cow meat and those consuming other types of meat. The method and degree of meat cooking have an effect on seropositivity to *Toxoplasma gondii* and the results indicated that, cooking using stove decrease the percentage of seropositivity to *Toxoplasma gondii*, compared with cooking using barbecue. Also pregnant women consuming undercooked meat showed higher percentage of seropositivity to *Toxoplasma gondii* than those eating well cooked meat, but the difference was not highly significant because in Libyan nutritional habits raw or under cooked meat is not usually consumed. The results of the current study showed nonsignificant difference in seropositivity to *Toxoplasma gondii*, due to place of consumed animal slaughter. The effect of dealing with domestic animals on seropositivity to *Toxoplasma* gondii among women proved that, contact with cats was found to be a significant risk factor for toxoplasma infection. Seroprevalence was found to be changed according to usage of different drinking water sources in the current study, and the highest prevalence of seropositivity to *Toxoplasma gondii* were in women using rain water and well water respectively. Meanwhile the lowest prevalence was in women using general network water.

**KEYWORDS:** Toxoplasmosis, pregnant women, seroprevalence.

## INTRODUCTION

*Toxoplasma gondii*, an obligate intracellular parasite found in many species throughout the world, causes a variety of clinical syndromes in human and animals [1]. Toxoplasmosis during pregnancy can cause congenital infection and manifest as mental retardation and blindness in the infant. The severity of fetal disease varies inversely with the gestational age at which maternal infection occurs [2]. Most of the toxoplasma infections are asymptomatic, the diagnosis relies mainly on the results of serological tests. The clinical implications of toxoplasma infection in pregnant patients are manifold. Such patients may have spontaneous abortions, still births or premature delivery in addition to various fetal anomalies[3]. Ideally every woman should know her toxoplasma status before conception. Toxoplasma antibodies may persist in the serum of an asymptomatic people for years at higher titres[4]. Seroprevalence estimated for human population varies greatly among different countries, among different geographical areas within one country, and among different ethnic groups living in the same area [2]. Seroprevalence of *Toxoplasma gondii* infection in women at childbearing age is found to be between 4%-100%. Incidence of primary maternal infection during pregnancy varies in a range of 1 to 310 per 10.000 pregnancies in the populations in Europe, Asia, Australia, and the Americas [2]. In a few studies performed in our country, seroprevalence of *Toxoplasma gondii* infection in women at childbearing age is found to be between 19.2% to 85%; and it is estimated that incidence of congenital toxoplasmosis is 0.1% [5&6].

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## MATERIALS AND METHODS

Four hundred and forty one consecutive women who attended private clinics and out patients clinics at Al-Khoms General Hospital, Al-Khoms, Al-Margeb, Libya, from December/2005 to December/2006. These cases represented different ages, social and educational levels. Aliquots of 10 ml. of blood samples were collected from each participant involved in the study. Enzyme linked immunosorbent assay (Biokit, Barcelona, Spain) was used to detect IgG antibodies to *Toxoplasma gondii* in participant bloods, according to the instructions of the manufacturing company.

## RESULTS AND DISCUSSION

The current study is one of few studies in Libya that evaluate some environmental and behavioral factors that may influence the infection rate of *Toxoplasma gondii* in Libya.

**Table (1):Distribution of cases according to their age.**

| Age | No | %* |
|---|---|---|
| 20-25 | 40 | 11.10 |
| 25-30 | 47 | 13.00 |
| 30-35 | 107 | 29.60 |
| 35-40 | 110 | 30.50 |
| >40 | 57 | 15.80 |
| Total | 361 | 100 |

N.B: Percentage were correlated to the total number of cases (361).

Distribution of the studied cases according to their age is presented in table (1), were age range 20-25 years involved 11.10%, age range 25-30 years involved 13.00% and age range >40 years involved 15.80%. The highest number of females participated in this study was in age ranges 30-35 (29.60%) and 35-40(30.50%).

Tables (2) showed the seropositive cases for toxoplasma (IgG), among pregnant women according to their age, using ELIZA assay. Seropositive cases ranged from 34.6% to 47.4%. The percentage of seropositive cases was lower for age range 30-35 years and there was a significant with other age range groups. The risk of toxoplasmosis among pregnant women was significantly greater among women in the older age group. Similar finding were reported by other authors [7, 8 & 9].This association does not mean that older age is a risk factor predisposing to infection but might be explained by the older the person the longer time being exposed to the causing agent and may retain a steady level of anti-toxoplasma IgG in serum for years. A contradictory results was reported in the eastern region of Saudia Arabia, where seropositivity declined with age[10]. The overall seropositivity to toxoplasma IgG, among the studied cases was (39.3%).

Effect of pregnant women occupation on seropositivity to toxoplasma were illustrated in table (3). The results indicated that only 41.0% of working wife showed seropositive test, while 45.5% of house wife showed seropositive test. There was no significant differences between working wife and house wife concerning seropositivity to toxoplasma.

**Table 2:Number and percentage of seropositive cases for toxoplasma IgG among pregnant women according to age.**

| Age | Seropositive | | Seronegative | | Total |
|---|---|---|---|---|---|
| | No | *% | No | *% | |
| 20-25 | 15 | 37.5 | 25 | 62.5 | 40 |
| 25-30 | 18 | 38.3 | 29 | 61.7 | 47 |
| 30-35 | 37 | 34.6 | 70 | 65.4 | 107 |
| 35-40 | 45 | 40.9 | 65 | 59.1 | 110 |
| >40 | 27 | 47.4 | 30 | 52.6 | 57 |

N.B: *Percentage were correlated to the total number in each age range group.

**Table 3:Distribution of positive cases for toxoplasma (IgG) among pregnant women according to occupation.**

| Occupation | seropositive | | seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Working women | 80 | 41.0 | 116 | 59.0 | 196 |
| House wife women | 75 | 45.5 | 90 | 54.5 | 165 |

N.B.*Percentage were correlated to the total number in each group.

Distribution of positive cases for toxoplasma (IgG) among pregnant women according to occupation revealed that there was no significant differences between seropositivity to *Toxoplasma gondii* among working women and house wife women (Tables 3).

**Table 4:Distribution of seropositive cases for toxoplasma (IgG) among pregnant women according to residence.**

| Residence | Seropositive | | Seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Urban | 77 | 45.0 | 94 | 55.0 | 171 |
| Rural | 67 | 35.0 | 123 | 65.0 | 190 |

N.B.*Percentage were correlated to the total number in each group.

Tables (4), showed the distribution of seropositive cases for toxoplasma (IgG) among the studied cases according to their residence. The results indicated that only **35.0**% of women living in rural areas showed seropositive test, while **45.0**% of house women living in urban areas seropositive test**.** There was a significant differences between those living in rural areas and those living in urban areas. Same results obtained by Ades *et al* **[11].** This may be explained by differences in the characteristics of the pregnant women studied. Such characteristics may contribute to the low prevalence found could be, those women living in rural areas belonged to a low socio-economic level and although they do eat meat, they certainly do it at a lower frequency and quantity than those with better socioeconomic level ( women those living in urban areas) because they cannot afford to buy meat in a regular basis. Since eating contaminated meat is well known route of *Toxoplasma gondii* infection, the

lower the frequency of meat consumption the lower the risk of infection.

The relation between seroprevalence to *Toxoplasma gondii* infection and type of meat consumed in the current study was illustrated in table (5). The highest percentage of seropositive cases (70.0%), was observed in women consuming sheep meat and (54.0%) in women consuming cow meat. There was a significant differences between those consuming sheep and cow meat and those consuming other types of meat. In Norwegian study, lamb but not beef was identified as a risk factor, but in northern France beef but not lamb was identified as a risk factor [12 & 13]. Evidence from studies that used bioassay suggested that lamb meat was more commonly infected than other types of meat [14]. The risk of met infected depends on the age of the animal, the proportion of time the animal has spent indoors, farm hygiene and the specific tissues used (non-skeltal muscle such as heart, diaphragm and tongue) had a higher density of cysts than skeletal muscle [15].

**Table 5: Distribution of positive cases for toxoplasma (IgG) among pregnant women according to type meat consumed.**

| Type of meat | Positive | | Negative | | Tot al |
|---|---|---|---|---|---|
| | NO | *% | No | *% | |
| Cow | 60 | 54.0 | 52 | 46.0 | 112 |
| Sheep | 77 | 70.0 | 33 | 30.0 | 110 |
| Goat | 10 | 53.0 | 9.0 | 47.0 | 19 |
| Camel | 65 | 54.0 | 55 | 46.0 | 120 |

N.B.*Percentage were correlated to the total number in each group.

**Table 6: Distribution of seropositive cases for toxoplasma (IgG) among pregnant women according to method of meat cooking.**

| Cooking method | Seropositive | | Seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Stove | 105 | 52.5 | 95 | 47.5 | 200 |
| Barbecue | 101 | 63.0 | 60 | 37.0 | 161 |

N.B.*Percentage were correlated to the total number in each group.

**Table 7: Distribution of seropositive cases for toxoplasma (IgG) among pregnant women according to degree of meat cooking.**

| Cooking | Seropositive | | Seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Well cooked | 103 | 34.44 | 196 | 65.55 | 299 |
| Undercooked | 10 | 40 | 15 | 60 | 25 |

N.B.*Percentage were correlated to the total number in each group.

**Table 8: Distribution of seropositive cases for toxoplasma (IgG) among pregnant women according to place of consumed animal slaughter.**

| Place | Seropositive | | Seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Home | 66 | 52.0 | 60 | 48.0 | 126 |
| Slaughter house | 125 | 53.0 | 110 | 47.0 | 235 |

N.B.*Percentage were correlated to the total number in each group.

The method and degree of meat cooking and their effects on seropositivity to *Toxoplasma gondii* were presented in tables (**6 & 7**). The results indicated that, cooking using stove decrease the percentage of seropositivity to *Toxoplasma gondii*, compared with cooking using barbecue. This may be attributed to the degree of meat cooking. Pregnant women consuming undercooked meat showed higher percentage of seropositivity to *Toxoplasma gondii* than those eating well cooked meat, but the difference was not highly significant because in Libyan nutritional habits raw or under cooked meat is not usually consumed. The association between eating undercooked meat found in this study has also been a consistent finding in previous study [16]. Reports from other countries in the region since 2001 found *Toxoplasma gondii* prevalence of 23% to 52% in sheep, suggesting that lamb, if it is undercooked (a prevalent cultural practice in this area), could be a source of *Toxoplasma gondii* infection[17& 18]. Also the results of the current study showed nonsignificant difference in seropositivity to *Toxoplasma gondii*, due to place of consumed animal slaughter.

**Table 9: Distribution of seropositive cases for toxoplasma (IgG) among pregnant women according to dealing with domestic animal.**

| Domestic animal | Seropositive | | seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Sheep | 12 | 43.0 | 16 | 57.0 | 28 |
| Cats | 42 | 64.0 | 24 | 36.0 | 66 |
| Dogs | 6 | 25.0 | 18 | 75.0 | 24 |
| Mixed | 28 | 44.0 | 35 | 56.0 | 63 |
| Nothing | 62 | 34.0 | 118 | 66.0 | 180 |
| Total | 150 | | 211 | | 361 |

N.B.*Percentage were correlated to the total number in each group.

The effect of dealing with domestic animals on seropositivity to *Toxoplasma* gondii among women was illustrated in table (**9**). It was clear from the results that contact with cats was found to be a significant risk factor for acute infection. It was similar to a study done in Tamil Naidu, India in which the rate of seropositivity to *Toxoplasma* gondii among women who had cats as a pet animal was significantly higher, than those without any cat in their house **[19].** These findings appear to be in accordance with other previous studies in Libya**[20 & 21],** but not consistent with results obtained by other authors **[22 & 23].** Theoretically, infected cats play a major role in contaminating soil; therefore persons living in a house with soil floors need to have a cat or have contact with it to become infected by this route.

**Table 10: Distribution of seropositive cases for toxoplasma (IgG) among pregnant women according to the type of drinking water.**

| Type of water | Seropositive | | Seronegative | | Total |
|---|---|---|---|---|---|
| | No | %* | No | %* | |
| Well water | 60.0 | 60.0 | 40.0 | 40.0 | 100 |
| Rain water | 75.0 | 68.0 | 35.0 | 32.00 | 110 |
| General network water | 50.0 | 33.0 | 101 | 67.0 | 151 |

N.B.*Percentage were correlated to the total number in each group.

Seroprevalence was found to be changed according to usage of different drinking water sources in the current study, (table 10). The highest prevalence (68.0% & 60%) were in the people using rain water and well water respectively. Meanwhile the lowest prevalence was in the people using general network water. The high seroprevalence in rain water and well water users may be in accordance with the published articles that have showed the presence of oocysts in those types of water[24 & 25]. Epidemiological investigation showed that the source of infection was water from a stream contaminated with oocysts excreted by jungle cats[25]. In British Columbia (Canada), 110 acute cases of toxoplasmosis were noted, associated with the contamination of water from the water supply system with *Toxoplasma gondii* oocysts washed from soil contaminated with wild cats' faeces during heavy rains. It was estimated that as many as 8,000 people contracted the infection[26]. The largest focus of infection (290 cases) was noted in Brazil. It was demonstrated that the disease was associated with the drinking of unfiltered water from a well [24].

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