Prevalence of Seroconversion Toxoplasmosis and Pregnancy Outcome among Childbearing Age Women in Thi-Qar

Zainab Ayad Abdalredha1*, Dawood Salman Mahdi1, and Mahmood Thamer Altemimi2

ABSTRACT

Background: In Iraq, the prevalence rate of toxoplasmosis is variable among different regions according to a few discrete studies. Ninety per cent of toxoplasmosis infections are asymptomatic in immunocompetent people.

Aim of Study: To assess the prevalence of seroconversion toxoplasmosis pregnancy outcome among childbearing-age women in Thi-Qar.

Patients and Methods: This cross-sectional observational study included pregnant women who were attending different primary care health institutions from September 2023 till April 2024. In-person interviews using a questionnaire administered by the interviewer to gather data on risk variables including age, address, education attained, family history of (DM), number of previous GDM deaths, etc.

Results: Pregnant ladies with positive Toxoplasmosis mean age (31.44 ± 6.61) years were significantly older than those with negative Toxoplasmosis (27.27 ± 6.11) years. Furthermore, they were having higher weight 77.49 ± 12.15 kg and BMI 31.20 ± 5.28 kg/m² than those negative Toxoplasmosis' (BMI = 29.24 ± 5.13 kg/m²) (p-value = 0.03). Women with positive Toxoplasmosis had higher blood glucose 154.42 ± 72.56 mg/dL than the other group 114.79 ± 44.67 mg/dL (p-value < 0.001), and HbA1c was higher 7.55 ± 1.76 than the other group 6.66 ± 1.18. Toxoplasmosis infestation has a significant effect on the fate of pregnancy as an increase in the risk and frequency of abortion show a significant statically difference with positive toxoplasmosis (71.1% vs. 23.6%). The incidence of congenital malformation was significantly higher among seropositive toxoplasmosis (9%) than those negative (2%).

Conclusions: History of abortion, number of abortions, congenital malformation and GDM are significant independent predictors of the infection.

Keywords: Pregnant woman, prevalence, seroconversion, Toxoplasmosis.

1. Introduction

Toxoplasmosis is one of the five neglected parasite illnesses in the United States because relatively little focus has been placed on its surveillance and care (US). About 25%–30% of humans worldwide were infected with toxoplasma. There are significant differences in prevalence between various communities in the same country or region (from 10% to 80%). Seroprevalence decreased (10%–30%) in North Europe, the Sahel region of Africa, North America, and Southeast Asia. Moderate prevalence (30%–50%) was detected in central-and southern European countries, whereas high prevalence rates were discovered in tropical countries in Latin America and Africa [1]. Geographical differences in prevalence show that infections are more common in tropical nations.

In Iraq, the prevalence rate of toxoplasmosis is variable among different regions according to a few discrete studies [2]. It ranged from 12.4% in AL-Saadoon et al. [3] to 62.9% in Hadi and Al-Omashi [4], as same as in other nearby nations. Ninety per cent of toxoplasmosis infections are asymptomatic in immunocompetent people [5] while during pregnancy is linked to fetal loss and abnormalities in newborns and fetuses in humans and animals. The
prevalence of latent toxoplasmosis in pregnant women is estimated to be 33.8% worldwide (95% confidence interval, 31.8%–35.9%; 345,870/1,148,677), with South America having the highest prevalence (56.2%; 50.5%–62.8%) and the Western Pacific region having the lowest prevalence (11.8%; 8.1%–16.0%) [6]. Due to the lack of precise data on toxoplasmosis in childbearing-age women in Thi-Qar province and its fetal consequences, we are arranging our objectives to assess the prevalence of seroconversion toxoplasmosis pregnancy outcome among childbearing-age women in Thi-Qar.

2. Patients and Methods

This cross-sectional observational study included pregnant women who were attending different primary care health institutions and Thi-Qar Specialized Diabetes Endocrine and Metabolism Center (TDEMC), a tertiary facility in Thi-Qar, Southern Iraq from September 2023 until February 2024. Patients came from all districts, sub-districts, and the city center. No pregnant and unwilling-to-participate women were excluded from the study. The sample size was defined by using the following equation [7]:

$$N = \frac{z^2 p (1 - p)}{d^2},$$

where $N = (1.96^2)10.6 \times (1 – 10.6)/0.05^2 = 145$

$p = $ the prevalence of Toxoplasmosis among pregnant women which was 10.5% according to a local study, $z = $ confidence level (1.96% for 95%), $d = $ allow a margin of error.

2.1. Demographics and Anthropometric Measurements

This step involved conducting in-person interviews using a questionnaire administered by the interviewer to gather data on the behavioral and demographic risk variables including age, address, education attained, family history of (DM), number of previous GDM deaths, polycystic ovarian syndrome (PCOS), prior abortion, stillbirth with congenital malformation, prior macrosomia babies, prior toxoplasmosis infection, number of children, and number of dead births. Anthropometric measurements of the height and weight of pregnant women were taken wearing light clothes and without shoes. Height was taken while the woman stood in the erect posture, touching the occiput, back, hip, and heels on a straight measuring wall, while she looked straight ahead. Then weight was recorded to the nearest 0.1 kg weighing machines placed on a flat surface. Body Mass Index (BMI) was calculated automatically in the majority of electronic medical records by dividing the patient’s weight in kilograms by the squared of their average height (kg/m²). The BMI classification system was as follows: class 1 obesity (30–34.9 kg/m²), class II obesity (35–39.9) kg/m², class III obesity >40, underweight <18.5 kg/m², normal (18.5–24.9) kg/m², overweight (25–29.9) kg/m², and kg/m² [8].

2.2. Estimated of Toxo-IgG & Toxo-IgM Antibodies

Before testing, let the test device, specimen, and/or controls reach room temperature (15 °C–30 °C). Then, take the test device out of its sealed bag and use it right away. For a whole blood test, place the test apparatus on a spotless, level surface and be sure to mark it with the specimen’s ID number. One drop of whole blood (approximately 40–50 μL) was introduced to the sample well, and for a serum or plasma test, one drop of sample diluent (about 35–50 μL) was added right away. As you fill the plastic dropper with the specimen and hold it vertically, pour one drop—roughly thirty to forty-five microliters—of the specimen into the sample well, being careful to remove any air bubbles. then quickly added 1 drop (about 35–50 μL) of Sample Diluent, set [9].

2.3. Ethical Considerations

Each pregnant woman who was enrolled gave her informed consent, and the targeted institutions’ ethical committee granted its approval following Helsinki regulations by the number (143/2023 on July 6, 2023).

2.4. Statistical Analysis

Parametric variables were normally distributed by Using the one-sample Kolmogorov-Smirnoff test and displayed as mean and standard deviation (SD). The Chi-Square test was used to analyze the data for independent qualitative variables using the statistical package of social science, version 23 (SPSS). For continuous variables, independent student t-tests and analysis of variance (ANOVA) were employed, and binary logistic regression analysis was carried out later to investigate the variable’s independence. $p$-values < 0.05 were considered significant enough to warrant further investigation.

3. Result

The age is indicated in Fig. 1, the results showed that the highest percentage (54.3%) was found to be among the age group 20–<30 years, while the lowest percentage (7.3%) was found to be among the age group <20 years old.

Distribution of the study sample according to their BMI in Fig. 2, the study found that the highest percentage (35.8%) was found to be among BMI group 25-29.9, while the lowest percentage (0.7%) was found to be among BMI group <18.5.

Distribution of the study sample according to their education in Fig. 3, the study found that the highest percentage found to be among participants held a university degree (37.7%) while the lowest one found to be among participants were illiterate (9.9%).
The study includes a total of 151 pregnant ladies, (29.2%) with positive toxoplasmosis and (70.2%) with negative toxoplasmosis, in Fig. 4.

In (Table I) the mean ages of pregnant ladies with positive Toxoplasmosis (31 ± 6) years were significantly older than those with negative Toxoplasmosis (27.27 ± 6.11) years (p-value = 0.103). Also, they had higher both body weight (77.49 ± 12.15 kg) and BMI (31.20 ± 5.28 kg\m^2) than those with negative Toxoplasmosis (body weight 74.48 ± 13.71 kg, BMI = 29.24 ± 5.13 kg\m^2) (p-value = 0.595, 0.479 respectively). Furthermore, pregnant ladies with positive Toxoplasmosis had higher dysglycemia (blood glucose 154.42 ± 72.56 mg\dl versus 114.79 ± 44.67 mg\dl, p-value < 0.001), and HbA1c 7.55 ± 1.76 vs. 6.66 ± 1.18, p-value = 0.05) as compared to those with negative toxoplasmosis.

In (Table II) Both history and the number of abortions were significantly higher among pregnant ladies with positive toxoplasmosis than those without (p-value < 0.001, < 0.001). also, the history of congenital malformation and new GDM was significantly higher among pregnant ladies with positive toxoplasmosis than in another group (p-value = 0.044, 0.002, respectively). While other.

4. Discussion

Toxoplasmosis infestation was more predominant among the third decade of age (30–39 years), but there was no statistically significant association between them or other specific age groups in this study. This agreed with the study done in Yemen in 2019 [10]. However, there was no significant association between BMI and toxoplasmosis infestation, the majority of both groups were either overweight or class-I obesity. It was clear that around one-quarter of pregnant ladies with positive toxoplasmosis had either class-II or III obesity as compared to one-tenth of those with negative toxoplasmosis (p-value = 0.479). These findings agreed with a local study in Baghdad [11], but they disagreed with another research [12].

Pregnant women with positive toxoplasmosis had significantly higher blood glucose levels and it was the same as the cross-sectional study in Prague [13]. The anti-Toxoplasma gondii antibody concentration and glucose level positively correlated, indicating that the consequences of toxoplasmosis diminished with time after infection, and compared to women free of Toxoplasma gondii, those infected with the parasite had a greater rate of GDM. Our findings—that is, that women infected with T. gondii had higher blood glucose levels and a higher prevalence of GDM—may also have significant therapeutic ramifications. For instance, these correlations might offer fresh perspectives on the intricate etiology of GDM. Both the short-and long-term effects of this illness on women and their children are significant. The most common
<table>
<thead>
<tr>
<th>Variables</th>
<th>Positive toxoplasmosis</th>
<th>Negative toxoplasmosis</th>
<th>95% confidence interval for mean</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>31.44 ± 6.61</td>
<td>27.27 ± 6.11</td>
<td>6.37</td>
<td>1.96</td>
</tr>
<tr>
<td>Weight (kg) Mean ± SD</td>
<td>77.49 ± 12.15</td>
<td>74.48 ± 13.71</td>
<td>7.67</td>
<td>–1.65</td>
</tr>
<tr>
<td>BMI (kg/m^2) Mean ± SD</td>
<td>31.20 ± 5.28</td>
<td>29.24 ± 5.13</td>
<td>3.77</td>
<td>0.139</td>
</tr>
<tr>
<td>RBS (mg/dl) Mean ± SD</td>
<td>154.42 ± 72.56</td>
<td>114.79 ± 44.67</td>
<td>59.21</td>
<td>20.03</td>
</tr>
<tr>
<td>FBS (mg/dl) Mean ± SD</td>
<td>110.71 ± 32.57</td>
<td>110.55 ± 23.56</td>
<td>28.14</td>
<td>–27.81</td>
</tr>
<tr>
<td>HBA1C (%) Mean ± SD</td>
<td>7.55 ± 1.76</td>
<td>6.66 ± 1.18</td>
<td>1.78</td>
<td>–0.012</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Positive toxoplasmosis</th>
<th>Negative toxoplasmosis</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence</td>
<td>Urban</td>
<td>38 (84.4%)</td>
<td>99 (93.4%)</td>
<td>137 (90.3%)</td>
</tr>
<tr>
<td>Education</td>
<td>Rural</td>
<td>7 (15.6%)</td>
<td>7 (6.6%)</td>
<td>14 (9.7%)</td>
</tr>
<tr>
<td>History of PCOS</td>
<td>Illiterate</td>
<td>6 (13.3%)</td>
<td>9 (8.5%)</td>
<td>15 (9.9%)</td>
</tr>
<tr>
<td>Family history of DM</td>
<td>Primary</td>
<td>19 (42.2%)</td>
<td>38 (35.8%)</td>
<td>57 (37.7%)</td>
</tr>
<tr>
<td>History of abortion</td>
<td>Intermediate</td>
<td>10 (22.2%)</td>
<td>24 (22.6%)</td>
<td>34 (22.5%)</td>
</tr>
<tr>
<td>Number of abortions</td>
<td>University</td>
<td>10 (22.2%)</td>
<td>35 (33.0%)</td>
<td>45 (29.8%)</td>
</tr>
<tr>
<td>Dead. Birth</td>
<td>History of PCOS</td>
<td>7 (15.6%)</td>
<td>14 (13.2%)</td>
<td>21 (13.9%)</td>
</tr>
<tr>
<td>Contact with domestic animals</td>
<td>Family history of DM</td>
<td>24 (53.3%)</td>
<td>44 (41.5%)</td>
<td>68 (45.0%)</td>
</tr>
<tr>
<td>History of congenital malformation</td>
<td>History of abortion</td>
<td>32 (71.1%)</td>
<td>25 (23.6%)</td>
<td>57 (37.7%)</td>
</tr>
<tr>
<td>GDM</td>
<td>Number of abortions</td>
<td>0</td>
<td>14 (31.1%)</td>
<td>79 (74.5%)</td>
</tr>
<tr>
<td>Duration GDM</td>
<td>Dead. Birth</td>
<td>1</td>
<td>17 (37.8%)</td>
<td>19 (17.9%)</td>
</tr>
<tr>
<td>(months)</td>
<td>Contact with domestic animals</td>
<td>2</td>
<td>6 (13.3%)</td>
<td>6 (5.7%)</td>
</tr>
<tr>
<td>History of congenital malformation</td>
<td>History of abortion</td>
<td>≥3</td>
<td>8 (17.7%)</td>
<td>2 (1.9%)</td>
</tr>
<tr>
<td>GDM</td>
<td>Number of abortions</td>
<td>0</td>
<td>36 (81.8%)</td>
<td>99 (93.4%)</td>
</tr>
<tr>
<td>Duration GDM</td>
<td>Dead. Birth</td>
<td>1</td>
<td>7 (15.9%)</td>
<td>8 (8.9%)</td>
</tr>
<tr>
<td>(months)</td>
<td>Contact with domestic animals</td>
<td>2</td>
<td>26 (57.8%)</td>
<td>44 (41.5%)</td>
</tr>
<tr>
<td>History of congenital malformation</td>
<td>History of abortion</td>
<td>6 (13.3%)</td>
<td>8 (7.5%)</td>
<td>14 (9.3%)</td>
</tr>
<tr>
<td>GDM</td>
<td>Number of abortions</td>
<td>New GDM</td>
<td>27 (60.0%)</td>
<td>35 (33.0%)</td>
</tr>
<tr>
<td>Duration GDM</td>
<td>No GDM</td>
<td>18 (40.0%)</td>
<td>71 (67.0%)</td>
<td>89 (58.9%)</td>
</tr>
</tbody>
</table>

There was no statistically significant correlation found between the pregnant women’s type of residency and their infestation of toxoplasmosis. More people (84.4%) who were seropositive for toxoplasmosis infestations lived in urban areas than in rural ones. Their findings concurred with those of research conducted in Kirkuk [14]. This may be because women’s immunity is compromised in the city center due to higher air pollution and population density than in rural areas. In addition to unhealthy eating practices like fasting, they run the risk of contracting toxoplasmosis [13]. There was no statistically significant correlation found between pregnant women’s education levels and the results of the current investigation. Seropositive toxoplasmosis was less common among illiterate people and more common in elementary school students than in intermediate and university settings. This may not make sense given that other research has linked a higher incidence of toxoplasmosis to lower educational attainment, which puts our results at odds with a study conducted in Sanandaj, west of Iran [16]. Low socioeconomic level and ignorance of the disease’s mode of transmission can raise the risk of infection during pregnancy [17]. Furthermore, there was no statistically significant correlation between the history of PCOS and the
family history of DM and the incidence of toxoplasmosis infection in pregnant women.

The results of this study indicate that toxoplasmosis infestation significantly affects the outcome of pregnancy, as evidenced by a statistically significant difference between those with positive toxoplasmosis and those without (p-value < 0.001) in terms of both risk and frequency of abortion. This was identical to the study in Yemen [10]. But in conflict with a study in Sanandaj, west of Iran [16], [18] and a study in Qadsiyah [19]. For those who are seroconverted, the overall risk of abortion is about 0.5%, and the risk of fetal death appears to be 1.3% to 1.6% in pregnancies with proven fetal infection [20].

Despite the fact that the group with seropositive toxoplasmosis had a higher incidence of dead newborns than the negative group, there was no discernible correlation between these characteristics (p = 0.056) as also observed in a cross-sectional study in Mexico [21]. In this study, women with positive toxoplasmosis had higher contact rates (57.8%) with indoor cats than did women with negative toxoplasmosis (41.5%), yet there was no discernible statistical difference (p-value = 0.067), this finding was in agreement with the study in Sanandaj, west of Iran [16]. One common risk factor for T. gondii infection in pregnant women is a history of cat interaction. Furthermore, the incidence of the parasite in domestic cats may vary depending on the species of cat in a particular nations’ cats [16]. The history of toxoplasmosis and macrosomia did not significantly differ statistically, according to the current study (p = 0.262). the results show a percentage of macrosomia in positive toxoplasmosis (13.3%), (7.5%) with negative toxoplasmosis.

Additionally, those with seropositive toxoplasmosis (9%) had a significantly greater prevalence of congenital deformity than those with negative toxoplasmosis (2%) (p = 0.004). This was a confirmed study in Saudi Arabia [22], and a thorough analysis of the literature supported this because of the low rate of vertical transmission. The incidence of transmission and severity of fetal infection are significantly influenced by the stage of pregnancy at which maternal toxoplasmosis is acquired. Transmission is very low (<20%) in the first trimester but rises to around 80% by the conclusion of the pregnancy [23]. While transmission rates are highest during the last trimester, most cases are subclinical and result in asymptomatic infections or recurrent chorioretinitis throughout early adulthood, which can cause vision problems and potentially blindness. Early in gestation cases are severe, with infection leading to spontaneous abortion, hydrocephaly, and mental retardation [24].

As previously indicated, among pregnant women with seropositive toxoplasmosis, the proportion of new GDM was considerably higher than that of pregnant women with negative toxoplasmosis (60% vs. 33%, p = 0.002). This study concurs with a Prague cross-sectional study in Prague [13].

It showed that in eastern China, T. gondii infection is linked to various forms of diabetes mellitus and that individuals with DM had greater frequencies of antibodies against T. gondii than control subjects [25]. The length of GDM had no bearing on the results of this investigation, and it also differed from those reported in South-West Iran [26]. There are some limitations to this study, firstly the small sample size which may affect the findings, secondly, the lack of polymerase chain reaction for definitive diagnosis of toxoplasmosis rather than using serological tests. Finally, absence the of two or three-step glucose tolerance tests for diagnosing GDM among pregnant ladies is the gold standard way for diagnosis. So further studies are required to judge these issues in the future.

5. Conclusion

Around 30% of the pregnant ladies had a positive seroconversion for toxoplasmosis after doing a rapid serological test and Toxoplasmosis infestation was more predominant among the third decade of age (30–39 years). Interestingly, around 60% of pregnant women with positive toxoplasmosis were aged ≥30 years which was higher than those comparable negative ones (29.3%). History of abortion, number of abortions, congenital malformation, and GDM are significant independent predictors of the infection.

Acknowledgment

We would like to thank the participants for their acceptance and cooperation in this study.

Conflict of Interest

Authors declare that they do not have any conflict of interest.

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