

Serological status for *Toxoplasma gondii* and cytomegalovirus in pregnant women

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ABSTRACT

Background and objective. *Toxoplasma gondii* and CMV cause congenital defects in TORCH (Toxoplasmosis, Rubella virus, cytomegalovirus, and Herpes simplex virus) infections. The primary objective of the study was to estimate the seroprevalence of *Toxoplasma gondii* (TOXO) and cytomegalovirus (CMV) infections among pregnant women in Al Qurnah, Iraq, and identify the presence of specific Immunoglobulin M (IgM) antibodies indicating recent infections.

Material and method. The study tested 1000 healthy pregnant women using VIDAS® TOXO and CMV IgM kits.

Results. The findings revealed a significant seroprevalence, with 37.2% of samples positive for Toxoplasma IgM, 22.8% for CMV IgM, and 9.6% for mixed infections. The highest rate of abortions occurred in the first trimester, with a significant increase in abortion parameters among pregnant women infected with *T. gondii* and CMV. Our study comprised 372 pregnant women with Toxoplasma infection; 286 (76.9%) were rural and 86 (23.1%) urban. Our analysis identified CMV in 228 pregnant women, 159 rural (69.7%), and 69 urban (30.3%).

Conclusion. The study suggests a higher prevalence of Toxoplasma IgM compared to CMV IgM infections in the region, emphasizing the importance of early detection and prevention, especially during the first trimester. The results also highlight the need for routine antenatal screening and educational measures to reduce the impact of these infections on pregnancy outcomes.

Keywords: *Toxoplasma gondii*, cytomegalovirus, IgM, abortion, pregnant women

INTRODUCTION

Toxoplasma gondii and cytomegalovirus (CMV) are pathogens responsible for congenital abnormalities associated with TORCH infections (Toxoplasmosis, Rubella virus, cytomegalovirus, and Herpes simplex virus) group [1]. Although TORCH agents can have severe consequences for the fetus, it's important to note that they usually only cause mild illness in pregnant women [2]. According to published information, two to three percent of all congenital abnormalities are linked to infections during pregnancy [3]. As an obligatory intracellular protozoan, *T. gondii* can cause latent infection in immunocompetent individuals [4]. Tachyzoites in the blood of seronegative mothers suffering from acute toxoplasmosis can penetrate the placenta and affect the fetus [5]. In 0.3%-2.4% of all live births, cytomegalovirus constitutes one of the more frequent infec-

tious pathogens that cause uterine infections [6]. Although reinfection or reactivation of CMV in a pregnant mother can transmit to the fetus (i.e., nonprimary infection), primary disease and its adverse effects, including long-term disability, are much more likely to occur [7]. Asymptomatic maternal infections from *T. gondii* and cytomegalovirus cause difficult clinical detection; These diseases can be prevented and treated [8]. The key to clinical success is the early discovery of symptoms, which may include screening during pregnancy [9]. The immunity status of women of reproductive age is a crucial determinant of their serological status. This information can be precious in identifying women at risk of acquiring infections and preventing congenital infections caused by these agents [3].

When they occur in the first trimester of pregnancy, infections by organisms that belong to the TORCH complex are linked to unintended conse-

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quences like sterility, congenital malformations, intrauterine fetal deaths, stillbirths, multiple abortions, and other reproductive failures [10]. Diagnosing these maternal infections depends on serological findings because they are primarily asymptomatic. Identifying TORCH infections can be best achieved by detecting the IgM antibody [11].

Many different analytical techniques exist for the serological detection of CMV, Rubella, and *T. gondii* infections [12]. Highly accurate and specific methods for detecting IgM and IgG antibodies against these infections include the Enzyme-linked immunosorbent assay (ELISA), enzyme immunoassay (EIA), and TORCH Panel Rapid Test [13]. In addition, developments in IgG avidity tests make it easier for medical professionals to differentiate between initial acute and recurrent or previous infections [14].

This study aimed to estimate the seroprevalence of *Toxoplasma gondii* (TOXO) and cytomegalovirus (CMV) infections and to identify the presence of specific IgM antibodies which reflect acute (recent) *T. gondii* and CMV infections.

MATERIALS AND METHODS

A total of 1000 sera samples were collected to detect the *Toxoplasma* IgM and CMV IgM during 13 months (December 2021 and December 2022). The study sample consisted of pregnant women in good health and with no long-term medical conditions. These women regularly visited the Department of Obstetrics and Gynecology at Al Qurnah Hospital in Basrah, Iraq. All pregnant women gave informed consent before the sample collection, which the institute's ethical council approved. To detect anti-*Toxoplasma* IgM and anti-CMV antibodies, the VIDAS Toxo IgM and CMV IgM (BioMérieux) test is an automated immunocapture assay for the VIDAS system. In brief, 100 µL of either sample, calibrator, or controls were transferred into a strip sample well, and all subsequent reaction steps were completed using the VIDAS instrument. The disposable container was a solid phase and pipetting device during the test. VIDAS equipment automatically calculated index I (ratio of fluorescent signal of serum to be tested to standard signal). An index of <0.55 was negative for IgM anti-*Toxoplasma* antibodies, 0.55–0.65 was equivocal, and ≥0.65 was positive. VIDAS equipment automatically calculated index I (ratio of fluorescent signal of serum to be tested to standard signal). An index of <0.70 was negative for IgM anti-CMV antibodies, equivocal between ≥0.70 and <0.90, and positive ≥0.90 [15].

Ethical consideration

The study obtained ethical approval from the Basra Health Department and authorization from the Department of Research and Development.

Statistical analysis

All data were analyzed by Microsoft Excel® 2021, using T-test. The P-value was calculated.

RESULTS

In our study, in a total of 1000 samples, 696 (69.6%) samples had positive serology samples, whereas 304 (30.4%) samples had negative serology. 372 samples (37.2%) were seropositive for *Toxoplasma*, and 228 samples (22.8%) were positive for CMV. Mixed infections were in 96 out of 696 samples (9.6%) positive cases for the *Toxoplasma* IgM and CMV IgM infections. The study population showed an average age of 23.4 years. The seropositivity percentages are shown in (Table 1). The seropositivities for *Toxoplasma* IgM and CMV IgM infections were seen in most samples in the 19-30 age group. Table 2 shows the abortion history of the total pregnant women involved in the study; a higher percentage of abortion was seen in the tested samples, 72% of which more women had 1 or 2 abortions (88% opposed to 12 % had multiple abortions). A large percentage of abortions were found to occur in the first trimester of pregnancy, with 55% (276/501) and 45% (225/501) occurring in the second trimester. There was a significant increase ($P < 0.05$) of all tested parameters of abortion in pregnant women infected with *T. gondii* and CMV, as in Table 2.

TABLE 1. Evidence of specific IgM antibodies detected by serology in pregnant women

Serological test	Total No. of samples	No. of positive samples = 696	Percentage (%) of positive samples = 69.6
<i>Toxoplasma</i> IgM	1000	372	37.2
CMV IgM		228	22.8
<i>Toxoplasma</i> + CMV (IgM)		96	9.6

TABLE 2. A history of abortion among pregnant women

History of abortion	Total	Variable	Total samples (%)
Presence of abortion	696	Positive	*501 (72)
		Negative	*195 (28)
Number of abortions	501	One-two	*440 (88)
		>2 (multiple abortion)	*61 (12)
Time of abortion	501	First trimester	*276 (55)
		Second trimester	*225 (45)

* Significant difference $P < 0.05$ of all testes parameters of abortion in pregnant women

In our study, 372 pregnant women were found to have *Toxoplasma* infection; 286 (76.9%) lived in rural areas, whereas 86 (23.1%) lived in urban areas. When pregnant were categorized based on their level of education, the highest prevalence of *T. gon-*

dii infection was observed among those with primary education (63.2%), followed by those with secondary education (30.9%), and finally, those with a university education for women (5.9%) (Table 3).

In our study, we identified CMV infection in 228 pregnant. Of these, 159 (69.7%) resided in rural regions, while 69 (30.3%) lived in urban areas. Upon categorizing the pregnant according to their educational attainment, it was found that the highest occurrence of CMV infection was among pregnant with primary education (110 out of 228, 48.2%). This was followed by those with secondary education (87 out of 228, 38.2%), and lastly, pregnant with a university education for women (31 out of 228, 13.6%) (Table 3).

TABLE 3. Pregnancy characteristics and serological status for *Toxoplasma gondii* and CMV

Serological test	Variables	Characteristics	Seropositive (IgM) N (%)
Toxoplasma IgM	Residence	Village	286 (76.9)
		City	86 (23.1)
	Education	Primary	235 (63.2)
		Secondary	115 (30.9)
University		22 (5.9)	
CMV IgM	Residence	Village	159 (69.7)
		City	69 (30.3)
	Education	Primary	110 (48.2)
		Secondary	87 (38.2)
University		31 (13.6)	
Toxoplasma + CMV (IgM)	Residence	Village	62 (64.6)
		City	34 (35.4)
	Education	Primary	32 (33.3)
		Secondary	54 (56.3)
University		10 (10.4)	

In our study, 96 pregnant women had infections with *Toxoplasma* and CMV; 62 (64.6%) lived in rural areas, whereas 34 (35.4%) lived in urban areas. It was found that the highest occurrence of *Toxoplasma* and CMV infection was among pregnant women with secondary education (54 out of 96, 56.3%). This was followed by those with primary education (32 out of 96, 33.3%), and lastly, pregnant with a university education for pregnant (10 out of 96, 10.4%) (Table 3).

DISCUSSION

In this study, nearly two-thirds of pregnant women who attended the Department of Obstetrics and Gynecology at AL Qurnah Hospital for one year were seropositive for *Toxoplasma* IgM and CMV IgM infections. This study used the VIDAS system to detect IgM anti-*Toxoplasma* antibodies, which are used to diagnose acute toxoplasmosis. IgM antibod-

ies rise one to two weeks after acute infection [16]. The current study has demonstrated an elevated prevalence of anti-IgM (37.2%) in pregnant females. This finding contrasts with a previous study in Salah-Adden, which reported an acute infection percentage of 3.1% among pregnant women [17]. The prevalence rates of *T. gondii* vary between research due to changes in study participants, study regions, and blood testing diagnostic procedures. Toxoplasmosis rates can also be interpreted depending on climatic circumstances, patient ages, nutritional and immunological state, hygiene practices, sanitary supplies, and socioeconomic situations in the study's region. Protozoan prevalence correlated with several risk factors, including host, zoonotic transmission, environment, and sociodemographic [18]. In the present study, 37.2 % of pregnant women had *Toxoplasma*-specific IgM antibodies which are more than ten times higher than a previous study found in 3.3% of women in a comparable population in India [19].

CMV is a type of virus that belongs to the same family as herpes viruses and can be found everywhere in the world, especially in regions with poor socioeconomic status. Most of these infections exhibit asymptomatic characteristics and challenge clinical diagnosis. On the other hand, the incidence of the primary infection is noticeably elevated among pregnant women from lower socioeconomic groups [20]. There have been reports of a CMV IgM seropositivity rate of 8.4% among women with a Bad Obstetric History (BOH) [11]. Following the results of this study, the CMV-specific IgM had a seropositive percentage of 22.8%; this indicates that the infection is more prevalent in Al Qurnah. Therefore, routine antenatal screening and behavioral and educational measures for prevention are required. This detected CMV prevalence rate is relatively higher than rates detected in previous studies conducted from variable areas all over Iraq, where CMV prevalence was found to be 10% in the central province (Baghdad) [21], 9.18% in the north (Sulaimania) [22], while in the west (AL-Anbar), it was 6.1% [23]. this higher rate might be attributed to the difference in environmental factors (Basrah has hotter weather compared to the studied provinces) and geographical differences (urban vs. rural areas).

Single and double abortions occur at a higher level (88%) than multiple abortions (12%). This result agreed with the findings of another study, which demonstrated that the highest percentage of IgM & CMV (50%) was among those who had previously undergone Single and double abortions. The prevalence of multiple abortions among infected women was also found to be low by others (6.3%) [24].

The present study revealed a higher percentage of abortions in the first and second trimesters. This

result is consistent with the results of a survey in Salah-Adden province [17] and in Diyala province [25].

This is in line with the observation that the severity of an injury sustained during pregnancy is proportional to both the degree to which the fetus is resistant and the amount of immune protection naturally acquired by the placenta. As a result, the fetus is more susceptible to infection during the first trimester of pregnancy, when the immune system is not yet fully developed, and after the third month of pregnancy, when it is composed of opposing components in the fetus's body. Exposure to *T. gondii* and CMV during the first & second trimesters often leads to death and spontaneous abortion, while during the last trimester, as the fetus is nearly fully developed exposure is more likely to cause asymptomatic prenatal infection, i.e., the birth of asymptomatic infected neonate [26].

In the current study, the incidence of toxoplasma and rotavirus infection in pregnant women living in rural areas was higher than in urban areas. Numerous study authors focused on the difference in *T. gondii* seropositivity between women living in rural and urban regions [5,27,28]. This analysis observed a similar pattern: only 23.1% of women residing in cities were seropositive, compared to 76.9% of women from rural areas. This finding is due to the increased contact between rural dwellers and cats, which frequently reside in or near houses and play a crucial part in the life cycle of *T. gondii*. In this cycle, oocytes are commonly deposited in the soil through the body waste of cats. Rural settings have a higher likelihood of women contracting toxoplasmosis due to increased exposure during activities such as gardening, farming, and dealing with animals. Furthermore, the consumption of meat products cooked at home, namely sausages, is another probable factor that contributes to the increased occurrence of toxoplasmosis among women residing in rural regions [5].

In the current study, it was observed that pregnant women with primary and secondary educational attainment had a higher incidence of Toxo-

plasma and CMV infection than pregnant women with university education, and this is attributed to low personal hygiene standards among pregnant women with primary and secondary education. This result is in line with previous research showing that pregnant women with lower levels of education are more likely to be infected with toxoplasmosis and CMV infections in northern Kosovo and Metohija [29].

Furthermore, it is recommended that comparative investigations to the present study, which reported the seroprevalence of TORCH infections, be conducted to establish primary data within the whole of the country. In such a situation, developing a vaccine plan to prevent these infections must be considered, particularly in developing countries. Although a history of pet breeders and their links with toxoplasmosis could not be revealed in this research, patients with toxoplasmosis should be advised to avoid raw or undercooked meat and unpasteurized milk and stay away from pets, particularly cats, thus Creating awareness in communities about protective ways to prevent this pathogenic disease would be possible. Women exhibiting signs of seroconversion during their pregnancies should have a close clinical observation to monitor any potential complications.

CONCLUSION

Our study indicates the prevalence of seropositive for Toxoplasma IgM and CMV IgM infections in women of childbearing age. The study findings show a significant seroprevalence percentage of Toxoplasma IgM compared to CMV IgM infections.

At the same time, the rate of abortions during the first trimester was the highest.

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