Academia Open
Vol. 10 No. 1 (2025): June
DOI: 10.21070/acopen.10.2025.11394

Serological Patterns of TORCH Infections in Early Pregnancy: Pola Serologis Infeksi TORCH pada Awal Kehamilan

Alaa Mahdy Obaid Khzal Department of Pathological Analyses, College of Science, University of Kufa, Najaf

General Background: TORCH infections—comprising *Toxoplasma gondii*, Rubella virus, Cytomegalovirus (CMV), and Herpes simplex virus (HSV)—pose severe risks to fetal health if acquired during pregnancy, particularly in the first trimester. **Specific Background:** In Iraq, and specifically Najaf, epidemiological data on TORCH prevalence among pregnant women remains scarce, despite the known perinatal risks. **Knowledge Gap:** The absence of localized seroprevalence data and gestational-age-based immunological profiles limits the development of targeted maternal-fetal health strategies. **Aim:** This study aimed to assess TORCH infection rates, identify immunoglobulin patterns (IgM and IgG), and compare seropositivity across pregnancy trimesters in Najaf. **Results:** Among 100 participants, 62% tested positive for TORCH infections, with 58.1% of those in the first trimester showing acute infections, mainly due to *T. gondii* and HSV. Later trimesters showed chronic infections dominated by CMV and Rubella, evidenced by IgG presence. **Novelty:** This is the first study in Najaf to report trimester-specific TORCH immunological dynamics, revealing a distinct shift from acute to chronic infection profiles. **Implications:** These findings highlight the necessity for early TORCH screening and ongoing antenatal surveillance in Iraq to minimize congenital complications and inform public health interventions.

Highlight :

- Early Detection Critical – Most acute infections (58.1%) occur in the first trimester, requiring urgent screening and intervention.
- Pathogen Pattern Shifts – Toxoplasma and HSV dominate early infections, while CMV and Rubella persist chronically later.
- Public Health Need – Routine TORCH testing and hygiene education must be integrated into antenatal care programs.

Keywords : TORCH Infections, Toxoplasma Gondii, Cytomegalovirus, Rubella Virus, Antenatal Screening

A . Introduction

Maternal infections acquired throughout pregnancy represent serious threats to fetal development because of pathogens that belong to the TORCH complex infection group. The acronym TORCH stands for Toxoplasma gondii, Rubella virus, Cytomegalovirus, and Herpes simplex virus, which are microorganisms that infiltrate the placental barrier to cause severe fetal infections [1],[2]. When pregnant women experience infections from this group of pathogens, they risk various detrimental

results, which span from abortion to stillbirth and intrauterine growth restriction to premature birth and later neurodevelopmental complications such as deafness, blindness, and intellectual impairment [3]. The point at which the mother gets infected as well as her maternal immunity status, determines vertical transmission outcomes [4]. The risk of substantial fetal harm becomes greatest when pregnant women acquire their first infection during the first trimester of gestation [5]. Early diagnosis of TORCH infections remains essential because appropriate treatment at an appropriate time helps minimize fetal issues and benefits maternal pregnancy success.

TORCH infection diagnosis requires detecting particular immunoglobulins such as IgM and IgG in individuals. Medical practitioners detect new infections and acute cases using IgM antibodies while these antibodies indicate transmission risk but IgG antibodies provide protection against future infections [6]. Elisa serves as the primary method for screening since low and middle-income nations face limited access to molecular diagnostic resources [7]. Epidemiological patterns of TORCH infections show wide variations across regions due to different vaccination approaches and hygiene practices, dietary patterns, socioeconomic conditions and health education levels [8]. The assessment of congenital infections in Iraq's developing nation remains uncertain due to the lack of advanced antenatal screening programs and weak health reporting systems [9]. Data about TORCH infection prevalence among pregnant women in Najaf province remain minimal while provincial monitoring needs to be brought up to date for improving clinical practices and prevention strategies. The current research aimed to study TORCH infection rates in Iraqi antenatal women from Najaf with a focus on analyzing gestational age group differences. Measuring seroprevalence and immunoglobulin distribution patterns among pregnant women will direct early intervention strategies and optimize prenatal care with the purpose of lowering congenital infection rates in the local community.

B . Methodology

1. Study Design and Setting

This cross-sectional study was conducted to investigate the detection rates of TORCH pathogens among antenatal women at different gestational ages in Najaf, Iraq. Blood samples were collected between September 2023 and February 2024 at Al-Zahraa Teaching Hospital and selected private laboratories within Najaf province.

2. Study Population

The study included 100 pregnant women when they came for antenatal clinic visits. The study accepted women in any pregnancy stage who provided consent along with TORCH screening obtained as per their standard antenatal care. The research excluded women who had autoimmune diseases or had received blood transfusions or those affected by chronic infections that were not connected to TORCH pathogens.

3 . Sample Collection

The participants had their blood drawn aseptically into sterile plain tubes from which venous blood obtained. The samples needed time to achieve clot formation prior to centrifugation at 3000 rpm for 10 minutes to obtain the serum fraction. Serological analysis followed by storing the samples at –20°C until their testing procedure began.

4 . Laboratory Analysis

The Enzyme-Linked Immunosorbent Assay (ELISA) kits were employed for TORCH screening testing through protocols established by the manufacturer. The assay checked for both immunoglobulin M (IgM) and immunoglobulin G (IgG) antibodies against individual pathogens.

Academia Open
Vol. 10 No. 1 (2025): June
DOI: 10.21070/acopen.10.2025.11394

1. An IgM positive result showed both acute and recent infection status.
2. A positive IgG test result indicates a patients previous exposure to either chronic infection or past contact with the disease agent.

A requirement to adhere strictly to testing quality controls continued from start to finish of operations which secured the accuracy of obtained results.

5. Classification of Gestational Age

The study participants received testing based on their gestational age during testing periods which determined their group assignment.

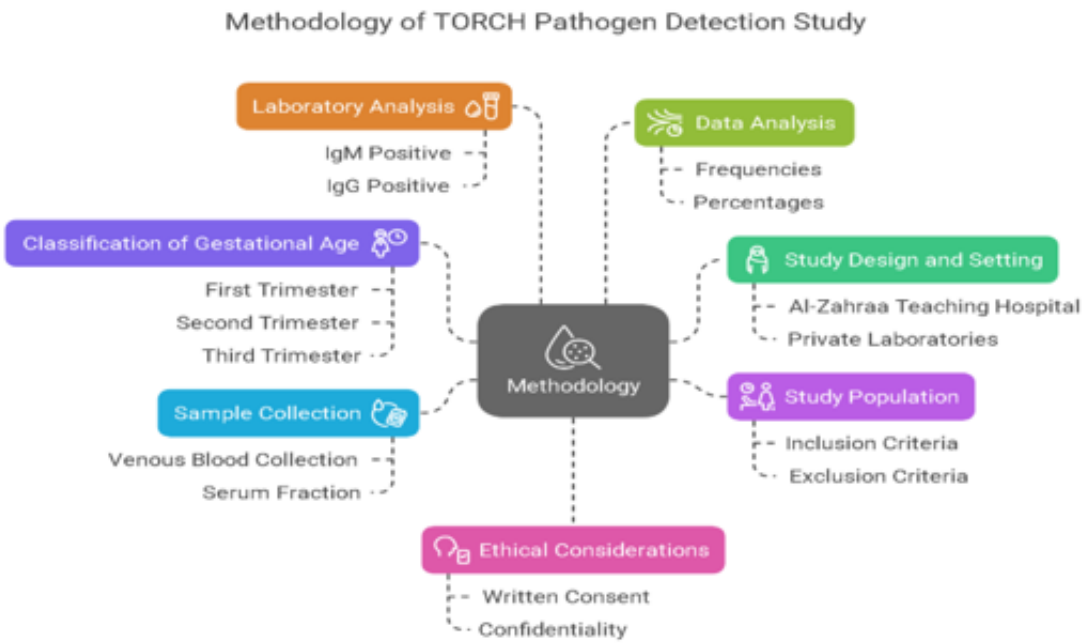
1. **First trimester: less than 14 weeks**
2. **Second trimester: 14–28 weeks**
3. **Third trimester: more than 28 weeks**

6. Data Analysis

The analysis and data entry proceeded using IBM SPSS Statistics version 29. Looking at different gestational age categories the researchers calculated the frequencies and percentages of TORCH results using descriptive statistical methods. The analysis examined pathogen IgM and IgG positive results according to maternal gestational age. The analytical methods only used counts and percentages since the study maintained a descriptive design thus inferring statistical tests were not possible.

7. Ethical Considerations

Prior to study commencement the local institutional review board granted ethical approval. Every participant provided their written consent following the study objectives explanation. All researcher practices protected participant information through strict confidentiality practices throughout the research duration.



Academia Open
Vol. 10 No. 1 (2025): June
DOI: 10.21070/acopen.10.2025.11394

Figure 1. *Overview of the Methodology Used for TORCH Pathogen Detection Among Antenatal Women in Najaf, Iraq*

C . Results

Table 1 shows that TORCH infections affected more women during their first pregnancy trimester, as 58.1% of positive results appeared in women who were less than 14 weeks pregnant. First-trimester primary infections acquired by pregnant women represent an essential concern because such infections maximize the risks of vertical transmission along with severe congenital anomalies. Fetal organogenesis at the early stage makes exposure to teratogens highly dangerous, resulting in potential spontaneous abortion with concomitant intrauterine growth restriction and severe neurological damage. TORCH positive results were less common in patients tested during the second trimester at 17.7% and the third trimester at 24.2%. During the second and third trimesters, pregnant women presented mostly negative results in their TORCH screenings (44.7% in the second trimester and 47.4% in the third trimester). As pregnancy progresses, the probability decreases for finding new or active TORCH infections because of prior immune system response as well as reduced exposure risks. The findings show that TORCH screening should become a mandatory part of antenatal care so healthcare providers can diagnose conditions and protect fetuses earliest possible.

Gestational Age (weeks)	TORCH Positive (n=62)	TORCH Negative (n=38)
<14 weeks (First Trimester)	36 (58.1%)	3 (7.9%)
14–28 weeks (Second Trimester)	11 (17.7%)	17 (44.7%)
>28 weeks (Third Trimester)	15 (24.2%)	18 (47.4%)
Total	62 (100%)	38 (100%)

Table 1. *Distribution of TORCH Screening Results According to Gestational Age (n=100)*

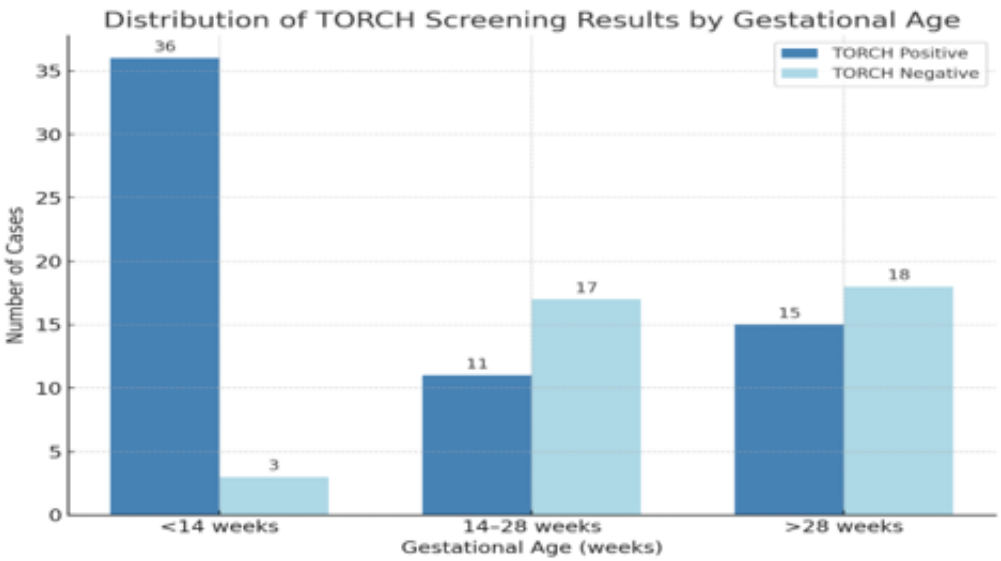


Figure 2. *Distribution of TORCH Positive and Negative Cases Across Different Gestational Age Groups*

Table 2 presents complete information about serological profiles involving TORCH infections across different gestational periods. Patients diagnosed with acute infections through IgM testing during the first trimester mainly tested positive for Toxoplasma gondii and Herpes simplex virus thus presenting an urgent risk for embryos. Acute toxoplasmosis together with herpes infections that occur during the first trimester result in severe fetal issues which may include hydrocephalus and

Academia Open
Vol. 10 No. 1 (2025): June
DOI: 10.21070/acopen.10.2025.11394

microcephaly with additional complications of chorioretinitis and intrauterine fetal demise. An IgM antibody detection in this stage requires immediate medical attention as it shows that the fetus faces severe health dangers. The majority of patients with TORCH pathogens showed IgG positivity as their main antibody response throughout the second and third trimesters with particular prevalence for Cytomegalovirus and Rubella virus. High levels of IgG antibodies maintain through pregnancy due to enduring protection provided by previous infections together with vaccinations. Medical professionals need to monitor patients with chronic CMV infection because the condition presents dangers for additional infections in the fetus. New exposures to Herpes simplex virus seem to be either infrequent or underidentified because this virus shows no presence during tests in the later stages of pregnancy. The recorded serological patterns strongly emphasize the necessity of conducting TORCH screening at the beginning of pregnancy and implementing regular antenatal tests because infections harming fetal health must be identified and managed throughout the pregnancy [10], [11].

Gestational Age	Pathogen	IgM Positive (Acute Infection)	IgG Positive (Chronic Infection)
<14 weeks	Toxoplasma gondii (T)	7	5
	Rubella virus (R)	4	8
	Cytomegalovirus (C)	2	7
	Herpes simplex virus (H)	3	0
14–28 weeks	Toxoplasma gondii (T)	2	1
	Rubella virus (R)	1	2
	Cytomegalovirus (C)	0	6
	Herpes simplex virus (H)	0	0
>28 weeks	Toxoplasma gondii (T)	1	2
	Rubella virus (R)	1	5
	Cytomegalovirus (C)	2	7
	Herpes simplex virus (H)	0	0

Table 2. *Reactivity of Immunoglobulins (IgM and IgG) for TORCH Pathogens According to Gestational Age*

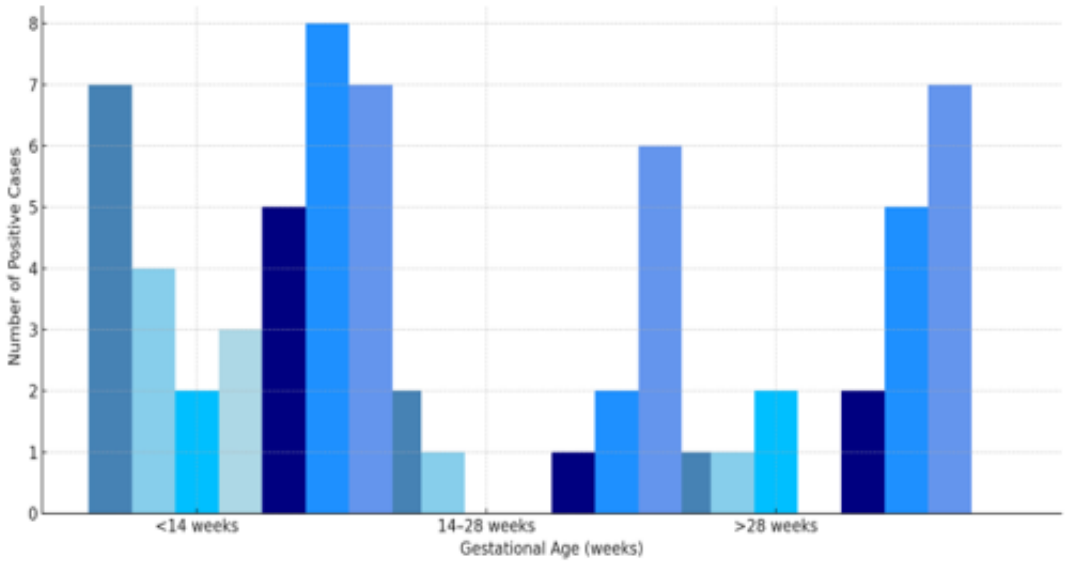


Figure 3. *Grouped Bar Chart Showing IgM and IgG Reactivity for TORCH Pathogens Across Different Gestational Ages*

D . Discussion

This study delivers vital information about TORCH infections occurring in pregnant women at Najaf, Iraq, while analyzing their immunological features. Research revealed that 58.1% of all TORCH infection positive results occurred among women during their first trimester of pregnancy. During the organogenesis stage of embryonic development, pregnant women demonstrate high rates of TORCH infection detection, which reveals their embryonic vulnerability to teratogenic infections that may lead to various catastrophic outcomes, including spontaneous abortion and congenital malformations and intrauterine growth restriction, and severe neurological problems [12], [13]. The autoimmune response for Cytomegalovirus (CMV) and Rubella virus showed increased transition from acute (IgM) to chronic (IgG) specificities from the second through third pregnancy trimesters. The observed distribution indicates that the maternal body acquired previously existing immunological protection, which provides passive protective benefits to the developing fetus according to Maldonado et al.'s description [14],[15]. Medical professionals should remain cautious about latent CMV reactivation since maternally reactivated CMV leads to congenital infection and not only first-time infections [16]. Research by Gilbert and Peckham showed that persistent CMV infections in pregnancy continue to transmit vertically and may cause developmental problems in newborns [17]. The identification of CMV-specific IgG antibodies should not automatically be treated as harmless due to possible risks during pregnancy so women with chronic CMV must receive ongoing care through their gestation period. Herpes simplex virus (HSV) demonstrated elevated rates of IgM detection during initial pregnancy trimesters while keeping a complete absence of HSV IgM in subsequent pregnancy periods. The epidemiological characteristics of HSV infections possibly explain this finding because most first HSV cases trigger active symptoms leading to early diagnosis. The reactivation rates of CMV were similarly low as observed by Al-Mashhadani et al. when evaluating CMV serological markers in Iraqi patients throughout pregnancy [18]. The 38% TORCH-negative finding across our study subjects mainly appeared in the second and third trimesters because past vaccination programs succeeded at protecting individuals especially from Rubella along with natural immunity development. Negative results of serology tests do not rule out potential new infections particularly among high-risk persons and communities which have restricted healthcare services. The data gathered from this study and other research provides strong proof to include routine TORCH testing in antenatal care standards particularly during early pregnancy. The prevention of primary infections becomes vital for maternal-fetal health when health education programs teach hygienic food practices to stop toxoplasmosis infections and present vaccination recommendations. The prevalence of TORCH infections in specific regions shows variations because of demographic and healthcare system aspects and cultural background elements. Research about congenital infections comparing different Iraqi provinces along with neighboring Middle Eastern nations would help develop specific guidance to prevent and manage congenital infections within particular regions.

E . Conclusion

The study reveals substantial infection rates and behavioral patterns of TORCH infections among pregnant women in Najaf Iraq because early gestation periods make the fetus particularly vulnerable. Evidence from the study confirms the importance of running standard TORCH examinations early in prenatal care to detect infections in pregnant women during their first trimester.Urgent identification of acute infections caused by Toxoplasma gondii, Cytomegalovirus, Rubella virus and Herpes simplex virus enables physicians to perform necessary treatments that decrease adverse fetal outcomes including congenital anomalies, miscarriage and limited intrauterine growth. The observed shift from acute to chronic immunological profiles during pregnancy trimesters, particularly for Cytomegalovirus and Rubella virus, underscores the dynamic characteristics of maternal immunity. Medical surveillance of latent CMV infection needs to continue throughout pregnancy because it presents an ongoing risk for vertical transmission. Preventative measures that integrate public health education about proper food cleanliness and immunization programs should be fundamental components of maternal-fetal healthcare.

Multicenter research across Iraq and surrounding zones should be performed because TORCH infection ranges vary geographically which would enable better prevention and treatment methods.

References

1. [1] F. S. Nabiyeva and S. I. Umirkulova, “Diagnosis and Prevention of TORCH Infection in Pregnant Women,” Web of Medicine: Journal of Medicine, Practice and Nursing, vol. 3, no. 1, pp. 76–78, 2025.
2. [2] X. Ren et al., “Serological Screening of TORCH Pathogen Infections in Infertile Women of Childbearing Age in Northwest China,” Reproductive Sciences, vol. 31, no. 9, pp. 2877–2884, 2024.
3. [3] M. Naseem et al., “TORCH Pathogens-Induced Histopathological Changes in Placental Tissues and Associated Post Obstetric Complications,” Acta Tropica, vol. 261, 107466, 2025.
4. [4] A. N. Fakhriddinovna, “The Impact of TORCH Infections on Pregnancy: Risks, Diagnosis and Prevention,” Shokh Library, pp. 521–529, 2024.
5. [5] E. Hunsperger et al., “Seroconversion and Seroprevalence of TORCH Infections in a Pregnant Women Cohort Study, Mombasa, Kenya, 2017–2019,” Epidemiology and Infection, vol. 152, e68, 2024.
6. [6] S. S. Firmino et al., “Toxoplasma Gondii Seropositivity and Co-Infection with TORCH Complex Pathogens in Pregnant Women from Araçatuba, Brazil,” Microorganisms, vol. 12, no. 9, 1844, 2024.
7. [7] R. A. Shqara et al., “The Utility of Maternal TORCH Screening Due to Obstetrical Indications in Detecting Congenital Infections: A Retrospective Observational Study,” Pediatric Infectious Disease Journal, vol. 43, no. 1, pp. 69–73, 2024.
8. [8] G. Pavia et al., “Seroprevalence and Age-Related Susceptibility of TORCH Infections in Childbearing Age Women: A 5-Year Cross-Sectional Retrospective Study and a Literature Review,” Journal of Infection and Public Health, 2024, 102537.
9. [9] A. Konopka et al., “A Comprehensive Review of TORCH Syndrome: Characterization and Prevention Strategies,” Quality in Sport, vol. 21, pp. 53987–53987, 2024.
10. [10] M. K. Yarmuxamedova, “Prevalence and Analysis of TORCH Infections Among Women of Reproductive Age in the Samarkand Region,” Shokh Library, 2025.
11. [11] E. P. Kahraman Kilbas et al., “Seroprevalence of TORCH Viral Agents in Pregnant Women in Turkey: Systematic Review and Meta-Analysis,” Pathogens, vol. 14, no. 1, 37, 2025.
12. [12] S. Kirat, “Investigation of TORCH Seroprevalence in a Tertiary University Hospital,” Medicine Science, vol. 13, no. 4, 2024.
13. [13] M. Naseem et al., “TORCH Pathogen-Induced Histopathological Changes in Placental Tissues and Associated Post Obstetric Complications in Pakistani Women,” 2024.
14. [14] R. A. Shqara et al., “The Utility of Serologic TORCH Testing During Pregnancy for Maternal-Related Versus Fetal-Related Indications: A Retrospective Study,” Pediatric Infectious Disease Journal, vol. 44, no. 3, pp. 257–262, 2025.
15. [15] S. Mansouri, Y. Alharbi, and A. Alqahtani, “Nanomaterials Connected to Bioreceptors to Introduce Efficient Biosensing Strategy for Diagnosis of the TORCH Infections: A Critical Review,” Critical Reviews in Analytical Chemistry, pp. 1–18, 2024.
16. [16] S. F. Zimmerman, S. H. A. Bonon, and S. T. M. Marba, “Systematic Review on Molecular Detection of Congenital and Neonatal Infections Caused by TORCH and SARS-CoV-2 in Newborns' Cerebrospinal Fluid,” Revista Paulista de Pediatria, vol. 43, e2023191, 2024.
17. [17] R. Karimah et al., “Successful Management of High-Risk Pregnancy with TORCH Infection History and Chronic Hypertension,” Journal of Medical and Health Technology, vol. 1, no. 2, pp. 6–14, 2024.
18. [18] J. J. U. Cedeño et al., “Prevalencia, Complicaciones y Pruebas Diagnósticas por Sensibilidad y Especificidad del Perfil TORCH en Gestantes y Recién Nacidos,” Revista Científica Salud BIOSANA, vol. 4, no. 4, pp. 183–201, 2024.