



RESEARCH ARTICLE

Epidemiological Insights into TORCH Infections in the Population of Erbil City

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ABSTRACT

A seroepidemiological study of the TORCH panel was conducted on inhabitants of Erbil City to provide updated baseline data on TORCH prevalence. 508 individuals were included in this study. 218 (42.91%) were females and 290 (57.09%) were males. Their ages ranged from 13 to 63 years, the majority being within the age group (21–30 years), 162 (31.89%) ($P < 0.05$). 20 individuals (3.94%) tested positive for anti-*Toxoplasma gondii* (TOX) immunoglobulin G (IgG) antibodies. One of the 20 (5%) tested positive for anti-TOX immunoglobulin M (IgM) antibodies, who was a 32-year-old female. 128 individuals (25.2%) (all females) tested positive for anti-Rubella IgG antibodies. 40 individuals (7.87%) were positive for anti-cytomegalovirus (CMV) IgG antibodies. One of the 40 (2.5%) also tested positive for anti-CMV IgM antibodies, who was a 26-year-old male. 18 individuals (3.54%) tested positive for anti-herpes simplex virus (HSV)-1 IgG antibodies. One of the 18 (5.56%) also tested positive for anti-HSV-1 IgM antibodies. One 18-year-old male (0.2%) tested positive for anti-HSV-2 IgG antibodies, and none were positive for anti-HSV-2 IgM antibodies. The results suggest the presence of *Toxoplasma*, CMV, HSV-1, and HSV-2 infections among the community, the majority ($P < 0.05$) being CMV followed by TOX and HSV-1 and finally HSV-2. The positive IgG results of rubella are most probably due to the obligatory vaccination program for females. Despite the fact that the majority of positive cases were for IgG, enhancing vaccination efforts and providing comprehensive health education is crucial for enhancing the well-being of the Erbil population.

Keywords: TORCH, epidemiology, transmission, prevalence, infectious diseases

INTRODUCTION

TORCH stands for toxoplasmosis, rubella, cytomegalovirus (CMV), and herpes simplex virus (HSV), which are four well-known causes of prenatal illnesses. After pregnancy ultrasound abnormalities are found, a TORCH serology panel is often utilized for testing maternal primary infections.^[1] Early recognition and management of congenital infections is important.^[2] However, most TORCH infections, including *Toxoplasma gondii* (TOX), rubella virus (RV), CMV, and HSV, are often unnoticed and pose diagnostic challenges due to their frequently asymptomatic nature and moderate to mild pathogenicity.^[3] Assessing antibodies against TORCH antigens early in pregnancy improves the evaluation of both maternal immunological state and the related risks of negative pregnancy outcomes.^[4] Maternal risk factors include missed immunizations, sexually transmitted diseases, and exposures to animals during pregnancy.^[5] Full screening with the TORCH panel is not advised for low-risk, asymptomatic expectant mothers.^[6] Pregnant women without rubella immunity are at

an increased risk of congenital rubella infection.^[7] In addition to providing comprehensive medical information regarding hospitalized children, this study concentrates on the general screening of TORCH in women of reproductive age, while congenital and perinatal TORCH infections are not covered.^[8] Precise information on the global, regional, and national prevalence of toxoplasmosis during pregnancy is needed to

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treat expectant mothers with the proper care.^[9] 1863 pregnant individuals were studied to determine the relationship between TORCH infections and aberrant pregnancy outcomes. The results showed that TORCH infection was a substantial risk factor for severe fetal harm in China, particularly congenital deformities.^[10]

Toxoplasmosis is a prevalent opportunistic infection that kills people who are immunocompromised.^[11] Transplacental transmission is one way that a primary illness in a pregnant woman might infect the fetus.^[12] Congenital toxoplasmosis in humans has a relatively high morbidity rate.^[13] The fetus may suffer serious neurological and ocular effects if the infection is passed from the mother to the unborn kid.^[14] A growing amount of data indicates that TOX exposure is decreasing in many high-income nations, but the precise causes of this trend are still unknown.^[15] German measles, sometimes known as rubella, are a virus that can cause congenital infections and devastating outcomes. For this reason, pregnant women should be especially concerned about this illness.^[16] Major abnormalities primarily stem from rubella infection during the initial 16 weeks of pregnancy. These abnormalities encompass deafness, eye and cardiovascular defects, central nervous system damage leading to intellectual disability, and a 50-fold elevated risk of later-onset type 1 diabetes.^[17] CMV is the most common congenital infection.^[18] Congenital CMV is the largest cause of non-genetic congenital hearing loss in much of the world, as well as a major cause of neurodevelopmental disorders.^[19] HSV causes both oral and genital herpes. HSV could be passed to the fetus, and HSV on an embryo may cause a variety of clinical consequences, including ventriculomegaly, microcephaly, intracerebral calcifications, limb dysplasia, eye problems, and fetal loss.^[20]

All the previously mentioned results have been among childbearing women. However, scarce data are available regarding TORCH among the normal population, including males who may be a source of infection to females, especially in Erbil City. Thus, the purpose of this study was to determine the prevalence of TORCH among inhabitants of Erbil City and the possible risk factors that lead to these infections.

METHODOLOGY

508 blood samples were collected from randomly selected individuals living in Erbil City. All of them were apparently healthy and had no chronic illnesses. The samples were collected during the period of June 2021 and June 2023. Each individual provided verbal consent.

Each person had 5 mL of blood withdrawn from them and transferred into a gel tube to separate the serum. Centrifugation was used to separate the serum for 10 min at 2200–2500 revolutions per minute. TORCH testing was conducted on the serum samples to identify specific immunoglobulin G (IgG) and immunoglobulin M (IgM) antibodies, employing an accessible commercial rapid strip test (Qingdao Hightop Biotech Co. Ltd., China), following the instructions of the manufacturer.

To analyze the TORCH IgG and IgM results, the data were entered into the Statistical Package for the Social Sciences Version 22 (IBM Corp., Armonk, NY, USA). A 5% threshold for significance was established, meaning that a $P < 0.05$ was considered statistically significant.

RESULTS

There were 508 participants in this study. Of the 508, 218 (42.91%) were females and 290 (57.09%) were males [Table 1].

The ages ranged from 13 to 63 year, the majority being within (21–30 years), 162 (31.89%) ($P < 0.05$) [Table 2].

20 individuals (3.94%) (8 [40%] females and 12 [60%] males) tested positive for anti-TOX IgG antibodies (one of 20 [5%] 18 years old, 3 of 20 [15%] were [21–30 years], 14 of 20 [70%] were [31–40 years], and 2 of 20 [10%] were [41–50 years]). One of the 20 (5%) tested positive for anti-TOX IgM antibodies, who was a 32-year-old female.

128 individuals (25.2%) (all females and all received the rubella vaccine) tested positive for anti-rubella IgG antibodies (51 of 128 [39.84%] were [21–30 years], 49 of 128 [38.28%] were [31–40 years], 27 of 128 [21.09%] were [41–50 years], and only one of 128 was 52 years old).

40 individuals (7.87%) (19 [47.5%] females and 21 [52.5%] males) tested positive for anti-CMV IgG antibodies (28 of 40 [70%] were [21–30 years], 11 of 40 [27.5%] were [31–40 years], and only one of 40 [2.5%] was in [41–50 years]). One of the 40 (2.5%) also tested positive for anti-CMV IgM antibodies, who was a 26-year-old male.

18 individuals (3.54%) (8 [44.44%] females and 10 [55.56%] males) tested positive for anti-HSV-1 IgG antibodies (one of 18 [5.56%] was 19 years old, 12 of 18 [66.7%] were [21–30 years], 4 of 18 [22.2%] were [31–40 years], and 1 of 18 [5.56%] was [41–50 years]). One of the 18 (5.56%) also tested positive for anti-HSV-1 IgM antibodies. One 18-year-old male (0.2%) tested positive for anti-HSV-2 IgG antibodies, and none were positive for anti-HSV-2 IgM antibodies [Table 3].

DISCUSSION

TORCH represents a group of pathogens linked to complications and consequences for both unborn and newborn children

Table 1: Gender of individuals included in studying the prevalence of TORCH among Erbil City inhabitants

Total samples	508	
	No.	%
Females	218	42.91
Males	290	57.09

Table 2: Age groups of individuals included in studying the prevalence of TORCH among Erbil City inhabitants

Total samples	508	
	No.	%
13–20	77	15.16
21–30	162	31.89
31–40	147	28.94
41–50	79	15.56
51–60	41	8.07
61–63	2	0.39

Table 3: Results of TORCH in individuals included in studying the prevalence of TORCH among Erbil City inhabitants

Test	Overall positive No.	%	No. of IgG positive	%	No. of IgM positive	%
<i>Toxoplasma</i> +ve	20	3.94	20	3.94	1	0.20
Rubella virus+ve	128	25.20	128	25.20	0	0
CMV+ve	40	7.87	40	7.87	1	0.20
HSV-1+ve	18	3.54	18	3.54	1	0.20
HSV-2+ve	1	0.20	1	0.20	0	0

IgG: Immunoglobulin G, IgM: Immunoglobulin M, CMV: Cytomegalovirus

during pregnancy. Elevated risk is particularly associated with primary infections during pregnancy. Countries lacking robust disease surveillance systems, the seroprevalence data concerning TORCH infections are essential for estimating levels of immunity and vaccination. In addition, they help gauge exposure rates and, consequently, the risk of infection during pregnancy.

A comprehensive review of the literature covering 30 years was undertaken to identify serosurveys on TORCH pathogens in Southeast Asia. The analysis of 96 identified studies revealed variations in the extent of research for different pathogens, with some well studied and others having limited available data. Studies from the more developed countries in the region were more prevalent. In addition, seroprevalence data were often restricted to specific geographic regions or cohorts within a country. There was a noticeable scarcity of recent serosurveys, and the overall study quality was frequently deemed inadequate. There is a clear need for well-designed, extensive serosurveys focusing on TORCH pathogens. If coupled with risk factor analysis, these studies have the potential to direct the creation and application of efficient infection control strategies, especially during pregnancy. Furthermore, urgent attention is required for educational programs targeting health-care workers and pregnant women during antenatal care.^[21]

The study of infectious diseases affecting both mothers and fetuses is vital in the realms of neonatology and obstetrics-gynecology, as it directly affects both fields' health individuals.^[22] Such infections are more prevalent among immunodeficient populations, including those HIV infections, organ transplants, and other conditions compromising the immune system.^[23,24] This research underscores the importance of conducting serological tests for infectious agents included in the TORCH panel within the population. This is crucial for assessing the overall health status, particularly among females, and for preventing infections during pregnancy.

In our current study, the prevalence of all five agents was relatively low. This may be attributed to the improvement of life quality in Erbil City and the increase in education regarding infectious diseases, in addition to the mandatory vaccination programs implemented on all children and adults, especially pregnant women.

In a previous study examining the prevalence of TORCH panel, serum IgG testing for infections revealed positive results for *T. gondii* at 27.4%, HSV-1 at 94.7%, and HSV-2 among women visiting the prenatal care clinic at a maternity hospital in Abha, Southwest Saudi Arabia 0.5%, CMV at 100%, and

rubella at 88.9%. Only 9.5% of serum IgM tested positive for CMV.^[25] These findings significantly exceed the results obtained in our present study.

A nationwide seroepidemiological investigation of TORCH was carried out among rural women in China to establish foundational data regarding TORCH prevalence. From 2010 to 2012, 1,541,329 women of reproductive age took part in the survey. Anti-CMV antibodies were detected in 602,251 of the samples, 40,055 for anti-TOX antibodies, and 858,072 for anti-RV IgG antibodies. Young individuals (25–34 years) had significantly greater TORCH prevalence ($P < 0.0001$). 49,988 (72.2%) of the 69,220 women (4.49%) who had gotten the RV vaccine had gained immunity as a result of it. 6,107 (0.40%) of the 1,541,329 women had positive anti-TOX IgM antibody tests, while 6,646 (0.43%) had positive anti-CMV IgM antibody tests, indicating TOX and CMV infections. These findings were discovered to be lower than in prior research, presumably due to advances in living standards and health practices in China.^[26]

There are large regional variations in the incidence of TORCH infections in women who are fertile. For example, the percentage of people who contract TOX infections varies from roughly 10% in the US and Switzerland to over 60% in Iran and Indonesia.^[27] Comparably, CMV infections show variation, with rates as high as 90% in Turkey and Korea and fewer than 50% in Ireland, France, and the United Kingdom.^[28,29] One of the most populous nations, China, had estimated countrywide seroprevalence rates of 2.3%,^[30] 38.6%,^[31] and 58.4%^[32] for TOX, CMV, and RV IgG antibodies in 2010 and 2012.

In a different study carried out in China, which involved women in the preconception stage. It included IgG antibodies for TOX, CMV, and RV, which were found in 2,409,137 persons with a prevalence of 3.20% (95% confidence interval [CI]: 3.18–3.22%), 77.67% (95% CI: 77.62–77.71%), and 76.03% (95% CI: 75.98–76.07%), in TOX, CMV, and RV, respectively. For TOX, RV, CMV, HSV-1, and HSV-2, the overall IgG/IgM seropositivity rates in China were 4.35%/0.35, 90%/0.63, 96.79%/0.97, 81.11%/0.14, and 6.1%/0.19%.^[3] These figures were considerably higher than those previously reported in Croatia.^[33]

Data on the seroprevalence of IgG and IgM antibodies against TORCH compounds in Romanian women were gathered by a comprehensive analysis. Finding population and regional variations as well as related risk factors were the goal. Twenty studies were included in the evaluation, and they showed that seroprevalence rates differed across the nation. Significantly, compared to Bihor, anti-*T. gondii* IgG seroprevalence rates were greater in Moldavia and Banat,

with notable declines in Banat. Higher *T. gondii* IgG levels were seen in older, multiparous, rural women. Anti-rubella IgG antibody prevalence was considerably reduced once the anti-rubella vaccine was introduced although recent drops in immunization rates have caused some worry. Geographic differences were noted in the seroprevalence of CMV and HSV, with rural areas typically having higher rates of CMV and HSV being influenced by variables including number of sexual partners and education level. In many cases, the simultaneous seroprevalence of several TORCH components indicates possible shared risk factors.^[34]

A study similar to the present one was carried out in Uzbekistan, focusing on the analysis of TORCH infections in the Republican Blood Transfusion Center among blood donors. Out of the 90 donors examined, 66 were men and 24 were women, within the age range of 18–60 years. The study revealed overall seropositivity of 20 (22.2%), 90 (100%), 88 (97.8%), and 90 (100%) for toxoplasmosis, CMV, rubella, and herpes, respectively, based on IgG antibodies.^[35]

The occurrence of RV infection in industrialized countries was shown to be minimal, primarily attributed to vaccination initiatives. However, in various countries, Nigeria (97.9%), Turkey (96.3%),^[36] India (83.4%), and southern Italy (85.8%)^[37] are among the countries where the frequency varies from 83.4% to 97.9%.^[38]

Several studies have been conducted in Erbil City for the prevalence of certain microbial diseases, including TORCH,^[39] HIV, hepatitis B virus, and hepatitis C virus^[40,41] in dumpsite workers, all of which call for an urge for microbiological surveys in Erbil City.

CONCLUSION

Our current study could be considered a preliminary study that needs further investigation. It emphasizes how important it is to continue surveillance and take preventative measures, such as immunizations and awareness campaigns to lessen the negative effects on pregnant women's health.

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