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Current status of TORCH infection Seroprevalence in pregnant women: a cross-sectional study in Al Sharqia Governorate, Egypt

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Abstract

Background TORCH infections during pregnancy significantly impact neonatal and maternal mortality rates worldwide. This study aimed to gather baseline serological data for pregnant women's immunological status to infection and determine if definite TORCH pathogens (*Cytomegalovirus*, *rubella virus*, and *Herpes simplex virus*) were associated with *Toxoplasma* infection, to improve prenatal care and provide appropriate infection control strategies.

Methodology Blood samples were gathered from 210 pregnant women attending Al Zagazig University hospitals from February to May 2023. Samples were examined for specific IgM and IgG antibodies against TORCH pathogens by electrochemiluminescence technique.

Results Regarding TORCH infection, 60 (28.6%) cases were seronegative, while 77 (36.7%), 63 (30.0%), 56 (26.7%), and 15 (7.1%) were positive IgG antibodies against *Toxoplasma gondii*, *Cytomegalovirus*, *rubella virus*, and *Herpes simplex virus*, respectively. There was no estimate for IgM for *Cytomegalovirus*, *rubella virus*, or *Herpes simplex virus*, indicating that no primary infection had been detected during the pregnancy. There was a statistically significant association between seroprevalence of toxoplasmosis infections (IgM and IgG) and age group ≤ 25 years, which is the most common childbearing age group. *Cytomegalovirus* seropositivity was found in those beyond 25 years (P -value 0.001). Antibodies to mono-infections were found in 97/210 (46.2%) subjects. It is substantially higher under-25 years age group, 71/97 (73.2%), P -value of 0.001. 45/210 (21.4%) participants had antibodies to two agents, with no significant difference in the age group over 25 years, 26/45 (57.8%). Antibodies to three agents were assessed in eight instances, all under 25 years.

Conclusions According to our findings, serological evaluation for the TORCH complex in all pregnant women is recommended to determine infection immunity, current immunization regimens, and infection reactivation. Low TORCH antibodies rates amongst pregnant women in Egypt's Sharqia governorate might be an appropriate starting point for prenatal screening initiatives.

Keywords *Toxoplasma gondii*, *Cytomegalovirus virus*, *Rubella virus*; *Herpes simplex virus*

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Background

The World Health Organization (WHO) implemented various strategies to eliminate preventable maternal and neonatal morbidity and mortality globally and locally. By 2030, improving maternal and child health will serve as a foundation for governments, communities, and families (WHO 2022).

Toxoplasma gondii (*T. gondii*), *Rubella* virus, *cytomegalovirus* (CMV), and *Herpes simplex* viruses (HSV) are called the TORCH complex (Zhang et al. 2022). The obligatory intracellular protozoan *T. gondii* infects warm-blooded animals, including humans and is globally distributed. Chorioretinitis, cerebral calcifications and hydrocephalus comprise the typical congenital toxoplasmosis trio (Fallahi et al. 2018). Congenital infections with CMV can have severe effects, including long-term neurological effects. Intrauterine growth restriction (IUGR), fetal hydrops, generalized petechiae, purpura, thrombocytopenia, jaundice, and other manifestations. Sensorineural hearing loss is the most common effect (Swanson and Schleiss 2013). The typical triad of *Rubella* is characterized by cataracts, cardiac defects, and sensorineural deafness, particularly when the infection starts during embryogenesis (Leung et al. 2019).

One of the significant causes of neonatal and maternal mortality globally is infection during various stages of pregnancy triggered by multiple pathogens, including the TORCH complex. These infections significantly contribute to worldwide neonatal and infant mortality rates (Zhang et al. 2022); they mostly result in mild to asymptomatic maternal morbidity. However, a significant influence on newborn outcomes was reported, with a spectrum of adverse outcomes such as restricted intrauterine growth (IUGR), congenital anomalies with varying degrees of long-term sequelae, and foetal death contingent upon the gestational age at the time of infection (Chung et al. 2018; Zhang et al. 2022).

The life cycles of TORCH agents exhibit distinct variations, and TORCH infections are purported to have enduring impacts throughout an individual's lifespan. The natural course of primary infection is associated with an elevation in IgG levels and a decline in IgM levels. It should be noted that IgG-seropositive women with CMV infection are not entirely immune to reactivation or reinfection by the same pathogen (Kagan & Hamprecht 2017; Heald-Sargent et al. 2020).

Since there is no baseline serological data on the TORCH infection immunity during pregnancy in Al Sharqia governorate, Egypt, it is critical to improve prenatal care and assess pregnant women's immunological status to the TORCH to provide appropriate counseling and infection control strategies. This study aimed to gather baseline serological data for TORCH infection

during pregnancy and determine if definite TORCH pathogens (*rubella* virus, CMV, and HSV) were associated with *T. gondii* infection in patients in Al Sharqia Governorate, Egypt.

Methods

Sample size calculation

According to Nirmal et al. (2017), the total prevalence of TORCH infection was 98.8%, and the lowest prevalence of individual infection was for *rubella* virus (9.2%). Considering the lowest prevalence (9.2%) at a power of the study of 95% and an alpha error of 0.05, the estimated sample size was 210 pregnant women.

Study population

This cross-sectional study included 210 pregnant women recruited from the Gynecology and Obstetrics Department at Zagazig University Hospitals in Zagazig, Al Sharqia, Egypt, for routine antenatal check-ups from February to May 2023. All women accepted participation in the current study were included regardless of their age, and past obstetric history. All the included females were informed about the study, its importance, and the potential drawbacks of puncture, and written consent to participate was obtained.

Questionnaire

The study utilized questionnaires to gather fundamental demographic and socio-economic information, as well as data related to knowledge about TORCH infection. Obstetrical histories such as gestational age, past occurrences of abortions, stillbirths, offspring with congenital anomalies, and the health of live-born children were also documented. The physical examination encompassed a comprehensive evaluation of the general, abdominal, and obstetric regions to identify potential systemic pathologies. Women who had undergone treatment for TORCH or were currently receiving treatment were excluded from the study at the time of enrollment.

Blood samples and serological tests

Five ml of venous blood was collected from each pregnant woman who consented to participate in the study. The blood specimens were transported to the central laboratory. Initially, the blood samples underwent centrifugation at a rate of 4000 revolutions per minute for 5 min. Subsequently, the sera were segregated and preserved at -20°C until further analysis. The Cobas e 411 immunoassay analyzer (Roche Diagnostics, Germany) was used for the TORCH panel screen for the detection of IgG and IgM antibodies for *Toxoplasma*, *rubella* virus, CMV, and HSVs using electrochemiluminescence (ELC) with kits obtained from COBAS (Roche Diagnostics) with Elecsys

TOXIGM (04618858119), TOXIGG (04618815119), CMVIGM (04784618190), CMVIGG (04784596190), RUBIGM (04618831190), RUBIGG (04618793190), HSV-1IGM (11,820,591,122), and HSV-1IGG (08948844190) according to manufacturer`s instructions.

Statistical analysis

Both data types, quantitative and qualitative, were collected and analyzed using SPSS (Statistical Package for Social Science) version 20.0 on an IBM-compatible computer (SPSS Inc., Chicago, IL, USA). Mean, standard deviation and range were the descriptive means of qualitative data, while the qualitative type was described as frequency and percentage. Comparing percentages of different studied groups was done using the Z test. Also, chi-square (X2) was used to compare groups with qualitative data. A *P-value* of less than 0.05 determined a statistically significant result.

Results

We recruited 210 pregnant women in our study, whose ages ranged from 19–35 years with a mean of 25.59 ± 4.04 years.

The routine check-up during the 1st trimester was the presenting complaint in 136 (64.8%) of the participants; 49 (36%) were seronegative to the TORCH test, while 87 (64%) were seropositive. 66 (31.4%) of the

participants had a history of previous abortion during the first trimester, 7 (10.6%) were seronegative to the TORCH test, whereas 59 (89.4%) were seropositive. Previous congenital abnormalities were noted in only eight cases (3.8%) of the individuals; four (50%) were seronegative to the TORCH test, whereas 4 (50%) were seropositive to the TORCH test (Table 1 & Fig. 1).

Data for all targeted IgM and IgG antibodies were analyzed. Regarding TORCH infection, 60 (28.6%) cases were seronegative, while there were 77 (36.7%), 63 (30.0%), 56 (26.7%), and 15 (7.1%) positive IgG antibodies against *T. gondii*, CMV, rubella virus, and HSV, respectively. IgM antibodies were found to be positive in 35 (16.7%) of the patients for *T. gondii* only, whereas no estimate was found for the remaining pathogens (Table 2).

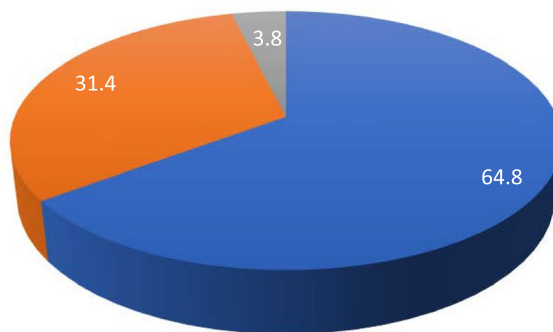
Table 3 represents the distribution of TORCH seroprevalence with age. A significant difference was found between pregnant women ≤25 years and those above 25 years concerning both toxoplasmosis and CMV seropositivity, with a *P-value* ≤0.001.

One hundred and twenty-eight women were below or equal 25 years old. Thirty of them were negative to TORCH panel, while the remaining exhibited seropositivity to *Toxoplasma* IgM, *Toxoplasma* IgG, CMV IgG, *Rubella* IgG, and *Herps simple* IgG in a variable percentage of 24.4%, 45.3%, 20.3%, 29.7%, and 8.6% respectively.

Table 1 Presenting complaints among the studied women

Presenting complaint	NO	Negative to TORCH	Positive to TORCH
NO	210	60 (28.6%)	150 (71.4)
Check during 1st trimester	136	49 (36%)	87 (64%)
Previous abortion during 1st trimester	66	7 (10.6%)	59 (89.4%)
Previous congenital anomalies	8	4 (50%)	4 (50%)

Presenting complaints among the studied women



■ Check during 1st trimester ■ Previous abortion during 1st trimester ■ Previous congenital anomalies

Fig. 1 Presenting complaints among the studied women

Table 2 Frequency of seroprevalence of TORCH immunoglobulin among all study participants (NO; 210)

TORCH infection	NO (%)
Seronegative	60 (28.6%)
<i>Toxoplasma</i> IgM positivity	
Positive	35 (16.7%)
Negative	175 (83.35%)
<i>Toxoplasma</i> IgG positivity	
Positive	77 (36.7%)
Negative	133 (63.3%)
CMV IgG positivity	
Positive	63 (30.0%)
Negative	147 (70.0%)
<i>Rubella</i> IgG Positivity	
Positive	56 (26.7%)
Negative	154 (73.3%)
<i>Herps simple</i> IgG positivity	
Positive	15 (7.1%)
Negative	195 (92.9%)

Pregnant women above 25 years old also showed different seropositivity to different TORCH elements. Seropositivity to *Toxoplasma* IgG, and IgM was reported at 4.9% and 23.2% respectively.

While seropositivity to CMV IgG, *Rubella* IgG, and *Herps simple* IgG were 45.1%, 22.0%, and 4.9% respectively.

In terms of confection, 150/210 (71.6%) has a wide range of infections. Antibodies to mono-infections were found in 97/210 (46.2%) of the subjects. It is substantially higher in the under-25 years age group, 71/97 (73.2%), P -value < 0.001. 45/210 (21.4%) participants had estimated antibodies to two agents, with no significant difference in the age group over 25 years, 26/45 (57.8%). Antibodies to three agents were estimated in eight instances, all of whom were under the age of 25 years (Table 4).

The most significant complaint was a check-up in the first-trimester visit in 68 cases, with mono-infection representing 70.1% while in all cases with mixed infection with three agents' previous abortion was the most significant complaint, with a P -value < 0.001. Previous abortion was the most significant complaint in patients screened positive for three agents representing 100%, followed by patient screened positive for two TORCH element with 57.8%, 25.8% in patients positive for one element and was the least reported complaint in negative women for TORCH. Previous congenital anomalies were reported in a very low percentage in negative pregnant women for TORCH and mono-infection at 6.7% and 4.1% respectively (Table 5).

A significant difference with a P -value < 0.001 was present between comorbidities of the TORCH complex, where combined CMV and *Rubella* seroprevalence showed the highest values 37/210 (17.6%), followed by *Toxoplasma* and *Rubella* seroprevalence at 16/210 (7.6%), *Toxoplasma* and CMV seroprevalence at 5.7%, and lastly, *Toxoplasma* and *Herpes simplex*, which were presented in four cases (Table 6).

Discussion

The TORCH complex pertains to the congenital infections caused by its infectious agents, which are transmitted to the fetus intrauterine and manifest various symptoms upon the child's delivery. The chronological occurrence of maternal infection is a crucial epidemiological determinant, as the extent of fetal impairment is typically contingent upon the stage of gestation. Except for HSV, infections contracted during the initial trimester of pregnancy exhibit the most unfavorable prognosis (Jaan & Rajnik 2023).

Despite its importance and consequences for maternal and child health, there are few statistics on the frequency of TORCH infections in pregnant women in Egypt. Most prior research endeavors individually examined the frequency of *T. gondii* infection and just mentioned other pathogens.

Table 3 Relation between serological tests of TORCH infection and age in study participants (No; 210)

	Women ≤ 25 years N (%) 128/210 (61%)	Women > 25 years N (%) 82/210 (39%)	Test	P value
Negative	30 (23%)	30 (36.6%)	1.9	0.06
<i>Toxoplasma</i> IgM positivity	31 (24.2%)	4 (4.9)	13.46	<0.001
<i>Toxoplasma</i> IgG positivity	58 (45.3%)	19 (23.2)	10.55	0.001
CMV IgG positivity	26 (20.3%)	37 (45.1)	14.65	<0.001
<i>Rubella</i> IgG Positivity	38 (29.7%)	18 (22.0)	1.53	0.22
<i>Herps simple</i> IgG positivity	11 (8.6%)	4 (4.9)	1.04	0.31

Table 4 The average incidence of TORCH infection with a heterogeneous aetiology

	No disease N (%) 60 (28.6%)	Infected with mono agents N (%) 97 (46.2%)	Infected with two agents N (%) 45 (21.4%)	Infected with three agents N (%) 8 (3.8%)	Total N (%) 210 (100%)
Age (years)					
≤ 25 years	30 (50.0%)	71 (73.2%)	19 (42.2%)	8 (100%)	128 (61%)
> 25 years	30 (50.0%)	26 (26.8%)	26 (57.8%)	0 (0.0%)	82 (39%)
Z test	1.9	6	1.26	3.5	
P-value	0.06	< 0.001	0.21	< 0.001	
Mono infection	The studied women				
	N = 210				
	N = 97				
			% from its category		% from the total group
<i>Toxoplasma</i>		54	55.70%		25.70%
<i>Rubella</i>		10	4.80%		10.30%
<i>CMV</i>		22	10.50%		22.70%
<i>Herpes simplex</i>		11	5.20%		11.30%
Double infection		N = 45			
<i>Toxoplasma + Rubella</i>		12	26.70%		5.70%
<i>Toxoplasma + Herpes simplex</i>		4	8.90%		1.90%
<i>Rubella + CMV</i>		29	64.40%		13.80%
Triple infection		N = 8			
<i>Toxoplasmosis + Rubella + CMV</i>		8	100%		3.80%

Table 5 The average incidence of Presenting complaint with a heterogeneous aetiology

Presenting complaint	No disease N (%) 60 (28.6%)	Infected with a mono agent N (%) 97 (46.2%)	Infected with two agents N (%) 45 (21.4%)	Infected with three agents N (%) 8 (3.8%)
Check during 1st trimester	49 (81.7%)	68 (70.1%)	19 (42.2%)	0 (0.0%)
Previous abortion 1st trimester	7 (11.7%)	25 (25.8%)	26 (57.8%)	8 (100%)
Previous Congenital anomalies	4 (6.7%)	4 (4.1%)	0 (0.0%)	0 (0.0%)
Z test (P-value)	7.5 (< 0.001)	4.06 (< 0.001)	4.65 (< 0.001)	3.5 (< 0.001)

Table 6 Coinfection between different types of TORCH infection

	<i>Toxoplasma</i>	<i>CMV</i>	<i>Rubella</i>	Test (P value)
<i>CMV</i>	12 (5.7%)	–	–	24.08 < 0.001
<i>Rubella</i>	16 (7.6%)	37 (17.6%)	–	
<i>Herps simplex</i>	4 (1.9%)	0 (0.0%)	0 (0.0%)	

Toxoplasmosis is acknowledged as a manageable yet potentially fatal ailment. Regrettably, the occurrence of primary infection during pregnancy can lead to irreversible fetal outcomes. This particular infection has the potential to manifest in individuals with compromised immune systems (Peyron et al. 2019).

T. gondii IgM seroprevalence indicating recent maternal infection was found to be positive in 35 (16.7%) of the

women who took part in the current investigation. *Toxoplasma* IgM seroprevalence was found to range between 7.7 and 76.7% among pregnant women in various nations and geographic regions within the same nation. Nigeria leads the list at 76%, followed by Brazil (50–75%), and India (24%) (Khan 2017). Our findings matched those recorded in India (18%), (Pal et al. 2011). Our findings were superior to the data from China (0.3%) (Cong et al. 2015) and to that recorded in the Sohag governorate in Egypt (0.8%) (Ahmed et al. 2018).

The current work found 77 (36.7%) pregnant women with *Toxoplasma*-specific IgG. The coinfection detected with toxoplasmosis was latent infection with *CMV*, *rubella* virus, and *HSV*. The regions with the highest prevalence rates of latent toxoplasmosis in pregnant women, as the World Health Organization (WHO)

reported, ranged from 56.2% in South America and 48.7% in Africa; to the lowest prevalence rate of 11.8% in the Western Pacific region. The prevalence rates for latent toxoplasmosis in pregnant women in other regions designated by the World Health Organization (WHO) were as follows: 35.1% in the Eastern Mediterranean region, 31.2% (with a confidence interval of 28.4% to 34.0%) in Europe, 28.2% in North America, and 23.4% in South-East Asia (Bigna et al. 2020). Accordingly, our findings were consistent with those in the Eastern Mediterranean region and outperformed those in North America and South-East Asia.

Our findings agreed with those obtained by previous Egyptian administrations. Beheira had (36.84%) (Elaadli et al. 2023), Sohag (37.2%), and Menoufia (31%). But other governorates exceeded our recorded results in Alexandria (41%) (Elaadli et al. 2023) and Gharbiya (64.7%) (El Deeb et al. 2012).

These disparities might be attributable to environmental variables such as climate, different research populations, interaction with domestic cats, lifestyle, study sample size, and diagnostic processes. Toxoplasmosis should be diagnosed and treated as early in pregnancy as possible, with a single dose of spiramycin achieving a complete cure. Therefore, pregnant women who exhibit seroconversion throughout their pregnancies should be closely monitored throughout subsequent pregnancies and encouraged to refrain from handling contaminated cat litter and consuming raw produce, meat, and dairy products. Additionally, in the absence of a toxoplasmosis vaccination, healthcare officials can prevent infection in expectant mothers through good hygiene, sanitization, and education (Sloan et al. 2022).

It was observed that there was a statistically significant association between seroprevalence of toxoplasmosis infections (IgM and IgG) and age group ≤ 25 years, which is the most common childbearing age group, highlighting the fact that high-risk antenatal women in all groups should be screened for TORCH infections to define the susceptible population (Khan 2017).

CMV seroprevalence in adults varies greatly between nations, ranging from 50 to 100%. Earlier Centers for Disease Control (CDC) reports indicated that by the age of 40, about half of all adults had been infected with CMV (CDC 2023). In the present study, CMV seroprevalence was relatively low (IgG: 30%) with no incidence of primary infection (IgM: 0%). To the best of our knowledge, this seroprevalence is the lowest ever documented in Egypt. A recent study evaluated CMV in pregnant women in Egypt, where IgG antibodies were positive in 39.7% (Ahmed et al. 2018) and 41.4% of cases (Eletreby et al. 2023). The findings were lower than previous studies in France and Canada at different time periods which

estimated maternal CMV seroprevalences of 50% in France (Leruez-Ville et al. 2013) and about 40% to 55% in Canada (Lamarre et al. 2016, Wizman et al. 2016 and Vaudry et al. 2010), and higher than that recorded by Balegamire et al. 2021 (23.4%) in Quebec. The elevated anti-CMV seroprevalences detected in Brazil, Mexico, China, and Turkey were explained by social determinants such as the increased and prolonged engagement of women of reproductive age in managing young children who may be carriers of the virus (Warnecke et al. 2020).

Our study's primary infection rate is lower than the expected yearly seroconversion rate during pregnancy in other nations, which might vary from 1% to 7 (Leruez-Ville et al. 2013; Balegamire et al. 2021). This might be explained by the likelihood that this study may not be generalizable to the entire community and hence underestimate maternal CMV seroprevalence in the general population.

Rubella, the viral infection, can be dangerous during the early stages of pregnancy due to the virus's teratogenic features. *Rubella* virus infection has been linked to a variety of adverse pregnancy outcomes, such as spontaneous miscarriages, intrauterine fetal death, premature labour, and congenital anomalies, which are referred to as congenital *Rubella* syndrome (Zahir et al. 2020).

Rubella IgG is recognized as a safeguarding antibody against recurring *Rubella* infections. Therefore, various guidelines, including those established by the WHO, strongly advise individuals to receive *Rubella* vaccination until they attain an IgG titer of 10 IU/ml anti-*Rubella* antibodies in their serum (Kempster et al. 2020).

In the present study, *Rubella* seroprevalence was relatively low (IgG: 26.7%) with no incidence of primary infection (IgM: 0%). The frequency of *Rubella*-specific IgG antibodies in reproductive-age women varies significantly, with some studies indicating a prevalence of 71.3% *Rubella* immunity, leaving around one-third of the women vulnerable to *Rubella* infection (Khan 2017). findings support the results recorded by some research in Egypt (27.3%) (Ahmed et al. 2018). *Rubella*-specific IgG antibodies have been reported at 87% in the North India (Dinkar and Singh 2020) and 89.4% in Iran (Nabizadeh et al. 2022).

The study makes it obvious that 73.3% of the participants were not immune to *Rubella*. This could be a result of low socioeconomic position, inadequate community education, or a lack of health care services and mandatory vaccinations in the country and the population's level of awareness, as hypothesized by Zahir and colleagues (Zahir et al. 2020). The variation in *Rubella* immune status across various nations could be attributed to the timing of *Rubella* vaccine implementation (in Egypt, it started in 1999) (Sayed et al. 2011).

The Government of Egypt began a statewide measles-*Rubella* vaccination campaign to target children aged 9 months to under ten years to lessen the burden of congenital *Rubella* syndrome, the MR vaccine campaign achieved an overall coverage of 98.2% in the mentioned age group (Kandil et al. 2019). However, it would be necessary to vaccinate women prone to pregnancy who missed vaccination and a booster dose if required to increase the immune status and prevent congenital anomalies caused by *rubella*.

The present investigation reported an HSV prevalence of 7.1%, which is comparable to those of a research endeavor that examined the seroprevalence of HSV in Brazil and reported 11.3% prevalence rates (Clemens and Farhat 2010) and is in contrast to the rates reported in Tanzania's rural areas of 37.7% (Ng'wamkai et al. 2019).

A significant risk of newborn morbidity and mortality was linked to widespread herpes infection, which is highly severe. Around eighty percent of infections were caught during childbirth, and the related fatality rate in untreated cases exceeded 75% (Fowler and Pass 2006). Therefore, to lower the risk of newborn herpes infection, pregnant women with HSV infection should receive proper prenatal, intrapartum, and postnatal care (Hamad and Konje 2021).

The findings of this study indicate that a considerable proportion of participants exhibited antibodies against mixed infections. Specifically, 17.6% of participants tested positive for both CMV and *rubella*, 5.7% tested positive for *Toxoplasma* and CMV, 7.6% for *rubella*, *Toxoplasma* and CMV IgG, and 1.9% tested positive for *Toxoplasma* and HSV. The most significant complaint in triple infection was previous abortion, while most checked routinely found their pregnancy had mono-infection or dual infection with a significant difference.

These findings are following Nirmal et al. (2017); their study showed that the co-occurrence of the TORCH complex in a mixed infection had a significantly negative prognosis. Therefore, obstetricians should be particularly mindful of such cases when encountering pregnant patients with bad obstetric history.

The present study revealed a noteworthy correlation between seropositivity to *T. gondii* and CMV and the age group of <25 years which is consistent with the findings of a study conducted in Varanasi (19–25 years) (Sen et al. 2012) and in contrast to another study in India by Nirmal et al., (2017) (<20 years). Research conducted in Turkey revealed a *Toxoplasma* seropositivity rate of 27.7% among individuals aged 35–44 years (Tüfekci et al. 2022). This finding emphasizes the need for screening high-risk antenatal women in all groups for TORCH infections, to identify the susceptible population.

Participants aged under 25 years old exhibited more infection rates than the other group. The current finding agreed with previous studies by other researchers who found that this age represent the frequent childbearing age in the community (Sen et al. 2012). It is also consistent with a recent study in China (Li et al. 2023).

Study restrictions

This study only involved one university hospital. As a result, data on the patients' living situations, socioeconomic levels, eating habits, and immunization status could not be fully gathered and assessed.

Conclusions

Finally, the findings for TORCH seropositivity among pregnant women in Sharqia governorate, Egypt, might serve as a useful starting point for prenatal screening programs. Because of the low seropositivity rates in our area, serological screening of all pregnant women for the TORCH complex is advised to assess infection immunity, current vaccination programs, and infection reactivation. Obstetricians should also treat mixed infections seriously to guard against poor obstetric outcomes and prevent newborn and maternal deaths.

Recommendation

The current findings help to alert public health administrative departments to the necessity for large-scale serological screening of all pregnant women to develop guidelines and policies to mitigate its possibly harmful implications. Furthermore, a health promotion approach in this sector should focus on increasing awareness of infection risk factors among women of reproductive age, resulting in a change in health behavior.

Abbreviations

<i>T. gondii</i>	<i>Toxoplasma gondii</i>
CMV	<i>Cytomegalovirus</i>
HSV	<i>Herpes simplex Virus</i>

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Author contributions

The manuscript was conceived, designed, and drafted by MG, and HS. Data acquisition was carried out by AE and HS. Statistical analysis was performed by MG, and WA; who also critically revised the text. The final version of the manuscript was reviewed and endorsed by all authors.

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Availability of data and materials

All data used for the study will be available upon request.

Declarations

Ethics approval and consent to participate

The current study protocol underwent review and received approval from the institutional review board at the National Liver Institute, Menoufia University, with reference number 00437/2023. Patients' confidentiality was upheld by omitting personal identifiers such as name and registration number during data compilation and assigning a unique identifier number instead. The authors have diligently adhered to ethical considerations, such as plagiarism error, information manipulation and deceit, twice publication and submission, and redundancy. All recruited women were informed about the research goals and a written consent was provided for participation in the current study.

Consent for publication

Not applicable.

Competing interests

There were no reported potential conflicts of interest relevant to this article.

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