

Research Article

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Serological study of *Toxoplasma gondii* in pregnant women: A systematic review and meta-analysis

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Abstract

Introduction: *Toxoplasma gondii* is a compulsory intracellular protozoan with worldwide spread. The parasite is transmitted from infected mothers to the fetus by eating raw or undercooked meat containing *Toxoplasma* cysts, drinking water or eating food contaminated with oocytes in cat feces, organ transplants, blood transfusions or congenitally infected mothers. The aim of this study was to evaluate the serological study of *Toxoplasma gondii* in pregnant women.

Methods: The methods used in this systematic review have been developed based on the Checklist Guidelines (PRISMA). The study includes cross-sectional studies, case studies, and cohort studies, and excludes case reports, letters to editors, case reports, clinical trials, study protocols, systematic reviews, and reviews.

Results: Based on the random effect model, the total prevalence of *Toxoplasma gondii* in 2822 pregnant women was 23% (95% confidence interval and 99.5% 22-25%).

Conclusion: Methods of transmission of *Toxoplasma* infection as well as its prevention should be considered in educational programs, especially for pregnant women. On the other hand, performing *Toxoplasma* screening tests in pregnant women will be effective in ensuring community health.

Keywords

Toxoplasmosis,
Serology,
IgG,
IgM,
Pregnant Women ,
Toxoplasma gondii

Introduction

Toxoplasma gondii is a compulsory intracellular protozoan with worldwide spread(1). Warm-blooded animals and humans have been the host hosts for the parasite, but its main hosts are domestic cats and some cats(2). The parasite is transmitted from infected mothers to the fetus by eating raw or undercooked meat containing *Toxoplasma* cysts, drinking water or eating food contaminated with oocytes in cat feces, organ transplants, blood transfusions or congenitally

infected mothers(3). Although infection with this protozoan is usually asymptomatic in people with a healthy immune system and may sometimes cause symptoms similar to mild flu and cervical lymphadenopathy, it can lead to clinical manifestations in immunocompromised individuals and infants with congenital toxoplasmosis (4). Severe such as chorioretinitis, pneumonitis, encephalitis, myocarditis or even death (5). In general, 1.5 cases of congenital

toxoplasmosis occur per 1000 live births (6). The highest incidence is in South America and some Middle Eastern and low-income countries. Although the risk of congenital infection in the first trimester is low (15-10%) and the highest incidence of infection is in the third trimester (60-90%), nevertheless, congenital infection in the first trimester can lead to severe complications including Spontaneous abortion, fetal and infant death or various congenital defects such as hydrocephalus, central nervous system abnormalities and chorioretinitis (7). Therefore, early diagnosis and timely treatment of infection in pregnant women is very important in maintaining the health of mother and child (8). Although various sources state that only acute untreated infection during pregnancy can lead to congenital toxoplasmosis with neonatal complications and latent infection cannot be transmitted to the fetus before pregnancy, some researchers believe that latent toxoplasmosis may also be present in Pregnancy is involved in causing various neurological disorders in mothers and children (9). Laboratory diagnosis of latent and acute toxoplasmosis is based on the diagnosis of specific IgG and IgM antibodies against *Toxoplasma gondii* (10). IgM antibodies are detectable in the blood about a week after infection and may persist for several months and are important in the diagnosis of acute toxoplasmosis (11). The presence of IgG antibodies in the blood also indicates infection, but alone does not provide any information about when the infection started. There are several serological tests to detect anti-*Toxoplasma* IgM and IgG antibodies, among which the ELISA method is more sensitive (12).

Methods

Inclusion criteria (eligibility criteria)

The methods used in this systematic review have been developed based on the Checklist Guidelines (PRISMA). The study includes cross-sectional studies, case studies, and cohort studies, and excludes case studies, letters to editors, case reports, clinical trials, study protocols, systematic reviews, and reviews.

Participants: All studies on the prevalence of *Toxoplasma gondii* in pregnant women were studied.

Results: The main purpose of the study was the prevalence of *Toxoplasma gondii* in pregnant women.

Sampling methods and sample size: All observational studies, regardless of their design, were included in the systematic review. The minimum sample size was 25 patients or more.

Search strategy

The searches were conducted by two independent researchers and the purpose of the search was to find published studies from 1/1/2009 to 5/30/2019. Studies published in MEDLINE were searched through PubMed, EMBASE through Ovid, the Cochrane Library, and an English language database. For studies published in Iran, we searched the national database (Magiran and SID). To ensure the adequacy of the studies, a list of research sources or related studies found by the search was read. Systematic review articles using MESH terms and expressions were searched in accordance with print standards, and after the MEDLINE strategy was finalized, the results were compared to search other databases, and PROSPERO was searched for recent or ongoing systematic reviews. Used in the search strategy are: Toxoplasmosis, Serology, IgG, IgM, Pregnant Women, *Toxoplasma gondii*.

Select study and extract data

The two researchers independently analyzed the titles and abstracts of the articles according to the eligibility criteria. After deleting additional studies, the full text of the studies was collected based on the eligibility criteria and information about the authors if necessary. General information (relevant author, province and year of publication), information about the study (sampling technique, diagnostic criteria, data collection method, research conditions, sample size and risk of bias) and output scale (frequency of *Toxoplasma gondii* in pregnant women) was collected.

Quality evaluation

The developed scale of Hoy et al. Was used to assess the quality of the method and the risk of bias in each observational study.

Translation results

Collecting data All eligible studies were included in the data collection after systematic review and the data were integrated using the accumulation diagram. The random effects model was evaluated based on the overall prevalence of the disease among the participants. The heterogeneity of the initial studies was assessed using the I^2 test. In addition, subgroups

were analyzed to determine heterogeneity based on age of participants, year of publication, and country. Finally, a meta-analysis was performed in STATA14 statistical software.

Results

A total of 780 articles were extracted through initial searches in various databases. Of the 780 studies identified by analyzing titles and abstracts, 530 studies were omitted due to irrelevant titles. Out of the remaining 250 studies, 218 articles were deleted. Out of the remaining 32 studies, 9 studies had study criteria. (figure 1).

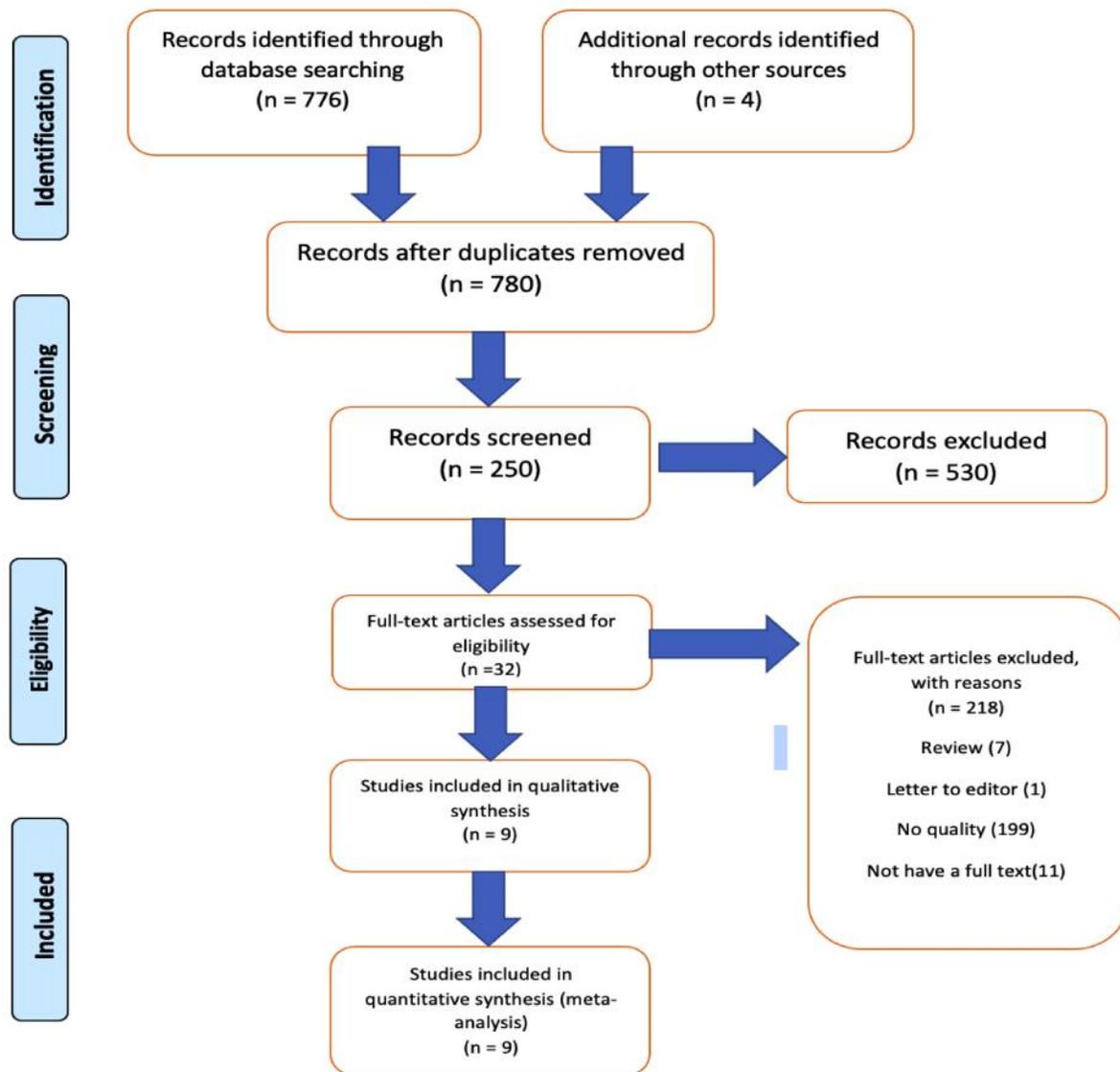


Figure 1.PRISMA flow diagram

Research specifications

A total of 2822 pregnant women were evaluated. All nine studies were retrospective. A total of 9 studies from 9 provinces that met the inclusion criteria were reviewed. Studies were from Zabol,

Tabriz, Ardabil, Nikshahr, Jahrom, Kerman, Urmia, Kazerun and Chaharmahal Bakhtiari. Easy sampling method was used to select the sample. The risk of bias was low in most studies. The main method of data collection was medical records. The main study sites were hospitals.

Table 1. Summary of included studies

Author	Year	Province	Patients	Prevalence	Publication bias	SE
Maani ¹⁹	2020	Jahrom	370	29.5%	Low	0.0324
Alimohammadi ²⁰	2008	Ardabil	272	42%	Moderate	0.0299
Mousavi ²¹	2014	Nikshahr	183	10.3%	Low	0.0221
Fallah ²²	2005	Tabriz	1000	21.8%	Low	0.0130
Aali ²³	2010	Kerman	57	30.8%	Low	0.0612
Tappeh ²⁴	2015	Oroumiye	346	28.32%	Low	0.0241
Jahantigh ²⁵	2020	Zabol	90	14%	Low	0.0365
Ebadi ²⁶	2010	Kazeroon	120	17.5%	Low	0.0350
Naeini ²⁷	2006	Chaharmahalvabakhtiyary	384	27.6%	Low	0.0229

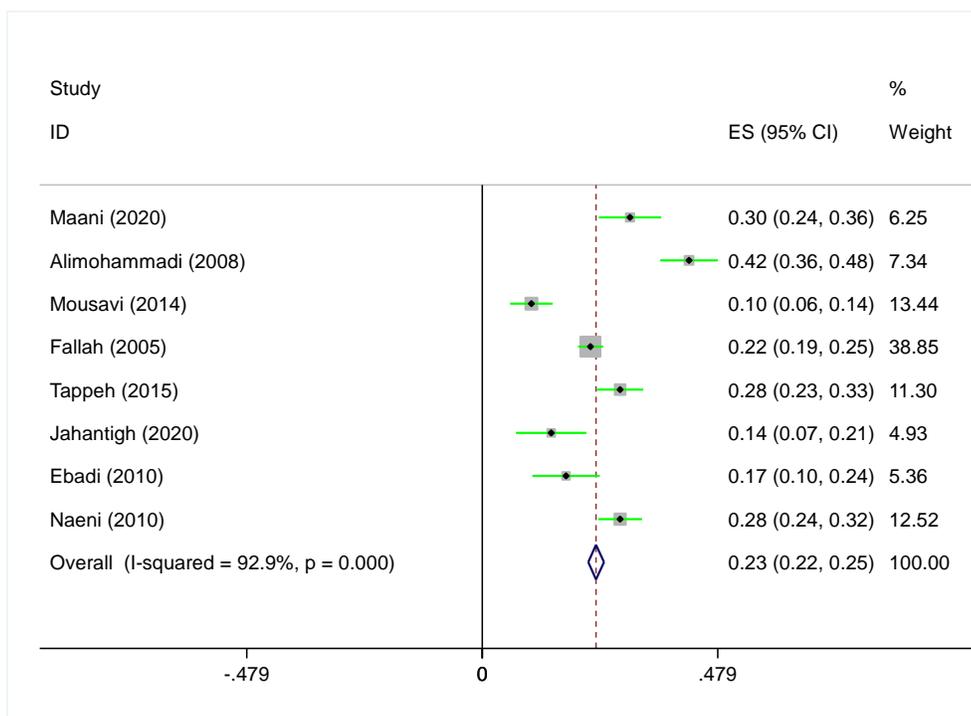


Figure 2. Meta analysis of Serological study of *Toxoplasma gondii* in pregnant women

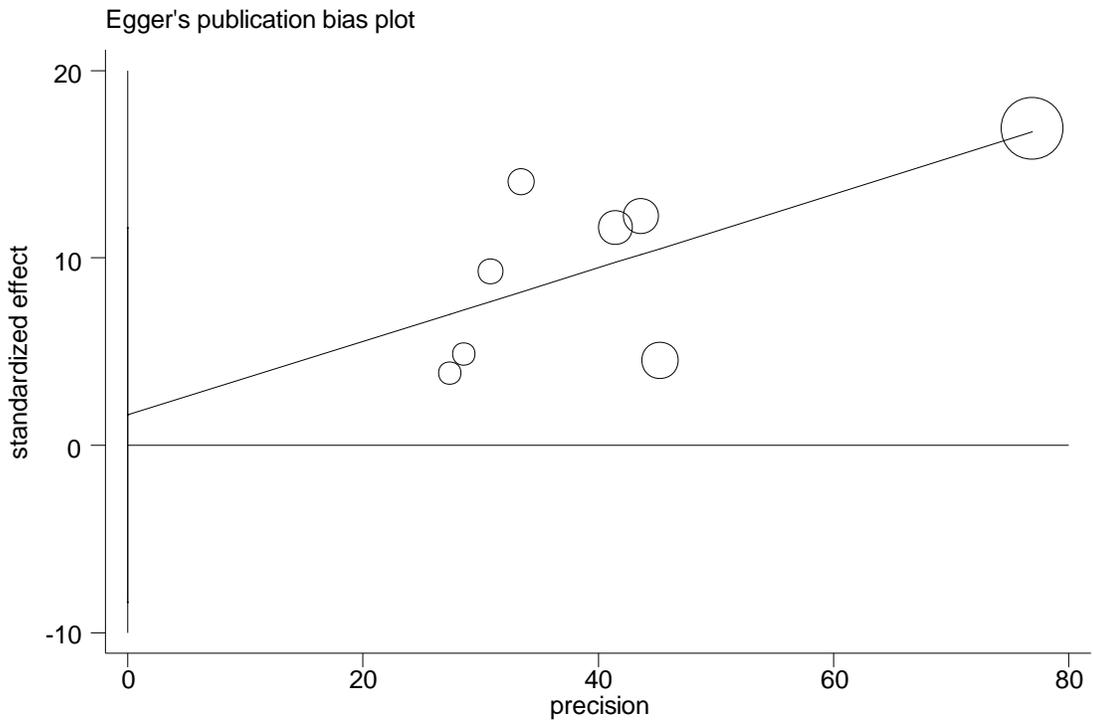


Figure 3. Egger's publication bias plot of Serological study of *Toxoplasma gondii* in pregnant women

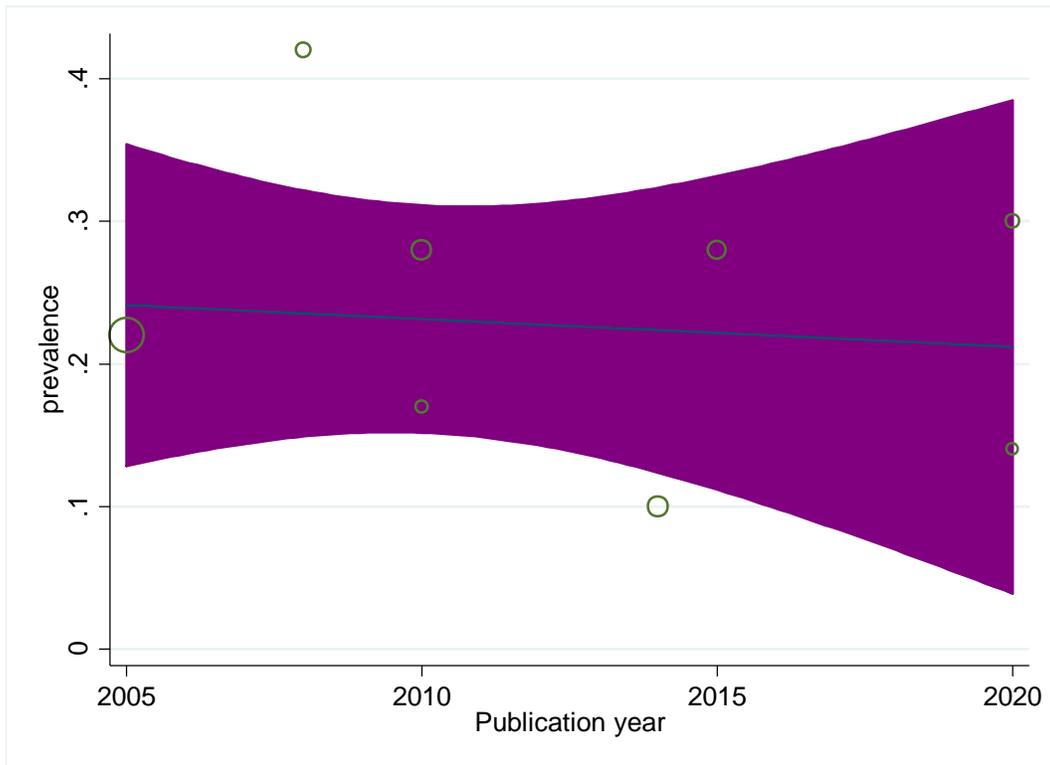


Figure 4.3: Meta-regression between study publication year and prevalence of Serological study of *Toxoplasma gondii* in pregnant women

Meta-analysis of *Toxoplasma gondii* in pregnant women:

Based on the random effect model, the total prevalence of *Toxoplasma gondii* in 2822 pregnant women was 23% (95% confidence interval and 99.5% 22-25%) (Figure 2).

Discussion

Due to the importance of toxoplasmosis in humans, many studies have been conducted by researchers on different population groups, including pregnant women in different parts of Iran and the world, and different results have been announced on the prevalence (13). The prevalence of Toxoplasmosis infection in humans is highly variable and depends on nutritional behaviors and environmental behaviors (14). Prevalence varies by age, geography, eating habits, and keeping cats at home (15). Risk of occurrence of acute primary toxoplasmosis infection during pregnancy due to factors such as prevalence of antiparasitic antibodies and dermatitis (16). And depends on the stage of pregnancy during which the transmission of the infection takes place (17). Signs such as chorioretinitis, psychomotor and mental retardation, anemia, jaundice, pneumonia, microcephaly, hydrocephalus, and intracranial calcifications and epilepsy in infants can guide guideline for the diagnosis of congenital toxoplasmosis is considered probable (18). About one-third of all women who become infected with *Toxoplasma gondii* during pregnancy pass the parasite on to their fetuses (19). One of the various factors that affect fetal health is gestational age (20). Women who are seropositive to toxoplasmosis before pregnancy are usually more resistant to acute infection (21). Considering the importance of health and treatment and the material damages imposed by this disease, the issue of disease prevention should be considered by the health care staff and at-risk groups, especially pregnant women and people with immunodeficiency under care (22). Be more hygienic (23). Therefore, the prevalence and measurement of anti-Toxoplasma antibodies before pregnancy is a useful step to determine the amount of positive cases of anti-

Toxoplasma IgG and IgM antibodies and also the relationship between these positive cases and the effective variables in the disease.

Conclusion

Methods of transmission of Toxoplasma infection as well as its prevention should be considered in educational programs, especially for pregnant women. On the other hand, performing Toxoplasma screening tests in pregnant women will be effective in ensuring community health.

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