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Short communication

Prevalence of Chronic *Toxoplasma gondii* Infection Among Women Who Had Undergone Abortion in Tobruk and Surrounding Areas, Libya.

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Abstract
Toxoplasmosis is a major cause of infection among pregnant women exposed to cat feces or consuming contaminated, undercooked meat. In this study, 80 serum samples were collected from women who had miscarried in Tobruk, eastern Libya. All samples were transported to a specialized center in Tobruk for testing for Toxoplasma gondii (IgA) antibodies using the enzyme-linked immunosorbent assay (ELISA), an important biotechnology for detecting this parasite, following the supplier's instructions. After testing the samples from the miscarried women, Toxoplasma gondii antibodies were found in 54% of the samples. This percentage indicates a high prevalence of this parasite. According to this study, further surveys should be conducted in other areas of Libya to provide statistical data on the prevalence and impact of this parasite, as it is a real risk factor for miscarriage, in addition to the recent rise in household cats.
Keywords: Toxoplasma Gondii, Women, Cats, Tobruk, ELISA, Antibodies, Pregnant.

Introduction

It is a parasitic disease that is considered one of the main causes of miscarriage in pregnant women around the word It is a parasitic disease that is considered one of the main causes of miscarriage in pregnant women around the world [1]. It also infects almost all animals, especially warm-blooded ones. It is one of the most widespread diseases around the world. Due to its great importance as a causative agent of a zoonotic disease, more than 16,000 original research articles and books have been published [2]. However, there are many aspects unknown about this parasite in terms of epidemiology, methods of infection, and life cycle [3-5].

In the late 1960s, the heterogeneous life cycle of Toxoplasma gondii was demonstrated, as infectious stages were found in cat feces when swallowed by the intermediate host, causing infection. Electron microscopy was used, and structural similarities with some species of Eimeria were revealed [6]. Through epidemiological studies conducted after the discovery of its heterogeneous life cycle, it was proven that there are two strains within Toxoplasma gondii, one of which is weakly virulent, and the other is highly virulent [7].

Unhealthy practices such as eating undercooked meat and improperly boiled milk contaminated with this parasite are among the main reasons for its transmission to pregnant women and other humans. Direct contact with pets, especially cats, that are not medically monitored and whose owners do not adhere to administering specific vaccines against the parasite, poses a risk to pregnant women, leading to fetal abnormalities and miscarriage, especially in the first months [8]. People with weak immunity are infected with this parasite and show a range of symptoms, often cold symptoms that progress to pneumonia, cough, swollen lymph nodes for several days and may reach weeks, skin rash, headache, and some infections can be concentrated in the eyes, causing eye pain, blurred vision, and impaired vision. The disease may become severe until it reaches encephalitis and epileptic seizures. When the infection reaches the fetus, it is called congenital toxoplasmosis [9]. The danger of this parasite is that it is highly transmitted between women due to their attachment to raising pets, especially cats. All women are advised not to deal with animals in general and cats in particular, and to wear personal protective equipment when dealing with pets, as well as to dispose of pet waste and clean the utensils and equipment of these animals' food periodically using effective disinfectants, and avoid direct contact, especially during pregnancy [10].

According to global reports and research, 50% of women around the world, especially in the Arab world, suffer from miscarriages caused by this parasite. The most common causes of transmission are eating undercooked meat or drinking contaminated milk from an unknown source. A higher degree of transmission is direct contact with pets without paying attention to vaccinations and following up with a specialized veterinarian [11]. There are many conflicting studies between Toxoplasma gondii and AIDS, as well as Crohn's disease, polymyositis, rheumatoid arthritis, and thyroid disease [12]. This parasite causes economic losses in the livestock sector, especially in goats and sheep, and the infection lies in the eye [13]. In this study, the ELISA technique was used to determine the prevalence of Toxoplasma gondii (IGA) in women who had abortions in Tobruk city.

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Methods

Study Design

This research was designed as a cross-sectional study conducted in Tobruk, Libya, between May and December 2021. The study aimed to determine the prevalence of *Toxoplasma gondii* infection among women who had experienced miscarriages.

Sample Collection and Ethical Considerations

This cross-sectional study was conducted in Tobruk, Libya, between May and December 2021. A total of 80 serum samples, previously collected for routine diagnostic purposes at the Tobruk Specialized Center, were used. Patient identities were fully anonymized, and no personal identifiers were accessible to the researchers. No direct contact with participants occurred. Since the study utilized only leftover, de-identified samples originally collected for medical testing, it qualified for exemption from direct human subject research according to international ethical guidelines. All procedures were conducted in compliance with local laws and relevant ethical standards. Inclusion criteria comprised women of reproductive age (18–40 years) who had experienced miscarriage during the study period. Exclusion criteria included women with chronic illnesses (e.g., diabetes, autoimmune disorders), confirmed concurrent infections, or incomplete/contaminated samples[14].

Statistical Analysis

Data were entered and analyzed using SPSS version 25 [15]. Descriptive statistics (frequency and percentage) were used to summarize categorical variables [16]. The prevalence of Toxoplasma gondii infection was compared across age groups using the Chi-square test (x^2). Fisher's exact test was applied when expected cell counts were <5. A p-value <0.05 was considered statistically significant. Results are presented as percentages with 95% confidence intervals where applicable [17].

ELISA Test

In this test, IgG and IgM antibody levels to *Toxoplasma gondii* were measured using a commercially available Acon test [18]. The manufacturer's instructions were strictly followed, and the test was performed in a sterile environment. Two replicates were performed. Results were considered positive when the index was above the cutoff value. The cutoff value was estimated using previously known independent negative serum samples.

Toxoplasma gondii was detected using ELISA, a specialized antibody detection technique. The test plate contains 96 wells micro-coated with parasite antigens. The test materials were then placed, incubated, and washed. The antibody complex was then added. A blue complex appears, then turns yellow. The manufacturer's instructions must be followed carefully. Statistical analysis was performed using manual statistical formulas to present the data.

Results and discussion

In this study, 80 samples were collected from women who had experienced abortions in Tobruk. Serological examination revealed that 54% were positive for IgA antibodies against Toxoplasma gondii, indicating chronic infection. The distribution of infection across age groups (20–25 years: 56%, 26–30 years: 63.6%, 31–35 years: 41.7%) showed no significant age-related difference, suggesting that maternal age was not an independent risk factor (Table 1, Figures 1–2).

Table 1. The incidence of Toxoplasma gondii infection among pregnant women

	Ages of pregnant women			**Total N/80**
(IgA) positive samples for Toxoplasma gondii antibody	20 /25 N/34	26/30 N/22	31/35 N/24	
	N/19 56%	N/14 63.6%	N/10 41.67%	43(54%)

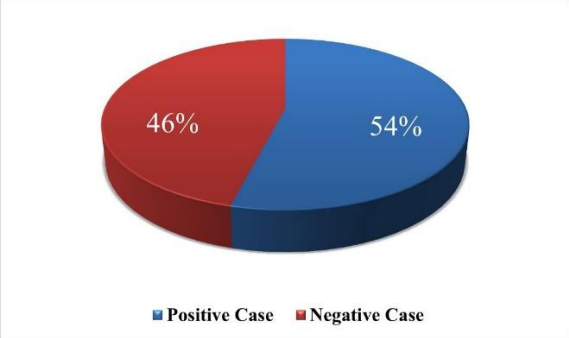

Figure 1. Samples for IgA antibodies against Toxoplasma gondii.

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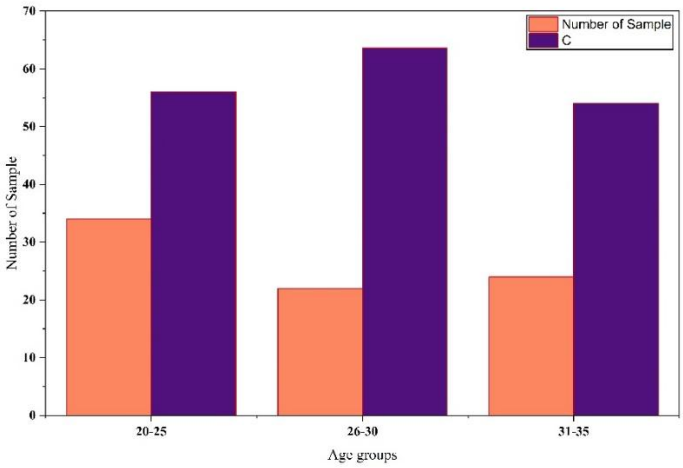

Figure 2. The prevalence of IGA against Toxoplasma gondii among women who had an abortion by age group

The prevalence reported here is markedly higher than that documented in previous Libyan studies, which found infection rates of about 20% in pregnant women in Benghazi and 14% among children in Tripoli. Such discrepancies may be related to differences in dietary habits (e.g., consumption of undercooked meat), exposure to cats and other domestic animals, or variations in awareness and preventive practices between regions [19]. When compared to other countries, the prevalence observed in this study (54%) falls within or even above the ranges previously reported. For example, studies in Egypt and Sudan reported rates between 35% and 55%, while in Algeria, toxoplasmosis is also considered highly prevalent. Interestingly, a previous Libyan report noted a 31% prevalence among pregnant women, which is considerably lower than the current findings [13]. This may reflect a true increase in infection burden in some areas or differences in sampling and diagnostic approaches [20]. The elevated IgA levels detected in our cohort reinforce the role of T. gondii as a significant contributor to spontaneous abortion, particularly in the early stages of pregnancy [21].
This aligns with global evidence that toxoplasmosis is one of the leading infectious causes of miscarriage during the first trimester. The lack of correlation with age in this study suggests that environmental exposure and immune response, rather than maternal age, are the primary determinants of susceptibility [22]. Overall, these findings emphasize the importance of implementing routine toxoplasmosis screening in antenatal care, particularly for women with a history of miscarriage. Public health initiatives should also focus on educating women of childbearing age about transmission risks and preventive measures. Further multicenter studies in Libya are warranted to clarify regional variations and provide a stronger basis for national prevention strategies.

Conclusion

According to this study, this parasite is considered a risk factor for miscarriage in pregnant women, although symptoms are not immediately apparent. However, there is a significant risk to the developing fetus. Surveys should be conducted to determine its prevalence. Preventive measures should be taken when handling pets, meat should be thoroughly cooked before consumption, and mothers should be educated about the dangers of this parasite, especially when handling cats or consuming contaminated meat.

Conflict of interest. Nil

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