

Prevalence and Outcomes of Maternal Toxoplasmosis on Pregnancy

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ABSTRACT

Toxoplasmosis, a zoonotic disease caused by the bacterium *Toxoplasma gondii*, affects more than one third of the world's population. In developing countries, it is associated with increased complications and peri-natal morbidity and mortality. The screening of pregnant women for antibodies against *Toxoplasma gondii* is an essential part of prenatal care. Therefore, the current study aimed to identify the prevalence and outcomes of Toxoplasmosis on pregnancy among women attending Nangarhar University Teaching Hospital. A cross-sectional study was conducted on 348 women who were screened for IgG and IgM antibodies from April to November, 2024. A non-probability convenience sampling was used. Data were collected through questionnaires from hospital-based medical records of all participants. Those women visiting the obstetrics and gynecology department with clinically or laboratory-confirmed *Toxoplasma gondii* infection. The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26. A total of 2,972 pregnant women attending antenatal care at Nangarhar University Teaching Hospital were screened for *Toxoplasma gondii*. Among them, 348 (11.7%) tested seropositive, while 2,624 (88.3%) tested negative. The participants' age ranged between 25 to 35 years, and most presented during the second trimester. Among the seropositive women, reported fetal complications included abnormal development (24.7%), abortion (5.7%), intrauterine fetal death (2.9%), low birth weight (4.0%), stillbirth (2.6%), and central nervous system (CNS) disorders (1.4%). Animal contact was reported in 121 (34.8%) of cases, whereas 226 (64.9%) reported no such history. The study concluded that 11.7% of pregnant women were seropositive for Toxoplasmosis, which is associated with a high risk of fetal complications such as abortion, intrauterine fetal death, low birth weight, stillbirth, hydrocephaly, microcephaly, chorioretinitis, and fetal CNS disorders, thereby highlighting the need for routine screening and continuous monitoring during antenatal care.

Keywords: Maternal, Outcomes, Prevalence, Pregnancy, Toxoplasmosis, *Toxoplasma gondii*

INTRODUCTION

Toxoplasmosis is an infectious disease caused by *Toxoplasma gondii*, an obligate intracellular protozoan capable of invading and multiplying within any nucleated cell. It progresses through three developmental stages: (i) sporozoite (spore-like form), which is shed by feline hosts in their feces and enclosed within an oocyst; (ii) bradyzoite (the slow-growing stage) found during chronic infection within tissue cysts; and (iii) tachyzoite (the rapidly dividing stage) present during acute infection. *Toxoplasma gondii*, with global prevalence, can infect a

wide range of warm-blooded vertebrates, including humans (Dubey, 2009). Affecting roughly one-third of the world's population, toxoplasmosis is mainly transmitted to humans through the ingestion of food and water contaminated with *T. gondii* oocysts, as well as raw meat, particularly lamb, containing tissue cysts infected with the parasite; it can also, though rarely, be transmitted via contaminated eggs or raw milk (Hill & Dubey, 2002). and the congenital pathway, mother-to-child transmission during pregnancy. Less frequent transmission occurs through blood transfusion and organ transplant (Megli & Coyne, 2022).

About 80% of cases of toxoplasmosis are due to acquired toxoplasmosis, which typically manifests in immunocompetent people as a low fever and transient lymphadenopathy (Dubey, 2009). Maternal infections are predominantly asymptomatic or cause only mild symptoms, including malaise, night sweats, myalgia, hepatosplenomegaly, swelling of the lymph nodes, and fever (Deng et al., 2018; Rahimi et al., 2024). Since these patients typically do not seek medical attention, there is a risk of silent epidemics of this parasite. Although generally harmless in healthy individuals, toxoplasmosis poses a life-threatening threat to people infected with AIDS/HIV+ or those on immunosuppressants (Dubey, 2009). Importantly, congenital toxoplasmosis is a form of this disease that affects the fetus, and its clinical presentation varies depending on the stage of pregnancy at which the mother becomes infected (Robert-Gangneux & Dardé, 2012). The severity of the infection and the frequency of congenital transmission vary significantly depending on the woman's gestational age of infection. Transplacental transmission is comparatively modest (<20%) during the first trimester and can reach 90% by the end of pregnancy (Garcia et al., 2013). Nonetheless, there is an inverse correlation between the severity of the disease and its transmission rate. Hydrocephaly, chorioretinitis, microcephaly, and other central nervous system (CNS) manifestations in newborns are key diagnostic indicators of congenital toxoplasmosis (Robert-Gangneux & Dardé, 2012). The primary approach for diagnosing congenital toxoplasmosis involves detecting IgG and IgM antibodies in the sera of pregnant women through various tests, including enzyme-linked immunosorbent assay (ELISA), which offers higher accuracy. Besides serological tests like ELISA, certain polymerase chain reaction (PCR) techniques, particularly nested-PCR, are valuable for detecting *T. gondii* in tissue samples from miscarried fetuses (Giakoumelou et al., 2016). However, studies investigating prevalence and impact of Toxoplasmosis among pregnant women attending Nangarhar University Teaching Hospital, Jalalabad, Afghanistan, are lacking. Therefore, this study aimed to determine the prevalence and outcomes of Maternal Toxoplasmosis on pregnancy among pregnant women attending Nangarhar University Teaching Hospital.

MATERIALS AND METHODS

Study Setting and Design

A retrospective cross-sectional study was conducted on 348 women who tested positive for *Toxoplasma gondii* during the time frame from April to November 2024, after obtaining ethical approval (referencing IRB no. 4/28-03-2024) from the Institutional Review Board (IRB), Faculty of Medicine, Nangarhar University. The inclusion and exclusion criteria were: 1) All Toxoplasmosis-positive pregnant women who attended the Obstetrics and Gynaecology outpatient or inpatient department for antenatal care (ANC) were included. 2) All Pregnant women with Toxoplasmosis, whether carrying a normal or abnormal fetus, who visited the Obstetrics and Gynecology department between April and November 2024, were included. 1) Women with Toxoplasmosis who did not have a complete medical record were excluded from the study.

Sample Size and Sampling Technique

The study employed a consecutive sampling approach. The sample consisted of all pregnant women who visited the Obstetrics and Gynaecology (OBGYN) outpatient and inpatient department of the Nangarhar University Teaching Hospital during a six-month period. In order to ensure comprehensive coverage of the study population, all eligible women during this period were included, regardless of demographic, clinical, or temporal characteristics.

Data collection and patient characteristics

Data were collected using questionnaires from the hospital-based medical records of all participants. The data contained demographic characteristics (age, residence, education, socioeconomic status, number of gravidities, gestational age), associated factors (history of fetal anomaly, history of abortion, history of infertility, history of another disease, history of blood transfusion, and condition of the fetus), and fetal complication (abortion, Intra uterine fetal death (IUFD), stillbirth, hydrocephaly, chorioretinitis, microcephaly, and other manifestations related to the central nervous system) as well as ultrasonography results were

included in the data. The data collectors received one week training regarding the questionnaire and data extraction techniques. The corresponding researcher routinely checked and monitored each questionnaire's consistency, completeness, and methods of data collection.

Statistical Analysis

The initial data was entered into an Excel spreadsheet and then exported to the Statistical Package for Social Sciences (SPSS) version 28. A descriptive analysis was performed on the data, with results presented in terms of percentages and frequencies. For each variable, the frequencies of different categories were calculated, and the corresponding percentages were determined accordingly.

RESULTS

Sociodemographic characteristics of study participants

A total of 2,972 women were registered for antenatal care (ANC) at Nangarhar University Teaching Hospital during the study period. Among them, 348 women tested positive for *Toxoplasma gondii*. For those who tested positive, the second trimester was the median gestational age at diagnosis. Baseline characteristics of the study participants are presented in Table 1.

Variables		Frequency	Percentage
Age (year)	16-25	99	28.4%
	26-35	209	60.1%
	36-45	40	11.5%
Residence	Urban	153	44.0%
	Rural	195	56.0%
Education	Educated	117	33.6%
	Uneducated	231	66.4%
Income group	High	44	12.6%
	Medium	193	55.5%
	Low	111	31.9%

Obstetric characteristics and factors associated with toxoplasmosis.

In terms of obstetric features, the majority of mothers (72.7%) had more than two parities, and the mean parity was 27.3%. About 29.9%

of mothers receive a diagnosis at term, 53.4% receive a diagnosis in the second trimester, and 16.7% receive a diagnosis in the first trimester. 8.6% of the mothers had assisted delivery, 22.1% had a cesarean section, and 69.3% had a spontaneous vaginal birth. among the 348 mothers, 78.2% had children who were still alive, 13.2% had children who had passed away, and the remaining 8.6% had one child who was abnormal (fetal abnormalities and fetal deaths). Normal vaginal birth was the most prevalent method (69.3%).

The statistical data on the obstetric characteristics of pregnant women with toxoplasmosis are presented in Table 2.

Variables		Frequency	Percentage
Gravidities	Primegravida	95	27.3%
	Multigravida	253	72.7%
Condition of the fetus	Alive	272	78.2%
	Death	46	13.2%
	Anomaly	30	8.6%
Gestational age	First trimester	58	16.7%
	Second trimester	186	53.4%
	Third trimester	104	29.9%
History of abortion	Present	68	19.5%
	Absent	280	80.5%
History of other diseases	Present	84	24.1%
	Absent	264	75.9%
History of anomaly	Present	56	16.1%
	Absent	292	83.9%
History of blood transfusion (BT)	Present	37	10.6%
	Absent	311	89.4%
History of infertility	Present	29	8.3%
	Absent	319	91.7%
Family history	Present	46	13.2%
	Absent	302	86.8%

Fetal complications among study participants

Out of 348 mothers with documented toxoplasmosis, 86 (24.6%) experienced at least one adverse fetal outcome. The most common

fetal complication was abortion (5.7%), followed by hydrocephalus (4.0%), low birth weight (4.0%), intrauterine fetal death (IUFD) (2.9%), stillbirth (2.6%), microcephaly (2.0%), chorioretinitis (2.0%), and central nervous system (CNS) disorders (1.4%). Statistical data on the impact of toxoplasmosis on pregnancy outcomes are presented in Table 3.

Table 3. Fetal complications among study participants [N=348].			
Variables		Frequency	Percentage
Complications	Hydrocephaly	14	4.0%
	Microcephaly	7	2.0%
	Chorioretinitis	7	2.0%
	IUFD	10	2.9%
	Abortion	20	5.7%
	Low birth weight	14	4.0%
	Still birth	9	2.6%
	CNS disorders	5	1.4%
	None	262	75.3%

DISCUSSION

Toxoplasmosis is linked to increased risks of adverse fetal outcomes, contributing to higher rates of both morbidity and mortality (Elsheikha & Macpherson, 2016; Menzies & Paré, 2009).

In this study, a total of 2,972 pregnant women were recorded for ANC during the study period at Nangarhar University Teaching Hospital Obstetrics and Gynecology department. Of these, 348 women (11.7%) tested positive for Toxoplasmosis, while 2,624 (88.3%) tested negative. The participants' mean age is 28.7443 with a standard deviation of 6.48968, with the average gestational age at the time of presentation being in the second trimester. The study identified seven major fetal complications associated with Toxoplasmosis in pregnancy. These included fetal abnormalities (24.7%), intrauterine fetal death (2.9%), low birth weight (4.0%), stillbirth (2.6%), central nervous system disorders (1.4%), and abortion (5.7%), which was the most commonly observed complication. Among the women who tested positive, 121 (34.8%) reported contact with animals, whereas

226 (64.9%) did not. Previous studies have indicated that *Toxoplasma gondii* infection may lead to recurrent miscarriages, potentially due to different strains of the parasite (Deng et al., 2018). This hypothesis suggests a need for further molecular and epidemiological research. The global prevalence of *T. gondii* varies widely, influenced by dietary habits, contact with animals (especially cats), geographical factors, and parasite strain diversity. In India, the predominant mode of transmission is through ingestion of oocysts, which differs from transmission patterns seen in other parts of the world (Turbadkar et al., 2003). In the United States, approximately 85% of women of reproductive age are at risk for *T. gondii* infection, with an estimated 400 to 4,000 cases of congenital toxoplasmosis occurring annually (Nayeri et al., 2020). Across European countries, prevalence among pregnant women ranges from 2% to 70%, with Italy reporting the lowest rates and France the highest (Robert-Gangneux & Dardé, 2012). In Africa, prevalence is estimated between 20% and 60% (Xu et al., 2022), while in Asia, studies report rates from 3% to 35% (Garcia et al., 2013). In Iran, findings from various provinces show prevalence among women of childbearing age ranges between 23% and 64%, depending on IgG antibody presence (Dubey, 2009). In our study, 86 of the 348 women who tested positive for toxoplasmosis (24.7%) experienced at least one pregnancy complication. Among these women, 231 (66.4%) were uneducated, while 117 (33.6%) had some level of education. The average age of participants was 30 years, which is slightly lower than the average reported by (Deng et al., 2018), which was 31 years. According to existing literature, the incidence of toxoplasmosis in pregnancy tends to increase with maternal age until approximately 35 years, after which it begins to decline (Robert-Gangneux & Dardé, 2012). Our study revealed a lower mean maternal age compared to global data, which may be attributed to cultural practices surrounding early marriage or ethnic demographic variations. Regarding parity and the prevalence of toxoplasmosis during pregnancy, our findings showed that primigravidae women had the lowest infection rate (27.3%). The highest prevalence occurred among multiparous women in the older age range, possibly due to cumulative exposure over multiple pregnancies. This contrasts with findings by (Thapliyal et al., 2005), who

reported higher toxoplasmosis prevalence among primigravidae in younger age groups, potentially influenced by different socio-demographic characteristics in their study population. In our study, 24.7% of pregnancies were classified as complicated, while 75.3% were non-complicated. Most toxoplasmosis cases (60.1%) were found in women aged 25 to 35. However, a study conducted in Ethiopia reported that more than half of all infections occurred in women under 24, suggesting regional and cultural differences in exposure, including dietary habits and hygiene. Concerning neonatal outcomes, 75.3% of infants born to infected mothers were healthy, while 24.7% were affected by congenital anomalies. These findings are consistent with research by (Nayeri et al., 2020). Hydrocephaly was observed in 4.0% of cases, slightly lower than the incidence reported by (Garcia et al., 2013). Additionally, 5.7% of pregnancies were complicated by abortion, a figure comparable to Nayeri et al.'s results but lower than the 44% reported by (Giakoumelou et al., 2016). Conversely, this abortion rate was significantly higher than the 1.6% reported by (Xu et al., 2022), potentially due to delayed initial consultations, lack of timely checkups, and insufficient antenatal care in our study region. The prevalence of chorioretinitis was 2.0%, aligning closely with the 2.9% rate reported by (Hill & Dubey, 2002). Microcephaly was detected in 2.0% of cases—substantially lower than the 18.9% documented by (Nimri et al., 2004). This difference may reflect improvements in antenatal monitoring and care adherence during pregnancy. Moreover, intrauterine fetal death (IUFD) and central nervous system complications were observed in 2.9% and 1.4% of cases, respectively, consistent with prior literature linking toxoplasmosis to such outcomes (Dubey, 2009). In contrast, (Turbadkar et al., 2003) reported a significantly higher intrauterine fetal death rate (32.2%) among infected women, suggesting potential differences in healthcare access or detection practices. Stillbirth occurred in 2.6% of pregnancies in our study, a finding comparable to previous research (Garcia et al., 2013). In conclusion, as previously emphasized by (Garcia et al., 2013), we underscore the importance of health education in reducing toxoplasmosis prevalence, both in the region studied and in other areas with high infection rates. Our

findings indicate that new cases of toxoplasmosis continue to emerge among pregnant women in this area, leading to uncertainty regarding pregnancy outcomes. Furthermore, future studies should investigate whether varying *T. gondii* strains may contribute to recurrent miscarriages or congenital anomalies across successive pregnancies.

This study had several limitations. Primarily, the retrospective nature of the study, relying on hospital medical records, restricted the ability to collect detailed data on specific sociodemographic and maternal factors that could influence pregnancy outcomes related to toxoplasmosis. Future studies that include all pertinent factors about the fetal outcomes of toxoplasmosis during pregnancy are warranted. Furthermore, the study's sample size was limited, and since data were collected from only one health center, it may not fully represent Afghan women. A larger sample could have enhanced our ability to analyze various individual factors more thoroughly. Finally, due to the descriptive cross-sectional design, we were unable to determine causal relationships between pregnancy-related toxoplasmosis, its outcomes, and associated risk factors; therefore, additional analytical studies are necessary.

CONCLUSION

The study concluded that 11.7% of pregnant women were seropositive for Toxoplasmosis, which is associated with a high risk of fetal complications such as abortion, intrauterine growth retardation (IUGR), low birth weight, stillbirth, hydrocephaly, microcephaly, chorioretinitis, and fetal central nervous system (CNS) disorders. According to our study, hydrocephaly and microcephaly were well-known causes of fetal death. Thus, early detection of maternal and fetal problems, as well as proper prenatal and postnatal treatment, can lower the risks to both the mother and the fetus. Mothers who are carrying abnormal pregnancies should be monitored closely and given counseling right away about all the hazards. To better understand how to screen for and manage fetal and maternal problems during abnormal pregnancies, more research is required.

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Authors' Contributions: Rahimi and Sherzad conceptualized the study topic, drafted the

protocol, and designed the questionnaires. Rahimi and Ahmady provided the raw data for the study. Sherzad did statistical analyses. Rahimi, Ahmady and Sherzad wrote the first draft of the manuscript, and Sherzad critically revised the final draft of the manuscript. All authors have read and approved the final version of the manuscript.

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