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Comparative studies on toxoplasmosis in different provinces of Afghanistan

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ABSTRACT

Toxoplasmosis, a zoonotic disease caused by Toxoplasma gondii (T. gondii), is a serious health problem for most undeveloped countries, including Afghanistan. The prevalence of toxoplasmosis in Afghanistan varies between different provinces, with rural areas showing a higher risk of infection compared to urban areas. This may be due to the lifestyle and environmental factors in these regions, such as agricultural practices, contact with animals, and consumption of contaminated food and water. The high prevalence of toxoplasmosis among pregnant women is particularly concerning, as it can lead to severe complications for both the mother and the unborn child. Overall, addressing toxoplasmosis in Afghanistan requires a multifaceted approach that considers the unique social, cultural, and environmental factors influencing its transmission and impact on human health. This may involve targeted interventions in rural areas, where the risk of infection is higher, as well as broader public health campaigns to raise awareness and promote preventive measures across the country. By addressing these factors, it may be possible to reduce the burden of toxoplasmosis and improve the overall health outcomes for the population of Afghanistan.

Keywords: Toxoplasmosis (T.gondii), Afghanistan.

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1. Introduction

Toxoplasmosis is an infectious disease caused by parasites. *Toxoplasma gondii* (T. gondii). *gondii* mainly infects warm-blooded animals, especially pigs, deer, raccoons, sheep, cattle, chickens, cats, and humans (2). The main host of toxoplasmosis is cats, and it may transmit from primate animals to humans. Toxoplasmosis commonly does not show significant symptoms in healthy people, but unborn infants, pregnant women, and others with impaired immune systems (3) are at risk for severe complications (4). An infected pregnant woman may transmit T.gondii to an unborn child and cause significant health problems, including stillbirth, miscarriage, or congenital impairments (5).

T.gondii was first identified in a congenitally infected newborn baby in 1939 (6). *T.gondii* has three stages: bradyzoites, sporozoites, and tachyzoites (7). Bradyzoites are present in the meat of infected animals, and by eating the meat, *T.gondii* may transmit to human (8). Oocysts exist in the faeces of infected felids and it is transmitted via contaminated food or water to intermediate hosts (9, 10). Tachyzoites are transmitted through congenital or blood transfusion (6). Sporulated oocysts occurred in cats and excreted to environment (11). Sporulated oocysts is transmitted by ingesting contaminated food. The gastrointestinal enzyme effect results to convert the oocysts to sporozoites then to tachyzoites in blood stream. These tachyzoites are able to cross any nucleated and the barrier of blood placenta. After reaching to blood taking about five days these tachyzoites change into bra bradyzoites and encyst n brain and skeletal muscles(12, 13) Transformed acute *T. gondii* through the placenta is linked with many adverse results, such as congenital malformations and stillbirths in immunocompromised women. In addition, it may cause abortion, neonatal death, hydrocephaly, and retinochoroiditis, leading to permanent neurological disabilities and severe local visual impairment (14, 15). Systemic lesions, pneumonia, systemic infection, coma, and even death are all possible (16).

Toxoplasmosis, a zoonotic disease, differs from country to country, even between provinces within the same country (15). Undeveloped countries are more susceptible to the widespread spread of toxoplasmosis. Afghanistan, one of the undeveloped countries, may link its toxoplasmosis with individual subpopulations, socio-economic status, cultural habits, and environmental factors (16). These factors might be the causes of the spread of toxoplasmosis in Afghanistan, but due to the lack of any recorded database of toxoplasmosis cases, it's still unclear to report the prevalence and type of infected living organism in Afghanistan. Therefore, we decided to review all the researched articles and summarize the available information for better understanding and awareness of Afghanistan's people.

2. Material and methods

We searched many databases to find articles (Google Scholar, Web of Science, and PubMed). Related articles published up to date are included. The search terms were meshed as (Toxoplasmosis AND Afghanistan, *T.gondii* AND Afghanistan). Out of all the articles retrieved about infected Afghan human patients, only those who lived in Afghanistan were included. Afghan immigrants with seropositive toxoplasmosis in other countries are excluded.

3. Result

Toxoplasmosis prevalence among Afghan people in different provinces: Suspected patients were referred to the public and private laboratories in Ghazni Province, Afghanistan. Ghazni province is located in the southeastern part of Afghanistan, and most people are busy with agriculture and animal husbandry, with 95% of them living in rural areas

Table 1. Infected numbers in different provinces of Afghanistan

Host	Sample type	Total sample size	Positive	Percentage	Test type	Location	Interpretation	References
Both gender	Blood	92	18	19.6%	chromatographic immunoassay	Ghazni	IgM and IgG	(17)
Women had abortion	Blood	100	47	47%	Latex agglutination test	Nangarhar	Toxo-antibodies indirect agglutination	(18)
Pregnant women	Blood	431	207	48.03 %	semi-quantitative serological chemiluminescence immunoassay	Kabul	Anti-T. gondii immunoglobulin G (IgG)	(16)

Chromatographic immunoassay was applied to the collected samples to detect the presence of IgM and IgG, and out of 92 patients, 18 tested positive for *T.gondii* infection (Table 1). The majority of those infected were male residents of the districts. The infected people stated that their animals had experienced abortion within the past three years, and they were 13.2 times more likely to be seropositive. (17). The second research was conducted in Nangarhar province, a tropical region in southern Afghanistan. This study focused only on women who had abortions, and 47 out of 100 suspected patients referred to the public hospital in Nangarhar city tested positive for *T.gondii* infection. The patients were divided into two groups, with 50% urban and 50% rural residents. Among them, 17 (34%) urban and 30 (60%) rural residents tested positive for the infection (Table 1-1), indicating that rural residents are significantly more at risk of *T.gondii* infections in this province. The two groups were compared based on their contact with raw or uncooked meat, contaminated food, water, soil, and animals. The results showed a significant difference between the two groups ($P<0.05$), with rural residents at a higher risk of toxoplasmosis disease compared to urban residents (18). The third study was conducted on toxoplasmosis in Kabul province, the capital and most populated city of Afghanistan. The research team included only pregnant women in this study. Out of 431 patient samples, 207 (48.03%) tested positive for *T.gondii* infections (Table 1-1), which is a significantly high number ($P = 0.000052$). In this study, they found that people who are residents in urban areas, have non-concrete floors in their houses, and use water from rivers or wells are significantly ($P<0.05$) at risk compared to their counterparts. This investigation suggests that living in a rural area is a protective option compared to urban living (16), whereas other studies have emphasized that living in an urban area is better (17). It might be due to highly polluted weather and non-standardized living buildings that cause an increase in the incidence of toxoplasmosis in pregnant women living in urban areas in Kabul city.

4. Discussion

Toxoplasmosis, a disease caused by the *Toxoplasma gondii* (T. gondii) protozoan, significantly affects humans and most domestic animals (19). Toxoplasmosis spreads to humans in three ways: from an infected mother through the placenta to the fetus, by ingesting raw or uncooked meat, and by ingesting contaminated water or soil (20). *T. gondii* has become a serious health problem in developing and undeveloped countries. The reason may be associated with basic living styles, non-educated people, or environmental contamination. Afghanistan, located among the countries with the highest number of non-educated people, is suffering from toxoplasmosis disease. Findings in this review

from published articles about infected humans in Afghanistan indicate limited data on human seroprevalence. Pregnant women in Kabul province are at high risk of toxoplasmosis disease. Furthermore, additional research conducted in Ghazni and Nangarhar provinces provides further evidence of *T.gondii* infections in Afghanistan, particularly among individuals with a history of animal abortions. The differences in seropositivity rates between urban and rural residents in Nangarhar province indicate that rustic areas may be at a significantly higher risk of *T.gondii* infections. Overall, these findings underscore the importance of further research and public health interventions to address *T.gondii* infections in Afghanistan, particularly among pregnant women and individuals living in rural areas. Efforts to increase awareness, improve understanding of risk factors, and implement preventive measures are essential for mitigating the impact of *T.gondii* infections in the region.

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