Review Article

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Toxoplasmosis in Nigeria (2015–2025): A Review of Epidemiology, Risk Factors, and Research Trends

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ABSTRACT

Toxoplasmosis is a zoonotic disease caused by Toxoplasma gondii, capable of infecting all warm-blooded animals, including humans. It has a significant veterinary and public health impact in Nigeria, yet completely neglected with no national control programme. Climate and geographic location influences infection rates. This review focus on the epidemiology, risk factors, transmission dynamics, diagnostic, and research trends of toxoplasmosis across Nigeria's geopolitical zones from 2015 to 2025. There exists limited data on toxoplasmosis from the South-East. Human seroprevalence varies by geopolitical zones, especially among pregnant women, women of childbearing age, HIV-positive people, school children, and workers in slaughterhouses. High prevalence has been documented in domestic animals, such as cats, livestock, poultry, and wildlife, which is of zoonotic and economic importance of the disease. Key risk factors identified are cat ownership, eating undercooked meat, unsanitary surroundings, contaminated water sources, and occupational exposure. Preventive measures include proper cooking of meat, responsible cat ownership, public enlightenment, and proper hygiene. Mainstream diagnostic techniques are immunohistochemistry, latex agglutination, enzyme-linked immunosorbent assay, modified agglutination tests and limited use of molecular techniques. This study shows the need for public health awareness and integrated One Health approaches to reduce toxoplasmosis burden in Nigeria.

Keywords: Epidemiology, Nigeria, Toxoplasmosis, Toxoplasma Gondii

Introduction

Toxoplasmosis, caused by the intracellular protozoan Toxoplasma gondii, remains a major global public health concern due to its widespread distribution and ability to infect a broad range of warmblooded hosts, including humans. It is estimated that nearly one-third of the world's population has been exposed to T. gondii, although prevalence varies considerably across regions depending on climate, environmental conditions, and cultural practices. Hundreds of millions of people are infected globally, with the parasite documented across diverse demographic and geographic settings. Infection risk is influenced by multiple factors, including age, gender, farm management practices, and regional ecological characteristics [1,2].

In subSaharan Africa, research consistently reports high seroprevalence levels ranging from 35% to 84%. This substantial burden has been attributed to close human–animal interactions, inadequate sanitation, favourable climatic conditions that support oocyst survival, and limited public health awareness. Key risk factors include consumption of undercooked meat, exposure to contaminated soil or water, and poor hygiene practices, which collectively facilitate transmission in many communities [3-5].

In Nigeria, the seroprevalence of human toxoplasmosis is estimated at 32%. Although infections have been documented in both humans and animals, veterinary toxoplasmosis has received comparatively greater attention. High seroprevalence has been reported in economically important species such as dogs, cats, and chickens, with studies linking elevated infection rates to overcrowding, poor environmental sanitation, and widespread contamination with cat faeces. In humans, toxoplasmosis during pregnancy has been associated with miscarriage, hydrocephalus, cerebral calcification, and chorioretinitis in newborns. Despite its clinical and economic significance, toxoplasmosis remains a neglected disease in Nigeria, with no coordinated national control or surveillance program. A comprehensive review of data generated between 2015 and 2025 is therefore essential to better understand its epidemiology and guide targeted public health interventions [3,5].

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Biology and Lifecycle of Toxoplasma Gondii

Toxoplasma gondii is an obligate intracellular protozoan belonging to the phylum Apicomplexa and is the causative agent of toxoplasmosis in humans and a wide range of warmblooded animals. The parasite has a complex lifecycle involving three major developmental stages tachyzoites, bradyzoites, and sporozoites which facilitate infection, persistence, and transmission across hosts [6,7].

Felids, particularly domestic cats, serve as the definitive hosts in which sexual reproduction occurs. Infected cats shed unsporulated oocysts in their faeces. These oocysts sporulate in the environment within one to five days, becoming highly infectious. Intermediate hosts including birds, rodents, livestock, and humans acquire infection through ingestion of sporulated oocysts from contaminated soil, water, or food. Once ingested, sporozoites are released and differentiate into rapidly multiplying tachyzoites, which disseminate via the bloodstream and invade various tissues. As the host mounts an immune response, tachyzoites convert into bradyzoites, forming tissue cysts that persist for the host's lifetime [8,9].

The lifecycle is completed when felids consume infected intermediate hosts, releasing bradyzoites that invade intestinal epithelial cells, undergo sexual reproduction, and produce new oocysts. Livestock such as cattle and poultry may also become infected through ingestion of oocysts, contributing to foodborne transmission [10].

Epidemiology of Toxoplasmosis in Nigeria

Toxoplasmosis is a globally distributed zoonotic disease caused by the protozoan parasite Toxoplasma gondii (T. gondii), whose definitive hosts are domestic and wild felids. Humans and other warmblooded animals become infected primarily through the consumption of raw or undercooked meat and offal, particularly liver, as well as through ingestion of unpasteurized milk [11-13]. The public health importance of toxoplasmosis lies in its wide clinical spectrum, ranging from asymptomatic infection to severe manifestations such as encephalitis, ocular toxoplasmosis, and congenital toxoplasmosis, which may result in longterm neurological and developmental impairments in newborns [14-16]. Immunocompromised individuals including people living with HIV/AIDS and organ transplant recipients are at heightened risk of severe disease [17].

Globally, T. gondii infection is widespread, with seroprevalence estimates ranging between 30% and 90% depending on geographic, socioeconomic, and cultural factors [18]. It is estimated that up to one-third of the world's population has been exposed to the parasite at some point [19]. Higher prevalence is typically observed in regions where foodborne transmission is common, such as areas where undercooked meat is frequently consumed or where environmental sanitation is poor and human–animal contact is close, particularly with cats [20]. Marked geographic variation exists. Seroprevalence is generally higher in Latin America, Eastern Europe, and parts of Africa, and lower in much of Asia and Scandinavia [21]. In the United States, approximately 11% of the population is infected, although most infections remain asymptomatic or mild [22]. In Brazil, a large serological survey of cattle, sheep, goats, and pigs reported an overall prevalence of 55.8%, with species-specific rates of 70.1% in goats, 68.4% in sheep, 43.7% in pigs, and 27.1% in cattle [23]. Environmental and agricultural factors including the density of domestic cats, livestock management practices, and food safety standards play a significant role in shaping transmission patterns [24]. A global systematic review estimated a pooled seroprevalence of 35% among domestic cats, highlighting the widespread ecological conditions that support T. gondii transmission [25]. In some European populations, seroprevalence may reach as high as 90%, underscoring the parasite's extensive distribution [26].

Across Africa, prevalence estimates vary widely by region, population, and diagnostic method, yet consistently indicate substantial exposure. In Cotonou, Benin, a molecular prevalence of 15.2% was reported among domestic small mammals [27]. In Morocco, an IgG seroprevalence of 39.8% (95% CI: 31.6–46.2) was documented among pregnant women [8], while studies in Egypt have reported seroprevalence levels of 25.7% [28]. A systematic review and metaanalysis from Ethiopia estimated a pooled prevalence of 38% (95% CI: 30–46%). These findings collectively demonstrate that T. gondii infection remains a significant and underrecognized public health concern across the continent, influenced by environmental contamination, food handling practices, and close human–animal interactions.

In Nigeria, the overall seroprevalence of human toxoplasmosis has been estimated at approximately 32%, with regional variations: SouthWest (37%), NorthWest (32%), NorthCentral (24%), and NorthEast (22%) [6]. Animal studies similarly reveal wide-ranging exposure. Seroprevalence in goats varies from 4.6% to 35.9% across different regions, while broader Nigerian studies report prevalence rates ranging from 2.00% to 88.24% depending on species, geography, and diagnostic approach [29-32].

Human infection patterns show particularly high prevalence among pregnant women and in southern regions, likely reflecting differences in dietary habits, environmental exposure, and contact with oocyst-contaminated environments [33]. In Benue State, 25.3% of 91 pregnant women tested positive for T. gondii antibodies [34]. In Nasarawa State, 37.9% of pregnant women (99/261) were seropositive, with the highest prevalence observed among those in their second trimester (45.7%). In Jos North, Plateau State, T. gondii antibodies were detected in 11.7% of 384 pregnant women [35].

Domestic cats play a central role in sustaining transmission. In Nigeria, cats are commonly kept for pest control, resulting in large populations of freeroaming or semidomesticated cats, an important concern given that felids are the definitive hosts of T. gondii (CDS, 2024). Cats that hunt rodents are more likely to acquire infection and subsequently shed environmentally resistant oocysts. In settings with limited sanitation infrastructure, widespread environmental contamination increases exposure risk for humans and livestock.

Animal studies further highlight the zoonotic potential. In Maiduguri, a seroprevalence of 32.1% was reported in goats, underscoring their role as reservoirs capable of transmitting infection to humans through consumption of contaminated meat or milk [36]. In Ekiti, a prevalence of 36.8% for T. gondii oocysts

was documented, aligning with global concerns regarding environmental contamination [37-39]. In Ibadan, seroprevalence was 13.91% in cattle and 29.14% in pigs, with higher rates in adult animals compared to younger groups significant in pigs ($P < 0.05$) but not in cattle ($P > 0.05$) [40].

Dietary exposure remains a major risk factor in Nigeria, particularly consumption of raw or undercooked foods. Understanding local prevalence patterns is therefore essential for designing targeted prevention strategies.

Despite the substantial burden, awareness remains limited. A questionnaire-based study reported moderate overall awareness (53%) among Nigerians, with no significant gender differences [41]. The finding that nearly half of respondents were unaware of toxoplasmosis highlights a critical gap in public health education.

Diagnosis of Toxoplasmosis

Diagnosis of toxoplasmosis typically relies on the detection of Toxoplasma-specific antibodies, including IgG, IgM, IgA, and IgE. Several serological assays such as the dye test (DT), indirect fluorescent antibody test (IFA), enzyme immunoassays (ELISA and immunoblots), agglutination tests, and IgG avidity assays are used to detect these immunoglobulins within weeks of infection [42]. Confirming seroconversion, defined as the appearance of T. gondii-specific IgG in a previously seronegative pregnant woman, remains the gold standard for diagnosing primary infection. However, a single positive IgG result cannot differentiate between acute and chronic infection, and routine prepregnancy screening is uncommon in many settings [43]. The Sabin–Feldman dye test continues to be regarded as the reference standard for detecting Toxoplasma-specific antibodies [44].

Globally, laboratory diagnosis relies on etiological, immunological, molecular, and histopathological/immunohistochemical methods. Two major biological approaches are used: (i) indirect detection through immunological assays and (ii) direct detection through parasitological methods, including microscopy [45]. Early detection of congenital toxoplasmosis involves maternal serum testing, fetal ultrasound, and amniocentesis. Serum markers such as IgG and IgM are routinely assessed using dye tests, IFA, and enzyme immunoassays [46]. By 2025, studies across Africa, Asia, Latin America, Europe, and North America indicated that diagnosis predominantly relied on serological assays (IgG/IgM ELISA), complemented by molecular techniques such as PCR and IgG avidity testing to identify acute infections during pregnancy [10]. In subSaharan Africa, rapid diagnostic tests and agglutination assays have also been used for screening pregnant women [47].

Diagnosis in Nigeria

In Nigeria, toxoplasmosis diagnosis is predominantly based on serological detection of T. gondii IgG and IgM antibodies, particularly among high-risk groups such as pregnant women, HIVinfected individuals, and abattoir workers. ELISA remains the most widely used diagnostic method in hospitals and research laboratories [48-50]. Serological testing has been used to determine prevalence among pregnant women attending antenatal clinics in Kaduna and Gombe States, where ELISA was employed to detect IgG and IgM antibodies [51,52]. Chromatographic ImmunoAssay (CIA) has also been used for screening pregnant women, while Toxoplasma IgG Enzyme Immunoassay (EIA) kits have been applied in other antenatal settings [35]. For ocular toxoplasmosis, funduscopy has been used to identify characteristic retinal lesions, such as those documented at ECWA Hospital in Kano State [53-54].

Molecular diagnostics, particularly PCR, are increasingly used in research settings to detect T. gondii DNA in human and animal samples. PCR has been applied to confirm infection in pregnant women and to detect T. gondii genomic DNA in pigs and freerange chickens [34]. Immunohistochemistry (IHC) has also been used to detect T. gondii antigens in tissues of wild rats (Zyzomys pedunculatus) across NorthCentral Nigeria, highlighting their role as reservoir hosts [41].

Treatment and Control

Treatment of toxoplasmosis typically involves drugs that inhibit folic acid synthesis, particularly dihydrofolate reductase (DHFR) inhibitors such as pyrimethamine and trimethoprim, combined with dihydropteroate synthetase inhibitors such as sulfadiazine, sulfamethoxazole, or sulfadoxine. Alternative regimens include trimethoprim–sulfamethoxazole, azithromycin, atovaquone, or pyrimethamine combined with clindamycin. Spiramycin is recommended for preventing congenital toxoplasmosis but is ineffective for treating established fetal infection. For ocular toxoplasmosis in immunocompromised individuals, pyrimethamine–sulfadiazine or pyrimethamine–clindamycin with folinic acid, or TMP–SMX, are recommended (55,56).

Preventive measures focus on reducing exposure to oocysts and tissue cysts. Key strategies include feeding cats only commercial canned or dried food, avoiding raw or undercooked meat, maintaining strict litter hygiene, and wearing gloves when handling cat litter or gardening. Additional measures include keeping cats indoors to reduce hunting, covering sandpits, thoroughly washing fruits and vegetables, avoiding undercooked molluscs, freezing meat for at least two days at −12°C, and cooking meat to safe internal temperatures (63–74°C depending on type). Public health education particularly for pregnant women and immunocompromised individuals remains essential for reducing transmission [55,57].

Public Health and Economic Impact

Toxoplasmosis is asymptomatic in 80–90% of immunocompetent adults but can cause severe disease in immunocompromised individuals. Clinical manifestations include chorioretinitis, lymphadenitis, myocarditis, and polymyositis, with fetuses, infants, and immunosuppressed individuals at highest risk. Coinfection with HIV can lead to severe complications, including encephalitis, abortion, and accelerated disease progression. Toxoplasmosis may also exacerbate hepatitis B virus (HBV) infection and contribute to reproductive disorders. Acute congenital toxoplasmosis can be fatal in the first month of life.

Economically, T. gondii infection contributes to reproductive losses in livestock, particularly goats and cattle, and leads to meat and milk condemnation, increased veterinary costs, and expenses associated with human treatment and prevention.

Dairy goats are frequently infected, posing both public health risks and significant economic losses [58,59].

Conclusions

This study reviewed that toxoplasmosis is a widely prevalent neglected zoonotic disease in Nigeria, which is of public health, veterinary, and economic importance. Evidence from studies published between 2015 and 2025 shows geopolitical zones variation in seroprevalence among pregnant women, women of childbearing age, immunocompromised individuals, schoolchildren, and workers at slaughterhouses. There is a high level of infection in livestocks, domestic animals and poultry birds. Animals and the environment significantly play roles in sustaining toxoplasmosis transmission. Major modes of transmission include cat ownership, consumption of undercooked meat, unsafe water, poor environmental sanitation, and occupational exposure, such as farming and abattoir. Commonly used diagnostic methods are serological methods such as ELISA and agglutination tests, but limited molecular surveillance constrains accurate burden estimation and strain characterization. Toxoplasmosis is mostly not included in national surveillance and control programs, despite its cause's congenital abnormalities, HIV-related morbidity, and losses in livestock production. Strengthened surveillance, standardized diagnostics, public health education, and improved food safety practices are urgently needed to reduce the burden of toxoplasmosis in Nigeria. One Health integrated approach that links human, animal, and environmental health sectors is important to reduce the burden of toxoplasmosis in Nigeria.

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