Prevalence of *Toxoplasma Gondii* Oocysts in the Domestic Cats in Ekiti State, Nigeria

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ABSTRACT

Background: *Toxoplasma gondii* is a globally distributed zoonotic parasite with significant public health implications, particularly for immunocompromised individuals and pregnant women. Domestic cats (*Felis catus*) serve as definitive hosts and contribute to environmental contamination through oocyst shedding. This study aimed to evaluate the prevalence of *T. gondii* oocysts in domestic cats and assess environmental risk in selected communities of Ekiti State, Southwest Nigeria.

Methods: A cross-sectional study was conducted November, 2024 and March, 2025 to collect faecal samples from 277 domestic cats. The samples were processed using a modified flotation technique, and the presence of *T. gondii* oocysts was determined. Data were analysed using SPSS version 20, with chi-square tests used to assess associations between potential risk factors and *T. gondii* prevalence

Results: *T. gondii* oocysts were detected in 102 (36.8%) of the 277 faecal samples. Free rooming was identified as contributing factor to the high prevalence in the environment.

Conclusions: The high prevalence of *T. gondii* oocysts in domestic cats in Ekiti State highlights a significant zoonotic risk. Public health interventions focusing on responsible cat ownership, improved sanitation, and targeted education are crucial for mitigating the risk of *T. gondii* transmission in this region.

Keyword: *Toxoplasma gondii*, Ekiti, Domestic Cat, Faecal, Public Health

Toxoplasma gondii is among the most prevalent obligate intracellular protozoan parasites distributed globally, capable of infecting a wide range of hosts, including humans, and numerous warm-blooded animals, and is associated with various health issues (Zhou *et al.*, 2011). *T. gondii* exhibits a complex life cycle, characterized by asexual reproduction occurring in diverse tissues of vertebrates. Domestic cats and other wild felines serve as definitive reservoirs and contaminate the environment with millions of oocysts (Dubey, 2010; Zemene *et al.*, 2012; Aguirre *et al.*, 2019*).*

T. gondii's sporulated oocysts exhibit resilience to severe environmental conditions (Cook *et al.*, 2002), with damp environments known to extend their survival period beyond one year (Dubey, 2010). Soil contaminated with oocysts can transmit via fruits and vegetables consumed by intermediate host, thereby increasing the infection (Berger *et al.*, 2009). Studies have reported varying levels of oocyst presence in soil (Wang *et al.*, 2014; Solymane *et al.*, 2014). A high environmental oocyst load may also infect definitive hosts (Dubey,

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2006), potentially enabling the parasite to circumvent intermediate hosts and establish a cycle between definitive hosts and the environment (Dubey, 2010). Several countries have reported widespread infections resulting from oocyst ingestion (Dubey and Jones, 2008; Zhou *et al*., 2011; Nasiru Wana *et al*., 2020).

Human infection with *T. gondii* occurs through the consumption of raw or undercooked meat, ingestion of cat-shed oocysts via contaminated soil, food, or water, and transplacental transmission from mother to foetus if the infection is contracted during pregnancy, potentially resulting in abortion or congenital deformity (Khairat *et al*., 2013; Olariu *et al*., 2011; Feleke et al., 2019). Exposure to contaminated soil poses a substantial risk factor, especially for children (Jones *et al*., 2008; dos Santos *et al*., 2010). The majority of human and animal *T. gondii* infections are asymptomatic, with only non-specific clinical signs of toxoplasmosis typically present (Fenta, 2019). *T. gondii* exhibits a propensity for causing latent infections, and potential behavioural alterations in hosts, including associations with neurological disorders, have been documented (Maxwell *et al.*, 2021)

The complex interspecies relationships are further complicated by evolving practices and attitudes towards the management of both owned and unowned (stray and feral) outdoor domestic cats (Felis catus), which act as the primary reservoirs of the parasite in urban and suburban environments where native wild felids are largely absent (Afonso *et al*., 2008). Domesticated cats, often kept as companion animals, tend to stray from their owners and become feral. These feral cats frequently inhabit residential areas during nocturnal hours, thereby contaminating the environment with oocyst-containing faeces (Awobode *et al*., 2020). Despite the availability of data on the prevalence of *T. gondii* infections, there have been no comprehensive efforts or programs to address the issue of toxoplasmosis in Nigeria holistically. This study aimed to evaluate the relationship between the prevalence of *T. gondii* infection and environmental factors in selected communities in Ekiti State, Southwest, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted in Ekiti, Southwest Nigeria. It is located between longitudes 40°51′ and 50°451′ East and latitudes 70°151′ and 80°51′ North. The state has a land area of about 5887.890 sqKm and an estimated population of 2.39 million people as of 2006 (NPC, 2006). The state is located within the rainforest area of Nigeria. Samples were collected from seven selected communities in the state.

Sampling Procedure

A purposive sampling technique was used for the selection of sampling units from the Ekiti State. Samples were collected from communities and neighbouring communities where there is high population of cats among the residence and previous study on ectoparasites of cats have been conducted (Omonijo and Sowemimo, 2017). For domestic cats, households owning cats were identified within the selected communities.

Ethical consideration

The research protocol was submitted to Ethical Review Board for consideration of ethical approval for the study and approved the proposal with (Reference number: IBR-24-0024). An original copy of the approval is available upon request.

Permission to conduct the study

Following identification of households owning cats in the selected communities, the household were approached and the purpose, procedure to be taken and the significance of the study was explained to them. Their full cooperation and participation were soughted for the success of the study.

Collection of data through questionnaires

Individuals owning cat was given structured questionnaire to collect information regarding number of cats and the purpose for rearing cats.

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Laboratory Procedure

Faecal samples were collected from domestic cats into clean, sterile, wide-mouthed bottles with the aid of wooden spatula. The samples were stored in a refrigerator at 4˚C until process for microscopic examination. The faecal samples were processed by flotation method using Sheather's sugar solution (Specific gravity=1.26) as described by Salant *et al*. (2007). The oocysts were collected from the coverslip on top of centrifuge tubes and examined microscopically for *T. gondii* oocyst.

About 1 gm of faeces was homogenized in a known volume of distilled water in a disposable plastic cup and poured into a 15 ml centrifuge tube before centrifugation at 1500 rpm for 15 minutes (Dryden *et al*., 2005). The supernatant was discarded and sucrose solution (Specific gravity 1.21) was added to the sediment and then centrifuge again. The content of the centrifuge tube was topped to the brim with more sucrose solution using a Pasteur Pipette to form a convex meniscus and a coverslip will be placed gently on it and allow to stand for 5 minutes. The coverslip was then placed on a glass slide and examine microscopically at ×100 magnification. *T. gondii* like oocysts observed was identified morphologically (Bowman *et al*., 2002; Olabiyi *et al*., 2009; Otubanjo *et al*., 2013; Kouassi *et al*., 2015).

Data analysis

Data will be collected and stored in Microsoft excel and later transfer to IBM SPSS version 20 (SAS Institute, Cary, NC, USA). The sociodemographic data and contact with animal will be analysed using chi-square test. The prevalence ratio will be calculated for each variable and will be considered as significant at a possibility less than 0.05 (i.e. < 0.05).

RESULTS

Socio-demographic Characteristic of the Study Population

The study population comprised 277 cats. The majority of cats originated from Ikere-Ekiti 105(37.9%), followed by Iloro-Ekiti 49 (17.7%), followed by Ilogbo-Ekiti 47 (17.0%), followed by Ikosu-Ekiti 31 (11.2%) followed by Ijurin-Ekiti 27 (9.8%), and Ayetoro-Ekiti 18 (6.5%) (Table 1).

Table2, shows the prevalence of *T. gondii* among communities

Geographic Variation: A statistically significant difference in T. gondii prevalence was observed across communities ($\chi^2 = 30.79$, $p = 0.08$), with Ikere-Ekiti exhibiting the highest prevalence at 10.1% and Ayetoro-Ekiti showing the lowest at 3.3% (Table 2).

The graph in Fig 1, clearly illustrates a dominant reason for rearing cats: "Kill rat", with a frequency approaching 200. This suggests that pest control is a major driver for cat ownership in Nigeria. The second most frequent reason is "Pet", with a frequency around 60, indicating that companionship is also a significant factor, albeit to a lesser extent than pest control. "Business" and "Others" are reported with much lower frequencies, below 20 and 10, respectively, suggesting these are less common motivations for cat ownership.

Table 1. Socio-demographic Characteristics of the Study Population (where N=277)

Variable	**Number of Host Examined (NHE)**	**Percentage (%)**
Community		
Ayetoro-Ekiti	18	6.5
Ijurin-Ekiti	27	9.8
Ikere-Ekiti	105	37.9

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Ikosu-Ekiti	31	11.2
Ilogbo-Ekiti	47	17.0
Iloro-Ekiti	49	17.7

Table 2: Prevalence of *Toxoplasma gondii* infection in Relation to the Communities

Variables	**Number Examined**	**Number Infected**	**Percentage (%)**
Community			
Ayetoro-Ekiti	18	9	50.0
Ijurin-Ekiti	27	14	51.9
Ikere-Ekiti	105	28	26.7
Ikosu-Ekiti	31	18	58.1
Ilogbo-Ekiti	47	18	38.3
Iloro-Ekiti	49	15	30.6
Total	277	102	36.8

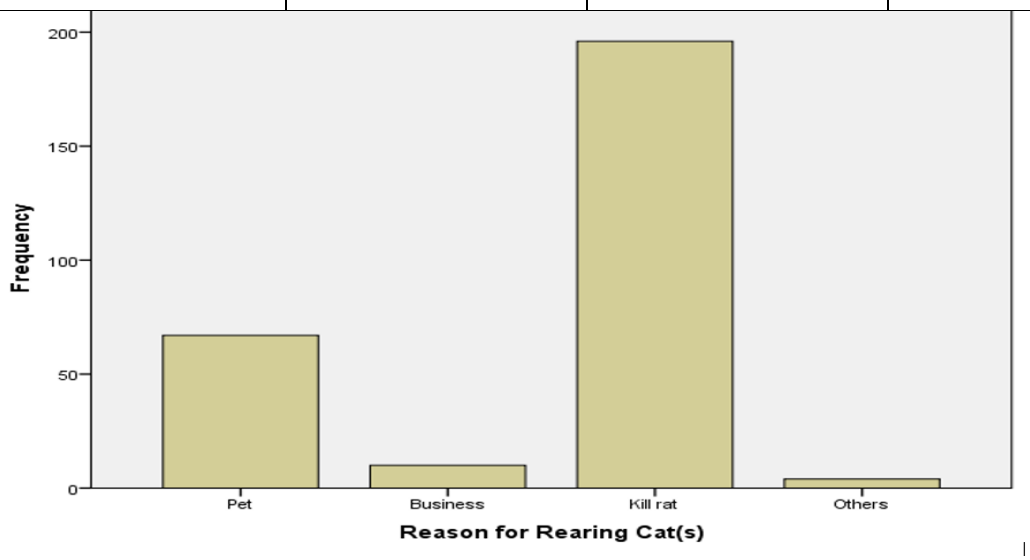

Fig 1: Shows the reason for Rearing Cat(s) in the Selected Communities

DISCUSSION

The prevalence of 36.8% of *Toxoplasma gondii* oocysts identified in this study is significant and aligns with findings from various regions, highlighting the global concern regarding this pathogen (Bisetegn *et al.*, 2023; Zaki *et al.*, 2024). Previous studies in Nigeria have a reported prevalence rates range from 2.00% to 88.24% (Karshima, 2020; Ogunrinade *et al*., 2020). The prevalence of *Toxoplasma gondii* in this study was higher than the seroprevalence of IgM and IgG (3.8% and 9.4%) reported in a study conducted in Ekiti, Nigeria. For instance, a systematic review indicated a pooled prevalence of 32.92% across multiple Nigerian states, suggesting that while our findings are within the expected range, they also reflect the potential for localized outbreaks or higher exposure risks in certain areas (Ogunleye *et al*., 2020). A study in Maiduguri reported a prevalence of 36.2% in cats (Ogunyemi *et al*., 2020). Another study indicated a prevalence of 50% in certain communities (Akinyele *et al*., 2020).

Globally, the prevalence of *T. gondii* varies significantly. A systematic review estimated a global pooled seroprevalence of 35% among domestic cats, which is comparable to our findings, indicating that the environmental and host factors influencing *T. gondii* transmission are prevalent in both local and global contexts (Dubey *et al*., 2020). In Europe, seroprevalence rates can approach 90% in some populations, underscoring the widespread nature of this parasite (Frenkel *et al*., 2022).

The variation in prevalence rates can be attributed to several factors, including geographical differences and the presence of definitive hosts such as cats. In Nigeria, the highest prevalence rates have been observed among pregnant women and in southern regions, which may reflect differences in lifestyle, dietary habits, and exposure to oocysts (Akinbo *et al*., 2020).

The primary reason for keeping cats being pest control suggests a potential for high numbers of free-roaming or semi-domesticated cats. This is significant because cats are the definitive hosts of *T. gondii* (CDC, 2024). Cats that hunt rodents are more likely to become infected with *T. gondii* by consuming infected prey. This increases the likelihood of oocyst shedding in the environment. Free-roaming cats, especially those hunting rodents, contribute to environmental contamination through the shedding of oocysts in their faeces. In urban and rural areas of Nigeria, where sanitation infrastructure may be limited, this contamination can pose a significant risk to humans and other animals (Gangneux & Dardé, 2012).

Furthermore, the implications of these findings are critical, especially considering the potential health risks associated with *T. gondii* infection, including congenital transmission and severe outcomes in immunocompromised individuals. The high prevalence of oocysts in our study area suggests a need for increased public health awareness and preventive measures, particularly in vulnerable populations.

CONCLUSION

The relationship between *T. gondii* prevalence and environmental factors is evident. The high percentage of free-roaming cats contribute significantly to the infection rates. The data aligns with global trends, highlighting the need for improved responsible pet ownership to mitigate the risks associated with *T. gondii*.

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