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Original Paper

Epidemiological Factors Associated with Ocular Toxoplasmosis among Patients with Diabetic Retinopathy

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ABSTRACT

Diabetes mellitus is a chronic disease that causes numerous vascular and neurological complications. Diabetic retinopathy is one of the most prominent of these complications due to the damage it causes to the retinal blood vessels and visual disturbances leading to impaired vision and vision loss. When infection with ocular toxoplasmosis occurs, the retinal inflammation intensifies due to the interaction between the vascular damage caused by diabetes and the inflammatory response triggered by the parasite, leading to worsening of the infection and increased severity of symptoms and ocular complications. The current study aimed to investigate the epidemiology of ocular toxoplasmosis among patients with diabetic retinopathy, while also evaluating the most important factors associated with infection and its accompanying clinical symptoms. The results showed that the incidence of ocular toxoplasmosis reached 20% among patients with diabetic retinopathy. The infection rate was also found to be higher in females compared to males and in the 60-69 age group, indicating an increased susceptibility with advancing age. Furthermore, the results showed a higher incidence rate among rural populations compared to urban populations. In urban areas, in addition to a clear association with cat breeding, where the exposure rate reached 45%, the results showed that unilateral eye infection was more common than bilateral infection, while high light sensitivity was the most prominent clinical symptom among patients. These results indicate a relationship between some demographic and environmental factors and the increased likelihood of developing ocular toxoplasmosis in diabetic retinopathy patients, which confirms the importance of early diagnosis and periodic follow-up to reduce visual complications and improve the health status of patients.

KEYWORDS: *Ocular toxoplasmosis, Diabetic retinopathy, Epidemiology, Risk factors*

Background

Ocular toxoplasmosis is a major cause of retinal inflammation and vision disorders. It causes damage to retinal tissue and chronic inflammation that can lead to impaired vision or blindness in advanced cases. The risk of infection increases in patients with diabetic retinopathy due to vascular changes and weakened immunity associated with diabetes, creating a favorable environment for persistent inflammation and worsening retinal damage. The infection is also linked to several epidemiological factors.

1-INTRODUCTION

The protozoan parasite *Toxoplasma gondii* is a medically significant obligate intracellular organism belonging to the phylum Apicomplexa. The lifecycle of *T. gondii* involves members of the Felidae family as definitive hosts, while humans and other warm-blooded animals serve as intermediate hosts. Domestic and wild cats represent the principal environmental reservoir of infection. The parasite replicates asexually as rapidly multiplying tachyzoites during acute infection, and converts into slowly growing bradyzoites within tissue cysts during the chronic phase. This differentiation is vital for persistence and transmission, and reactivation of bradyzoites can lead to symptomatic clinical disease. Transmission occurs via oocysts shed in feline feces, ingestion of tissue cysts in undercooked meat, or transplacental transmission.

While typically asymptomatic in immunocompetent individuals, *T. gondii* can cause destructive retinitis and choroiditis, particularly within anatomically privileged or immunologically altered environments like the eye. Both diabetic retinopathy (DR) and toxoplasmosis actively compromise the blood-retinal barrier (BRB). Chronic hyperglycemia in DR damages capillary endothelial cells and induces pericyte loss, increasing vascular permeability. Concurrently, *T. gondii* invades retinal tissue through active kinetic mechanisms and incites focal inflammation, further destabilizing the BRB. Chronic low-grade inflammation driven by pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-\alpha) characterizes DR

Superimposed *T. gondii* infection triggers a strong Th1 immune response. This localized inflammatory convergence can cause hyper-inflammatory responses and accelerated apoptosis of retinal neural and vascular cells. Recent literature suggests a complex interplay where *T. gondii* infection may alter the clinical progression of diabetic retinopathy. To evaluate the clinical manifestations and descriptive epidemiological characteristics associated with ocular toxoplasmosis among patients with diabetic retinopathy.

2-MATERIAL AND METHODS

Study Design and Setting

This study was established as a cross-sectional descriptive study to document the descriptive epidemiological characteristics of ocular toxoplasmosis within a select cohort of patients with diabetic retinopathy. The study was conducted from October 2025 to March 2026. The study population comprised 100 convenience-sampled patients previously diagnosed with diabetic retinopathy who were attending hospitals and outpatient clinics in Samarra, Iraq (aligning with the institutional affiliation of the authors). Informed consent was obtained from all participating patients or their legal guardians, and all socio-demographic and clinical information was documented using a pre-formulated data entry sheet.

Patient Diagnosis

Diabetic retinopathy was diagnosed by specialist ophthalmologists utilizing clinical fundus examination via ophthalmoscopy and digital retinal imaging in accordance with international clinical classification protocols. Ocular toxoplasmosis cases were diagnosed purely on a clinical basis by ophthalmic evaluation showing characteristic active or scarred intraocular focal retinochoroiditis lesions associated with vitritis, supported by the clinical history.

Data Collection

Socio-demographic, environmental, and clinical data were compiled using a targeted questionnaire that captured variables including age, sex, residential setting, domestic cat contact, specific ocular symptoms, and the laterality of the disease (unilateral vs. bilateral). Data were compiled and analyzed using descriptive statistics, reporting simple frequencies and percentages to outline the baseline characteristics of the infected sub-cohort. No inferential statistics (such as Chi-square tests, odds ratios, or p-values) were applied due to the purely descriptive design of the presented data.

3-RESULTS

1. Descriptive Frequency of Ocular Toxoplasmosis: Out of the 100 evaluated patients presenting with diabetic retinopathy, clinical features of ocular toxoplasmosis were identified in 20 patients, yielding a descriptive frequency of 20% within this cohort, while 80% showed no signs of the parasitic infection (Figure 1).

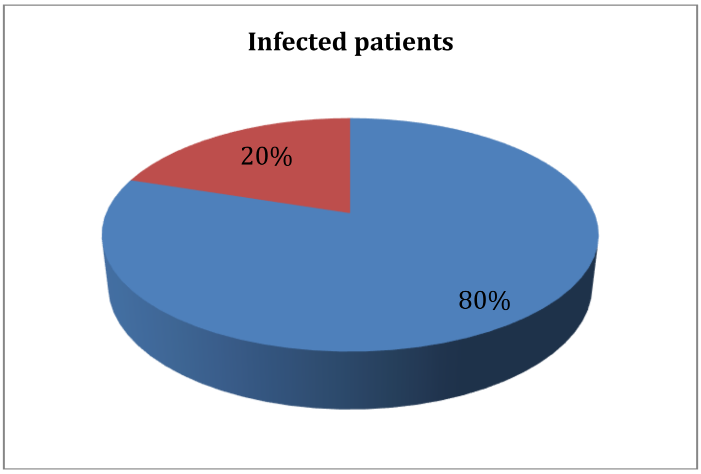

Figure (1): Distribution of Ocular Toxoplasmosis inside the Diabetic Retinopathy Cohort

2- Distribution by Age Group : The results of this study, shown in Table 1, indicate that the 60–69-year-old age group had the highest infection rate at 35%, followed by the 50–59-year age group at 25%, then the 70–79-year age group at 20%, and then the remaining age groups.

Figure (2) Fundus Photographs demonstrating Retinal Structures in Ocular Toxoplasmosis)

Table (1): Infection Rates of Ocular Toxoplasmosis by Age Group

Percentage of the total	Infected group	Age group
5	1	20 – 29
5	1	30 – 39
10	2	40 – 49
25	5	50 – 59
35	7	60 – 69
20	4	70 – 79
100.0	**20**	**Total**

3- Distribution by Sex : The results of this study, shown in Table 2, indicate a higher infection rate of ophthalmic toxoplasmosis among females (65%) compared to males (35%).

Table 2 Distribution by Sex

Percentage	Infected group	Sex
35%	7	Males
65%	13	Females
100.0	20	**Total**

4. **Distribution by Residence and Cat Ownership:** The results of this study, shown in Table 3, indicate that infection with ocular toxoplasmosis was more common in rural areas (60%) compared to urban areas (40%).

Table 3: Distribution by Residence and Cat Ownership

Percentage	Number	Residence
60	12	Rural
40	8	Urban
100.0	**20**	**Total**

5- Cat ownership as a risk factor for ocular toxoplasmosis: The results of this study showed that among 20 patients with ocular toxoplasmosis, 45% owned cats in their homes, while 55% did not, as shown in Table 4.

Table 4: Cat ownership as a risk factor for ocular toxoplasmosis

Percentage	Number	Status
45	9	Cat owners
55	11	Non-cat owners
100.0	**20**	**Total**

6- Monogenic and Bilateral Infection Rates in Ocular Toxoplasmosis: The results of the study shown in Table (5) indicate that the infection rate of ophthalmic toxoplasmosis was higher in unilateral cases, reaching 85%, compared to bilateral cases which reached 15%.

Table (5) Monogenic and Bilateral Infection Rates in Ocular Toxoplasmosis

Percentage	Number	Eye
15	3	Both eyes
85	17	Single eye
100.0	**20**	**Total**

7- Clinical Symptoms in Patients with Ocular Toxoplasmosis: The results of the study shown in Table (6) indicate that the most common visual symptom in patients with ocular toxoplasmosis was increased light sensitivity (60%), followed by photophobia (25%), while blurred vision was recorded in(15%).

Table 6: Clinical Symptoms in Patients with Ocular Toxoplasmosis

Percentage	Number of cases	Clinical manifestation
60%	12	Photophobia
25%	5	Ocular photosensitivity
15%	3	Blurred vision

DISCUSSION

The descriptive findings of this investigation revealed that 20% of the sampled patients with diabetic retinopathy exhibited clinical features of *Toxoplasma gondii* co-infection. This descriptive finding aligns with observations by Elliott et al. (2024) and prior regional work identifying higher frequencies of toxoplasmosis exposure among diabetic individuals, possibly facilitated by altered metabolic and cell-mediated immune responses characteristic of advanced diabetes. Analysis of age groups within our infected sub-cohort showed a concentration of cases in older individuals (aged 60–69 years), which is consistent with literature demonstrating that increasing age acts as a factor in cumulative environmental exposure and immunosenescence, making older diabetic patients more prone to clinical reactivation of latent ocular lesions. In terms of sex distribution, the higher frequency observed in females (65%) mirrors studies by Hutton (2023) and Tabatabaei et al. (2011), who noted higher clinical recurrence or detection rates among women, which has been hypothetically linked to distinct endocrine and immune interactions governing latent intracellular infections. Geographically, a higher descriptive frequency was found in rural settings (60%) compared to urban areas, supporting observations by Mohammad et al. (2025) and Filho et al. (2026) . Rural environments often involve more direct exposure to soil, agricultural activities, and unfiltered environmental sources that elevate the probability of acquiring oocysts. This environmental route is further contextualized by the 45% cat ownership rate among our infected patients, consistent with established risk dynamics regarding feline fecal contamination of immediate environments. The clinical presentations observed here predominantly involved unilateral eye lesions (85%), which aligns with classic descriptions of ocular toxoplasmosis where localized focal reactivation of latent bradyzoite cysts drives unilateral neuroretinitis, rather than a symmetrical bilateral process. Crucially, regarding presenting clinical symptoms, our descriptive data demonstrates that photophobia and light sensitivity comprised the dominant clinical manifestation, affecting a combined 85% of our clinical subset (with 60% expressing explicit severe photophobia). This directly reflects active posterior chorioretinitis and vitritis, where intraocular inflammation alters the intraocular visual environment and triggers photoreceptor hyperexcitability. Blurred vision was noted as the secondary predominant complaint in 15% of our specific cohort. While broad international contexts (such as Park & Nam, 2013) identify blurred vision as the most common generalized presentation across wider public health settings, our specific diabetic retinopathy sub-cohort demonstrated a pronounced clinical sensitivity to light, which could be exacerbated by baseline diabetic retinal vascular changes.

CONCLUSION

This cross-sectional study outlines the descriptive baseline frequencies of ocular toxoplasmosis within a cohort of diabetic retinopathy patients in Samarra, Iraq. The preliminary findings indicate distinct descriptive variations in infection distribution based on age, rural residence, feline contact, and a clinical predominance of unilateral light sensitivity. Given the descriptive nature of this study and the absence of serological validation, these results should be interpreted as preliminary trends. They highlight the clinical value of comprehensive structural screening in diabetic cohorts to limit compounding visual morbidity.

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