



# Detection of Toxoplasmosis Infection in Diabetic Patients

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## Abstract

**Background:** *Toxoplasma gondii* is an obligate intracellular protozoan parasite. Diabetes is a dangerous disease. It is one of the important causes that increase the exposure to other diseases.

**Objective:** To study was performed to detect *T. gondii* infection in diabetic patients using serologic tests.

**Patients and Methods:** Overall 270 serum samples that included 172 diabetic cases and 98 serum samples from non-diabetic (healthy controls) in Baghdad city were collected for *T. gondii* infection from December 2015 to March 2016. All sera were tested for fasting blood sugar and antibodies of *T. gondii* using enzymatic technique and ELISA methods respectively of BioCheck. Inc Company. Gender and age were considered in diabetic cases.

**Results:** The incidence of toxoplasmosis infection in diabetic patients and healthy controls were 55.81% and 38.78% respectively. There were (50%) diabetic females infected with IgG-Abs while there were (50%) diabetic males with IgG-Abs of *T. gondii*. Also, the range age of patients infected with *T. gondii* was 30-50 years old which have (51.04%). While there was (8.33%) diabetic patient's age was less than 30 years.

**Conclusion:** The sero-prevalence of toxoplasmosis in diabetic patients was found to be comparatively higher than in non-diabetic patients.

**Key words:** Toxoplasmosis, Diabetes, ELISA.

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## Introduction

*Toxoplasma gondii* is an obligate protozoan parasite that causes toxoplasmosis infection. About one third of the world's human population is predictable to be infected with toxoplasmosis disease [1]. Cats are the primary hosts and the parasite infects the central nervous system of animals and humans. Transmission starts by ingestion of food or contaminated water containing cysts of the parasite; it also can be transmissible through blood transfusion and organ transplant [2][3].

Toxoplasmosis is asymptomatic infection in immunocompetent individuals

[4]. However, only a few cases develop severe clinical symptoms, such as cerebral toxoplasmosis [5-6]. It can cause severe symptoms in pregnant women which can lead to hurt the fetus, or in lesions which usually involve the eyes and brain [7]. For immunocompromised patients, such as with HIV or common immunodeficiency diseases, this parasite can be a lethal pathogen [8]. Toxoplasmosis can be a chronic condition when it affects the central nervous system [8][9][10].

*Toxoplasma gondii* infection can be diagnosed through different types of screening, directly through polymerase



chain reaction, hybridization, and histology and indirectly through serological techniques [11-13]. Today, serological tests such as ELISA test have utilized to detect the antibodies against *T. gondii*. These same tests are also used in diagnosing the fetal infections in diabetic mothers. Therefore, it is highly recommended that this screening for asymptomatic immunocompromised patients for IgG antibodies to *T. gondii*, as this allows recognizing recurrence of latent infection [11]. It is generally accepted that the presence of antibodies is likely to indicate a recent infection which might be happened during a period of past three to four months; on the other hand, low avidity antibodies be likely to be present well after three months of infection indicating a past acquired infection [11].

Diabetes is a chronic infection that occurs when the pancreas yield in sufficient amount of insulin, or when the body cannot efficiently use the insulin. Diabetes also occurs when the blood sugar is raised which is in turn leads to severe damage to several body systems, mainly the nerves and blood vessels [14]. In 2007, the number of people identified with diabetes was around 2.5 million in age range of 25 to 64 [15]. It is estimated that 366 million around the world would infect with diabetes in 2030 [16]. There are numerous case reports indicating that diabetic patients have an increased susceptibility to other infection. Though, other non toxoplasmic infections can occur to increase the danger of complications in diabetic patients [17][18]. For people who are at danger, appropriate detection of *T. gondii* can prevent the disease's progression [19]. The genetic element has been marking out to particular human leukocyte antigen (HLA) genotypes that closely depend on the immune system. It is a metabolic disorder characterized by high blood glucose accompanied by insulin resistance and relative insulin deficit [20].

This study was performed to show the correlation between the incidence diabetes mellitus and toxoplasmosis according to sex and age of the patient.

## Patients and Methods

A total of 270 patients attending the clinics in Baghdad city were screened for *T. gondii* from December 2015 to March 2016. Overall 270 serum samples that included 172 Type 2 diabetes mellitus and 98 serum samples from non-diabetic (healthy controls) were examined. Age (>30 years old to <50 years old) and gender (72 male and 100 female) of the patients were recorded.

Two ml of blood sample was collected without EDTA anticoagulant. All tubes centrifuged at 3500 - 4000 rpm for five minutes. Serum samples were divided into ependrof tubes and kept at -20 °C until using. When sampling was completed, the level of glucose (Fasting Blood Sugar) was measured using the enzymatic technique. In this technique, serum and 1ml of selected solution was mixed and incubated for 10 minutes at 37 °C. The results were gained by Spectrophotometer at wavelength 545nm. Serums were then reserved at -20 °C for ELISA technique.

The level of IgG antibody against *T. gondii* was read through the ELISA technique using the available kits (BioCheck.Inc).

## Data Analysis

The statistical analysis system that was used is SPSS version 2012 to analyze the results of present study. Chi-square test was used to significant compare between percentages in this study [21].

## Results

The serum for 270 samples was analyzed. Table 1 showed the prevalence of (IgG-Abs) in both healthy controls and diabetic patients, there were 38.78% of healthy controls while there were 55.81% of diabetic patients. There was a statistically significant difference between them ( $P < 0.01$ ).



**Table (1):** Distribution of diabetes and Toxoplasmosis in healthy and diabetes group.

Group	No.of tested samples	No. and (+) Toxoplasmosis (%)
Healthy controls	98	38 (38.78%)
Diabetes cases	172	96 (55.81%)
Chi-square ( $\chi^2$ )	----	9.224 **
** (P<0.01)		

Considering the age groups and it's relation with the toxoplasmosis infection and diabetes disease, Table 2 showed the distribution of toxoplasmosis according to the age of study group. The results showed that the highest prevalence was between (30-50) years of diabetic patients infect with toxoplasmosis which was 49 (51.04%), while

the lowest percent was 8 (8.33%) in age group less than 30. There was statistically significant differences between the two group age (P<0.01).

**Table (2):** Distribution of sample study according to age group.

Age group (year)	Diabetes (+)	No. and % of Diabetes (+) <i>Toxoplasma</i> (+)
>30	26 (15.16%)	8 (8.33%)
30-50	89 (51.74%)	49 (51.04%)
<50	57 (33.14%)	39 (40.63%)
Total	172	96
Chi-square ( $\chi^2$ )	10.428 **	11.952 **
** (P<0.01).		

Considering the sex and it's relation with the infection of toxoplasmosis and diabetes, overall, 48 [50%]of the diabetic groups were females and males. Table 3 showed the distribution of toxoplasmosis in diabetic patient's gender. There were 72

[41.86%] diabetic male did not infect with toxoplasmosis while there were 48 [50%] diabetic male had toxoplasmosis. There were 100 [58.14%] diabetic female did not infect with toxoplasmosis while there were 48 [50%] diabetic female had toxoplasmosis.

**Table (3):** Distribution of sample study according to sex.

Sex	Diabetes (+)	Diabetes (+) <i>Toxoplasma</i> (+)
Male	72 (41.86%)	48 (50.00%)
Female	100 (58.14%)	48 (50.00%)
Total	172	96
Chi-square ( $\chi^2$ )	7.519 **	0.00 NS
** (P<0.01).		



## Discussion

This investigation clarified that out of 172 diabetic patients there were 96(55.81%) positive for the *T.gondii* IgG-Abs while it was 38 (38.78%) in healthy controls. These results are agreed with previous study that reported by Shirbazou *et al.*, 2014 in Iran which determined that toxoplasmosis infection in patients with diabetic and healthy samples were 60.43% and 38% respectively [17]. Another study in Iran has shown that 70.3% among diabetic patients were seropositive for Toxoplasma antibodies [22]. This result was higher than Gocke *et al.* study who confirmed that 56% of diabetic patients were positive for IgG [19]. Thus, these results propose those diabetic patients are more susceptible to have toxoplasmosis than those lacking diabetic disease.

Damage of the pancreas of *T.gondii* infection includes  $\beta$ -cell damage of nerve cells and secretion of the insulin is sometimes too much, which is resulting in decrease the blood sugar [23]. A simulative effect in cells of insulin on *T. gondii* replication has lately been stated. The number of the replicated tachyzoites increases rapidly when the insulin concentrations are between 10–2 and 10–1  $\mu\text{g/ml}$  in vitro [24]. During acute infection of toxoplasmosis, the tissue necrosis occurs in the pancreas [25]. Thus, this infection also involves as a probable causal for chronic pancreatitis and the insufficiency of the levels of insulin. A study has reported that the incidence of toxoplasmosis and diabetes globally is high. On the other hand, the occurrence of *T. gondii* in the pancreas might directly weaken the pancreas cells. When cells are injured, insulin levels would be affected. Possibly the damage of *T. gondii* would disturb the nervous system and harm the cells of pancreas which in turn lead to increase the risk of diabetes [17].

In serological investigations, the described seropositive or seronegative result is based on the study area. The current study showed that the infection of toxoplasmosis increased significantly in age group 30-50 which disagree with another study that demonstrates that the seroprevalence of toxoplasmosis is identified to rise in elder people [25]. Taken together, this study suggests that diabetes could increase susceptibility of *T. gondii* infection.

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