



# **Effect of *Toxoplasma gondii* on Some Physiological Indicators in Women's Patients with Diabetic Mellitus Type 2**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors SJM, NNB, LAM and ABH managed the research. Authors SJM, NNB and ABH done the research and wrote the main manuscript text. Authors SJM, NNB, LAM and ABH prepared tables and wrote a part of manuscript text. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aims:** Diabetes mellitus is thought to be caused by infection with the parasite *Toxoplasma gondii*, although this is still debated, In order to better understand the potential link between toxoplasmosis and diabetes mellitus

**Study Design:** China's prevalence rate of diabetes has been gradually growing in recent years, as a result of the country's rising living standards.

**Place and Duration of Study:** 40 patients who suffer from type 2 diabetes mellitus who were randomly chosen from the Diabetes Mellitus clinic in Al-Sadder Teaching City in Al-Najaf governorate.

**Methodology:** Prior research "on the link between *T. gondii* infection and diabetes mellitus has been conflicting, we performed matched case-control studies to see whether *T. gondii* seropositivity is linked" to type 2 diabetes, more research is required. To investigate *T. gondii* seroprevalence and recognize risk factors and potential transmittal pathways of *T. gondii* infection in type 2 diabetes

(T2DM), forty women's blood samples have been gathered and tested for *anti-T. gondii* IgG, IgM, and SOD. *T. gondii* seroprevalence in T2DM patients as a whole. Patients' information was collected through a questionnaire that included their age, weight, and blood pressure. Each patient and control participant had five milliliters of venous blood samples collected using a disposable needle and plastic syringes.

**Results:** Patients ranged in age about from (35 to 65) years old. The current investigation was performed on 40 patients who suffer from type 2 diabetes mellitus, Diabetic and *T. gondii* patients had a significantly higher compared with control and Diabetic patients only. Also, there were significant differences between patients of diabetic mellitus and control.

**Conclusion:** Blood was permitted to clot for 10 minutes at room temperature before being centrifuged at 6000 rpm for 10 minutes, after which serum was extracted and transferred into fresh disposable tubes. An ELISA test was performed on the blood samples earlier using commercially available kits (EIA-3519 IgG and IgM Germany) and SOD kits.

**Keywords:** ELISA; SOD kits; parasite; *Toxoplasma gondii*.

## 1. INTRODUCTION

Both kinds of diabetes are diverse illnesses with a wide range of clinical manifestations and disease progression[1]. Inappropriate insulin production as a result of poor islet cell activity or beta cell mass is the pathological cause of type 2 diabetes[2]. Defective insulin secretion is linked to a variety of metabolic abnormalities in T2DM, including dyslipidemia, which includes fatty acid, triglyceride, and lipoprotein homeostasis [3]. Type 2 diabetes (T2D), which frequently known as "adult-onset diabetes", refers to a type of diabetes described by high blood sugar levels, insulin resistance, and a shortage of insulin [4]. Raised thirst, usual urination, and unclear weight loss are all popular symptoms [5]. Raised appetite, exhaustion, and unhealed wounds are also potential symptoms [6]. Symptoms often appear progressively. Superoxide dismutase (SOD) is one of the most important antioxidative enzymes. The highly sensitive SOD Assay Kit utilizes WST-1 that produces a water-soluble formazan dye upon reduction with the superoxide anion. The rate of the reduction with a superoxide anion is linearly related to the xanthine oxidase (XOD) activity, and is inhibited by SOD. Therefore, the inhibition activity of SOD can be determined by a colorimetric method. .,diabetic retinopathy, that may result in blindness, renal failure, and poor blood flow in the limbs, that in turn can cause amputations, are all long-term consequences of high blood sugar [7]. *Toxoplasma gondii* points out to a parasitic obligate intracellular opportunistic parasite that may infect almost any warm-blooded mammal, including humans [8]. Notably, it is believed that about one-third of the world's population is infected with this parasite, "and over 7% of Chinese people have chronic *T. gondii*

infection"[9]. Most *T. gondii* infections do not result in any major clinical signs[10]. Meanwhile, a meta-analysis of research on the link between chronic toxoplasmosis and diabetes mellitus revealed chronic toxoplasmosis as a possible risk factor for type 2 diabetes (T2DM) [11]. Because prior research "on the link between *T. gondii* infection and diabetes mellitus has been conflicting, we performed matched case-control studies to see whether *T. gondii* seropositivity is linked" to type 2 diabetes.

## 2. METHODOLOGY

The current investigation was performed on 40 patients who suffer from type 2 diabetes mellitus who were randomly chosen from the Diabetes Mellitus clinic in Al-Sadder Teaching City in Al-Najaf governorate. As a healthy group, ten seemingly control individuals were included. Patients were selected in age about from (35 to 65) years old. Patients' information was collected through a questionnaire that included their age, weight, and blood pressure. Each patient and control participant had five milliliters of venous blood samples collected using a disposable needle and plastic syringes. Blood was permitted to clot for 10 minutes at room temperature before being centrifuged at 6000 rpm for 10 minutes, after which serum was extracted and transferred into fresh disposable tubes. An ELISA test was performed on the blood samples earlier using commercially available kits (EIA-3519 IgG and IgM Germany) and SOD kits [12].

### 2.1 Statistical Analysis

The Chi-Square Test and T-test were utilized in statistical analysis to identify significant disinctions between two research variables at the

probability threshold of  $P \leq 0.05$ . Also, least significant difference was used to find the significant differences between more than two variables [12].

### 3. RESULTS

To investigate *T. gondii* seroprevalence and recognize risk factors and potential transmittal pathways of *T. gondii* infection in type 2 diabetes (T2DM), forty women's blood samples have been gathered and tested for anti-*T. gondii* IgG, IgM, and SOD. *T. gondii* seroprevalence in T2DM patients as a whole. Diabetic and *T. gondii* patients had a significantly higher compared with control and Diabetic patients only. also, there were significant differences between patients of diabetic mellitus and control.

The result indicated that diabetic mellitus and *T. gondii* patients significant increase ( $p < 0.01$ ) in level of disease as compared with Diabetic patients and control, it was  $(0.632 \pm 0.275)$  in SOD compared with control and Diabetic patients only, as Table 1. The result indicated that diabetic mellitus and *T. gondii* patients significant increase ( $p < 0.01$ ) in level of disease as compared with Diabetic patients and control, it was  $(2092 \pm 259)$  in IgG compared with control and Diabetic patients only, as Table 2. The result

indicated that diabetic mellitus and *T. gondii* patients significant increase ( $p < 0.01$ ) in level of disease as compared with Diabetic mellitus and control, it was  $(350 \pm 112)$  in IgM compared with control and Diabetic patients only, as Table 3.

### 4. DISCUSSION

The link between *T. gondii* infection and type 2 diabetes is still debated, with a few research yielding contradictory findings [13]. As a result, the current research was carried out to see whether *T. gondii* infection is linked to type 2 diabetes mellitus. Diabetes mellitus patients had greater frequencies of *T. gondii* patients than controlled individuals, according to the findings. As a result, our results backed previous approaches that predicated diabetes mellitus on *T. gondii* infection [14]. T2DM is an autoimmune illness characterized by complicated interplay between hereditary and environmental variables [15]. T2DM was shown to be linked to enter overuse and other infectious agents [16]. T2DM patients exhibited substantially greater *T. gondii* seroprevalence than controls in this research, indicating that T2DM "patients are more likely to be infected with *T. gondii*". However, more focused research is needed to investigate and establish the link between T2DM and *T. gondii*

**Table 1. Concentration of SOD in blood serum comparison between patients and control group**

| Type of sample                         | Concentration of SOD ( u / ml ) M $\pm$ SD |
|--|--|
| control                                | 0.486 $\pm$ 0.130                          |
| Diabetic patients                      | 0.567 $\pm$ 0.234                          |
| Diabetic and <i>T. gondii</i> patients | *0.632 $\pm$ 0.275                         |
| Tc                                     | 2.8  |
| Tt p < 0.05                            | 1.90                                       |

**Table 2. Concentration of IgG in blood serum comparison between patients and control group**

| Type of sample                         | Concentration of IgG ( mg / dl ) M $\pm$ SD |
|--|---|
| control                                | 1033 $\pm$ 112                              |
| Diabetic patients                      | 2043 $\pm$ 158                              |
| Diabetic and <i>T. gondii</i> patients | *2092 $\pm$ 259                             |
| Tc                                     | 17.8  |
| Tt p < 0.05                            | 1.89  |

**Table 3. Shows concentration of IgM in blood serum comparison between patients and control group**

| Type of sample                         | Concentration of IgM ( mg / dl ) M $\pm$ SD |
|--|---|
| control                                | 140 $\pm$ 326                               |
| Diabetic patients                      | 233 $\pm$ 134                               |
| Diabetic and <i>T. gondii</i> patients | *350 $\pm$ 112                              |
| Tc                                     | 10.4  |
| Tt p < 0.05                            | 1.75  |

infection [17]. *T. gondii* infection through pregnancy may result in dangerous results including "miscarriage, microcephaly, hydrocephalus, and severe neurological disorders in the fetus"[18]. Furthermore, in immunocompromised people, discharged bradyzoites from tissue cysts reverting to quickly reproducing tachyzoites may reactivate latent infection and spread in the body[19]. Also The result indicated that diabetic mellitus and *T. gondii* patients significant increase ( $p < 0.01$ ) in level of disease as compared with Diabetic mellitus and control ,it was ( $350 \pm 112$ ) in IgM compared with control and Diabetic patients only. Diabetes patients' immune systems are weakened, and Gestational Diabetes Mellitus (GDM) patients are more vulnerable to *T. gondii* infection [20]. GDM patients showed a substantially greater *T. gondii* seroprevalence than control individuals in this research. As a result, "serological screening of GDM patients is required", followed by appropriate *T. gondii* infection therapy [21].

## 5. CONCLUSION

Blood was permitted to clot for 10 minutes at room temperature before being centrifuged at 6000 rpm for 10 minutes, after which serum was extracted and transferred into fresh disposable tubes. An ELISA test was performed on the blood samples earlier using commercially available kits (EIA-3519 IgG and IgM Germany) and SOD kits.

## DISCLAIMER

The company name used for this research is commonly and predominantly selected in our area of research and country. There is absolutely no conflict of interest between the authors and company because we do not intend to use this company as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the company rather it was funded by personal efforts of the authors.

## CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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