The Seroprevalence of *Toxoplasma gondii* and Associated Risk Factors Among Type 1 Diabetes Mellitus Patients in Abadan, Southwest Iran

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Dear Editor,

*Toxoplasma gondii* (*T. gondii*) is an obligate intracellular parasite capable of infecting warm-blooded animals, especially in humans and domestic animals (1). Infection with *T. gondii* in healthy individuals is often mild, while in immunocompromised patients causes a serious disease (2). Type 1 diabetes mellitus (T1DM) is an autoimmune disease, in which insufficient or no insulin is produced (3). In fact, the exact causes of T1DM are still controversial; however, it is apparent that environmental and genetic factors, as well as infectious agents are involved (3, 4). According to evidence, infection with *T. gondii* is more common in diabetic patients (5). Therefore, this study aimed to determine the seroprevalence rate of *T. gondii* infection in T1DM patients and its associated risk factors in Abadan, southwest Iran.

In this cross-section study, we included 41 patients with T1DM referred to Taleghani hospital in Abadan from December 2019 to March 2020. Written informed consent was obtained from all participants, and a questionnaire including demographic information was filled out, as earlier described (6, 7). To evaluate IgG antibody against *T. gondii* infection, 5 mL of blood sample was collected from each subject. The samples were centrifuged at 1700 *g* for four minutes and then stored at -20°C until use. To detect IgG antibodies against *T. gondii* infection, we used commercial ELISA kit (Torch-IgG-Trinity Biotech Company) based on the manufacturer’s guideline, as previously performed (7, 8). Data were analyzed by SPSS software (version 21), and the *P* value less than 0.05 was considered as statistically significant.

Overall, the seroprevalence of *T. gondii* infection in T1DM subjects was 68.29% (28 out of 41). The demographic characteristics and risk factors related to seroprevalence of *T. gondii* in T1DM patients was presented in Table 1. Out of 41 patients with T1DM (24 female vs. 17 male), 16 female participants (66.66%) and 12 male patients (70.58%) had IgG antibody against *T. gondii*. No statistically significant difference was observed between T1DM and *T. gondii* infection according to gender (*P* = 0.79). In terms of residence, 20 (66.66%) patients living in urban areas and eight (72.72%) patients living in rural areas were positive for IgG antibody. Among the risk factors, there was only statistically significant association between IgG seroprevalence and contact with cat (*P* = 0.009) (Table 1).

In general, previous reports have shown that toxoplasmosis develops susceptibility to DM, and diabetic patients are more sensitive to be infected with *T. gondii* (5, 9). This study aimed to evaluate anti-*T. gondii* IgG antibodies among T1DM patients using ELISA method. The results of the present study demonstrated that 28 subjects (68.29%) were seropositive. In accordance with our results, Soltani et al. reported that the seroprevalence of *T. gondii* infection in T1DM patients was 69.4% in Khorramshahr, southwest Iran (6). In addition, Nassief Beshay et al. reported 86.37% seropositivity rate of anti-*T. gondii* IgG among T1DM patients (10). The probable risk factors of *T. gondii* infection in all participants were assessed in the current study. According to the results, there was only a statistically significant difference between contact with cats and IgG seroprevalence. This study confirmed some previous reports highlighting the importance of cats in acquiring *T. gondii* infection (6, 7, 11).

In conclusion, the present study revealed a relatively
high seroprevalence of *T. gondii* infection among T1DM patients in Abadan, southwest Iran. Since the T1DM patients are among susceptible groups to acquire toxoplasmosis, they should be examined regularly for *T. gondii* to avoid severe infection. In addition, preventive programs, improving the knowledge of T1DM patients about infection with *T. gondii*, as well as effective control efforts must be performed.

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**Footnotes**

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**Data Reproducibility:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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**Table 1. Demographic Characteristics and Risk Factors Related to Seroprevalence of *T. gondii* in Type 1 Diabetes Mellitus Patients in Abadan**

| Characteristic                  | Type 1 DM (N= 41) | P-Value |
|--------------------------------|-------------------|---------|
|                                | No. Tested | IgG Positive, No. (%) |         |
| Age                            |            |                      | 0.914   |
| 0 - 10                         | 7          | 4 (57.14)             |         |
| 11 - 20                        | 10         | 7 (70.00)             |         |
| 21 - 30                        | 13         | 9 (69.23)             |         |
| 31 - 40                        | 11         | 8 (72.72)             |         |
| Gender                         |            |                      | 0.79    |
| Female                         | 24         | 16 (66.66)            |         |
| Male                           | 17         | 12 (70.58)            |         |
| Residence                      |            |                      | 0.513   |
| Urban                          | 30         | 20 (66.66)            |         |
| Rural                          | 11         | 8 (72.72)             |         |
| Education level                |            |                      | 0.378   |
| Diploma or lower               | 29         | 21 (72.41)            |         |
| University degree              | 12         | 7 (58.33)             |         |
| Contact with cat               |            |                      | 0.009   |
| Yes                            | 25         | 21 (84.00)            |         |
| No                             | 16         | 7 (43.75)             |         |
| Source of drinking water       |            |                      | 0.501   |
| Unpurified water               | 8          | 6 (75.00)             |         |
| Purified water                 | 33         | 22 (66.66)            |         |
| Consumption of raw/undercooked meat |        |                      | 0.581   |
| Yes                            | 12         | 8 (66.66)             |         |
| No                             | 29         | 20 (68.96)            |         |
| Total                          | 41         | 28 (68.29)            |         |
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**Informed Consent:** All subjects participated in the study voluntarily. Written informed consent was obtained from adult individuals and the parents or guardians of subjects less than 18 years old.

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