

# *Toxoplasma gondii* Seroprevalence Among Blood Donors in Zahedan, Southeastern Iran

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**Background:** Blood transfusion is one of the many ways, through which *Toxoplasma Gondii* (*T. gondii*), a protozoan parasite, can be transmitted to humans.

**Objectives:** This cross sectional study aimed to evaluate the seroprevalence of *toxoplasma* infection and related epidemiological features among healthy blood donors.

**Materials and Methods:** A total of 375 blood samples from donors were tested for specific *T. gondii* antibodies (IgG and IgM) by ELISA method, in Blood Transfusion Organization, Zahedan, Iran. Positive samples for *T. gondii* IgG were further tested for *T. gondii* IgM. A positive IgG test with a negative or positive IgM test was interpreted as a chronic or acute toxoplasmosis case, respectively.

**Results:** From the total 375 blood donors, 94 samples (25%) were *T. gondii* IgG positive. No positive cases of anti-*T. gondii* IgM antibodies were found. The difference between age and presence of anti-*Toxoplasma* antibodies was statistically significant ( $P < 0.05$ ). Other characteristics of blood donors, including male gender, ABO blood groups and having a history of blood transfusion showed no association with infection.

**Conclusions:** Our results highlighted that 25% of blood donors were infected by *Toxoplasma*, prior to the sampling and it can relapse, when facing a decreased immunity level.

**Keywords:** Blood Donors; *Toxoplasma*; Antibody

## 1. Background

Toxoplasmosis is one of the most widespread infections in animals and humans, caused by an intracellular obligatory parasite, *Toxoplasma Gondii* (*T. gondii*), which is usually transmitted to humans, orally (by ingesting food or water, contaminated with oocytes from infected cat feces or tissue cysts in meat). However, blood or leukocyte infusion, organ transplantation and transmission via the placenta are other possible routes of infection (1-3). The infection can result in severe consequences, including encephalitis, chorioretinitis and myocarditis in immunocompromised individuals, like transplant recipients and HIV-positive patients (4). It has been demonstrated that *toxoplasma* infection can be transmitted through blood transfusion (5). Since *T. gondii* organism may stay alive in citrated blood, at 5°C, for up to 50 days and the buffy coat (6), it is likely that toxoplasmosis could be acquired via blood or leukocyte transfusions, especially if parasitized leukocytes are transfused in a high concentration (6). Multiple blood units from different donors are regularly administered for children with thalassemia, sickle cell anemia and aplastic anemia who need regular, frequent and multiple transfusions for survival. Many studies have shown high prevalence of *T. gondii* antibodies in healthy volunteer blood donors (7-14), while pre-transfusion *T.*

*gondii* screening has not been considered yet. Not a lot of studies have been conducted on the epidemiology of *T. gondii* infection in this region blood donors. Healthy seropositive blood donors, especially those who are in the acute phase of the infection, may have a major role in this scenario (15). The rate of *toxoplasma* infection in healthy blood donors, varies in different areas of the world and this mainly depends on the rate of infection in the community (10, 11, 13, 16-18). In some areas, like Northeast Brazil, north India and north Egypt, more than 50% of blood donors have been detected to be seropositive for *toxoplasma* infection (7, 16, 18). Lower rates of infection in blood donors have been reported from Taiwan (9.3%), Thailand (9.6%), Mexico (7.4%) and Turkey (19.5%) (9, 10, 13, 19). Lack of information about the status of *toxoplasma* infection in healthy blood donors in Southeastern Iran justified this study, to evaluate the seroprevalence of this infection and its relative epidemiological factors in asymptomatic healthy blood donors.

## 2. Objectives

The aim of this study was to determine the prevalence of *T. gondii* infection in blood donors in Zahedan city, Iran and to identify characteristics of blood donors associated with seropositivity.

### 3. Materials and Methods

#### 3.1. Study Design

We performed a cross sectional study in the Blood Transfusion Organization (BTO) of Zahedan city, Iran. Samples were collected from voluntary blood donors and routinely tested for human immunodeficiency virus (HIV), hepatitis B virus, hepatitis C virus, HTLV1-HTLV 2, and *Treponema pallidum*.

#### 3.2. Serological Tests

Serum samples were obtained from fresh whole blood, transferred from each blood service center of each county to the serology laboratory at the department of parasitology and mycology of Zahedan (Zahedan University of Medical Sciences, Zahedan, Iran) and kept at -20°C, until use. Serum samples were tested for anti-*Toxoplasma* IgG and IgM, using a commercial enzyme immunoassay kit (Pishtaz Teb Diagnostics, Tehran, Iran). Anti-*T. gondii* IgG antibodies levels > 14.5 UL/mL were considered positive. Anti-*T. gondii* IgM antibodies levels were assessed in samples that IgG anti-*T. gondii* were positive. Anti-*T. gondii* IgM antibodies levels > 1.1 UL/mL were considered positive. Samples with positive IgG and negative IgM anti-*T. gondii* antibodies were considered as chronic toxoplasmosis, while those with both positive IgG and IgM anti-*T. gondii* antibodies were considered as acute toxoplasmosis.

#### 3.3. Analysis of Data

Results were analyzed using SPSS software (version 18), with a P Value < 0.05 taken as statistically significant. Chi-squared and Fisher exact tests were used to compare the seroprevalence values, related to the characteristics of the subjects.

### 4. Results

From the total of 375 blood donor samples, Anti *T. gondii* antibodies were detected in sera of 94 blood donors, corresponding to an overall seroprevalence of 25% in this population, all seropositive for IgG. Among IgG antibody positive samples, 83 were male (88.29%) and 11 were female (11.71%). The highest seroprevalence rate of *Toxoplasma* (38%) was found in the age group of 25-36, while the lowest seropositivity (20.7%) was seen in the age group of 17-25. The difference between age and presence of anti-*Toxoplasma* antibodies was statistically significant ( $P < 0.05$ ). Blood group B was the most frequent group (29%) and blood group A was the least frequent (17%) blood group (Table 1). No correlation was found between *Toxoplasma* seropositivity and ABO or Rh blood group ( $P > 0.05$ ). Moreover, no association was found between the occupation of participants and *toxoplasma* seropositivity ( $P > 0.05$ ).

**Table 1.** Demographic Characteristics of Blood Donors and Relative Seropositivity to *T. gondii* in Zahedan Province, Southern Iran

Characteristics	Frequency No. (%)	Donor With Anti- <i>T. gondii</i> IgG, No. (%)	P Value
<b>Gender</b>			> 0.05
Male	333 (88.8)	83 (24.92)	
Female	42 (11.2)	11 (26.1)	
<b>Age group, y</b>			< 0.05
17-25	232 (61.86)	48 (20.7)	
26-35	93 (24.8)	30 (32.25)	
> 36	50 (13.4)	19 (38)	
<b>Blood group</b>			> 0.05
A	99 (26.4)	16 (17)	
B	112 (29.87)	32 (29)	
AB	27 (7.2)	7 (26)	
O	137 (36.53)	37 (28)	
<b>Rh</b>			> 0.05
Positive	285 (76)	73 (25.6)	
Negative	90 (24)	21 (23.4)	

### 5. Discussion

Organism presence in blood, during the course of infection, ensures its transmission through transfusion (15). Moreover, the ability of organism to survive in the stored blood is another factor, increasing the chance of transmission through transfusion. It has been demonstrated that *toxoplasma* tachyzoites can survive in stored blood for several weeks (20). During the active infection course, *toxoplasma* might be present in blood and this would be a real threat for blood recipients, especially patients undergoing multiple transfusions or those requiring blood transfusion for transplantation management. The current study is the first seroprevalence study of *toxoplasma* infection among healthy blood donors in south of Iran. The Iranian Blood Transfusion Organization (IBTO) is a nationally qualified organization, performing blood transfusion procedures. This organization has a main center in each province and different branches in counties of each province. Recent data showed that there are 23 blood donors per 1000 populations in Iran. More than 90% of blood donations in Iran are from voluntary non-remunerated blood donors and the rest is donated as family replacement donation (21). In this study, 375 blood samples were assessed for IgG and IgM antibodies. Our results showed that the prevalence of anti-*toxoplasma* IgG was 25% and IgM antibodies were not found in any of the samples. It can be concluded that a chronic infection existed in blood donors, which had possibly occurred in a younger age (22). In comparison to previous studies conducted in Iran, our results were similar to those of Sharif et al. study (22%) (23). However the results were not simi-

lar to other studies in different parts of Iran. The prevalence was lower than reports from Salahi Moghaddam (68.4%), Assmar (51.8%) and Gorman (55.7%) (24-26) and higher than Gorbani's report (17.7%) (26). The result was also similar to other studies in other countries (4, 7, 8). In our study, the age group 25-36, had the highest *Toxoplasma* infection rate and the prevalence rate increased by age. The reason might be due to the increased risk of exposure to infection sources with age. These results were in accordance with the results of Bahador Sarkari and other authors' study (27). In Caucasian populations, the carriers of AB blood group are the most susceptible group for *T. gondii* infection (28). In our study, the Iranian population studied, blood group B was associated with a higher *T. gondii* seroprevalence, compared to other blood groups. However, the difference was not statistically significant. This result is consistent with the results from Movayedi and Zamorano's study (29, 30). Consequently blood transfusion is considered another potential transmission route for *Toxoplasma* infection, therefore, it is necessary to specify the major blood recipients. According to the official statistics, there are about 20000 patients with thalassemia in Iran, most of which live in Southeastern Iran). These patients with hematopoietic disorders need multiples transfusion courses. Therefore, we need a system to evaluate this infection in order to prevent infection transmission to this population (31). Since There is no a substitute for blood yet, transmission of any infection, including toxoplasmosis, concerns people. In a report, more than 50% of heart transplant recipients who were *Toxoplasma* seronegative, became seropositive following the surgery, showed toxoplasmosis symptoms and finally died due to severe complications, like myocarditis (32).

Since *T. gondii* can be transmitted through blood transfusion, it may alarm patients with different kinds of immunodeficiency, who are at a higher risk of exposure to transfusion transmitted diseases. Therefore, appropriate strategies should be adapted to reduce the risk of acquiring toxoplasmosis through blood transfusion.

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