



# Prevalence of IgM And IgG Antibodies to *Toxoplasma gondii* in Blood Donors in the North Region of Jordan

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A total of 1500 blood donors were examined for *Toxoplasma gondii* antibodies (IgG), and (IgM), by serological techniques. Eighty normal cross matched controls were subjected to the same examination.

The aim of this study is to examine the sero prevalence rate of *Toxoplasma gondii* in northern region of Jordan population among blood donors. A retrospective study was carried out at Prince Rashid Bin Al-Hassan Military Hospital in the north region of Jordan over one year period in 1999.

Fresh blood samples were randomly drawn from all donors. Serum was separated and stored at -20 C° until it was tested. *Toxoplasma gondii* antibodies were detected using the Enzyme Linked Immunosorbent Assay (ELISA ). A total of 1500 (1200 males, 300 females) blood donors were screened for *Toxoplasma gondii* antibodies IgG and IgM. The prevalence of *Toxoplasma* among the study population was 35.5% and the prevalence in males and females were 35.8% and 34.3% , respectively.

The peak age range of *Toxoplasma gondii* antibodies IgG donors among males 20 to 29 years; followed 30 to 39, 40 to 49, and < 20 years respectively. Among the female donors, the highest detection of *Toxoplasma gondii* antibodies IgG was between the ages of 20 to 29, followed by 30 to 39 years, < 20 years and by age from 40-49 years, respectively.

The lowest seropositivity was in the age group  $\geq 50$  years among males and females. So we concluded that seropositivity in our donors was significant, and previous studies carried out in Jordan and other countries indicated the high prevalence of *Toxoplasma gondii* infection.

The results obtained in this study, expanded immunization programme must be introduced considering all age groups. Future studies are necessary to determine the prevalence of *Toxoplasma gondii* antibodies in more common populations by using sensitive screening methods.

**Key Words:** *Toxoplasma gondii*, Blood donors.

## Ürdün'ün Kuzey Bölgesindeki Kan Donörlerinde *Toxoplasma gondii* Antikorumun IgG, IgM Prevalansı

Ürdün'ün Kuzey bölümünde yaşayan 1500 uygun kan donörü *Toxoplasma gondii* antikoru varlığı yönünden tarandı. Bu çalışmanın amacı, Ürdün popülasyonundaki kan donörlerinde *Toxoplasma gondii* antikorumun (IgG, IgM) seroprevalansını değerlendirmektir. Bu amaçla 1999 yılında Prince Rashid Bin Al-Hassan Military Hospital'da retrospektif bir çalışma yapıldı ve veriler toplandı. Bütün donörlerden taze kan örnekleri alınarak, serumlar ayrıldı ve test yapılana kadar -20 °C'de saklandı. *Toxoplasma gondii* antikorumları IgG, IgM ELISA testi (DiaSorin Entities, ETI -Toxok-G plus) kullanılarak, toplam 1500 kan donörü (1200 erkek, 300 kadın) *Toxoplasma gondii* IgG and IgM antikorumları yönünden incelendi. Çalışma popülasyonu içerisinde *Toxoplasma gondii* IgM antikorumları saptanmadı.

*Toxoplasma gondii* IgG olgularının prevalansı %35.5 olarak belirlenirken erkek ve kadınların prevalansları ise sırası ile %35.8 ve %34.3 bulundu. *Toxoplasma gondii* pozitif donörlerin pik yaş aralığı 20-29 olarak belirlendi.

Donörlerimizde seropozitiflik oranının belirgin olarak yüksek olduğu kararlaştırıldı. Bu nedenle, genişletilmiş immünizasyon programları oluşturularak, bütün yaş gruplarına uygulanması, *Toxoplasma gondii* markırlarının ölçümünde daha duyarlı tarama yöntemleri kullanılarak, daha geniş popülasyonlarda *Toxoplasma gondii* prevalansının saptanması gerektiği kanısına varılmıştır .

**Anahtar Kelimeler:** *Toxoplasma gondii*, Kan Donörleri

Toxoplasmosis is caused by an obligate intracellular protozoan parasite, *Toxoplasma gondii*. Toxoplasmosis is a very common infection among adults in different parts of the world. In the United States, an estimated 23% of

adolescents and adults have laboratory evidence of infection with *T. gondii*. Although most of the toxoplasma infections are usually either asymptomatic or associated with self-limited symptoms (e.g., fever, malaise, and lymphadenopathy), infection in immunosuppressed persons (e.g., persons with acquired immunodeficiency syndrome (AIDS)) can be severe. In addition, infections in pregnant women can cause serious health problems in the fetus if the parasites are transmitted (i.e., congenital toxoplasmosis) and cause severe sequelae in the infant (e.g., mental retardation, blindness, and epilepsy).<sup>1</sup>

*Toxoplasma gondii*, an obligate intracellular parasite can persist in the white cells for a long time, severe acute toxoplasmosis has been reported in immunosuppressed patients by leucocyte transfusion.<sup>2</sup> Transmission may occur by eating uncooked meat, contaminated vegetables, blood transfusion, organ transplantation, and across the placenta from the mother to the fetus. Transmission to the fetus occurs when the mother acquires acute infection during pregnancy. Antibodies to *Toxoplasma gondii* may persist in the serum at high titers for years. Patients with Acquired Immunodeficiency Syndrome (AIDS), transplant recipients, and patients receiving cytotoxic therapy, may develop severe or even fatal consequences and the patients with AIDS who are seropositive, about 25% to 50% of them will develop toxoplasmic encephalitis.<sup>1</sup>

*Toxoplasma* infections are asymptomatic or benign, but may cause severe or fatal consequences in immunodeficient patients, transplant recipients, and in the fetus.<sup>3</sup>

Organ transplantation and blood transfusion can result in toxoplasma infection, transmission generally occurs when the intermediate host ingests the toxoplasma oocyst, whereupon bradyzoites and sporozoites are released in the host's Gastro Intestinal tract. These enter the small bowel epithelium and transform into tachyzoites that are able to replicate in the cells of the host. It is difficult to distinguish between the recently acquired infection and chronic infection because of the frequent presence of toxoplasma antibodies in the general population.<sup>4</sup>

In recent years, there has been increased public concern on the safety of blood transfusion with respect to transfusion – transmitted infections. In developing countries, the risk of transfusion-

transmitted infections diseases can be minimized by appropriate selection of donors, promoting altruistic voluntary repeat donation, improving serologic screening, and by reducing the number of blood transfusion in accordance with appropriate standards of medical practice.<sup>5</sup>

In this study, sera from 1500 (1200 males, 300 females) blood donors at Prince Rashid Bin Al-Hassan Military Hospital were screened for toxoplasma antibodies and it was observed that 532, (35.5%) of the donors have antibodies to toxoplasma at different titers. However regarding simplicity, specificity, accuracy and time consumption factor it is recommended to check for toxoplasma IgG and IgM for all blood donors to avoid the risk of infection.

## METHODS AND MATERIAL

One thousand-five hundred eligible blood donors at Prince Rashid Bin Al-Hassan Military Hospital in the northern region of Jordan was randomly collected between July 1998 to July 1999 for the study. The sera were separated and stored at -20°C for about two months.

Eligibility of donors were based on age (<20 years, 20-29, 30-39, 40-49, and ≥50 years), weight (>50kg), Hct > 40%, negative history of blood transfusion, negative history of jaundice, negative history of intravenous drugs and normal physical examination.

All blood samples were tested in the immunology laboratory of Prince Rashid Bin Al-Hassan Military Hospital. *Toxoplasma gondii* antibodies IgG and IgM were detected using the Enzyme Linked Immunosorbent Assay (ELISA), kits produced by DiaSorin, (DiaSorin Entities, ETI-Toxok-G plus), were used for determination of specific immunoglobulins.

## RESULTS

A total of 1500 (1200 males, 300 females) blood donor were enrolled in our study. Table (I) shows the age and sex distribution of all screened donors.

Out of 1500 sera tested, 532 subject (35.5%) were found to be positive for *Toxoplasma gondii* antibodies IgG. There were 429 male subject (35.8%) and 103 female subject (34.3%) Table (II). Among males, the highest detection of antibodies was in the age group 20 to 29, n=180 (42.0%), followed by 30 to 39, n= 148 (34.5%); 40 to 49, n=55 (12.8%), and <20

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years n= 39 (9.1%). The lowest seropositivity is in the age group  $\geq 50$  years, n= 7 (1.6%). Among the females, the highest detection of antibodies is in the age group 20 to 29, n= 40 (38.8%); followed by 30 to 39, n= 30 (29.1%);  $<20$ , n=17 (16.5%), and 40 to 49, n=10 (9.7%). The lowest seropositivity is in the age group  $\geq 50$ , n= 6 (5.9%). Table (III).

### DISCUSSION

Toxoplasmosis is caused by an obligate intracellular protozoan parasite. *Toxoplasma gondii* is a very common infection among young adults in different parts of the world. The disease may be transmitted by blood transfusion. Transmission to the fetus occurs when the mother acquires acute infection during pregnancy.<sup>6,7</sup>

The protozoan parasite, *Toxoplasma gondii*, is transmitted to human by ingestion of the tissue cysts in raw or under cooked meats, particularly lamb and pork, or contact with cat feces.<sup>8</sup>

The prevalence of *Toxoplasma* antibodies ranges from 5% to 95% among young adults in different parts of the world. In the United States, by the end of the fifth decade of life, approximately 50% of the population are asymptotically infected.<sup>6</sup>

Intrauterine transmission occurs in approximately 25%, 54%, and 65% of untreated pregnant women

who develop acute toxoplasmosis during the first, second, and third trimesters respectively. Fetal involvement is most severe when maternal infection is contracted early in pregnancy.<sup>3</sup>

The parasite can survive in stored blood at 4°C for up to 50 days<sup>3</sup>, therefore, there is a risk of transmitting the infection to recipients. This risk may be reduced by obtaining seronegative donor blood for transfusion. In our study, the prevalence of *Toxoplasma* antibodies among apparently healthy blood donors was 35.60% by ELISA test. Similar surveys conducted in Scotland, United Kingdom among the general population showed a rate of only 27% using the dye test.<sup>8</sup>

In a study from King Fahad Hofuf Hospital, Al-Hassa, Saudi Arabia, seropositivity was 37.5% by IHA test positive for toxoplasma antibodies.<sup>9</sup> In a study from Jordan, 37% were seropositive among women using IHA test,<sup>10</sup> a study from Scotland and England in rural and urban blood donors showed 7.6% and 7.8% seropositivity respectively, which is much lower compared to our findings.<sup>11,12</sup> Behbehani et al. have found 95.5% seropositivity among Kuwaitis, reported that the age groups from 20 to 31 and from 32 to 42 had the highest number of seropositive persons.<sup>13</sup> In a study from Adana a city in the Mediterranean region of Turkey, the prevalence rates of *Toxoplasma gondii* was 56% of 510 blood donors.<sup>14</sup>

**Table I:** Age and sex Distribution Of All Donors

| Age          | Total (n)   | %          | Male (n)    | %           | Female (n) | %           |
|--------------|-------------|------------|-------------|-------------|------------|-------------|
| <20          | 130         | 8.6        | 100         | 6.7         | 30         | 2.0         |
| 20-29        | 600         | 40.0       | 500         | 33.3        | 100        | 6.7         |
| 30-39        | 570         | 38.0       | 450         | 30.0        | 120        | 8.0         |
| 40-49        | 145         | 9.7        | 100         | 6.7         | 45         | 3           |
| $\geq 50$    | 55          | 3.7        | 50          | 3.3         | 5          | 0.3         |
| <b>Total</b> | <b>1500</b> | <b>100</b> | <b>1200</b> | <b>80.0</b> | <b>300</b> | <b>20.0</b> |

**Table II :**Prevalence Of *Toxoplasma gondii* Positive According To Gender

| Gender       | No          | <i>Toxoplasma</i> IgG (positive) | Prevalence%  |
|--------------|-------------|----------------------------------|--------------|
| Males        | 1200        | 429                              | 35.8%        |
| Females      | 300         | 103                              | 34.3%        |
| <b>Total</b> | <b>1500</b> | <b>532</b>                       | <b>35.5%</b> |

**Table III:**Age Range Of Donors With Positive *Toxoplasma gondii*

| Age          | Positive Cases (n) | %          | Male (n)   | %          | Female (n) | %          |
|--------------|--------------------|------------|------------|------------|------------|------------|
| <20          | 56                 | 10.5       | 39         | 9.1        | 17         | 16.5       |
| 20-29        | 220                | 41.4       | 180        | 42.0       | 40         | 38.8       |
| 30-39        | 178                | 33.5       | 148        | 34.5       | 30         | 29.1       |
| 40-49        | 65                 | 12.2       | 55         | 12.8       | 10         | 9.7        |
| $\geq 50$    | 13                 | 2.4        | 7          | 1.6        | 6          | 5.9        |
| <b>Total</b> | <b>532</b>         | <b>100</b> | <b>429</b> | <b>100</b> | <b>103</b> | <b>100</b> |

The prevalence of *Toxoplasma gondii* antibodies IgM among the study populations was negative.

In a study from Kenya serological and parasitological survey of blood donors for toxoplasmosis, the prevalence rates of *Toxoplasma* was 42 % of 322 blood donors with 5,9 % showing high titres indicating possible active infection.<sup>15</sup> In a study from Abha, Asir Region, South –Western Saudi Arabia, 1000 healthy blood donors in the were screened for *Toxoplasma gondii* IgG antibodies, a prevalence of 52.1% was found.<sup>16</sup>

In our study, the highest rate of seropositivity was found in the age group from 20 - 29 years among the male population and from 20 - 29 years among the female population. After 50 years of age , the presence of antibodies declined. This finding is consistent with those of Jackson and Hutchinson, who observed that in the rural blood donors the maximum presence of antibodies in the age group 25 - 44 years.<sup>12</sup>

Yaneza, and Prasanna have reported the highest rate of seropositivity in the age group from 21 to 30 years among the male population and from 18 to 30 among the female population.<sup>9</sup>

The higher rate of seropositivity among 20 to 29 year–old females and 20 - 29 years-old among the males should be confirmed by further studies as the number of female donors studied is very low (300), and the findings are not comparable to the large number of male donors examined.

Our study highlights the prevalence rates of *Toxoplasma* antibodies among different groups. The prevalence varies from one group to another, being the highest among young donors. Therefore

increased public concern on the safety of blood transfusion with respect to transfusion-transmitted infections include *Toxoplasma gondii* antibodies IgG, and IgM to ensure a long –term increase in the blood supply without jeopardizing safety.

In the view of these findings, we suggest that when considering blood transfusion for a special group of patients (i.e. Immunosppressed), when selecting donors, it should be wise to exclude those with evidence of previous exposure to *Toxoplasma gondii*.

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