

Original Article

Seroprevalence of *Toxoplasma gondii* in Military Personnel and their Families Referred to the Military Hospital in Tehran, Iran

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Abstract

Background: Toxoplasmosis is one of the world's most common infections in human and other warm-blooded vertebrates and has the most extensive universal spread. The purpose of this study is determining the seroprevalence of human *Toxoplasma gondii* infection, in the military personnel and their families referred to Baqiyatallah hospital, 2011-2015.

Materials and Methods: In this cross-sectional study, the serum of 3370 person contain 770 men and 2600 women attending the laboratories were selected and after completing the questionnaires and also by implementing Chemiluminescence method, these serums were examined for the presence of IgM and IgG immunoglobulins of the *Toxoplasma gondii*.

Results: The results were analyzed using the chi-square test. They showed that there were no statistical relationships between the prevalence of IgG and gender in 2011, 2013, ($P>0.05$) but there were significant relationships between them in 2012, 2014 and 2015 ($P<0.05$), also there were no statistical relationships between the prevalence of IgM and gender in all years ($P>0.05$). The results showed that there were statistical relationships among IgG and age ($P<0.01$) but there was no statistical relationships between IgM and age in all cases ($P>0.05$).

Conclusion: The results showed high prevalence of Toxoplasmosis in the military personnel and their families in Baqiyatallah hospital. The prevalence of IgG was somehow in the range and positive IgG titer was somewhat higher than what was reported in other studies in the North-West of the country; this could be partly due to the sensitivity and specificity of Chemiluminescence method compared to other methods of serology in diagnosis of Toxoplasmosis.

Keywords: Toxoplasmosis, Seroprevalence, Chemiluminescence, Military, *Toxoplasma gondii*

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Introduction

Toxoplasmosis is a disease that caused by a protozoan called the *Toxoplasma gondii* which is one of the most consequential parasitic infections in humans and other warm-blooded vertebrates and has the most extensive universal spread^{1,2}.

Although only felidae, especially ordinary cats, play the role as the final host (Enteric cycle), a wide range of animals, including birds, ruminants, rodents, primates, and particularly humans are discussed as the host interface (Toxoplasmic cycle) of this coccidian protozoa³. *Toxoplasma gondii* belongs to the genera Isospora (in Apicomplexa categories) in which due to owning oocyte (resistant to adverse environmental conditions) as well as various transmission methods such as contamination by soil (consuming short-based vegetables and plants, and also working with soil), drinking water, eating raw or undercooked meat of birds and mammals, nourishing from contaminated milk of mammalian, blood transmission, organ transplants, etc. as well as a broad and relatively rare host range is globally epidemic⁴.

Infection in patients with immune function is often without clinical manifestations and the most common manifestation of toxoplasmosis among these people is lymphadenopathy which is benign and self-limiting⁵.⁶ *Toxoplasma* in people with immune disorders, especially patients with acquired immune deficiency Syndrome (AIDS) could be perfectly opportunist and can cause serious diseases which are mainly brain-related and may lead to death^{7,8}.

It is estimated that approximately 500 million people worldwide are infected with the parasite. The prevalence of this infection varies by age, geographical area, temperature, moisture content, and food habits of people and also keeping cats in residential areas. The least amount of contamination is usually in hot and dry and cold spots and the highest rate belongs to hot and humid climates¹. Sulfonamide and pyrimethamine is the effective therapy for toxoplasmosis. In acute toxoplasmosis, the tachyzoite is the appropriate stage for treatment while, bradyzoites or tissue cyst cannot be eradicated in chronic toxoplasmosis. As a result, prevention and treatment of toxoplasmosis are important to conduct⁹. Many surveys have been conducted in Iran and other

countries about toxoplasmosis and different results in different regions have been obtained¹⁰⁻¹³. Considering that there are no epidemiological data regarding the recent prevalence of toxoplasmosis in the military, this study was designed to investigate the prevalence of *T. gondii* infection among the military personnel and their families in Baqiyatallah hospital during 2011-2015.

Methods

This study was a cross-sectional study and the samples were collected from men and women who were admitted to laboratories of Baqiyatallah hospital during 2011-2015, Tehran, Iran and also simple sampling was actuated.

Due to the prevalence of infection and on the basis of studies reported in neighboring areas, 3370 people were selected as sample sizes through estimated proportion of the population with absolute precision formula. Within 5 years, all admitted patients in Baqiatallah hospital for whom requested to the toxoplasma test, were studied and statistical tests were done.

After obtaining informed consent from participants and completing the questionnaires, data were gathered about sex, age and marital status. Blood samples were collected and their serums were separated then they were stored at -20 °C.

After completion of sampling, all samples were examined for IgM and IgG antibody titers by implementing Chemiluminescence method and IgM and IgG kits for the diagnosis of toxoplasmosis (Diasorin and by LIAISON machine, USA). According to the kit manufacturer's instructions about IgM, higher than 8 (Au/ml) and in case of IgG higher than 11 (IU/ml) were positive.

To analyze the data, chi-square test and SPSS 18 statistical software were used. P-value less than 0.05 were considered significant.

Results

In this study 3370 blood samples were examined; 745 of them had IgG antibody, 114 of them had IgM antibody. The prevalence rates of IgG and IgM anti-*Toxoplasma gondii* antibodies were 22% and 3.3%, respectively. 770 (22.84%) patients were men and

Table 1: Seroprevalence of Toxoplasmosis in men and women in different years.

Sex	Year	IgM			P-value	IgG			P-value
		Total individuals	Positive cases	Overall prevalence (%)		Total individuals	Positive cases	Overall prevalence (%)	
Male	2011	14	0	0	>0.05	16	3	18/75	<0.05
	2012	329	22	6/68		311	129	41/47	
	2013	169	13	7/69		161	46	28/57	
	2014	236	4	1/69		185	35	18/91	
	2015	56	8	14/28		60	27	45	
Female	2011	65	2	3/07	>0.05	62	24	38/70	>0.05
	2012	428	8	1/86		364	96	26/37	
	2013	653	29	4/44		576	157	27/25	
	2014	953	12	1/25		810	96	11/85	
	2015	427	14	3/27		438	139	31/73	
Total	2011	79	2	2/53	>0.05	78	27	34/61	<0.05
	2012	757	30	3/96		679	225	33/13	
	2013	822	42	5/10		737	203	27/54	
	2014	1189	16	1/34		995	131	13/16	
	2015	483	22	4/55		498	166	33/33	

2600 (77.15%) were female.

For gender, seroprevalence of anti-*Toxoplasma gondii* IgG antibody was significantly higher among female donors. The chi-square test results showed no significant differences between men and women with IgG positive in 2011 and 2013 ($P < 0.05$) but there were significant differences in 2012, 2014 and 2015. About the prevalence of IgM positive among men and women there were no significant differences (Table 1).

The highest prevalence of IgG antibody was in the age range of 31 to 40 with 44.61 % in men and in women was in the range higher than 40 with 53.12% which by aging, the prevalence could be increasingly aggrandize. However, the highest prevalence of IgM antibody was in the age range of 11 to 20 with 12.9% for men and 3.28 for women in the same range. Out of the 3370 blood donors, 930 (27.5%) tested seropositive for anti-*Toxoplasma gondii* antibodies; 745 (22.1%) donors tested seropositive for only IgG

Table 2: Seroprevalence of toxoplasmosis in men and women in different ages.

Sex	Age	IgM			P-value	IgG			P-value
		Total individuals	Positive cases	Overall prevalence (%)		Total individuals	Positive cases	Overall prevalence (%)	
Male	<10	180	4	2.22	>0.05	171	17	9.94	<0.05*
	11-20	93	12	12.90		83	15	18.07	
	21-30	255	21	8.23		268	111	41.41	
	31-40	78	4	5.12		65	29	44.61	
	>40	165	6	3.63		146	62	42.46	
Female	<10	106	2	1.88	>0.05	97	8	8.24	<0.05*
	11-20	152	5	3.28		118	13	11.01	
	21-30	1505	40	2.65		1331	252	18.93	
	31-40	593	13	2.19		544	154	28.30	
	>40	249	7	2.81		160	85	53.12	
Total	<10	286	6	2.09	>0.05	268	25	9.32	<0.01**
	11-20	245	17	6.93		201	28	13.93	
	21-30	1760	61	3.46		1599	363	22.70	
	31-40	671	17	2.53		609	183	30.04	
	>40	414	13	3.14		306	147	48.03	

Stars indicate the level of *significance* (*p < 0.05, ** p < 0.01)

antibody, 71 (2.1%) tested seropositive for both IgM and IgG and 114 (3.3%) were positive for IgM antibody alone. For gender, seroprevalence of anti-*Toxoplasma gondii* IgG antibody was significantly higher among female donors. 512 (32.7%) female donors were positive in terms of IgG anti-*Toxoplasma gondii* antibodies compared to 234 (20.8%) male donors (P<0.05). In contrast, there was no significant

difference in the prevalence of IgM anti-*Toxoplasma gondii* among the female and male donors (p = 0.91). Furthermore, There was a significant relationship between age and the prevalence of IgG antibody and chi-square test for trend revealed that seroprevalence of IgG anti-*Toxoplasma gondii* antibodies increased with age (p<0.01) but there was no significant relationship between different ages and the prevalence

of IgM antibody (Table 2).

Discussion

Toxoplasma gondii infection as a blood-born protozoan disease can cause significant consequence, especially among uncompromised and pregnant women¹⁴⁻¹⁶. Since current therapies are not fully effective and there is no safe and immune vaccine available, it is necessary to make the effort for reducing toxoplasmosis transmission to diminish the severe side effects of toxoplasmosis. In this study, 3370 blood samples were tested and among these only 22% had IgG positive and 3.33% had IgM positive.

Based on the previous surveys, the prevalence of this infection is divergent in different parts of Iran. According to the similar studies conducted in the malignant patients admitted to a hospital in Tabriz, the prevalence of positive serum titer of the *Toxoplasma gondii* was 48%¹⁷. The prevalence of IgG and IgM antibodies by implementing Chemiluminescence method were estimated 34.9% and 32.8% for IgG, and 2.9% and 3.7% for IgM¹⁸.

The results of this study, in terms of prevalence of IgM antibody (acute or sub-acute infection) were consistent with the results of other studies carried out in the North-West of the country, but positive titers of IgG in this study were somewhat less than what had been reported in the cities of Tabriz, Ardebil and Urmia¹⁸⁻²⁰.

This issue is due to the high sensitivity of the Chemiluminescence method in diagnosing *Toxoplasma* serology compared to the other serology methods, including Enzyme-linked immunosorbent assay (ELISA) and indirect immunofluorescent testing.

The results of studies in different parts of the world show different ways of the prevalence of *Toxoplasmosis* which can be due to the differences in climate, food habits, individual and environmental health, statistical population and serological diagnosis^{21, 22}.

In this study, as the results of previous researches, the highest levels of antibodies were in the age range of 21 to 30 and with aging the prevalence increases. The risk of parasite contamination increases over time by one of the possible methods of acquisition of infection through aging. There was a significant relationship

between age and IgG antibody titer but no significant relationship was found about IgM antibody titer and age. This is similar to the results of the study conducted in Kermanshah²².

Although the higher frequency of the prevalence of IgG and IgM antibodies belongs to women than men, from a statistical point of view, there was no significant relationship between sex and positivity of IgG and IgM antibody titers; the findings of research conducted by Asmar were corresponded to 12 provinces of Iran²³. There were significant differences between woman and men in 2012 and 2014. This significant difference might be because of the difference between the number of men and women samples.

The present study was subject to a limitation which is the patients referred to this hospital are sometimes nonmilitary persons; this study cannot be expanded to all military families. The overall results of this study revealed that there is a relationship between the prevalence of toxoplasmosis and factors such as age. Public health should prevent toxoplasmosis by focusing on the prevention of transmission of *Toxoplasma* to humans, since the elimination of *Toxoplasma gondii* in animal sources is not feasible.

The limitation and weak point are the patients referred to this hospital are sometimes nonmilitary persons; this study cannot be expanded to all military families.

Conclusion

Therefore, the result of this study can be warned for military organizations in order to pay more attention to toxoplasmosis among military individuals and also design screening programs for prevention transmission rout of *Toxoplasma gondii*. It is the first report about seroprevalence of *Toxoplasma gondii* on military personnel and their families.

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