

Prevalence of toxoplasmosis and related risk factors among humans referred to main laboratories of Urmia city, North West of Iran, 2013

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Abstract Toxoplasmosis is mostly asymptomatic infection in immunocompetent individuals while it can cause a severe infection in human fetus during pregnancy and immunocompromised patients. This study aimed to determine the prevalence of anti-*Toxoplasma* IgM and IgG seropositivity and potential risk factors of the infection in humans referred to Urmia City main diagnostic laboratories, Urmia, Iran. Totally 195 blood samples were collected from the individuals referred to main diagnostic laboratories of Urmia City, 2013. Serum concentration of anti-*Toxoplasma* IgG and IgM were determined using ELISA method. Demographic variables of the participants were collected by interviewing, which are including sex, age, occupation, educational and residential status, eating undercooked meat, consumption of raw vegetable and the method of washing raw vegetables. None of all 200 serum sample were anti-*Toxoplasma* IgM positive, but different concentrations of anti-*Toxoplasma* IgG were observed in 88 (45.12 %) of samples. The significant higher rate of anti-*Toxoplasma* IgG seropositivity were observed in people with soil related jobs ($P = 0.005$, OR = 2.266; 95 % CI 1.260, 4.078) and history of eating raw vegetables at restaurant ($P = 0.036$, OR = 1.985; 95 % CI 0.991,

3.978). Also anti-*Toxoplasma* IgG concentration mean was significantly higher in people who were commonly eaten raw vegetable at restaurants ($P < 0.001$, $t = 7.918$). The prevalence of chronic toxoplasmosis is considerably high while the acute infection is very low in the studied area. Having soil related jobs and eating raw vegetables at restaurants increases the risk of acquiring the infection.

Keywords *Toxoplasma gondii* · IgM · IgG · Risk Factor · Iran

Introduction

Toxoplasmosis is one of the most prevalent and globalized infections caused by parasitic protozoa *Toxoplasma gondii*. The infection is mostly benign in healthy individuals, but it can become life threatening when the host became immunocompromised or immunosuppressed (Weiss and Dubey 2009). Also acute toxoplasmosis in pregnant women can results in devastating complications in fetus such as ocular toxoplasmosis and CNS complications (Commodaro et al. 2009; Kieffer and Wallon 2013). The prevalence of the chronic infection is considerably high, but the acute infection is less prevalent in most societies (Jafari et al. 2012; Rasouli et al. 2014).

In fact *T. gondii* is a parasite of felids and the other animals including humans are its intermediate host (Fayer et al. 2004). Unsporulated oocysts shed by cats and soon became infective in the environment. If intermediate hosts including a wide variety of animals, human and also cat ingest the oocysts the acute infection will occurs (Fayer et al. 2004; Tenter et al. 2000). Human and other animals can acquire the infection by ingesting raw or undercooked meat, water and vegetables contaminated by sporulated oocysts (Dhama et al. 2013; Jones and Dubey 2010, 2012).

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Nowadays by increasing the prevalence of some disease causing immune deficiencies such as AIDS and intentional manipulation of human immune system for organ transplantation, the population of at risk people is increasing too. It is necessary to study the prevalence of *Toxoplasma* infection in every region in every time period to conduct better updated health strategies in each area.

This study aimed to determine the prevalence of toxoplasmosis among humans referred to Urmia city main diagnostic laboratories.

Materials and method

Sampling

In this cross sectional study, 195 blood samples were taken from humans referred to the main diagnostic laboratories of Urmia city, North West of Iran, 2013. The sera were isolated from whole blood and kept frozen in $-20\text{ }^{\circ}\text{C}$ until the examination. The demographic variables of the participants of study have been collected by interviewing, which are including sex, age, occupation, educational and residential status, eating undercooked meat and the method of washing raw vegetables.

Enzyme linked immunosorbent assay

For determination of anti-*Toxoplasma* IgG and IgM antibodies in the serum samples, the *Toxoplasma* IgG and IgM ELISA kits (PISHTAZ TEB DIAGNOSTICS, Iran) were used. The tests procedure performed according to the manufacturer's instruction. The summary of the tests are as following. For anti-*Toxoplasma* IgM, the required number of wells was chosen, the first three consecutive wells used as blank, positive and negative control and the next two wells as cut standard serums. For the first step of the test, 100 μl of the positive and negative control, cut offs and 1:101 diluted samples added to the wells, but nothing added to the blank well. The wells incubated for 30 min at $37\text{ }^{\circ}\text{C}$. The wells washed five times, each with 300 μl of working wash solution. Then 100 μl of working enzyme conjugate added to the wells except blank well. The wells incubated for 30 min at $37\text{ }^{\circ}\text{C}$ and then the washing procedure was repeated. After washing was ended, 100 μl of chromogenic substrate added to all wells and incubated for 15 min at room temperature at dark place. Finally 100 μl of stop solution added and photochromic measurement was done at 450 nm with 630 nm filter as reference using ELISA reader device. The procedure of IgG ELISA is just like the IgM except that the all incubations have been done in room temperature and standards were used instead of cut offs.

IgG concentration results higher than 1.1 IU/ml considered as positive and <0.9 IU/ml considered as negative. Values between 0.9 and 1.1 IU/ml considered as borderline.

For IgM test, Cut-off index lower than 0.9 considered as negative and those greater than 1.1 considered as positive results. The results between 0.9 and 1.1 considered as suspected.

Data analysis

Data were analyzed by SPSS v.16 software using *t*- and Chi square tests.

Results

From total of 195 studied people, 8 female and 187 male, none (0 %) has been observed to be anti-*Toxoplasma* IgM seropositive and consequently none had acute infection. Despite, 88 (45.13 %) and 107 (54.78 %) out of 195 serum samples were anti-*Toxoplasma* IgG seropositive and seronegative, respectively.

The significant higher rate of anti-*Toxoplasma* IgG seropositivity were seen in people with soil related jobs ($P = 0.005$, OR = 2.266; 95 % CI 1.260, 4.078) and history of eating raw vegetables at restaurant commonly ($P = 0.036$, OR = 1.985; 95 % CI 0.991, 3.978). Also anti-*Toxoplasma* IgG mean concentration was significantly higher in people who were commonly eaten raw vegetable at restaurants ($P < 0.001$, $t = 7.918$).

No significant difference was observed about prevalence of toxoplasmosis between other demographic variables, such as age, sex, having domestic cats, method of washing raw vegetables, eating under cooked barbecued meat and eating barbecued game meat (Table 1).

Discussion

Totally 195 serum samples were tested about the presence of anti-*Toxoplasma* IgG and IgM. The results show none of serum samples is anti-*Toxoplasma* IgM seropositive. It can be concluded that acute toxoplasmosis is not prevalent in Urmia city, North West of Iran, 2013. However, the high prevalence of chronic toxoplasmosis is considerable (45.13 %). Furthermore, having continuous soil contact and eating raw vegetables at restaurants increase risk of the infection. On the other hand results illustrated that anti-*Toxoplasma* IgG concentration mean is higher in humans eating raw vegetable, which is indicative of the possible heavier burden of infection in this group of people.

There are plenty of studies in Iran, which some reported a similar results comparing to our results. For example, in

Table 1 Anti-*Toxoplasma* IgG mean concentration and seropositivity among demographic variables of the studied population

Demographics	Anti- <i>Toxoplasma</i> IgG		Total	OR	P	IgG titer	P
	Positive	Negative					
Soil contact							
Yes	60	52	112	2.266	0.006	67.098	0.816
No	28	55	83	1		70.118	
Eating undercooked meat							
Yes	10	9	19	1.396	0.325	83.180	0.370
No	78	98	177	1		66.121	
Eating raw vegetable							
Yes	84	100	184	1.470	0.548	70.530	<0.001
No	4	7	11	1		16.175	
Eating raw vegetable at restaurants							
Yes	73	76	149	1.985	0.036	69.447	0.613
No	15	31	46	1		61.307	
Having household cat							
Yes	6	3	9	2.537	0.184	41.950	0.241
No	82	104	186	1		69.970	

Iran having soil related jobs, eating raw vegetable at restaurants have been reported as a risk factor of acquiring the *Toxoplasma* infection (Jafari et al. 2012; Rasouli et al. 2014). Rasouli et al. 2014, reported that the washing method of vegetables is related to *Toxoplasma* infection. Also they found anti-*Toxoplasma* IgM in 3.5 % of Urmia province, which is higher than what we observed (Rasouli et al. 2014).

Reports from Iran illustrates different prevalence rates range from 12.8 to 80 % in different geographical regions and on different populations such as hemodialysis, diabetic and schizophrenia patients and also healthy general population (Assmar et al. 1997; Bayani et al. 2013; Borna et al. 2013; Ebrahim Zadeh et al. 2014; Ghorbani et al. 1981; Khademvatan et al. 2014; Shirbazou et al. 2013).

Ghorbani et al. (1978) carried out one of the oldest studies in Iran on seroprevalence of toxoplasmosis among inhabitants of Caspian sea basin. They reported 55.7 % of infection with *Toxoplasma* among 1,779 humans using indirect fluorescent antibody technique (Ghorbani et al. 1978). Three years later in another study Ghorbani et al. found 12.8 % of seroprevalence of toxoplasmosis among 3,370 plasma samples collected from residents of three mountainous regions of Azerbaijan and Khuzestan provinces, Iran. They noticed that by increasing the age the intensity of infection increases too. Considering the some overlapping regions of present study with work of Ghorbani et al. (1978), toxoplasmosis has been increased over the past three decades or may their method has been possessed lower sensitivity (Ghorbani et al. 1981).

Fallah et al. (2008) found that the toxoplasmosis is more prevalent among women who consume undercooked red

meat or barbecue, but in the present study there was no statistically significant difference between humans who either consume undercooked red meat or not. Also they reported the consumption of raw vegetable as a risk for infection which is somehow similar to our findings (Fallah et al. 2008).

Sarkari et al. (2014) reported 19.3 % of seroprevalence of toxoplasmosis among 1,480 blood donors of Fars province. They found anti-*Toxoplasma* IgG and IgM seropositivity in 12.3 % and 5.47 % of their studied population. Using PCR method, they found toxoplasmic parasitemia in only 2 (1.9 %) out of 104 anti-*Toxoplasma* IgM positive individuals. They have also reported the age, residential status and educational level as factors that affect the rate of the infection (Sarkari et al. 2014). In our study the later factors had no effect on the prevalence of toxoplasmosis. Based on their study in Fars Province the prevalence of anti-*Toxoplasma* IgG was much lower and IgM higher than Urmia city.

Based on the results of the present study the prevalence of toxoplasmosis is high in Urmia city while the acute toxoplasmosis is rare.

Conclusion

According to the results of this study, the prevalence of chronic toxoplasmosis is considerably high while the acute infection is very low in Urmia city, North West of Iran. Also having continues soil contact or having soil related jobs and eating raw vegetables at restaurants increases the risk of acquiring the infection.

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Conflict of interest We have no conflict of interest regarding this study.

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