Seroprevalence of toxoplasmosis in mentally retarded patients in Iranian rehabilitation centers

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Abstract *Toxoplasma gondii* is one of the most common causes of latent infections in humans and animals. Although *T. gondii* infection is widely prevalent in the world, most acquired cases of the disease are asymptomatic. The important aspect of this parasitic infection is the probable danger of congenital transmission and its severe effects on the fetus. There have been many reports about the prevalence of anti-*T. gondii* antibody among different groups of people in Iran; however the epidemiological data in mentally retarded patients are rare. The present study

was conducted on 158 mentally retarded persons (94 males, 64 females) in the rehabilitation centers of Khoramabad from autumn 2012 to winter 2013. The overall prevalence of anti-*T. gondii* antibody was 30.4 % (48 cases). There were no significant difference between sex and toxoplasmosis ($p > 0.05$). However, there were no statistically significant difference between age and toxoplasmosis, nevertheless the prevalence of toxoplasmosis in the patients less than 10-years-old had significantly the lowest rate. The highest infection rates were found in the two age groups of 10–19 and ≥ 30 years old. Our results showed that the prevalence of toxoplasmosis in the mentally retarded persons in the rehabilitation centers of Khorramabad was similar to the prevalence in pregnant women in this city. Therefore, the disease does not cause additional danger to this group of women.

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Introduction

Toxoplasma gondii, an obligate intracellular parasite found in many species throughout the world, causes a variety of clinical syndromes in human and animals (Lee et al. 2000). It is estimated that over one-third of the world's population are infected with the parasite (Weiss and Dubey 2009). The prevalence of *T. gondii* in various groups in Iran has been reported to be 30–75 % (Ajami et al. 2005). It is generally accepted that prevalence of antibody in human populations depends on geographic, climatic, hygienic, and socio-economic conditions, as well as on the life style of the population (Daryani et al. 2011). All of these factors are considered to be related to the opportunity for an individual

to accidentally ingest either of two forms (oocyst or cyst) of the toxoplasma organism (Terazawa et al. 2003; Linguissi et al. 2012).

Toxoplasmosis is usually asymptomatic in adults, but the infection acquired during pregnancy may cross the placenta and cause irreparable harm and injuries to fetus and infant. In some cases, abortion is observed and sometimes the infection may lead to severe sequelae which are observed during infancy (Allain et al. 1998).

The frequency of toxoplasmosis acquisition during pregnancy ranges from 1 to 4 per 1,000 pregnancies in several countries, and congenital infection has a prevalence of 0.2–2 per 1,000 births (Sharif et al. 2007). According to result of studies (Wong and Remington 1994), 90 % of infected cases are asymptomatic or oligosymptomatic. Toxoplasmosis during pregnancy can cause congenital infection and manifest as mental retardation, blindness and low IQ in the infant (Fallahi et al. 2009). The severity of fetal disease varies with the gestational age at which maternal infection occurs (Remington et al. 2011).

A previous study showed that a high percentage (69 %) of pregnant women in Khorramabad lack specific immunity to *T. gondii*, and this endangers their fetuses seriously (Cheraghipour et al. 2010). Considering the results of this research, the present study was conducted to investigate the prevalence of *T. gondii* infection in mentally retarded persons in the rehabilitation centers of Khorramabad in the west of Iran.

Methods

Studied area

The city of Khorramabad, with a population of approximately 350,000 people, is the most populated city and the center of Lorestan Province in the west of Iran. It is located at an altitude of 1,125 m above sea level, and has the geographical coordinates of 33°26'N 45°17'E. The average temperature is 17.6 °C, but in the coldest months of the year (December to March), it reaches 5 °C above zero. The average humidity is 46.08 %, and the average monthly precipitation is 42.74 mm (Available at: <http://www.climate-charts.com/Locations/i/IR40782.php>).

Sampling and tests

This descriptive study was done from autumn 2012 to winter 2013 in Khorramabad. Blood samples were obtained from 158 mentally retarded persons in the rehabilitation centers of Khorramabad. Then, the serum samples were isolated in the laboratory of the Razi Herbal Medicines Research Center, and kept at −20 °C until being examined.

All the serum samples were examined to detect specific anti-*T. gondii* IgG antibody according to the instructions of the diagnostic kit (DS-EIA-ANTI-TOXO-G-FAST, Italy) with a sensitivity and specificity of 98 %. Briefly, serum samples were diluted (1:100), then negative control, cut-off calibrator, positive control and diluted serum were all poured into wells (100 µl each). Strips were then incubated for 20 min in an incubating bag in room temperature. Using diluted buffer, wells were washed three times and HRP (Horse Radish Peroxidase) conjugated anti-human IgM was added to each well (100 µl), incubation and washing process was repeated then 100 µl of TMB (tetra methyl benzidine) was applied as enzyme substrate. After being incubated for 10 min in room temperature positive samples turned into blue. The results were read by the ELISA reader (STAT FAX 2100, USA) at a wavelength of 450 nm. The samples with the OD readings <13.05 were considered as negative, between 13.05 and 15.95 as equivocal, and >15.95 as positive. Finally, the statistical analyses were performed using the SPSS software, version 19.

Results

Infection rate in different age groups undergone the survey and the distribution of the infection according to sex showed in Table 1. Out of 158 mentally retarded persons, 94 (59.4 %) were male and 64 (40.6 %) were female. A total of 48 cases (30.4 %) had anti-*T. gondii* IgG antibody. No significant relationship was found between age group and *T. gondii* infection, nevertheless the prevalence of toxoplasmosis in the patients <10 years old was significantly lower than the other groups. There were no significant differences between sex and toxoplasmosis in the age group of 10–19 years old ($p = 0.095$). However, the seroprevalence of toxoplasmosis in the males was higher than females (41.4 vs. 15.4 %).

The fewest cases of infection were observed in the age group of <10 years old, and the most cases in the 10–19, and ≥30 year-old age groups. The results of Fisher's exact test did not show any significant differences between the seroprevalence of toxoplasmosis in the patients <20 years old with patients >20 years old ($p = 0.074$). However, the seroprevalence of toxoplasmosis in the females >20 years old was higher than <20 years old (34.9 vs. 14.3 %).

Based on the results of Fisher's exact test, no significant difference was found between the seroprevalence of toxoplasmosis in the males and females in the cases <20 years old ($p = 0.091$). However, the seroprevalence of toxoplasmosis in the males <20 years old was significantly higher than females <20 years old (34.3 vs. 14.3 %).

Table 1 Distribution of prevalence toxoplasma infection in different sex and age groups in the mentally retarded persons in rehabilitation centers of Khorramabad, Iran

Age group	N	Male		Female		Total of positive (%)
		Positive N (%)	Negative N (%)	Positive N (%)	Negative N (%)	
10<	14	0 (0)	6 (42.8)	1 (7.1)	7 (50)	1 (7.1)
10–19	42	12 (28.5)	17 (40.4)	2 (4.7)	11 (26.2)	14 (33.3)
20–29	69	12 (17.4)	30 (43.5)	10 (14.5)	17 (24.6)	22 (31.9)
30≥	33	6 (18.2)	11 (33.3)	5 (15.1)	11 (33.3)	11 (33.3)
Total	158	30 (19)	64 (40.5)	18 (11.4)	46 (29)	48 (30.4)

N number

Discussion

Toxoplasmosis is a disease caused by the protozoal parasite *T. gondii*. Newly acquired *T. gondii* infection in a pregnant woman can be transmitted to the fetus and may cause mental retardation, blindness, epilepsy, and death. Researchers have reported the prevalence of congenital toxoplasmosis to be 1–310 per ten thousand pregnancies (Ertug et al. 2005). IgG antibody against toxoplasma usually appears 1–2 weeks after the infection and stays in blood for a long time, while IgM antibody appears in the blood immediately after the arrival of the parasite and disappears quickly (Black and Boothroyd 2000). Accordingly, we investigated the existence of IgG antibody in the serum samples of the mentally retarded persons in Khorramabad. The results of our study are similar to Yemen study. The rate of toxoplasmosis in the mentally retarded persons in the rehabilitation centers of Khorramabad was 30.4 %, and the rate of the infection in the visually or hearing disabled children in Yemen was 32.5 % (Saleh et al. 2010). On the other hand, the results of our study differ to other studies conducted in this area. The infection rate in our study was higher than the 15.1 % in Isfahan province (Farid and Sharif 1990) and 13.89 % in rehabilitation centers of Tehran province of Iran (Gharavi et al. 2005). This difference may be attributed to climatic differences, more humidity in Khorramabad, and dietary differences between Khorramabad and the other two cities. The oocytes of *T. gondii* are able to survive more in soil in humid climates, keep their pathogenicity, and, as a result, increase the possibility of infection in humans and animals (Dubey 2009). However, the rate of toxoplasma infection in this study was lower than 51.5 % in Gilan province (Asmar et al. 1999), 77.4 % in Mazandaran province (Sharif et al. 2007), and 43.75 % in Egypt (Amrei et al. 1999). The higher prevalence rates of toxoplasmosis in these studies compared to our study can be due to the differences in climate, animal distribution, intermediate and final host distribution, cultural habits, lifestyle, and use of various diagnostic methods for the parasite detection.

Rainfall and humidity in Gilan and Mazandaran provinces are more than in Khorramabad. Moreover, the IFAT technique was applied in the studies conducted in Gilan and Mazandaran, while the ELISA technique was utilized in our study to detect of *T. gondii*. The ELISA technique is one standard method to detect of antibodies (Walle et al. 2013).

In this survey, no significant difference in seropositivity was found between males and females. This is consistent with previous reports (Shin et al. 2009; Rostami et al. 2006; Griffin and Williams 1983), although other report sex differences (Walle et al. 2013; Shimelis et al. 2009; Shirbazou et al. 2011).

In the present study, there was no significant difference between age and the number of positive cases of toxoplasmosis, while such a relationship has been reported in various studies (Sharif et al. 2007; Cheraghipour et al. 2010; Sharif et al. 2006).

When pregnant women acquire primary infection with *T. gondii* especially during their second or third trimester, they can transmit the infection transplacentally to their fetus (Jones et al. 2003). The infected babies may develop congenital toxoplasmosis (Elbez-Rubinstein et al. 2009). In China, Wen et al. (2003) evaluated 95 pregnant women with positive IgM antibodies and followed up their children for 12 months and concluded that congenital toxoplasma infection is closely correlated with abnormal pregnancy outcomes and infantile mental retardation. Early intervention can improve intelligence development. In Brazil, Caiaffa et al. (1993) compared the prevalence of *T. gondii* infection between Intellectual disability (ID) children and normal controls by designing a case–control study, and concluded that the congenital toxoplasmosis, in its sub clinical form, appears to be an important component in the etiology of ID, especially in high risk (lower socio-economic) groups. Ameri et al. (1999) evaluated the prenatal infections in Egyptian children with unknown cause of ID, based on their study results, specific toxoplasmosis IgG antibodies were 43.75 % for MR cases and 37.5 % for their mothers. Six (18.75 %) mothers gave history of eating raw

meat and canned food, while eight (25 %) had pet cats. Unfortunately, we could not get access to most of the mothers of the disabled persons who participated in the study, and could not obtain the data related to maternal pregnancy state as well as behavioral and nutritional habits. However, our results are highly consistent with the results of a study that done on pregnant mothers in Khorramabad reporting toxoplasmosis prevalence rates of 30.8 % for urban pregnant women and 31.4 % for rural pregnant women (Cheraghipour et al. 2010). Although these results suggest that toxoplasmosis does not cause additional danger to pregnant women and their fetuses in Khorramabad, they show the high risk of infection in the pregnant women who have not been infected with the disease yet, and danger of congenital toxoplasmosis to their fetuses. Nevertheless, the accomplishment of health education programs as an appropriate approach for prevention is warranted and we suggest that a health surveillance program be used as a primary preventive measure for congenital toxoplasmosis and focus on educating women in the reproductive age group to forcefully practice personal hygiene.

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Conflict of interest We declare that we have no conflict of interest.

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