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Sero-prevalence of *Toxoplasma Gondii* in Two Migrating Lore and Khamseh Tribes in Southern Iran

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Abstract

Background: Toxoplasmosis is a zoonotic disease which occurs mostly through ingestion of tissue cysts or oocyst excreted by infected cats. This study was conducted to determine the sero-prevalence of toxoplasmosis in two migrating Lore and Khamseh tribes in southern Iran living in tents with their domestic animals. **Materials and Methods:** During 2010, using cluster random sampling method, 357 blood samples were collected from two migrating tribes (Khamseh and Lore) in both genders and age groups of 8-80 years in Fars Province, southern Iran. Samples were tested for prevalence of toxoplasmosis using IgG Indirect Fluorescent Antibody Technique (IFAT). Findings in both tribes were compared regarding age, sex and lifestyle. **Results:** Prevalence of toxoplasmosis among both tribes was 12.3%. There was a significant difference for prevalence of toxoplasmosis between Khamseh (15.6%) and Lore (6.77%) tribes. No significant difference was observed between males (14.3%) and females (10.8%). The rate of infection increased with age. The highest prevalence was seen among those who used unhygienic water from well (15.7%). No relationship was observed between the prevalence of toxoplasmosis and the rate of abortion. In our study, sero-prevalence was lower than other studies in Iran. **Conclusion:** It seems that lifestyle trends like low consumption of vegetables and absence of cats in their lives are the most important factors for this low prevalence. This infection may be due to their lifestyle of consuming undercooked barbecue meat. [GMJ. 2014;3(4):238-44]

Key words: Prevalence; *Toxoplasma Gondii*; Tribe; Zoonose; Iran.

Introduction

Toxoplasma gondii is a zoonotic protozoan parasite which is still prevalent worldwide leading to economic losses in most live-stocks [1]. It is an important parasite infecting man and most warm-blooded animals. As the

only definitive host, cat has an important role in transmission of parasite by shedding oocysts in their feces [2]. In man, the parasite can be acquired by ingestion of tissue cyst in contaminated meat or oocysts present in the environment [3]. The importance of the sources of contamination differs locally based on

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the environmental characteristics, the variations in eating habits and the presence of cats [3] while the parasite was shown to have no sexual transmission [4].

In 2000, it was estimated that one third of the human population were infected with toxoplasmosis. Infection in human may be congenital or acquired [5]. In healthy humans, infection with the parasite is usually subclinical or mild, but during pregnancy, there is the risk for maternofetal transmission in acute infection with serious consequences for the fetus including abortion or congenital infection [6]. Toxoplasmosis is well-documented to cause bad obstetric history and is a major reason for congenitally-acquired infection to the parasite [7]. Congenital toxoplasmosis in children may be asymptomatic at birth but they will be at risk of developing retinal diseases or neurological abnormalities later in life [8]. Chorioretinitis, hydrocephaly, microcephaly or jaundice were also reported as manifestations of acute toxoplasmosis [9,10]. Infection with the parasite may result in severe encephalitis in immunosuppressed patients which may also be due to reactivation of a latent infection [11]. The results of IFAT on 13018 individuals in Iran showed that 51.8% of the population had significant levels of antibody against *T. gondii* [12]. In Southern Iran, there are several reports on sero-prevalence of toxoplasmosis in domestic animals including; 26.5% in sheep [13], 14.02% in goats [14], 36.1% in chicken [15] and 20.24% in cattle [16]. The migrating lifestyle of nomads in Fars Province, Southern Iran is unique. They live in tents with their domestic animals migrating from summer to winter quarters up to 600 km in search of food for their herd. As sero-prevalence of toxoplasmosis has not yet been studied among this ethnic group, this study was performed to determine the sero-prevalence of disease in the migrating Lore and Khamseh tribes.

Materials and Methods

The migrating Khamseh tribe (Population: 75000) speak Arabic and live in southeastern parts of Fars Province and Lore tribe (Population: 41000) live in southwestern areas of the province. During 2010, three hundred and

fifty seven migrating nomads including 224 subjects in Khamseh tribe and 133 individuals in Lore tribe were enrolled in their summer quarters in a cluster random sampling method. Blood samples were collected and the sera were stored in -20°C and then tested for toxoplasmosis using IgG Indirect Fluorescent Antibody Technique (IFAT) (Antigen vials: Pasteur Institute, Tehran, Iran; Fluorescent conjugated IgG: Bahar Institute, Tehran, Iran).

The sera were diluted 1/25 for preliminary screening and the positive samples were serially diluted up to 1/800 to obtain the real IgG antibody titer. The procedure was performed as described by Assmar *et al.* [12]. A written consent was retained from each participant.

Based on the epidemiological factors such as residential area, type of tribe, sex, age and source of drinking water, results were analyzed by SPSS software (Version 11.5; Chicago, IL, USA) using Chi-Square test. P value <0.05 was considered statistically significant.

Results

Among all participants, 154 were male and 203 were female (Age range: 8-80 years). Prevalence of toxoplasmosis among both migrating nomads was 12.3% (Table 1). There was a significant prevalence difference between Khamseh (15.6%) and Lore tribes (6.8%) (P=0.01) (Table1). The prevalence of toxoplasmosis among males was 14.3% compared to females 10.8% (Table 1). There was no significant difference between two genders (P=0.1). The distribution of age is presented in Figure 1, showing an increase with age (P=0.03). The highest prevalence was seen among those who used unhygienic well water (15.7%) (P=0.02) and the lowest prevalence was among those who consumed river water (5.2%) (P=0.02). Among individuals who drank tap water, the prevalence was 9.5%. No relationship was observed between the prevalence of toxoplasmosis and the rate of abortion (P=0.3).

Discussion

Sero-positivity to *T. gondii* was reported in 51.8% for all parts of Iran. In northern and

southern parts of Iran, using IFAT was reported to be 55% [17] and 29% [18], respectively. Davarpanah *et al.* (2007) reported the sero-prevalence of toxoplasmosis among 208 HIV/AIDS patients to be 18.2% while 4 (10.4%) and 34 (89.6%) subjects showed *Toxoplasma* sero-positivity with and without *Toxoplasma* encephalitis, respectively. The majority of these patients were in 25-34 age group, male, unemployed, single and resident in Shiraz, southern Iran; showing the importance of disease in active age group in Fars Province [19].

Among Iranian childbearing women, the maximum and minimum reported prevalence rates of anti-*Toxoplasma* IgG antibody using IFTA serological method were 21.8% and 54%; and using ELISA serological method were 23% and 64%, respectively. The overall estimation for prevalence of anti-*Toxoplasma* total antibody was 39.9%. So, prenatal screening can help identify mothers susceptible to infection [20].

Among diabetic patients of Iran, the prevalence of IgG antibodies against *T. gondii* was found 60.43% meaning that probably the destruction of *T. gondii* may affect nervous system and damage pancreatic cells leading to increased risk of diabetes [21].

The consumption of undercooked meat has been identified as a risk factor in acquisition of toxoplasmosis [5]. So, in migrating nomads the prevalence was lower than other studies in urban and rural regions in Iran. In this study, the rate of infection was 12.3%. Since nomads consume sheep and goat meat in undercooked (barbeque kebab) form and drink unboiled milk, they may acquire the infection this way [22].

Khamseh and Lore migrating nomads have different lifestyles, culture and nutritional habits. They live in tents with their domestic animals and migrate up to 600 km from summer to winter quarters from one province to another in search of food for their animals, although they do not keep cats among their ani-

Table 1. Toxoplasmosis in Migrating Nomads in relation to Epidemiologic Factors

		Infected		Non infected		Total	
		No.	Percent	No.	Percent	No.	Percent
Tribe (P=0.01)	Khamseh	35	15.6	189	84.4	224	100
	Lor	9	6.8	124	93.2	133	100
	Total	44	12.3	313	87.7	357	100
Gender (P=0.1)	Male	22	14.30	132	85.70	154	100
	Female	22	10.80	181	89.20	203	100
	Total	44	12.3	313	87.7	357	100
Supplied Water (P=0.02)	Spring & well	34	15.7	183	84.3	217	100
	River	4	5.2	73	94.8	77	100
	Tap	6	9.5	57	90.5	63	100
	Total	44	12.3	313	87.7	357	100
Age (Years) (P=0.3)	7-10	0	0	8	100	8	100
	11-20	11	8.7	115	91.3	126	100
	21-30	8	14	49	86	57	100
	31-40	7	15.9	37	84.1	44	100
	41-50	6	11.1	48	98.9	54	100
	50<	12	17.6	56	92.4	68	100
	Total	44	12.3	313	87.7	357	100

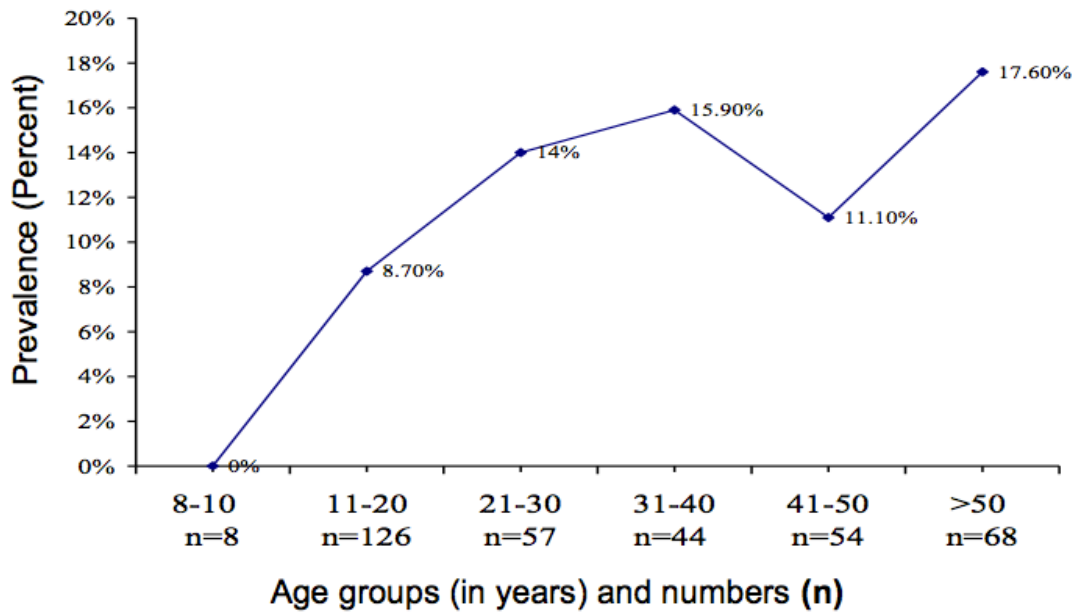


Figure 1. The Prevalence of Toxoplasmosis in Different Age Groups of Nomad Tribes

mals. As nomads do not keep cats among their animals and based on their migrating lifestyle that do not usually have any agricultural lands in their summer and winter quarters, it may explain the low prevalence of toxoplasmosis in this population. In autumn and winter, they live in dry sub-Saharan environment, with mean rainfall of 250 mm which is not suitable for survival of oocyst for long periods [17]. In spring, they move to Zagros Mountain at an altitude of 3000 m where the weather is cold with an average annual temperature of 10°C and rainfall of 500 mm. In spring, river and occasionally local tap water provide their drinking water which can be among other sources of infection.

The rate of sero-positivity for toxoplasmosis in Khamseh tribe was shown to be significantly higher than Lore tribe because the latter have access to natural gas and power-supplied refrigerators in their tents and can freeze their meat resulting in a reduction in survival of tissue cysts and less contamination of their meat products. Khamseh tribe does not have access to such facilities and live more closely to rural population. Their migration passages result in more contact with this population which may provide more risk of contact with stray cats and infection with oocyst of *T. gondii* in

comparison to Lore nomads. Similar to other studies [23,24], the rate of toxoplasmosis was shown to increase with age (Figure 1), which may be due to increased chance of acquiring the infection. So, gender does not affect the rate of infection significantly. Although, transmission by water may be a possible source of infection, individuals who used river water (5.2%) had a significantly lower sero-positivity than those using spring, well (15.7%) and tap water (9.5%). Since tap water was transported to nomadic areas by Fars Nomadic Organization for migrating nomads, they had less chance for contamination by oocysts which can explain the different rates of infection by stray cats.

Other reports demonstrated a higher infection rate [24,25]. The sero-prevalence was reported at 28% in a nomadic population of Scotland. They had minimal contact with cats because of their lifestyle and the infection showed no correlation with age [25]. The prevalence of *T. gondii* in Brazil using IFA method was demonstrated at 55.6%, 80.4% and 59.6% in three different tribes, respectively. Different exposures and contacts with soil-harboring oocysts of wild felines may explain different sero-prevalence in these tribes [26]. A sero-epidemiological survey of *T. gondii* infection

among mountain aborigines and Southeast Asian laborers in Taiwan was determined by latex agglutination test. The sero-prevalence of *T. gondii* infection was 19.4% and 26.7% for two mountain aborigines and Southeast Asian laborer population without any significant gender difference [27]. Another study among an indigenous population of Mato Grosso showed that 80.4% were positive for IgG using ELISA and Indirect Fluorescent Antibody tests while the sero-positivity increased significantly with age. In this population, the presence of wild felines in the vicinity of the village and areas where water was collected, play an important role in infection [28]. Various studies on toxoplasmosis in Malaysia showed that specific antibodies to *T. gondii* are common among Malaysians. Among ethnic groups, Malays had the highest prevalence followed by Indians. The antibody was acquired early in life and increased with age; no significant difference was present between males and females. The prevalence rate was influenced by environmental conditions, occupation, diet and cultural habits but uncooked meat does not seem to be the source of infection since Malaysians normally cooked their meat well [29].

Ngui *et al.* (2011) in Orang Asli (Indigenous) Communities in Peninsular Malaysia showed that the overall sero-prevalence of *T. gondii* was 37.0% with 31.0% immunoglobulin (Ig) G, 1.8% IgM, and 4.2% sero-positivity for both anti-Toxoplasma antibodies. They demonstrated that age above 12 years, using untreated river and mountain water supplies and close proximity with cats were factors associated with toxoplasmosis [30].

Another survey on serum antibodies to *T. gondii* in 2-12 year-old children in Bayano and San Blas areas of Panama showed prevalence of 0-42.5% [31]. The prevalence of *T. gondii* in humans in Ethiopia is very high, up to 41% in children aged 1-5 years [32]. In Brazil up to 50% of elementary school children and 50-80% women of child-bearing age have antibodies to *T. gondii* [33]. The sero-positivity for *T. gondii* was 49.52% in antenatal women at Mamata General Hospital, Khammam,

Andhra Pradesh, India [25]. The overall prevalence of anti-Toxoplasma antibodies was 10.3% in Japanese pregnant women. It was significantly higher in women aged above 35 years [6]. The sero-prevalence in household cats was assessed to be 15.6% and in stray cats was 45.2% in Lanzhou, northwest China [34]. This study showed the high sero-prevalence of *T. gondii* in cats poses a threat to animals and human health that necessitates measures to control and prevent toxoplasmosis of cats in the area. The sero-epidemiological survey for toxoplasmosis among school children of public schools of the urban areas of the Sari, Mazandaran Province, Northern Iran, was 23.1% [35]. IgG anti-Toxoplasma sero-positivity in community health center laboratory for pre-marriage examinations in Qazvin, Iran was shown to be 34% [36]. In all these studies, transmission by oocysts showed the role of cats in causing infection [34]. Another survey on the prevalence of *T. gondii* antibodies in Southern Africa showed a sero-positivity of 20% while the highest prevalence was in Blacks (34%) and Indians (33%). Climate and lifestyle were reported as affecting factors [24]. Our study demonstrated a low prevalence of toxoplasmosis in two tribal populations and is correlated with their lifestyles and the environmental factors as have been shown in previous studies.

Conclusion

In our study, the sero-prevalence of toxoplasmosis in two tribal populations was lower than other studies in Iran. Their lifestyles including low consumption of vegetables, climate in their residence area and absence of cats may explain the low prevalence of toxoplasmosis.

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