

Seroprevalence of *Toxoplasma gondii* Antibodies in Dairy Cows in Kerman Province, South East Iran

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Abstract: *Toxoplasma gondii* is a ubiquitous protozoan that causes the most common parasitic infection in humans. Since the disease is of economic importance with regard to animal productions, it is necessary to investigate the prevalence of *T. gondii* infection in meat producing animals especially cattle which constitutes the main source of meat for local consumption. The aim of this study was to investigate the seroprevalence of toxoplasmosis in dairy cows of Kerman region (southeastern Iran) using Modified Agglutination Test (MAT). The sera of 300 dairy cows have been investigated for antibodies against *Toxoplasma gondii*. The results indicated two hundred and fourteen samples (71.3%) were seropositive and 86 samples (28.7%) were seronegative. Out of the 300 cattle (39 male, 261 female) screened, 87% of male and 13% of female cattle were contaminated with toxoplasmosis. Since cows are one of the most important meat sources in Iran, there is a high risk of contamination through meat from this host due to their susceptibility to infection. Further studies are required for more data on the prevalence of *T. gondii* in other meat producing animals to apply effective control strategies against toxoplasmosis.

Keywords: Agglutination, cattle, Iran, Kerman, seroprevalence, *Toxoplasma gondii*

INTRODUCTION

Toxoplasma (T.) gondii is a heteroxenous coccidian parasite that could be found worldwide and cause a disease known as toxoplasmosis (Elamin *et al.*, 1992; Raeghi *et al.*, 2011). *Toxoplasma* is capable of infecting almost all the warm-blood animals in most part of the world and is estimated to infect 4-77% of humans (Tenter *et al.*, 2000; Dubey *et al.*, 2004). It especially affects immunosuppressed individuals, causing serious damage to the central nervous system and also has a clinical impact on the unborn fetus (Chintana *et al.*, 1998; Khan *et al.*, 2005). Cats of the family *Felidae* are the natural reservoir of *T. gondii* and are involved in the transmission cycle by excreting the resistant oocysts in the environment (Elmore *et al.*, 2010). *Toxoplasma* infection is mainly caused by consumption of undercooked meat and/or by drinking water or unpasteurized milk contaminated with oocysts or tissue cysts of *T. gondii* (Montoya and Liesenfeld, 2004; Sacks *et al.*, 1982). In most areas of the world, cattle and pigs are important protein sources for human populations. Several studies have noted the presence of *T. gondii* in pork and beef used for human consumption (Dubey *et al.*, 2002; Oliveira

et al., 2001). Serological studies carried out in dairy cattle, have shown variable frequencies for *T. gondii* (Avezza *et al.*, 1993; Dubey, 1992).

Although parasites are not detected directly, the seroprevalence can give an indication of the risk of human infection by eating meat from a certain species if the detection of antibodies against *T. gondii* and the presence of tissue cysts have a strong correlation (Opsteegh *et al.*, 2011). The Modified Agglutination Test (MAT) has proved to be the most sensitive and specific assay for the serological diagnosis of feline toxoplasmosis (Dubey and Thulliez, 1989). The MAT is the major recommended test for diagnosis *T. gondii* infection in several animals and man. MAT is cheaper, easier than other tests and no special equipment or conjugates are needed (Dubey and Thulliez, 1993) and it has the highest sensitivity among all serological assays (Barakat *et al.*, 2009). Because of the great importance of *T. gondii* as a causative agent of a zoonosis, the World Health Organization (WHO), has repeatedly advised the collection of accurate epidemiological data on this parasite.

Since the disease is of economic importance with regard to animal productions (Lunde'n *et al.*, 2002) and also a health concern due to neonatal complications; it is

necessary to investigate the prevalence of *T. gondii* infection in meat producing animals especially cattle which constitutes the main source of meat for local consumption in Kerman province, south east of Iran. Using MAT we conducted a survey on seroprevalence of *T. gondii* infection of dairy cows in Kerman province and to investigate the possible role of animals in transmission of human toxoplasmosis.

MATERIALS AND METHODS

Samples: The location of Kerman, south eastern province of Iran as study area, has been described elsewhere (Bahrieni *et al.*, 2008). Three hundred blood samples were randomly collected between June-October 2010 from 14 dairy farms located in suburbs of Kerman province to examine for *T. gondii* infection. The ages of the cattle were classified into two groups less and more than 4 years old. Blood was collected from the jugular or caudal vein and sera were separated for further use. The sera specimens were stored at -20°C until used for serological assay.

Serological assay: *T. gondii* specific IgG antibodies were examined by the Modified Agglutination Test (MAT) as described earlier (Desmonts and Remington, 1980). The sera were screened at dilutions of 1:20-1:10240 and an agglutination titer at a 1:320 dilution was considered as a cut-off level for *T. gondii* antibodies. Positive, negative and antigen controls were included in each test. Moreover, positive or doubtful samples were re-assessed.

Statistical analysis: The data analysis was performed by Chi-Square test using SPSS 11.5. Chi-Square was used to analyze the associations between seroprevalence and influence of risk factors such as gender and age. The differences were considered statistically significant when $p < 0.05$ was considered.

RESULTS

The sera of 300 dairy cows have been investigated for *T. gondii* antibodies using MAT. The obtained results are presented in Table 1 and Fig. 1 to 3. Out of the 300 cattle screened, 214 samples (71.3%) were seropositive and 86 samples (28.7%) were seronegative (Fig. 1). Out of the 300 cattle, 87% of male and 13% of female cattle were contaminated. Out of 214 seropositive samples, 32 (15%) were male and 182 (85%) were female. The ratio of contamination between male and female cattle was not significant ($p = 0.113$) (Fig. 2). From a total of 214 seropositive samples, 131 cases (61.2%) aged <4 years old and 83 (38.8%) were >4 years old. There was no significant difference between the cattle <4 years old and those over 4 years of age ($p = 0.759$) (Fig. 3).

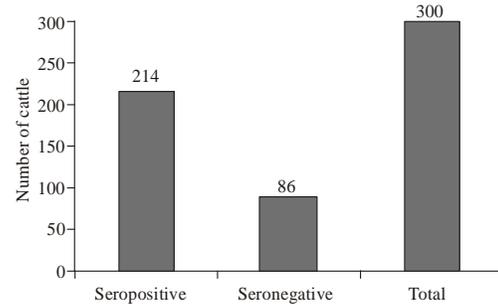


Fig. 1: Frequency distribution of anti toxoplasma antibodies in the cattle of Kerman

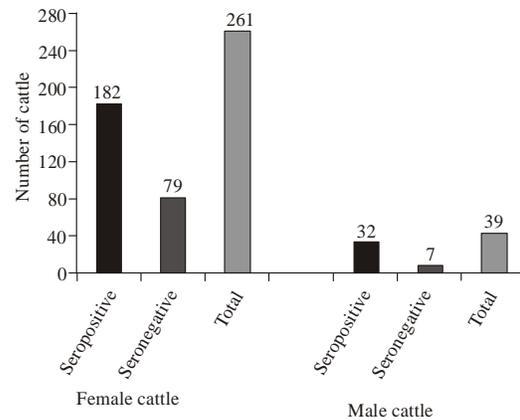


Fig. 2: Frequency of anti toxoplasma antibodies in the cattle of Kerman according to gender

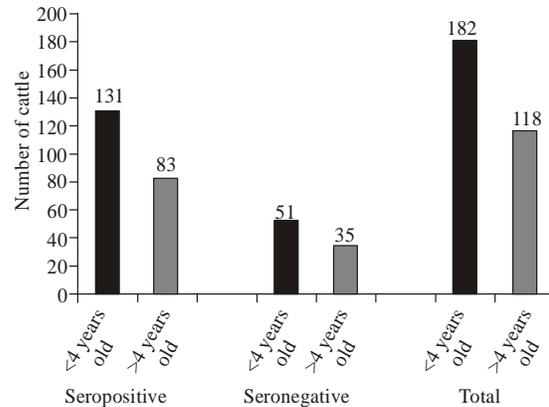


Fig. 3: Frequency of anti toxoplasma antibodies in the cattle of Kerman according to age

Among 182 female cattle with antibodies against toxoplasma in their sera, 105 (57.7%) were <4 years old and 77 (42.3%) aged more than 4 years. Out of total of 32 male cattle infected with toxoplasma, 26 (81.3%) were under four and 6 (18.8%) were over than four years age. No significant differences were observed in infected cattle

Table. 1: Distribution of seroprevalence in cattle of Kerman in terms of gender and age

Variation		Cattle			Total Frequency (%)	p-value
		Total Number	Seropositive	Seronegative		
Gender	Male	39	32	7	32(15%)	0.113
	Female	261	182	79	182(85%)	NS*
Age	<4years old	182	131	51	131(61.2%)	0.759
	>4years old	118	83	35	83(38.8%)	NS*

*NS: Not significant

of both genders in terms of age. Significant analysis between female and male cattle younger and older than 4 years old, presented a $p < 0.77$ and $p < 0.21$, respectively. Therefore, differences between female and male cattle less and more than 4 years were not significant. The highest titer against *T. gondii* in our study was 1:320 (43%) (Table 1).

DISCUSSION

Toxoplasmosis is a public health concern due to its association with consumption of uncooked meat or unpasteurized milk (Sacks *et al.*, 1982; Riemann *et al.*, 1975). Many studies have been carried out in different countries aimed at detection of the prevalence of *T. gondii* in animals. Results of this research showed 71.3% seropositivity for *T. gondii* in the cattle in Kerman province located in south east Iran. Various studies carried out in other countries and other provinces of Iran; have reported different contamination rates for *T. gondii* in cattle. This may be due to difference in time and season of sampling and also differences of sensitivities and specificities of assays used.

Although, the prevalence of *T. gondii* reported in some countries such as Brazil with 71% (Santos *et al.*, 2009), Italia with 91.8% (Avezza *et al.*, 1993) and Serbia with 76.3% (Klun *et al.*, 2006), confirm the results of this study. However, in other studies, the seropositivity value which was observed were less than values of our finding including 27.5% (Rozette *et al.*, 2005) and 7.8% (Gliot-Fromont *et al.*, 2009) in France using the same method (MAT) as we applied; 20.6% in Italia (Sindoni *et al.*, 1989), 43% in Portugal (Fortier *et al.*, 1990), 15.7% in Spain (Gonzalez-Warleta *et al.*, 2008), 5% in America (Dubey, 1992) and 10.5% in Vietnam (Huong *et al.*, 1998). The low seropositivity values could be attributed to the following reasons; variation of assays used for measuring *T. gondii* antibodies, method of cattle breeding, frequency of cats in the region and climate variations.

The prevalence rate for toxoplasmosis in the present work was higher compared to the result of Ghazaei (2006) with 31% rate, which was carried out on 200 cattle and also Hashemi-Fesharaki (1996), that observed no anti-*T. gondii* antibodies in the sera of 2000 dairy cows, using both latex agglutination and indirect hemagglutination

tests. Our results also is higher than the findings of Gorbani *et al.* (1983), which performed a study on dairy cows and showed the prevalence rate of 21.6% on the coastal region of Caspian Sea (North Iran) and 32%, in Khuzestan province (South West Iran). Furthermore, it is in accordance with the findings of Hoghooghi-Rad and Afraa (1993) with 13.8% rate in Ahvaz (South west Iran) using Latex test; and Nematollahi and Moghaddam (2008) with a 15.9% rate in Tabriz (North West Iran) using IF assay.

Since cows are one of the most important meat sources in Iran, there may be a high risk of contamination through milk and meat from this host due to their susceptibility to infection. Although, according to Iranian's habit, meat is not consumed in semi-cooked or raw forms but in some foods such as Kebab, inside part of meat is not completely cooked and this could be considered as a risk factor for contamination.

CONCLUSION

This research demonstrated 71.3% seropositivity for *T. gondii* in the cattle of Kerman province (South East Iran). Different contamination rates for *T. gondii* in other provinces of Iran may be associated with epidemiological parameters including season of sampling, diagnosis assay, type of cattle, raining condition, prevalence of cats, etc. Such data are essential to elucidate the relative importance of the various sources of infection for humans and animals. Further studies are required for collecting more data on the prevalence of *T. gondii* antibodies in meat producing animals all over the world to apply effective control strategies against toxoplasmosis.

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