



## *Toxoplasma* Infection in Farm Animals: A Seroepidemiological Survey in Fars Province, South of Iran

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### ABSTRACT

**Background:** *Toxoplasma gondii* is a worldwide parasite which infects animals and human. Infections with this zoonotic parasite are acquired mostly by consumption of undercooked or raw meat, which contains tissue cysts.

**Objectives:** The current study was conducted to determine the seroprevalence of *Toxoplasma* infection in farm animals in southern Iran.

**Materials and Methods:** Sera were obtained from 346 farm animals including 80 cows, 33 dogs, 35 horses, 95 sheep, 90 goats, 9 turkeys and 4 geese and evaluated by Modified Agglutination Test (MAT) to detect anti-*Toxoplasma* antibodies.

**Results:** Anti-*Toxoplasma* antibodies were detected in sera of 121 out of 346 (34.9%) animals. The highest rate of infection (55%) was found in the cattle, followed by dogs (51.5%), horses (40%), sheep (29.5%), goats (18.8%) and turkeys (11.1%). No antibody was detected in any sera of 4 geese. Most of animals (86%) had antibody titer of 1:20. Males consisted 34.3% and females 40% of seropositive animals but the difference was not statistically significant ( $P > 0.05$ ). Correlation between age of animals and *Toxoplasma* infection was also insignificant ( $P > 0.05$ ).

**Conclusions:** High seroprevalence of toxoplasmosis observed in this region indicates that farm animals may play a major role in transmitting the infection to human through consumption of undercooked meats.

**Keywords:** *Toxoplasma gondii*; Farm animal; seroprevalence; Iran

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►Implication for health policy/practice/research/medical education:

The current study determined the seroprevalence of *Toxoplasma* infection in farm animals. Meat and milk consumption of some of these animals has been considered as main sources of *Toxoplasma* infection for human.

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## 1. Background

*Toxoplasma gondii* is a worldwide parasite which infects any nucleated cells of birds and mammals including human. In human, it may cause severe medical complications in immunocompromised individuals or in congenitally acquired cases. The parasite can cause congenital abnormalities such as abortion, chorioretinitis, hydrocephaly and jaundice (1). The disease is severe in HIV positive individuals where HIV positive cases develop toxoplasmic encephalitis (2, 3).

*T. gondii* infection in livestock such as sheep and goats is responsible for considerable economic losses due to abortion of fetus. Infections with this zoonotic parasite are acquired mostly by consumption of undercooked or raw meat, which contains tissue cysts, or water contaminated with oocysts of *T. gondii*. *T. gondii* oocysts are shed by domestic cats and other felines resulting in widespread contamination of the environment. Domestic cats are most likely the main source of contamination as they are common and produce large numbers of oocysts (4).

## 2. Objectives

Rate of *Toxoplasma* infection in farm animals is considered as the indicator of contaminated soil to oocyst of parasite. Moreover, consumption of meat and milk of farm animals has been considered as main sources of human infection. The current study was conducted to determine the seroprevalence of *Toxoplasma* infection in farm animals in southern Iran.

## 3. Materials and Methods

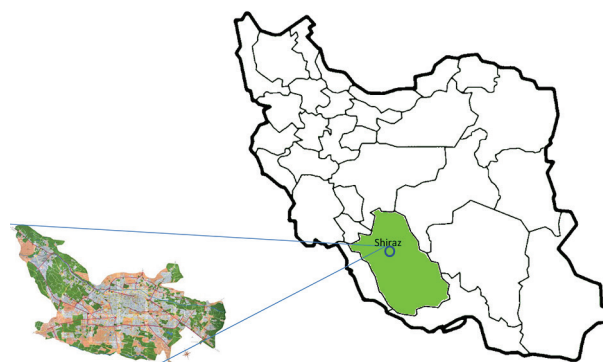
### 3.1. Study Area

The study was conducted in Fars province, south of Iran. The main city and capital of Fars province is Shiraz which is the sixth most populous city in Iran (the 2009 estimated population for the city was 1,455,073 people). Fars province has a moderate climate with relatively rainy mild winters and hot dry summers. Shiraz is located in the mountainous region of the province with an average altitude of 5,200 ft. The rainfall in recent years, during which an atmospheric condition has changed perceptibly, has been comparatively sufficient and has reached 23 inches in a year, but the average rainfall is between 14 and 18 inches. *Figure 1* shows the location of this province in the country.

### 3.2. Animal Samples

A total of 346 serum samples from animals including 33 dogs, 35 horses, 80 cows, 95 sheep, 90 goats, 9 turkeys and 4 geese were collected from sub-urban farms and Shiraz

slaughterhouse in 2010 and 2011. All serum samples were stored at -20° C until use.



**Figure 1.** Maps of Iran, Showing the Location of Fars Province in the South of the Country and the Location of Shiraz District, Capital of Fars Province.

### 3.3. Detection of Anti-Toxoplasma Antibodies in Sera Samples

Modified Agglutination Test (MAT) was used to detect specific antibodies to *T. gondii* in collected sera as originally described by Desmonts and Remington (5). The formaldehyde-killed whole tachyzoites of RH strain of *T. gondii* were used as antigens. Sera were diluted two-fold (1:20 to 1:160) and evaluated for anti-*Toxoplasma* antibodies while positive and negative controls were included in each plate. Antibody titers of  $\geq 1:20$  were considered as positive.

## 4. Results

Anti-*Toxoplasma* antibodies were detected in sera of 121 out of 346 (34.9%) animals. Most of animals (86%) had antibody titer of 1:20 while higher antibody titers, up to 1:640, were detected in sera of the rest of animals. The highest rate of *Toxoplasma* infection (55%) was found in cattle followed by dogs (51.5%), horses (40%), sheep (29.5%), goats (18.8%) and turkey (11.1%) No antibody was detected in any sera of the four geese.

Considering the sex of animals, 34.3 % of male and 40% of female animals were seropositive for *Toxoplasma* but the differences was not statistically significant ( $P > 0.05$ ). Moreover, no significant correlation was found between the age of animals and seropositivity to toxoplasmosis.

## 5. Discussion

Toxoplasmosis is a worldwide zoonotic disease which is caused by the protozoon *T. gondii*. The disease has got its public health as well as economic importance. It has been estimated that around 30% of the world population have

serological evidence of *Toxoplasma* infection (6).

Human can be infected with *T. gondii* by ingestion of undercooked or raw meat containing tissue cysts (6). The relative roles of various potential sources of *Toxoplasma* infection for human are not well described. Knowledge of sources of infection within an area can provide valuable information for designing cost-effective food safety and preventive interventions. Evaluating the scale of infection in farm animals, especially those with edible meat, may help to estimate the scale of problem in any given region. Seroprevalence of toxoplasmosis is relatively high among human population in Iran (7-9). In a comprehensive study, 13,018 sera samples collected by stratified cluster random sampling method from 12 provinces in Iran were evaluated for toxoplasmosis and anti-*Toxoplasma* antibodies were detected in 51.8% of the samples (10).

Moreover, seroprevalence of *Toxoplasma* among animals is relatively high in Iran. In a study conducted by Hashemi-Fesharaki *et al.* in Iran, serum samples from 3311 sheep and 638 goats were examined for antibodies to *T. gondii* and antibodies were found in 24.50% of sheep and 19.25% of goats (11). In the current study seropositive rate of toxoplasmosis in sheep and goats were 29.5% and 18.8% respectively. This is consistent with currently available data on seroprevalence of toxoplasmosis in animals in other parts of the country (11-13).

Several studies stated a connection between age and sex of animals with the rate of *Toxoplasma* infection (11, 14), however such connection was not observed in the current study. Consumption of meat of infected lambs and goats is considered as one of the main sources of human infection, although consumption of milk might also be considered as another source of infection (15). In the authors' previous study in Fars province samples of brain, tongue, liver, and muscles of neck, intercostals, and femoral of sheep and goats were tested by PCR for *Toxoplasma* infection. Infection was confirmed in tissues of 22.7% of goats and 37.5% of sheep (16).

The rate of toxoplasmosis in cattle in the current study was 55%, which is relatively higher than those reported from south-west (15.77%), north (21.6%) and south-west (37.5%) parts of the country (17-19). In the current study the seroprevalence rate of the infection in dogs was 51.5%. The dogs were referred to clinics for check up and clinically were found healthy. The seroprevalence of *T. gondii* antibodies in dogs in west and central parts of Iran using an optimized indirect ELISA was 8.94% (20). Rate of toxoplasmosis in horses was 40% in the current study. The prevalence of toxoplasmosis in sport horses from Qazvin, in north-west of Iran, reported to be 71.2% (14).

The differences of prevalence rates of *Toxoplasma* in farm animals in Iran and also in other areas of the world might be due to variability of the susceptibility of hosts and also the serological methods which have been used to evaluate the seroprevalence. Furthermore, other factors such as management and hygienic standards in

breeding, density of cats and environmental conditions are effective on the acquisition of *T. gondii* oocysts by animals (21). MAT has been the method of choice in most of the studies which evaluated the seroprevalence of toxoplasmosis in animals (22-24). However different studies have been using molecular methods to assess the rate of *Toxoplasma* infection in animals (16, 25). Whether the rate of molecular infection is well correlated to the seroprevalence rate, is still unclear.

The overall rate of *Toxoplasma* infection in farm animals in the current study was relatively high. It is noteworthy that the majority of these animals are raised by nomadic tribes. In Fars province, nomads and their animals move from one place to another place within Fars or neighboring provinces during summer and winter in search of food for their animals. This may increase the chance of acquiring the infection while their animals are grazing in different regions with relatively different climates.

In conclusion, high seroprevalence of toxoplasmosis observed in this region indicates that farm animals may play a major role in transmitting the infection to human through consumption of undercooked meats. Moreover, economic losses due to *Toxoplasma* infection in these animals would be considerable. Further studies are required to explore the other epidemiological factors related to animal infection and to find out the strains of the parasite in different animals in the region.

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## Authors' Contribution

None declared.

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