

## Occurrence of *Toxoplasma gondii* antibodies in sheep in Istanbul, Turkey

Taraneh Oncel\*, and Gulay Vural

Department of Parasitology, Veterinary Control and Research Institute, Pendik, Istanbul, Turkey

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### ABSTRACT

This study was carried out in order to determine the occurrence of *Toxoplasma gondii* antibodies in sheep in five districts of Istanbul, Turkey. A total of 181 sera taken from sheep were examined for antibodies to *Toxoplasma gondii* using an enzyme-linked immunosorbent assay (ELISA). Of the 181 samples tested 56 (31%) were determined as seropositive. The prevalence of *Toxoplasma* antibodies was significantly higher in adult sheep ( $P < 0.001$ ). No significant difference between male and female sheep groups was observed ( $P > 0.05$ ). These results indicate that ovine toxoplasmosis is widespread in Istanbul. To our knowledge, this is the first report on the status of *T. gondii* infection in sheep in Istanbul.

**Key words:** enzyme-linked immunosorbent assay, sheep, *Toxoplasma gondii*, Turkey

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### Introduction

Toxoplasmosis is a widespread zoonosis caused by the coccidian protozoan *Toxoplasma gondii*. It is an important cause of abortion, stillbirth and neonatal mortality in sheep (DUBEY and BEATTIE, 1988). The definitive hosts of the parasite are domestic cats and other felines, the sexual cycle occurring only in these species (FRENKEL et al., 1970). Human toxoplasmosis can be acquired both through ingestion of sporulated oocysts and via ingestion of bradyzoites in the tissues of numerous food animals. The infection is also transmitted transplacentally (DUBEY, 1994; ESTEBAN-REDONDO et al., 1995). Transmission of *T. gondii* tachyzoites in unpasteurised sheep or goat milk and blood transfusions can occur, but are probably not important epidemiologically (SCHIRLEY, 1995).

The diagnosis of *Toxoplasma* infection is conventionally made by the direct demonstration or isolation of the parasite from biopsy or autopsy material, but such

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\* Contact address:

Dr. Taraneh Oncel, Department of Parasitology, Veterinary Control and Research Institute, Pendik, 34890, Istanbul, Turkey, Phone: +90 216 3901 280; Fax: +90 216 3547 692; E-mail: taranehonsel@hotmail.com

techniques are unsuitable for use in large-scale surveys. Therefore, recourse has been made to immunoserological tests for specific host antibody, and a variety of tests have been described (ANDERSON and REMINGTON, 1975).

Numerous reports from various countries exist on the prevalence of toxoplasmosis. It is estimated that 35-40% of the world's adult population have been infected with *T. gondii* (SMITH, 1991). The prevalence rates in sheep have been varied among countries, as have the diagnostic methods used (HASHEMI-FESHARKI, 1996; PITA GONDIM et al., 1999; TENTER et al., 2000; HOVE et al., 2005). In Turkey, these rates were reported as being between 7.1% and 88.7% on regional basis. (WEILLAND and DALCHOW, 1970; ALTINTAS, 1996; BABUR et al., 2001)

The prevalence of *T. gondii* in sheep in Istanbul has been unknown, thereby making it impossible to assess their potential significance to public health. The aim of the present study was to investigate the occurrence of antibodies to *T. gondii* among sheep in Istanbul, Turkey.

### Materials and methods

A total of 181 serum samples were collected from sheep in Istanbul between February and November 2001. Istanbul is located at sea level, in north-west Turkey. Its western part



Fig. 1. Map of Istanbul showing sampling districts

is in Europe and its eastern part is in Asia. Istanbul has a mild climate. The average annual humidity, temperature and precipitation are 74.9%, 14.6 °C and 700.4 mm, respectively.

Sheep were sampled by a simple random sampling method in five districts of Istanbul (Fig. 1). The sera were separated from blood samples by centrifugation and stored at -20 °C until analysis. Information collected on sheep was age, sex and source of sheep. The age range was from 6 months to 8 years.

Sheep IgG antibodies to *T. gondii* were tested by using an enzyme-linked immunosorbent assay (ELISA). The method was a modification of an ELISA previously described for human IgG antibodies to *T. gondii* (MONDESIRE et al., 1981). Positive and negative control sera were included on each plate. Anti-Sheep IgG horseradish peroxidase conjugate (Sigma Chemical Co., St. Louis, USA) was used. Reading was carried out at 492 nm using Titertek Multiskan Spectrophotometer.

Results were analyzed statistically using the Chi-square test for significance in the present study. The analytical software package (Statistix Version 1.0., 1996) was used for the analysis.

## Results

In total, 56 (31%) samples by ELISA were found to be seropositive out of 181 blood samples in this study. Antibodies to *T. gondii* were found in all 5 districts sampled. Sheep sampled in Gaziosmanpasa had the highest prevalence (64.52%) of toxoplasmosis, while the lowest prevalence was found among sheep from Kartal (10%), as shown in Table 1. The seropositivity of toxoplasmosis in sheep from Tuzla, Silivri and Sile was 60%, 23.86% and 19.05%, respectively. Seroprevalence of *T. gondii* was significantly different according to the percentage of seropositive sheep present in each district ( $P < 0.05$ ).

Table 1. *T. gondii* infected sheep according to district in Istanbul, Turkey

Districts	N° of serum samples	N° of positives	Seropositive rate* %
Gaziosmanpasa	31	20	64.52 <sup>a</sup>
Tuzla	10	6	60 <sup>a</sup>
Silivri	88	21	23.86 <sup>b</sup>
Sile	42	8	19.05 <sup>b</sup>
Kartal	10	1	10 <sup>b</sup>
Total	181	56	31

\*Values having different superscripts were significantly different ( $P < 0.05$ ).

The association of age with the presence of infection is shown in Table 2. In Istanbul, seroprevalence was the highest in the  $\geq 1$ -year-old age group. There was a significant difference between these two groups ( $P < 0.001$ ).

Table 2. Age distribution of sheep with *T. gondii* infection

Age groups	N° of examined	N° of positives	Seropositive rate %
0.6-1 yr	64	8	12.5
$\geq 1$ -yr	117	48	41

There was a significant difference between these two groups ( $P < 0.001$ ).

Thirty-eight (31.40%) of 121 female sheep and 18 (30%) of 60 male sheep tested were seropositive for toxoplasmosis (Table 3). There was no significant difference between these two groups ( $P > 0.05$ ).

Table 3. Sex distribution of sheep with *T. gondii* infection

Sex	N° of examined	N° of positives	Seropositive rate %
Female	121	38	31.40
Male	60	18	30

There was no significant difference between these two groups ( $P > 0.05$ ).

## Discussion

Toxoplasmosis is a zoonotic disease caused by *T. gondii* and has been known in many countries since 1908 (DUBEY and BEATTIE, 1988). SMITH (1991) reported that the prevalence of toxoplasmosis varies among countries, depending on traditions, customs and the life styles of the inhabitants. *T. gondii* infection in sheep is distributed worldwide, with prevalence rates ranging from 0% to 100% in different countries (DUBEY and BEATTIE, 1988; TENTER et al., 2000). It is therefore not possible to compare prevalence data of studies which used different serological tests with variable sensitivity and specificity. The prevalence of 31% for toxoplasmosis found in this study is lower than reported for sheep in Canada (57.6%) and Ghana (33.2%) but is higher than reported in Greece (23%) and Morocco (27.6%), where enzyme-linked immunosorbent assay was used (WALTNER-TOEWS et al., 1991; STEFANAKES et al., 1995; PUIJE et al., 2000; SAWADOGO et al., 2005). The 31% seropositivity rate detected in 181 sheep in Istanbul is lower than those reported previously in the other regions of Turkey (BABUR et al., 2001; TUTUNCU et al., 2003; ONCEL et al., 2005). This difference was concluded to be due to the fact that the studies were carried out in different geographical regions. However, our results demonstrate that *T. gondii* is widely distributed in the environment.

For many authors (O'DONOGHUE et al., 1987; PUIJE et al., 2000), age is an important factor. Older sheep have a higher prevalence of toxoplasmosis than younger sheep. We found the highest prevalence in animals over one year of age.

ALEXANDER and STINSON (1988) reported that female animals are more susceptible than males to infections with protozoan parasites. In the present study, no significant difference was observed between male and female groups ( $P > 0.001$ ).

The high seroprevalence of *T. gondii* antibodies in sheep may be associated with the presence of cats in almost every farm sampled, and the probability that a young cat may shed oocysts on a farm will always be present. (WEILAND and DALCHOW, 1970; DUBEY, 1994). Infected cats excrete toxoplasma oocysts which, after sporulation, become infectious to man and animals, remaining infectious for a long time (GHORBANI et al., 1983).

Higher prevalence rates of toxoplasmosis in warm, moist areas compared to those which are cold and dry is attributed to the longer viability of *T. gondii* oocysts in moist or humid environments (FAYER, 1981; PUIJE et al., 2000). Istanbul is a warm and moist area, which helps *T. gondii* oocysts to maintain their viability.

In conclusion, the results of this study confirm the presence of toxoplasma antibodies in sheep in Istanbul. Toxoplasma infection among animals is of great importance, because some of the infected animals play a distinct role as a source of human infection. Finally, we emphasize that further studies are needed to clarify the impact of toxoplasmosis on the animal industry and losses due to clinical toxoplasmosis in livestock in Turkey.

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**SAŽETAK**

Istraživanje je provedeno sa svrhom da se ustanovi nalaz protutijela za protoozon *Toxoplasma gondii* u ovaca s pet područja Istanbula u Turskoj. Ukupno je bilo pretražen 181 uzorak seruma imunoenzimnim testom. Specifična protutijela bila su dokazana u 56 (31%). Prevalencija protutijela bila je značajno veća u odraslih ovaca ( $P < 0,001$ ). Nije utvrđena značajna razlika između mužjaka i ženki ( $P > 0,05$ ). Rezultati potvrđuju veću proširenost ovčje toksoplazmoze i ujedno predstavljaju i prvo izvješće o stanju bolesti u Istanbulu.

**Ključne riječi:** imunoenzimni test, ovca, *Toxoplasma gondii*, Turska

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