Iranian J Parasitol: Vol.2, No.1, 2007, pp.7-11

Original Article

Serological Prevalence of Toxoplasmosis in Meat Producing Animals

***Y Hamzavi [1], A Mostafaie [2], B Nomanpour [1]**

[1] *Dept. of Microbiology, School of Medicine, Kermanshah University of Medical Sciences, Iran*
[2] *Medical Biology Research Center, Kermanshah University of Medical Sciences, Iran*

(Received 12 May 2006; accepted 2 Jan 2007)

Abstract

Background: Toxoplasmosis is a zoonotic disease, caused by cosmopolitan coccidian Parasite, *Toxoplasma gondii.* One of the most important sources of human infection is feeding from raw or uncooked meat of infected animals. In this study the prevalence of toxoplasmic infection in three important meat producing animals in Iran was studied.

Methods: Using indirect immunoflourcent antibody assay (IFA), 483 serum samples of goats, sheep and cattle from industrial slaughterhouse of Kermanshah, western Iran were tested for total antibodies against *T. gondii*.

Results: Antibodies to *T. gondii* were found in 23.7% of goats, 22.5% of sheep and 4.8 % of cattle at titer of ≥1:20. The highest titers observed in goats, sheep and cattle were 1: 2560, 1: 1280 and 1: 640, respectively.

Conclusion: It is suggested that feeding of raw or undercooked meat of goats and sheep is important in transmition of toxoplasmic infection to human in Kermanshah district.

Key words: *Toxoplasmosis, Goats, Sheep, Cattle, Iran*

Introduction

Toxoplasmosis is a widespread zoonosis caused by *Toxoplasma gondii,* a ubiquitous coccidian parasite of felines, man and many wild or domestic warm-blooded animals (1). This parasite is transmitted to human mainly by ingesting food or water which is contaminated with oocysts shed by cats or by eating undercooked or raw meat containing tissue cysts (2). Toxoplasmosis is very common among human population. It is estimated that every third person in the world is infected and the frequency differs depending on geographical area: people from USA were found serologically positive from 20%-30%, in Japan 25%, Netherlands 60%, Italy 60%, France 50%, Finland 35% and Poland 50%-60% (3). Asmar *et al.* using IFA test, found an average seropositivity rate of 51.8% from 12 provinces in Iran (4).

It is well known that meat from persistently infected animals is one of the most important potential sources of human toxoplasmosis (5). So it is necessary to investigate the prevalence of *T. gondii* infection among meat producing animals. The dye test is the longest established serological method, and in many ways represents the 'gold standard', at least in humans. The indirect fluorescent antibody (IFA) test gives titers comparable with the dye test, but is safer as it uses killed tachyzoites. So the IFA test is a simple and widely

***Corresponding author:** Fax: +98 831 4276477,
E-mail: yhamzavi@kums.ac.ir

used method (6). The most important meat producing animals in Iran are cattle, sheep and goat. In Iran, some studies have shown the presence and importance of *T. gondii*, especially in these animals (7-10). Kermanshah Province situated at the foot of the Zagros Mountains chain in the west of Iran. According to the results of a seroepidemiological study in the human population in Kermanshah the rate of anti toxoplasmic antibodies was 36.3% (11). This province is one of the most important regions for animal husbandry in the country but there was not any information about the infection and prevalence of *T. gondii* infection in sheep, goat and cattle in this region.

The purpose of this study was to determine the titer of antibody and rates of seropositivity against *T. gondii* among goats, sheep and cattle in this province.

Materials and Methods

Blood samples were obtained from 118 goats, 240 sheep and 125 cattle in industrial slaughterhouse of Kermanshah district. These animals had been collected from different regions of the province. Serum samples were prepared and stored at -20 ºC until use.

Fluorescine conjugated anti sheep, anti goat and anti bovine antibodies (prepared from Sigma Co.) were employed to detect antibodies against *T. gondii* infection (total Ig-IFA). Whole, killed *Toxoplasma* tachyzoites were incubated with diluted test serum, the appropriate fluorescent anti species serum was added, and the result was observed under fluorescence microscope (6). The sera were screened at dilutions of 1:20 to 1:320. Dilution of 1:20 was considered as a cut -off level for *T. gondii* antibodies. Positive serum samples showing a titter of 1:320 were diluted to determine the end point. Goat, sheep and cattle positive and negative controls were used in each analysis.

Results

Totally about 18.2% of studied animals showed anti-toxoplasmic antibodies. Serum samples from goats and sheep showed high proportions of positive reactions, compared to those of cattle (Table 1).

The highest titter against *T. gondii* in goats, sheep and cattle was 1:2560, 1: 1280 and 1: 640, respectively (Table 2).

Table 1: Frequency of seropositive goats, sheep and cattle against *T.gondii* in Kermanshah Province, West of Iran

Host animal	No. of sera tested	Seropositivity (%)
Cattle	125	4.8
Sheep	240	22.5
Goat	118	23.7
Total	483	18.2

Table 2: Frequency of anti toxoplasmic antibody titers in slaughtered cattle, sheep and goats, Kermanshah, Province, 2003

Ab titters	1:20	1:40	1:80	1:160	1:320	1:640	1:1280	1:2560	Total
No. of cattle sera (%)	2(1.6)	-	1(0.8)	-	2(1.6)	1(0.8)	-	-	6(4.8)
No. of sheep sera (%)	10(4.2)	11(4.6)	9(3.8)	9(3.8)	7(2.9)	5(2.1)	3(1.2)	-	54(22.5)
No. of goats sera (%)	1210.2	8(6.8)	1(0.8)	-	1(0.8)	2(1.7)	3(2.6)	1(0.8)	28(23.7)

Discussion

In the present study some positive reactions were observed in cattle (4.8%). Serum samples of the goats and sheep showed high proportions of positive reactions, compared to those of cattle. Throughout the world, data on the seroprevalence in cattle show great variation, ranging virtually from 0% to 99% (12). Dubey *et al.* recorded a seropositivity of 3.2% to *T. gondii* antibodies among cattle in Montana, using a modified agglutination test (13). In Bangladesh, Samad *et al.* reported that a higher percentage of antibodies against *T. gondii* by Latex agglutination test (LAT) were shown in cattle (16.1%) than in goats (12.09%) (14). In Iran Hashemi-Fesharaki *et al.* tested sera from cows, sheep and goats by latex agglutination test (LAT) and indirect hemagglutination test (IHA) and about 24.50% of sheep and 19.25% of goats showed positive reactions. They did not find any positive reaction in cows (8). Sharif *et al.* by IFA test from Mazandaran Province, North of Iran, did not find any seropositivity in cattle (9).

In the present study, level of IFA antibody ranged from 1:20 1:640 in cattle, 1:20 to 1280 in sheep and 1:20 to 1:2560 in goats. Ivan *et al.* by the modified agglutination test, were determined the seropositivity rate of 76.3% in cattle and 84.5% in sheep. The antibody levels ranged from 1:25 to 1:400 in cattle and up to 1:25600 in sheep, so the levels of specific antibody determined in the cattle were relatively low (not above 1:400) (15). In our study only one serum sample (0.8%) from cattle showed titer of 1:640 and the other samples of cattle showed titers of ≤ 1:320. However titers of anti toxoplasmic antibodies in cattle were not high.

Lower seropositivities in cattle compared to those of goats and sheep may be attributed to differences in susceptibility to *T. gondii* and to differences in management methods. Dubey and Thulliez have reported that the infection in cattle dose not usually cause clinical symptoms as they have a high natural resistance to the *T. gondii* (16). It is unclear whether this is associated with fast elimination of cysts from cattle tissues or there is inconsistent cyst formation following infection (15).

Jacek Sroka by direct agglutination test in cows, pigs, chickens and other animals, found a very high percentage of positive results in cattle (53.8%) and a high percentage in pigs (15%), he also observed the highest percentage of high titers in cows, and concluded that cattle are one of the main reservoirs of *T. gondii* among domestic animals (3).

Predominant differences are observed between the rate of seropositivity of goats, sheep and cattle in different studies in the world. Dubey showed that the seropositivity of sheep and goats from Montana against *T. gondii* by the Sabin-Feldman dye test was 13.2% and 22.7%, respectively (13). Ghorbani *et al*. have reported the prevalence of toxoplasmosis in sheep in Iran as 12.6%, 32.5-35.8% and 29-31% in Kuzestan, Mazandaran and Gilan Provinces, respectively. Shahmoradi *et al.* (7) has emphasized on the sheep as an important source of toxoplasmosis in Iran (10). Their study on sheep by direct ag-glutination test (DAT) showed positive results two times more than that previously reported (7). Sharif *et al.* by IFA test from Mazandaran Province, North of Iran, found 30%, 35% and 0% of sero-positivity in goats, sheep and cattle, respectively. Their cut off point for sera of goats and sheep was 1:16 and for cattle was 1:128. The highest titers observed in cattle, goats and sheep were 1:64, 1:128 and 1:64, respectively (9). In Japan, Sathaporn *et al.* by latex agglutination test

found 27.9% of seropositivity in goats (17). The antibody titers in positive samples varied from 1:64 to 1:4096. Figliuolo *et al.* using IFA test observed antibodies to *T. gondii* in 34.7% of the serum samples in ovine from Sao Paulo (Brazil), with titers ranging from 1:64 to 1:16384 (18). These differences in seropositivity between the different regions indicate that animals bred in these areas were exposed to different environmental contamination with *T. gondii* oocysts. Furthermore it can be related to differences in the kind of the techniques and cut off point in each study.

In Iran, cattle, sheep and goats are used not only for production of meat but also for milk. Although milk from infected cattle is regarded as a very unlikely means of *T.* gondii transmission (19), Skinner paid attention to milk from goats as a potential source for human toxoplasmosis because of their greater susceptibility to infection and their higher rate of seropositivity than cattle (20). Our study showed that not only goats but also sheep, as regarded by Shahmoradi *et al.* (10), and perhaps cattle, were the potential sources of human toxoplasmosis in Iran. So their milk, in addition to their meat, can infect human.

In conclusion, according to the importance of the meat in transmission of toxoplasmosis to human, investigation on the infection of the other domestic and meat producing animals is recommended.

Acknowledgements

We are indebted to Educational and Research Vice Chancellor of Kermanshah University of Medical Sciences for supporting of this research. We also are indebted to Dr Hagh Nazari, Mrs Zamzam and their co-workers from Central Diagnostic Laboratory of Kermanshah for their kind co-operations.

References

1. Levine ND. Veterinary protozoology. First ed. Iowa State University Press, Ames; 1985.
2. Cosme AE, Antonio SA, Sergio GND, Sergio EM, Juan HDG, Oliver L, Sergio AMG , Arturo CM. Seroepidemiology of *Toxoplasma gondii* infection in pregnant women in a public hospital in northern Mexico. BMC Infectious Diseases. 2006; (6): 113.
3. Sroka J. Seroepidemiolog of toxoplasmosis in the Lublin region. Ann Agric Environ Med. 2001; (8): 25-31.
4. Asmar M, Amirkhani A, Piazak N, Hovanesian A, Kooloobandi A, Etessami R. Toxoplasmosis in Iran. Results of a seroepidemiological study. Bull Soc pathol Exot. 1997; 90(1): 19-21.
5. Lunden A, Uggla A. Infectivity of *Toxoplasma gondii* in mutton following curing smoking, freezing or microwave cooking. Int J Food Microbiol. 1992; (15): 357-63.
6. Munday BL, Corbould A. The application of the *Toxoplasma* indirect fluorescent-antibody test to sheep sera. Aust J Med Technol. 1971; (2): 3-6.
7. Ghorbani M. Animal toxoplasmosis in Iran. J Trop Med Hyg.1983; (86): 73.
8. Hashemi-Fesharaki R. Seroprevalence of *Toxoplasma gondii* in cattle, sheep and goats in Iran. Vet. Parasitol. 1996; (61): 1-3.
9. Sharif M, Gholami Sh, Ziaei H, Daryani A, Laktarashi B, Ziapour SP, Rafiei A, Vahedi M. Seroprevalence of *Toxoplasma gondii* in cattle, sheep and goats slaughtered for food in Mazandaran Province, Iran, during 2005. Vet Journal. 2006. Under pub-

lish. available online from: science direct.com/science/Jurnal/ 10900233

10. Shahmoradi A, Rezaeian M, Dalimi Asle AH. Sheep an important reservoir of human toxoplasmosis in Iran. Med J I R Iran. 1993; 7(3): 173-74.
11. Mansouri F, Hatami H, Mahdavian B, Hashemian AH. Seroepidemiology of toxoplasmosis in Kermanshah Province. Behbood (The scientific quarterly of Kermanshah University of Medical Sciences) 1993; 7 (2):12-19.
12. Ivana K, Olgica DD, Sofija KR., Aleksandra N. Cross- sectional survey on *Toxoplasma gondii* infection in cattle, sheep and pigs in Serbia: Seroprevalence and risk factors. Vet Parasitol. 2006; (135): 121-31.
13. Dubey JP. Serologic prevalence of toxoplasmosis in cattle, sheep, goats, pigs, bison, and elk in Montana. J Am Vet Med Assoc.1985; (186): 969-70.
14. Samad MA, Rahman KB, Halder AK. Seroprevalence of *Toxoplasma gondii* in domestic ruminants in Bangladesh. Vet Parasitol. 1993; (47): 157-59.
15. Ivana K, Olgica DD, Sofija KR, Aleksandra N. Cross-sectional survey on *Toxoplasma gondii* infection in cattle, sheep and pigs in Serbia: Seroprevalence and risk factors. Vet Parasitol. 2006; (135): 121-31.
16. Dubey JP, Thulliez P. Persistence of tissue cysts in edible tissues of cattle fed *Toxoplasma gondii* oocysts. Am J Vet Res. 1994; (54): 270-73.
17. Sathaporn J, Arkom S, Nongnuch P, Wissanuwat C, Witaya K, Seiichi K, Soichi M. Seroprevalence of *Toxoplasma gondii* infection in domestic goats in Satun Province, Thailand. Vet Parasitol. 2005; (127): 17-22.
18. Figliuolo LPC, Kasai N, Ragozo AMA, deaula VSO, Dias RA, Souza SLP, Gennari SM. Prevalence of anti-*Toxoplasma gondii* and anti- *neospora caninum* anti-bodies in ovine from Sao-Paulo state, Brazil. Vet Parasitol. 2004; (123): 161-66.
19. Dubey JP. Toxoplasmosis. J Am Vet Med Assoc. 1994; (205): 1593-98.
20. Skinner LJ, Timperley AC, Wightman D, Chatterton JM, Ho-Yen DO. Simultaneous diagnosis of toxoplasmosis in goats and goat owner's family. Scand J Infect Dis. 1990; (22): 359-61.