

Seroprevalence of *Toxoplasma gondii* in Domestic Goats in Multan, Punjab, Pakistan

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Abstract

The present study was conducted to investigate the seroprevalence of *Toxoplasma (T.) gondii* in goats. Out of 200 goats 104 were seropositive showing an overall prevalence of 52%. *T. gondii* was more prevalent (55%) in female goats as compared to male goats (25%) with statistical significance ($P<0.05$). Results regarding the relationship between different breeds of goats and *T. gondii* revealed that the prevalence of toxoplasmosis was highest (57.14%) in Beetal and lowest (46.03%) in Teddy goats with statistical significance ($P<0.05$). Toxoplasmosis had highest prevalence (77.27%) in age group of (60-75months) and lowest prevalence (39.32%) was recorded in age group of (12-27months) showing the statistical significance ($P<0.05$). Results regarding the relationship between body weight of animals and *T. gondii* showed that parasite had highest prevalence (60.71%) in body weight group of (45-59kg) and lowest prevalence (34.54%) in body weight group of (15-29kg) with statistical significance ($P<0.05$).

Keywords: prevalence, *Toxoplasma gondii*, goat, age, sex, breed, LAT, Pakistan

Introduction

Toxoplasmosis is a widespread zoonotic disease caused by protozoan parasite, *Toxoplasma gondii*. It has economic relevance to both veterinary and human medicine (Hill et al., 2005). In sheep and goats infection not only results in significant reproductive losses, but also has implication for public health since consumption of infected meat and milk can facilitate zoonotic transmission (Bisson et al., 2000). Fetal death rates (including caprine abortion and neonatal mortality due to *T. gondii*) in affected flocks can be as high as 50% and in non-clinical cases may result in low losses (Radostits et al., 1994).

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Goats are economically important animal in many countries and are the most important source of meat and milk to Islamic people (Neto et al., 2008). Infected goats represent an important source of Toxoplasma infection in Islamic countries where consumption of unpasteurized goat milk due to their cultural traditions (Jittapalapong et al., 2005).

Lack of modern farming has increased the prevalence of *T. gondii* in many countries, including Pakistan. After transport from slaughterhouses, meat can easily be contaminated with *T. gondii* oocysts in the surrounding area later on. Open-air markets are common in Pakistani culture and pose a potential source of pathogen contamination since stray cats are normally found around the markets. Unpasteurized goat milk is commonly consumed by Islamic people due to their cultural traditions. These factors result in a higher potential risk of infection after consumption of these foodstuffs.

Seroprevalence studies have been conducted on different animal species in different parts of the world (Bisson et al., 2000; Ivana et al., 2006; Sharif et al., 2006; Spisak et al., 2010; Berger-Schoch et al., 2011). There are relatively fewer reports on the prevalence of toxoplasmosis in sheep and goats in different parts of Punjab, Pakistan (Ramzan et al., 2009; Lashari and Tasawar, 2010).

T. gondii infection in goats in the Multan however, is questionable to date. This study therefore was conducted to provide information on the prevalence of *T. gondii* and its relationships between age, sex, body weight and breeds of goats in Multan.

Materials and Methods

Animal blood sera

A total of 200 goats of both sexes male (n=20), female (n=180) with age of 1-6 years from Budhla Sant, Multan district of Punjab province were tested for toxoplasmosis. These goats belonged to three breeds Beetle (n=56), Teddy (n=63) and Nachi (n=81). A blood sample was obtained (5ml) from the jugular vein of each animal. After clotting, sera were extracted by centrifugation at 4000 rpm for 10 minutes and were stored at -20°C till further analysis.

Serological test used for detection of *T. gondii*

The collected sera were examined for detection of *T. gondii* antibodies using the latex agglutination test. This test was evaluated as a screening serologic test for toxoplasmosis in animals (Tsubota et al., 1977).

Latex agglutination test

The test procedure was carried out according to the method described by manufacture. The commercial "Toxoplasmosis Latex Kit" (Antec Diagnostic Product TM Uk) was used for this purpose. Briefly, fifty microliters of 1:8 diluted sera was mixed with the (LAT) buffer. A positive result was expressed by agglutination. Sera were serially 2- fold diluted i.e. 1:16, 1:32 and 1:64.

Statistical analysis

Statistical analysis of frequencies of the number of positive animals of different breeds, age and sex were performed using chi-square test. The differences were considered statistically significant at $P \leq 0.05$.

Results and Discussion

The overall prevalence of toxoplasmosis

Out of 200 goats, blood sera, 104 were reacted positively (52%). Different prevalence rate from 0-100 % was recorded in different areas of the world (Olivier et al., 2007) depending upon their customs, traditions, life styles of the inhabitants, weather conditions, age of the animals and husbandry practice. Sanad and Al-Ghaban (2007) found almost similar findings 51% prevalence in goats of Saudi Arabia as recorded in the present study. The prevalence rate in the present study is higher than those reported by several authors in goats from different areas of the world; prevalence rate of 28.9 % in Brazil (Bisson et al., 2000), 27.9 % in Satun Province, Thailand (Jittapalapong et al., 2005), 25.4% in Pakistan (Ramzan et al., 2009) and 19.88% in sheep of southern Punjab, Pakistan (Lashari and Tasawar, 2010) were already reported. On the other hand the prevalence rate recorded in the present study is lower than 67.9% level of infection found in Zimbabwe (Hove et al., 2005), 59.4% in Giza, Egypt (Barakat et al., 2009).

The differences in prevalence reported by all these studies could be accounted on the basis of host age, breed, sex, environmental conditions, farm size, number of cats and management practices (Arko-Mensah et al., 2000; Van der Puije et al., 2000; Ghazaei, 2006).

Relationship between sex and toxoplasmosis in goats

During the present study, out of 20 male hosts, 5 were reacted positively showing 25% prevalence of toxoplasmosis. The female hosts showed significantly ($P < 0.05$) higher prevalence 55% as compared to male hosts. Alexander and Stinson

(1988) reported that the female animals are more susceptible to protozoan parasites as compared to male. In the present study the males are found less seropositive than females. The present results are in agreement with previous studies (Ramzan et al., 2009). Van der Puije et al. (2000) studied the prevalence of anti-*T. gondii* antibodies in Ghanaian sheep and goats. Prevalence of antibodies in female animals (35.8%) was significantly higher ($P < 0.01$) than that for males (21.1%). Teshale et al. (2007) determined the prevalence and risk factors of toxoplasmosis in goats in southern and central Ethiopia. The prevalence of anti *T. gondii* antibody was significantly higher in females than in males. The hormonal differences between males and females play an important role in determining susceptibility to parasitic infection. It is now widely accepted that many hormones including the sex-associated hormones directly influence the immune system (Roberts et al., 2001). It has been reported that estrogen enhances antibody production and androgen suppress both T-cell and B-cell immune responses (Da Silva, 1999), but immunity in females can be broken down due to various factors e.g., nutrition, age, pregnancy and environmental factors. Reasons for higher prevalence of *T. gondii* during the present study may be the number of female goats examined which are greater in number as compared to male goats.

Relationship between breed and toxoplasmosis in goats

The prevalence of toxoplasmosis was (29/63) 46.03% in Teddy, (32/56) 57.14% in Beetal and (43/81) 53.08% in Nachi. The difference was non-significant ($P > 0.05$), But apparently the teddy breed showed higher infection rate Beetal and Nachi goats. Similar findings were reported by Jittapalapong et al. (2005). The prevalence of toxoplasmosis varies in different breeds of animals. The reasons for different prevalence may be due to genetic variation and resistant to infection in different breeds (Van der Puije et al., 2000; Arko-Mensah et al., 2000).

Relationship between body weight and toxoplasmosis in goats

The highest prevalence of toxoplasmosis 60.71% was recorded in body weight group of 45-59kg and lowest prevalence 34.54% in body weight group of 15-29kg. The prevalence of toxoplasmosis directly related to the body weight as the body weight of animal increases the prevalence was also increased. The similar results have been reported by (Clementino et al., 2007). Contrary to present findings, generally higher prevalence of toxoplasmosis in lower body weight group was recorded by Lashari and Tasawar (2010) in sheep. The higher prevalence of parasites in heavier body weight group may be due to low resistance to parasitic infection.

Relationship between age and toxoplasmosis in goats

Relationship between age and toxoplasmosis in goats revealed that the parasite had highest prevalence 77.27% in age group of 60-75months and lowest prevalence 39.32% in age group of 12-27months. The prevalence increased as the age of animal increased. Progressive increase of *T. gondii* with age suggests a continuous exposure to the organism in the environment as earlier reported (Jittapalpong et al., 2005; Ivana et al., 2006; Sharif et al., 2006).

Dubey and Adams (1990) reported that seroprevalence increased with age of goats; 3.7% of 54 six-month-old goats were seropositive (greater than or equal to 1:40) vs 17.8% of 218 one-year-old goats. Jittapalpong et al. (2005) studied the seroprevalence of antibodies to *T. gondii* in domestic goats of Satun Province in Thailand with commercial latex agglutination test kits. A total of 631 goat sera were examined for antibodies against toxoplasmosis. Older goats were more seropositive than young goats under 1-year old (Teshale et al., 2007). The prevalence of anti *T. gondii* antibody was significantly higher in older goats than in kids. Results of the present study are in agreement with results reported by (Arko-Mensah, 2000; Van der Puije et al., 2000; Clementino et al., 2007). This may be explained on the basis that older animals are less resistant to toxoplasmosis due low immunity (Roberts et al., 2001).

References

Alexander J and WH Stinson, 1988. Sex hormones and the course of parasitic infection. *Parasitology Today*, 4: 189-193.

Arko-Mensah J, KM Bosompem, EA Canacoo, JM Wastling and BD Akanmori, 2000. The seroprevalence of toxoplasmosis in pigs in Ghana. *Acta Tropica*, 76: 27-31.

Barakat AMA, MM AbdElaziz and M Fadaly, 2009. Comparative diagnosis of toxoplasmosis in Egyptian small ruminants by indirect hemagglutination assay and elisa. *Global Veterinaria*, 3: 9-14.

Berger-Schoch1 AE, D Bernet, MG Doherr, B Gottstein and CF Frey, 2011. *Toxoplasma gondii* in Switzerland: A serosurvey based on meat juice analysis of slaughtered pigs, wild boar, sheep and cattle. *Zoonoses and Public Health*, doi: 10.1111/j.1863-2378.2011.01395.x.

Bisson A, S Maley, CM Rubaire-Akiiki, JM Watling, 2000. The seroprevalence of antibodies to *Toxoplasma gondii* in domestic goats in Uganda. *Acta Tropica*, 76: 33-38.

Clementino MM, MF Souza, and VF Andrade Neto, 2007. Seroprevalence and *Toxoplasma gondii*-IgG avidity in sheep from Lajes, Brazil. *Veterinary Parasitology*, 146: 199-203.

Da Silva JAP, 1999. Sex hormones and glucocorticoids: Interactions with the immune system. *Annals of the New York Academy of Science*, 876:102-118.

Dubey JP and DS Adams, 1990. Prevalence of *Toxoplasma gondii* antibodies in dairy goats from 1982 to 1984. *Journal of the American Veterinary Medical Association*, 196: 295-301.

Ghazaei C, 2006. Serological survey of antibodies to *Toxoplasma gondii*. *African Journal of Health Sciences*, 13: 131-134.

Hill DE, S Chirukandoth and JP Dubey, 2005. Biology and epidemiology of *Toxoplasma gondii* in man and animals. *Animal Health Research Reviews*, 6: 41-61.

Hove T, P Lind and S Mukaratirwa, 2005. Seroprevalence of *Toxoplasma gondii* infection in goats and sheep in Zimbabwe. *Onderstepoort Journal of Veterinary Research*, 72: 267-72.

Ivana L, DD Olgica, KK Sofija, N Aleksandra, 2006. Cross sectional survey of *Toxoplasma gondii* infection in cattle, sheep and pigs in Serbia: seroprevalence and risk factors. *Veterinary Parasitology*, 135: 121-131.

Jittapalpong S, A Sangvaranond, N Pinyopanuwat, W Chimnoi, W Khachaeram, S Koizumi and S Maruyama, 2005. Seroprevalence of *Toxoplasma gondii* infection in domestic goats in Satun Province, Thailand. *Veterinary Parasitology*, 127: 17-22.

Lashari MH and Z Tasawar, 2010. Seroprevalence of toxoplasmosis in sheep in Southern Punjab, Pakistan. *Pakistan Veterinary Journal*, 30: 91-94.

Neto JOA, SS Azevedo, SM Gennari, MR Funada, HFJ Pena, ARCP Araujo, CSA Batista, MLCR Silva, AAB Gomes, RM Piatti and CJ Alves, 2008. Prevalence and risk factors for anti-*Toxoplasma gondii* antibodies in goats of the Serido Oriental micro region, Rio Grande do Norte state, Northeast region of Brazil. *Veterinary Parasitology*, 156: 329-332.

Olivier A, B Herbert, B Sava, C Pierre, DC John, DK Aline, 2007. Surveillance and monitoring of *Toxoplasma* in humans, food and animals: a scientific opinion of the panel on biological hazards. *The European Food Safety Association Journal*, 583: 1-64.

Seroprevalence of *Toxoplasma gondii* in goats

- Radostits OM, DC Blood and CC Gay, 1994. A textbook of the disease of cattle, sheep, pigs, goats and horses. 8th ed. W.B. Saunders, London, UK.
- Ramzan M, M Akhtar, F Muhammad, I Hussain, E Hiszczynska-Sawicka, AU Haq, MS Mahmood and MA Hafeez, 2009. Seroprevalence of *Toxoplasma gondii* in sheep and goats in Rahim Yar Khan (Punjab), Pakistan. *Tropical Animal Health and Production*, 41:1225-1229.
- Roberts CW, W Walker and J Alexander, 2001. Sex-Associated Hormones and Immunity to Protozoan Parasites. *Clinical Microbiology Reviews*, 14: 476-488.
- Sanad MM and AJ Al-Ghabban, 2007. Serological survey on toxoplasmosis among slaughtered sheep and goats in Tabouk, Saudi Arabia. *Journal of the Egyptian Society of Parasitology*, 37: 329-340.
- Sharif M, Sh Gholami, H Ziaei, A Daryani, B Laktarashi, SP Ziapour, A Rafiei and M Vahedi, 2006. Seroprevalence of *Toxoplasma gondii* in cattle, sheep and goats slaughtered for food in Manzadaran Province, Iran. *Journal of Animal and Veterinary Advances*, 5: 188-190.
- Spisak F, L Turcekova, K Reiterova, S Spilovska and P Dubinsky, 2010. Prevalence estimation and genotypization of *Toxoplasma gondii* in goats. *Biologica* 65: 670-674.
- Teshale S, A Dumetre, ML Darde, B Merga, and P Dorchie, 2007. Serological survey of caprine toxoplasmosis in Ethiopia: prevalence and risk factors. *Parasitology*, 14:155-159.
- Tsubota N, K Hiraoka, Y Sawada, T Watanabe, S Ohshima, 1977. Studies on latex agglutination test for toxoplasmosis. *Japanese Journal of Parasitology*, 26: 286-290.
- Van der Puije WNA, KM Bosompem, EA Canacoo, JM Wastling and BD Akanmori, 2000. The prevalence of anti-*Toxoplasma gondii* antibodies in Ghanaian sheep and goats. *Acta Tropica*, 76: 21-26.