SERO-EPIDEMIOLOGICAL STUDIES ON *TOXOPLASMA GONDII* INFECTION IN MAN AND ANIMALS IN BANGLADESH

Muhammad Abdus Samad[1], Badal Chandra Dey[2], Nasher Shama Chowdhury[1], Sayeba Akhtar[2] and AKM Mozibur Rahman Khan[2]

[1]Department of Medicine, Bangladesh Agricultural University, Mymensigh - 2202, and [2]Department of Obstetrics and Gynaecology, Mymensingh Medical College, Mymensingh, Bangladesh

Abstract. Sera from randomly selected 49 professional blood donors, 617 pregnant women, 14 butchers, 528 slaughtered goats and 24 domestic cats in the district of Mymensingh were tested for the presence of *T. gondii* antibodies using a Latex agglutination test (LAT). Overall 12.4% blood donors, 11.18% pregnant women, 50.00% butchers, 12.88% slaughtered goats and 33.33% cats had diagnostically significant antibody titers (≥ 1:64) *to T. gondii.* Epidemiological studies on *T. gondii* infection with LAT were conducted in 25 family members with sero-positive cats and 9 family members with 2 sero-positive women without cats in the family. Significantly ($p < 0.01$) higher sero-positivity rate was recorded in the family members (24.00%) with positive cats in comparison to family members (11.11%) without cats. The epidemiologic study indicates that infected cats and goat meat might be significant sources of *T. gondii* infection for humans in Bangladesh.

INTRODUCTION

Toxoplasmosis is an important cosmopolitan zoonotic disease, caused by a protozoan parasite, *Toxoplasma gondii.* It is a parasite with a high prevalence within the environment and with relevance to both veterinary and human medicine. Domestic cats, including wild *Felidae* are the only known definitive hosts and all warm-blooded animals and man are the intermediate hosts of this parasite (Dubey and Beattie, 1988). Analysis of the world literature on sero-prevalence reports revealed that about 38.5% humans, 32.90% cats and 24.20% goats had antibodies to *T. gondii* infection (Samad and Begum, 1990). Recently,we have reported sero-prevalence of *T. gondii* infection in women and ruminants, and a relationship between *T. gondii* infection and adverse reproductive outcome in women and goats from Bangladesh (Samad, 1992; Samad *et al,* 1993a; Samad *et al,* 1993b). This paper describes the sero-epidemiological findings of *T. gondii* infection in man and animals in Bangladesh.

MATERIALS AND METHODS

A sero-epidemiological study was conducted in both the definitive (cats) and intermediate (man and animals) hosts of *T. gondii* in the district of Mymensingh during one year period from June 1994 to May 1995. A total of 49 professional blood donors of the Blood Bank Department of Mymensingh Medical College (MMC), 617 pregnant women who were admitted for treatment related to pregnancy and parturition at the Department of Obstetrics and Gynaecology, MMC, 528 slaughtered goats and 14 butchers of the Mymensingh slaughter houses, and 24 domestic cats were used for this study. Blood was collected from each of these randomly selected subjects, allowed to clot and transported to the laboratory. The serum was separated and stored at -20°C until tested.

Each of the collected sera was tested for *T. gondii* antibodies by using the commercial Latex agglutination test (Toxoreagent®, Eiken Chemical Co, Japan) at a dilution of 1:4 in U-well microtiter plate (Nunc, International, Denmark) and those which gave positive reactions at that dilution were titrated to the end point reaction by doubling serial dilutions as described by Samad *et al* (1993a).

The possible source of transmission of *T. gondii* infection from infected cats to family members and slaughtered meat animals to butchers were examined. Three sero-positive cats and two sero-positive pregnant women with titer of ≥ 1:512 were randomly selected to investigate the occurrence of this infection in their family members. Blood was

collected from 25 family members of the infected cat owners and 9 family members of the infected pregnant women without cats in the family.

Each of the collected serum was tested by using LAT as described (Samad *et al,* 1993a). A titer of ≥ 1:64 dilution was classified as positive and the results were analysed statistically using standard Chi-square test for significance (Gupta, 1882).

RESULTS AND DISCUSSION

The sero-prevalence results were based on a single collection of blood from each individual and sera that gave reaction to ≥ 1:64 dilution were considered positive to *T. gondii* with the commercial Latex agglutination test. Of the 49 blood donors, 617 pregnant women, 14 butchers, 528 slaughtered goats and 24 cats screened, 20.41%, 23.50%, 57.14%, 26.33% and 45.83% had antibodies against *T. gondii* infection but 12.24%, 11.18%, 50.00%, 12.88% and 33.33% had positive titers (≥ 1:64), respectively (Table 1).

The sero-prevalence rate of 12.24% *T. gondii* infection recorded in the professional blood donors in this study which is much lower than 42 to 54% reported from Kenya (Griffin and Williams, 1983) but much higher than 1.2 to 6.4% reported from Thailand (Morakote *et al,* 1984; Maleewong *et al,* 1989). However, the occurrence of *T. gondii* infection in 12.24% professional blood donors indicates the risk of random blood transfusion to sero-negative recipients especially pregnant women (Renieni-Livieraton *et al,* 1980).

The 11.18% sero-prevalence rate of *T. gondii* infection recorded in pregnant women supports the earlier sero-results of 15.89% reported from Bangladesh (Samad *et al,* 1993b). This finding also supports the 8 to 10% *T. gondii* infection reported in India (Bhatia *et al,* 1974; Mahajan *et al,* 1974), 9.80% in Hong Kong (Ko *et al,* 1980) and 13.0% inThailand (Bunnag *et al,* 1988). However, studies in Europe and America have shown that the sero-prevalence of *T. gondii* infection in women to be 62.6% in Germany (Gringmuth and Muller, 1977), 53.0% in Italy (Campello *et al,* 1979), 23.36% in UK (Broadbent *et al,* 1981) and 30% in USA

Table 1

Sero-prevalence of *Toxoplasma gondii* infection in man and animals.

Antibody titer LAT	Sero-positives, No. (%)				
	Professional blood donors (n = 49)	Pregnant women (n = 617)	Butchers (n = 14)	Slaughtered goats (n = 528)	Semi-pet cats (n = 24)
Negative	39	472	06	389	13
1:4	02	18	00	-	01
1:8	02	30	00	66	00
1:16	00	07	00	00	01
1:32	00	21	01	00	01
1:64	00	24	03	36	00
1:128	02	20	04	14	01
1:256	03	07	00	00	00
1:512	01	15	00	08	02
1:1,024	00	00	00	10	02
1:2,048	00	03	00	00	03
Total	10 (20.41)	145 (23.50)	08 (57.14)	139 (26.33)	11 (45.83)
≥ 1:64	06 (12.24)	69 (11.18)	07 (50.00)[a]	68 (12.88)	08 (33.33)[b]

LAT = Latex agglutination test, n = Total number tested, - = Titer not tested
[a]Significantly ($p < 0.01$) higher than pregnant women and blood donors
[b]Significantly ($p < 0.01$) higher than slaughtered goats

(Dubey, 1994). It becomes apparent that the sero-prevalence rate of *T. gondii* infection in East and Southeast Asia is generally lower than that reported from Europe and America. These variations of sero-prevalence rate of *T. gondii* infection in humans might probably be due to difference of food habits, association of pet cats, environmental conditions and socio-economic status.

Cattle and goats are mainly used as meat animals in Bangladesh. The prevalence of *T. gondii* infection in 12.80% goats recorded in this study confirm the earlier report of 12.09% seropositive rate of *T. gondii* infection in Bangladesh (Samad *et al,* 1993b). The sero-prevalence studies on *T. gondii* infection in butchers showed that 50% butchers had sero-positive titer which is significantly ($p < 0.01$) higher in comparison to 11.18% sero-prevalence rate in women and 12.24% in professional blood donors (Table 1). Similarly, higher sero-prevalence rate (72%) of *T. gondii* infection has been reported in abattoir workers elsewhere (Riemann *et al,* 1975, Ishizuka, 1978; Mayers *et al,* 1981). This high prevalence rate of *T. gondii* infection in slaughter house workers might probably be due to accidental entry of tissue cyst during processing of meat. Persons handling raw meat (slaughter house workers) have shown to have a prevalence of antibodies to *T. gondii* approximately double that comparable groups without such exposure (Swanepoel *et al,* 1974; Riemann *et al,* 1975).

Cats are important in the epidemiology of toxoplasmosis in humans and animals as they are the only species of domestic animals known to excrete resistant oocyst of *T. gondii.* The serological studies on *T. gondii* infection in 24 cats revealed that 33.33% cats gave a positive reaction at a titer $\geq$ 1:64 which is close to the worldwide mean (32.9%) and range (2.1 - 74.4) sero-prevalence rates (Wilkinson and Thompson, 1986; Samad and Begum, 1990).

The three sero-positive cats and two women with titers $\geq$ 1:512 were used to determine the epidemiological association of *T. gondii* infection in their family members. A significantly ($p < 0.01$) higher sero-prevalence rate of *T. gondii* infection was recorded in the family members of the positive cat owners (24.0%) in comparison to the family members (11.11%) of the positive women without cats (Table 2). The results of high sero-prevalence rate of 24.0% in the family members with positive cats in comparison to general sero-prevalence rate of 11.18% in women and 11.11% in the family members of the positive women without cats indicates that *T. gondii* oocyst might have disseminated from these infected cats and oocyst were probably present in the environment. These findings support the previous epidemiologic studies of Paterson *et al* (1972), Wallace *et al* (1974) and Ulmanen and Leinikki (1975) who reported a significantly higher prevalence of antibodies against *T. gondii* among owners of cats than the controls. It appears from the results of this study that the epidemiology of toxoplasmosis in association with cats, and the significance of transmission through meat need to be further evaluated in detail in the light of this epidemiologic findings.

ACKNOWLEDGEMENTS

This collaborative study was supported in part by a research project of Bangladesh Medical Research Council (BMRC) under the World Bank Research Program. The authors would like to thank Head and staff of the Department of Blood Bank, Mymensingh Medical College for assistance during blood sampling.

REFERENCES

Bhatia VN, Meenakshi K, Aggarwal SC. Toxoplasmosis in South India - a serological study. *Indian J Med Res* 1974; 62 : 1818-25.

Broadbent EJ, Ross R, Hurley R. Screening for toxoplasmosis in pregnancy. *J Clin Pathol* 1981; 34 : 659-64.

Bunnag T, Klongkamnuankarn K, Impand P, Vorasanta P, Nabnean K. Sero-epidemiology of toxoplasmosis in rural villages, Phayao Province. *J Med Assoc Thai* 1988; 71 : 96-9.

Campello C, Mandruzzato GP, Fabris C, Ella A, Majori L. Epidemiology of the 'TORCH' complex. 1. Prevalence of antibodies against cytomegalovirus, herpesvirus and *Toxoplasma* in women from Trieste. *Ingiene Moderna* 1979; 72 : 1247-57.

Dubey JP. Toxoplasmosis. *J Am Vet Med Assoc* 1994; 205 : 1593-8.

Dubey JP, Beattie CP. Toxoplasmosis of Animals and Man. Boca Raton, Fla : CRC Press, 1988.

Table 2

Relationship of *Toxoplasma gondii* infection between man and animals screened by using latex agglutination test.

Sero-positive host No. (titer)	Sero-results in contact hosts (family members), No. (%)						
	No. tested	1:16	1:32	1:64	1:128	≥1:64	Total
Cat 1 (1 : 1,024)	08	00	00	02	00	02	02
Cat 2 (1 : 1,024)	07	00	00	01	00	01	01
Cat 3 (1 : 512)	10	01	01	03	00	03	05
Overall	25	01	01	06	00	06 (24.0)[c]	08 (32.00)
Woman 1 (1 : 512)	03	00	00	00	00	00	00
Woman 2 (1 : 512)	06	00	00	01	00	01	01
Total	09	00	00	01	00	01 (11.11)	01 (11.11)
Slaughtered goats[a]	14[b]	00	01	03	04	07 (50.00)	08 (57.14)

[a]12.88% had positive antibody titer to *T. gondii* infection, [b]Butchers
[c]Significantly ($p < 0.01$) higher than women without cats in the family.

Griffin L, Wlliams KAB. Serological and parasitological survey of blood donors in Kenya for toxoplasmosis. *Trans R Soc Trop Med Hyg* 1983; 77 : 763-6.

Gringmuth A, Muller WA. Prophylaxis of congenital toxoplasmosis by serological surveillance of pregnant women. *Deutsche Gesundheitswegen* 1977; 32 : 104-6.

Gupta SP, Statistical Methods. 16th ed. New Delhi: Sultan Cand, 1982.

Ishizuka MM. Indirect immunofluorescence reactions (anti-IgG) to *Toxoplasma gondii* in butchers. *Revista Fac Univ Sao Paulo*. 1978; 15 : 155-8.

Ko RC, Wong FWT, Todd D, Lam KC. Prevalence of *Toxoplasma gondii* antibodies in the Chinese population of Hong Kong. *Trans R Soc Trop Med Hyg* 1980; 74 : 351-4.

Mahajan RC, Chitkara NL, Jolly JG. Serological survey of *Toxoplasma* antibodies in Chandigarh area (Northern India). *Indian J Med Res* 1974; 62 : 1-6.

Maleewong W, Lulitanond V, Pipitgool V, Auwijitaroon Y, Kuttsarejriya S, Morakote N. Prevalence of *Toxoplasma* antibodies in blood donors and pregnant women in Khon Kaen Province. *J Med Assoc Thai* 1989; 72 : 256-9.

Mayers JC, Bratin AC, Maggio M. Prevalence of toxoplasmosis in meat workers. *Rev Millit Vet* 1981; 27 : 251-2.

Morakote N, Thamasonthi W, Charuchinda K, Khamboonruong C. Prevalence of *Toxoplasma* antibodies in Chiang Mai population. *Southeast Asian J Trop Med Public Health* 1984; 15 : 80-5.

Paterson DR, Tronca E, Bonin P. Human toxoplasmosis prevalence and exposure to cats. *Am J Epidemiol* 1972; 96 : 215-18.

Renieni-Livieraton N, Koumentakok E, Stavropoulou-Gioka C, Kapellou P, Pharmakis A. Toxoplasma and blood transfusion. *Acta Microbiol Hellenica* 1980; 25 : 254-60.

Riemann HP, Brant PC, Behymer OE, Franti CE. *Toxoplasma gondii* and *Coxiella brunetti* antibodies among Brazilian slaughter house employees. *Am J Epidemiol* 1975; 102 : 396-403.

Samad MA. Serological diagnosis of *Toxoplasma gondii* associated with abnormal reproduction in Black Bengal goats. *Prev Vet Med* 1992; 13 : 217-20.

Samad MA, Begum N. Epidemiological and clinical status of toxoplasmosis in man and animals. *Bangl Vet* 1990; 7 : 50-4.

Samad MA, Rahman KB, Halder AK. Seroprevalence of *Toxoplasma gondii* in domestic ruminants in Bangladesh. *Vet Parasitol* 1993a; 47 : 157-9.

Samad MA, Begum N, Shamsunahar, Ahmed MU. Serological diagnosis of *Toxoplasma gondii* infection in women associated with gynaeco-obstetric problems. *Southeast Asian J Trop Med Public Health* 1993b; 24 : 102-6.

Swanepoel R, Blackburn NK, Efstratiou S. An investigation of the relationship between infection and *Toxoplasma gondii* and contact with animals. *Centr Afr J Med* 1974; 20 : 206-10.

Ulmanen T, Leinikki P. The role of pet cats in the sero-epidemiology of toxoplasmosis. *Scand J Infect Dis* 1975; 7 : 67-81.

Wallace GD, Zigas V, Gajdusek DC. Toxoplasmosis and cats in New Guinea. *Am J Trop Med Hyg* 1974; 23 : 8-14.

Wilkinson GT, Thompson HL. Prevalence of *Toxoplasma gondii* antibodies in cats in Southeast Queensland. *Aust Vet Practit* 1986; 16 : 144-6.