academicJournals

Vol. 7(27), pp. 3479-3482, 5 July, 2013
DOI: 10.5897/AJMR12.1411
ISSN 1996-0808 ©2013 Academic Journals
http://www.academicjournals.org/AJMR

African Journal of Microbiology Research

Full Length Research Paper

Seroprevalence of *Toxoplasma gondii* infection in dogs in Jinzhou City, Northeast China

Yi-Ming Tian[1], Dong-Hui Zhou[1]*, Hui-Qun Song[1], Chao Yan[3], Min Bao[4] and Feng-Cai Zou[2]

[1]State Key Laboratory of Veterinary Etiological Biology, Key Laboratory of Veterinary Parasitology of Gansu Province, Lanzhou Veterinary Research Institute, Chinese Academy of Agricultural Sciences, Lanzhou, Gansu Province 730046, China.
[2]College of Animal Science and Technology, Yunnan Agricultural University, Kunming, Yunnan Province 650201, P. R. China.
[3]Department of Pathogen Biology and Immunology, Xuzhou Medical College, Xuzhou, Jiangsu Province 221004, China.
[4]College of Animal Science and Veterinary Medicine, Liaoning Medical University, Jinzhou, Liaoning Province 121000, China.

Accepted 3 July, 2013

To investigate the prevalence of dogs exposed to *Toxoplasma gondii* in Jinzhou City, Liaoning Province, northeast China, 304 dogs were screened for specific antibodies to *T. gondii* by enzyme-linked immunosorbent assay (ELISA) using a commercially-marketed kit. The overall prevalence of *T. gondii* IgG antibodies were found in 82 of 304 (26.97%) dogs with regional variations, but these differences were not statistically significant ($P > 0.05$). The study also showed that prevalence increased significantly with age ranging from 18.49 to 45.20%, of which, the prevalence of dogs >3 years was significantly higher than those <1 year ($P < 0.01$). The results of our study indicated that dogs in Jinzhou had a relatively high *T. gondii* seroprevalence, which has implications for public health in this region.

Key words: *Toxoplasma gondii*, Toxoplasmosis, dog, enzyme-linked immunosorbent assay (ELISA), seroprevalence, Jinzhou, Northeastern China.

INTRODUCTION

Toxoplasmosis caused by the obligate intracellular protozoan, *Toxoplasma gondii* is an important parasitic zoonosis with a world-wide distribution (Zhou et al., 2008; Dubey, 2010; Zhou et al., 2011). Although, toxoplasmosis is mainly benign or associated with mild non-specific clinical symptoms in most patients, toxoplasmosis in congenitally infected children and immunocompromised persons such as AIDS and organ transplant recipients can cause high rates of morbidity and mortality (Montoya and Liesenfeld, 2004; Dubey, 2010). Humans can be infected postnatally by ingesting tissue cysts from undercooked meat of intermediate hosts, consuming food or drink contaminated with oocysts, or by accidentally ingesting oocysts in the environment (Dubey, 2010; Pereira et al., 2010).

Cats and wild felids as the only definitive hosts play a crucial role in the epidemiology of this parasitic disease due to shedding oocysts in their faeces directly (Dubey, 2010). Although, dogs that become infected by ingestion of infective oocysts from soil contaminated with *T. gondii* or by ingestion of tissues cysts from infected small animals such as birds, rodents do not produce *T. gondii*

*Corresponding author. E-mail: zhoudonghui@caas.cn. Tel: +86-931-8342813.

oocysts like cats (Lindsay et al., 1997). In addition, free living dogs such as stray dogs are exposed without any protection from pathogens in the environment, roam freely and contact the same contaminated environment which humans are also exposed to, especially in the urban areas where free-range chickens are not available, so stray dogs could be used as sentinels of environmental spreading with *T. gondii* in densely built urban areas; the prevalence of *T. gondii* antibodies in stray dogs might be a good model for indicating environmental contamination and the risk of toxoplasmosis to humans (Meireles et al., 2004; Salb et al., 2008; Dubey, 2010; Yan et al., 2012).

There has been some published epidemiological studies of *T. gondii* prevalence in dogs in China (Wu et al., 2011; Yan et al., 2012), but little is known about *T. gondii* infection in northeastern China. The aim of our study was to determine the seroprevalence of *T. gondii* in dogs in Jinzhou, Liaoning Province, Northeast China.

MATERIALS AND METHODS

The investigated city

The survey was conducted in Jinzhou City (41°07′N，121°08′E), western Liaoning Province, which covers an area of 10,301 square kilometers with a population of approximately 3 million. Jinzhou City has a low elevation of 20 to 400 m lying to the north of China's Bohai Sea, and has a typical monsoon-influenced humid continental climate with an annual rainfall of 540 to 640 mm, and an average annual temperature of 8 to 9°C.

Serum samples

A total of 304 blood samples were randomly collected from dogs in nine regions of Jinzhou City between August and October, 2011, including 141 urban pet dogs from municipal districts and Taihe District, 136 rural dogs from towns or villages of Bezhen City, Heishan County, Linghai City, Yi County, Linghe District, Guta District, Songshan New District and 27 dogs from the Experimental Animal Center of Liaoning Medical University. Data on gender, geographic origin and age of each dog were collected. About 5 ml blood was collected from the saphenous veins of dogs into a sterile, plain test tube without anticoagulant. The blood samples were sent to the Parasitology Laboratory, College of Animal Science and Veterinary Medicine, Liaoning Medical University and centrifuged at 3,000 *g* for 10 min, and then the serum was collected and stored at -20°C until assayed.

Serological examination

Toxoplasma-specific IgG antibodies were measured by enzyme-linked immunosorbent assay (ELISA) using a commercially-marketed kit (Zhuhai S.E.Z Haitai Biological Pharmaceuticals Co., Ltd., Zhuhai, China) according to the manufacturer's recommendations. Positive, negative and critical control sera were provided in the kit. Briefly, the *T. gondii*-specific antigen was coated on a 96-well ELISA microplate. Positive control, negative control and three critical controls were added in each plate, respectively. After the diluted serum sample (1:100) was added to each well, the plate was incubated at 37°C for 30 min. The plate was washed three times and a conjugate was then added with an incubation at 37°C for 30 min. A chromogenic enzyme substrate was then added followed by three washings, after dark incubation at 37°C for 10 min, the reaction was stopped with stop solution. The optical density (OD) at 450 nm was measured in a microplate reader (Bio Tek Instrument Inc, Vermont, USA). The serum was considered as positive if the OD450 (sample) > mean OD450 (critical control) multiplied by 1.1.

Statistical analysis

Differences in the seroprevalence of *T. gondii* infected dogs between male and female, the sources of dogs and different age groups were analyzed using a Chi square (χ^2) test in Predictive for Analytics Software (PASW®) Statistics 18 (Release 18.0 standard version, SPSS Inc., Chicago, America). The *P*-value < 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

A total of 304 sera of dogs were examined by ELISA for *T. gondii* antibodies (Table 1). Antibodies to *T. gondii* were found in 82 (26.97%) dogs. The seroprevalence in male dogs was 27.29% (27 of 99), while the seroprevalence in female dogs was 26.83% (55 of 205), but no significant difference in *T. gondii* prevalence was found between male and female dogs ($P > 0.05$). In general, seroprevalence increased with age and the seropositivity was higher in older dogs, indicating postnatal infection (Lin et al., 1998; Dubey, 2010). Our results showed that a significantly higher (45.20%) prevalence of *T. gondii* infection was detected in > 3-year-old of dogs, when compared with a seropositive rate of 27.40% in dogs of < 1-year-old ($P < 0.01$), suggesting that the risk of exposure to *T. gondii* may increases with age. The present survey demonstrated that the prevalence of *T. gondi* in rural dogs (29.41%) was higher than that in urban dogs (25.00%) and experiment dogs (25.93%) (Table 2), which is consistent with reports by others (Lin et al., 1998; Dubey, 2010), but the difference in this study was not statistically significant ($P > 0.05$). Varied *T. gondii* seroprevalence was detected for dogs in different districts of Jinzhou City, the differences may be attributed to the hunting habits, living conditions of dogs and the density of stray cats (the probable disseminator of *T. gondii* in this area).

The overall seroprevalence of *T. gondii* infection in dogs in Jinzhou was 26.97% (82 of 304). This result was similar to that of Hebei province (26.92%) (Yuan et al., 2004), lower than the seroprevalence of 33.3% in stray dogs in Guangzhou (Zhang et al., 2010) and 40.3% in Xuzhou dogs (Yan et al., 2012), but was higher than that in other regions of China, such as Beijing (13.21%) (Yu et al., 2006), Lanzhou (10.8%) (Wu et al., 2011), Xinjiang (10.5%) (Wang et al., 2011), Haikou (20.7%) (Huang et al., 2008) and Inner Mongolia (12.6%) (Lu et al., 2010). These differences may be related todietary habits, geographic

Table 1. Seroprevalence of T. gondii infection in dogs by gender and age in Jinzhou City, Northeastern China.

Statistical characteristic	Male		Female		*P*- value	Odds ratio (95% CI)	Total	
	No. positive/ total no.	(95% CI)	No. positive/ total no.	(95% CI)			No. positive/ total no	(95% CI)
Types								
Urban pet dogs	11/40	27.50(15-44)	24/101	23.76(15.46-32.06)	0.643	1.217(0.530-2.795)	35/141	24.82(17.69-31.95)
Rural dogs	11/48	22.92(12-37)	29/88	32.95(23.15-42.77)	0.220	0.605(0.270-1.355)	40/136	29.41(21.75-37.07)
Experimental dogs	5/11	45.45(17-77)	2/16	12.50(2-38)	0.141	5.833(0.874-38.936)	7/27	25.93(11-46)
Total	27/99	27.27(18.5-36.04)	55/205	26.83(20.76-32.90)	0.935	1.023(0.596-1.754)	82/304	26.97(21.98-31.96)
Age (years)								
< 1 year	6/41	14.63(6-29)	16/78	20.51(11.55-29.47)	0.432	0.664(0.238-1.853)	22/119	18.49(11.51-25.47)
1-3	12/36	33.33(19-51)	17/77	22.08(12.82-31.34)	0.202	1.765(0.734-4.244)	29/113	25.67(17.62-33.72)
>3	9/22	40.91(21-64)	22/50	44(30-59)	0.807	0.881(0.319-2.436)	31/72	43.06(31.62-54.50)
Total	27/99	27.27(18.5-36.04)	55/205	26.83(20.76-32.90)	0.935	1.023(0.596-1.754)	82/304	26.97(21.98-31.96)

Table 2. Seroprevalence of *T. gondii* infection of dogs in different residences of Jinzhou City, Liaoning province.

Residence area of dogs	No. tested	No. positive	Prevalence (%)
Urban areas			
Jinzhou municipal districts	97	29	29.89
Taihe district	44	6	13.64
Total	141	35	25.00
Rural areas (towns or villages)			
Lvyang town, Beizhen city	2	0	0
Bailaohu village, Guta district	7	3	42.86
Villages of Taihe district	55	12	21.82
Villages of Yi county	48	18	37.50
Daling village, Songshan new district	11	3	27.27
Villages of Heishan county	9	4	44.44
Daye town, Linghai city	4	0	0
Total	136	40	29.41
Experimental animal center	27	7	25.93
Total	304	82	26.97

variation, climate changes, animal welfare conditions in these areas, as well as the various diagnostic techniques of different sensitivity and specificity.

Conclusion

The results of the present survey showed that *T. gondii* infection in dogs in Jinzhou was relatively high, especially in older dogs, which raises public health concern. Therefore, it is imperative for the public health authorities, dog owners and veterinarians in Jinzhou to pay more attentions to this concern, and further investigations of *T. gondii* infection in other animals in this city need to be performed.

ACKNOWLEDGEMENTS

This work was supported, in part, by the National Natural Science Foundation of China (Grant Nos. 31172316 and 31101812), and the Science Fund for Creative Research Groups of Gansu Province (Grant No. 1210RJIA006).

REFERENCES

Dubey JP (2010). Toxoplasmosis of Animals and Humans. CRC Press Inc., Boca Raton, New York; Second. pp.1-313.

Huang SM, Zhou QP, Cui K, Huang ZS, Li QX (2008). Survey and clinical treatment of toxoplasmosis canis in urban area of Haikou City. China Trop. Med. 8:1462-1392.

Lindsay DS, Dubey JP, Blagburn BL (1997). Mechanical transmission of *Toxoplasma gondii* oocysts by dogs. Vet. Parasitol. 73:27-33.

Lin DS (1998). Seroprevalences to *Toxoplasma gondii* in privately-owned dogs in Taiwan. Prev. Vet. Med., 35:21-27.

Lu AT, Gao Y, Du S (2010). Survey on cats and dogs infected with *Toxoplasma gondii* in some areas of inner mongolia. Anim. Husb. Feed Sci. 31:155-156.

Meireles LR, Galisteo AJ, Pompeu E, Andrade HJ (2004). *Toxoplasma gondii* spreading in an urban area evaluated by seroprevalence in free-living cats and dogs. Trop. Med. Int. Health 9:876-881.

Montoya JG, Liesenfeld O (2004). Toxoplasmosis. Lancet, 363:1965-1976.

Pereira KS, Franco RM, Leal DA (2010). Transmission of toxoplasmosis (*Toxoplasma gondii*) by Foods. Adv. Food Nutr. Res. 60:1-19.

Salb AL, Barkema HW, Elkin BT, Thompson R, Whiteside CA, Black SR, Dubey JP, Kutz SJ (2008). Dogs as sources and sentinels of parasites in humans and wildlife, Northern Canada. Emerg. Infect. Dis. 14:60-63.

Wang WS, Zhang JS, Chen W, Wang JW, Meng QL, Qiao J (2011). Serological survey of *Toxoplasma gondii* infection among human and animals in Shihezi Region. Prog. Vet. Med. 32:120-122.

Wu SM, Huang SY, Fu BQ, Liu GY, Chen JX, Chen MX, Yuan ZG, Zhou DH, Weng YB, Zhu XQ, Ye DH (2011). Seroprevalence of *Toxoplasma gondii* infection in pet dogs in Lanzhou, Northwest China. Parasite. Vector 4:64.

Yan C, Fu LL, Yue CL, Tang RX, Liu YS, Lv L, Shi N, Zeng P, Zhang P, Wang DH, Zhou DH, Zhu XQ, Zheng KY (2012). Stray dogs as indicators of *Toxoplasma gondii* distributed in the environment: the first report across an urban-rural gradient in China. Parasite Vector 5:5.

Yuan WY, Ma K, Yang HL (2004). Surveys of *Toxoplasma gondii* infections in animals in Hebei province. Chin. J. Schistosomiasis Control 16:72-76.

Yu YL, Fu LJ, Wang M (2006). Serological survey of *Toxoplasma gondii* infection in dogs and cats in Beijing. Chin. J. Vet. Med. 42:7-9.

Zhang H, Zhou DH, Chen YZ, Lin RQ, Yuan ZG, Song HQ, Li SJ, Zhu XQ (2010). Antibodies to *Toxoplasma gondii* in stray and household dogs in Guangzhou, China. J. Parasitol. 96:671-672.

Zhou P, Chen N, Zhang RL, Lin RQ, Zhu XQ (2008). Food-borne parasitic zoonoses in China: perspective for control. Trends Parasitol. 24:190-196.

Zhou P, Chen Z, Li HL, Zheng H, He S, Lin RQ, Zhu XQ (2011). *Toxoplasma gondii* infection in humans in China. Parasite. Vector., 4:165.