

Seroprevalence of *Toxoplasma gondii* Infection in Police Dogs in Shenyang, Northeastern China

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Abstract: In recent years, worldwide surveys of *Toxoplasma gondii* infection in dogs have been reported. However, only limited surveys of *T. gondii* infection in police dogs have been available, including China. In the present study, we report the seroprevalence of *T. gondii* in police dogs in Shenyang, northeastern China. Sera from 291 police dogs were examined for *T. gondii* antibodies with the modified agglutination test (MAT), and 30.9% animals were tested seropositive. The results of the present study indicated a relatively high prevalence of *T. gondii* infection in police dogs in Shenyang, China.

Key words: *Toxoplasma gondii*, police dog, modified agglutination test, seroprevalence, Shenyang, China

Toxoplasmosis is an important parasitic zoonosis caused by the protozoan *Toxoplasma gondii*, which is widespread in humans and animals worldwide, including dogs [1-4]. *T. gondii* infection may cause serious results in pregnant women and immunocompromised patients [5]. All the warm-blooded animals and intermediate hosts become infected mainly by consuming food or drink contaminated by oocysts evacuated from felids and tissue cysts from other intermediate hosts [1]. Dogs are often regarded as faithful friends and intimate companions of humans. Unfortunately, however, dogs are known to be involved in mechanical transmission of *T. gondii* oocysts to humans by excreting oocysts [6,7], which can pose a health problem for humans.

Worldwide seroprevalences of *T. gondii* in dogs are summarized by Dubey [1]; however, only limited surveys of *T. gondii* infection in police dogs have been reported, including China. Moreover, in China, papers were published in Chinese language in local journals and are not easily accessible to foreign scholars. Therefore, the objective of the present study was to investigate the seroprevalence of *T. gondii* infection in police dogs in Shenyang, northeastern China.

Shenyang is located in the southern part of northeastern China, covering an area of 12,948 km² and a population of approximately 8.2 million people. Its geographical position is at east longitude 122°25'-123°48' and north latitude 41°11'-43°2'. The area has a temperate monsoon climate, with abundant sunshine, a long winter and hot summer, with a brief spring and autumn. The average annual temperature is 8.3°C, with a mean annual rainfall of 600-800 mm. There are approximately 600 police dogs in Shenyang.

This investigation was carried out between October and December 2012 in Shenyang, and a total of 291 blood samples were collected from police dogs. Sera were separated and stored at -20°C for analysis through the modified agglutination test (MAT). Police dog owners were asked for details of the dogs breed, age, gender, source, living conditions, and daily diet using a structured questionnaire.

The MAT test for *T. gondii* antibodies was performed as previously described by Dubey and Desmonts [8] using 2-fold serial dilutions from 1:25 to 1:3,200. Briefly, the harvested parasites were kept in 6% formaldehyde solution at 4°C overnight, and suspended in the alkaline buffer at 20,000 parasites/ml. Two-fold dilutions of sera were performed using the serum diluting buffer, and agglutination was performed in U-bottom 96-well microtiter plates using a mixture of 50 µl antigen and 50 µl diluted sera. The plates were incubated at 37°C overnight. The test was considered positive when a layer of agglutinated parasites was formed in wells at dilutions of 1:25 or higher;

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Table 1. Seroprevalence of *Toxoplasma gondii* infection in police dogs in Shenyang, northeastern China determined by the modified agglutination test (MAT)

Factor	Category	No. dogs examined	No. dogs positive	Seroprevalence (%)
Sex	Female	168	39	23.2
	Male	123	51	41.5
Age (yr)	< 1	180	51	28.3
	1-3	69	21	30.4
	> 3	42	18	42.9
Breed	German Shepherd dog	186	63	33.9
	Holland Shepherd dog	69	18	26.1
	Belgian Malinois dog	36	9	25.0
Total		291	90	30.9

positive and negative controls were included in each test.

Statistical analysis of *T. gondii* seroprevalence between different breeds, age groups, and genders were performed using a Chi-square test with SPSS (SPSS Inc., Chicago, Illinois, USA). A *P*-value of <0.05 was considered statistically significant.

The results showed that the overall seroprevalence of *T. gondii* infection in police dogs was 30.9% (Table 1), which was far higher than that observed in Guangxi (3.3%) [9] and Guangdong (5.6%) [9] in China, and in the Czech Republic (21.7%) [10]. These differences may be due to different serological testing methods, investigation periods, and ecological and geographical factors. The MAT antibody titers were 1:25 in 45, 1:50 in 27, 1:100 in 12, 1:200 in 3, and 1:800 in 3, respectively.

The seroprevalence of *T. gondii* infection in males (41.5%) was higher than that in females (23.2%), and the difference was statistically significant (*P*<0.05). It may be interpreted that male dogs have more chance to feed on food or have contact with the surrounding environment that can be contaminated by *T. gondii* oocysts because in most cases police dogs, males, participate in the duty and training. There were also some differences in the seroprevalence by breed, but these data were not significant (*P*>0.05).

The seroprevalence of toxoplasmosis in police dogs increased progressively with age (Table 1), and the prevalence (42.9%) in older police dogs (>3-year-old) was higher than that in animals below 3-year-old (28.9%) ones, indicating that older police dogs were more likely to be seropositive than dogs under 3-year-old. However, the difference was not statistically significant among age groups (*P*>0.05). The results provided further evidence for the increased risk of *T. gondii* infection with acquisition of age through ingestion of infective oocysts from the environment or tissue cysts from intermediate hosts.

The seroprevalence (30.9%) of *T. gondii* infection in police

dogs in this study was much higher than the results in pet dogs; 10.0% in Shenyang [3], 10.8% in Lanzhou [2], 11.2% in Xinjiang [5], 11.3% in Heilongjiang [5], 12.3% in Zhengzhou [11], 13.2% in Beijing [12], and 17.5% in Guangzhou [13]. The police dogs were often fed raw meat (chicken, pork, and beef), which may contain tissue cysts present in the meat of infected animals and lead to a higher seroprevalence in police dogs than pet dogs. Therefore, people training police dogs will be infected with *T. gondii* more easily, and then enhanced and integrated strategies must be implemented to prevent and control *T. gondii* infection in police dogs.

In this study, we used MAT for detection of *T. gondii* seroprevalence in police dogs because it is the major recommended test for diagnosis of *T. gondii* infection in several animals and man [1]. The most data on isolation of viable *T. gondii* are available with MAT [1]. MAT has high sensitivity and specificity among all serological methods, and it is cheaper, easier than other tests, and does not need special sophisticated equipments [1,4,14,15].

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ETHICS STATEMENT

The collection of serum samples from police dogs in the present study was consented by owners of dogs, and all police dogs were handled in strict accordance with good animal practice according to the Animal Ethics Procedures and Guidelines of the People's Republic of China.

Conflict of interest

We have no conflict of interest related with this report.

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