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BRIEF COMMUNICATION

Seroprevalence of *Toxoplasma gondii* antibodies from slaughter pigs in Chongqing, China

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Abstract Toxoplasmosis is a disease caused by the protozoan *Toxoplasma gondii* which infects most genera of warm-blooded animals, including humans. The objective of this investigation is to evaluate the seroprevalence of toxoplasmosis in pigs in Chongqing Municipality, southwest China. Slaughterhouse pigs' serum samples collected from six different regions in Chongqing were assayed for *T. gondii* antibodies by an indirect hemagglutination test. The average seroprevalence of *T. gondii* were found in 30.6% (278/908) in slaughter pigs, ranging from 21.6% to 40.9% among different sampling sites. The results indicated that toxoplasmosis in swine of Chongqing Municipality was relatively serious, and the pork may be an important source for human infection with *T. gondii*. Comprehensive measures are needed to strengthen further prevention and control of the disease in Chongqing.

Keywords Toxoplasmosis · Slaughter pig · Indirect hemagglutination test · Seroprevalence · Chongqing Municipality

Introduction

Toxoplasma gondii infection is widespread in humans and other warm-blooded animals (Montoya and Liesenfeld 2004). Toxoplasmosis is an important cause of neonatal deaths and abortion in animals (Dubey and Urban 1990). Usually, undercooked pork is considered an important source of human infection for *T. gondii* (Dubey 2004; Torda 2001). The parasite may lead an immunocompromised person such AIDS patients or pregnant women to become seriously ill, though it rarely causes any clinic symptoms in otherwise healthy adults (Dubey and Jones 2008).

Chongqing is one of four municipalities of China where the live pig output is one of the largest in the country, and the annual output value of live pigs achieved 15.1 billion, accounting for 60.6% of the total output value of animal husbandry (National Bureau of Statistics of China 2006). Pork is the staple meat in Chongqing, however, little is known of the prevalence of *T. gondii* infection in the pigs in the municipality.

It was reported that *T. gondii* IgM and IgG antibodies and TOX-DNA in pregnant women of Chongqing were found as 7.0%, 11.0%, and 7.9%, respectively (Ding et al. 2002). The seroprevalence of TORCH (toxoplasma, rubella virus, cytomegalovirus, and herpes virus) in pregnancy women was examined by ELISA, and the Toxo-IgM positive rate was 0.8% (Yue et al. 2005). Therefore, the objective of the present survey was to examine the seroprevalence of *T. gondii* infection in pigs in Chongqing. The results would provide the fundamental data for the execution of prevention and control of *T. gondii* infection in humans and other animals in this municipality.

Materials and methods

Regions

Six different areas including Zhongxian, Rongchang, Dazu, Bishan, Jiangbei, and Beibei were selected for samples

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Table 1 Percentage (percent) seroprevalence of *T. gondii* infection in 908 pigs from different regions of Chongqing Municipality, China as determined by a commercially available IHA test

[a]IHA kit was manufactured (batch no. 194) by Veterinary Research Institute, Jiangsu Academy of Agricultural Sciences (JAAS), No. 50 Zhongling St., Nanjing 210014, China

Region	Number and (%) positive	IHA numbers and (%) positive/titer				
		1:64	1:128	1:256	1:512	1:1024
Zhongxian	26/67 (38.8)	9 (34.6)	3 (11.5)	3 (11.5)	3 (11.5)	8 (30.7)
Rongchang	75/220 (34.1)	15 (20.0)	17 (22.7)	12 (16.0)	9 (12.0)	22 (29.3)
Dazu	50/207 (24.2)	9 (18.0)	11 (22.0)	11 (22.0)	5 (10.0)	14 (28.0)
Bishan	36/88 (40.9)	8 (22.2)	5 (13.8)	2 (5.6)	5 (13.8)	16 (44.4)
Jiangbei	80/275 (29.1)	19 (23.8)	12 (15.0)	17 (21.3)	11 (13.8)	21 (26.3)
Beibei	11/51 (21.6)	3 (27.3)	2 (18.2)	1 (9.1)	3 (27.3)	2 (18.2)
Total	278/908 (30.6)	63 (22.7)	50 (17.8)	46 (16.6)	36 (13.0)	83 (29.9)

collection (Table 1). All of the above regions are the main suppliers of pork to Chongqing and the neighboring regions.

Blood samples

A total of 908 blood samples were collected from the pig slaughterhouse from the above six regions in Chongqing, and about 10 mL blood was collected from each pig before butchering. The blood samples were sent to the laboratory for serological examination and centrifuged (3,000 rpm) for 5 min, and the serum was collected to assay for antibodies to *T. gondii*.

Serological assay

Antibodies to *T. gondii* were detected in sera by an indirect hemagglutination antibody (IHA) test using a commercially available kit (Veterinary Research Institute, Jiangsu Academy of Agricultural Sciences, Nanjing, China) according to the manufacturer's instructions; the method is a kind of national standard (GB/T 18448.2-2008) of China for detection animal toxoplasmosis. Positive and negative control sera were provided in the kit. In brief, sera were added to 96 multi-well V-bottomed polystyrene plates and diluted in a fourfold series from 1:16, 1:32, 1:64, 1:128, 1:256, 1:512, and 1:1024; the plates were shaken gently for 2 min and then incubated at 37°C for 2 h without shaking. The test was considered positive when a layer of agglutinated erythrocytes was formed in wells at dilutions of 1:64 or higher, and positive and negative controls were included in each test.

Results and discussion

From a total of 908 pigs' blood samples, 278 (30.6%) were seropositive to *T. gondii*, and the prevalence rates ranged from 21.6% (Beibei) to 40.9% (Bishan). There seems to be a trend for more samples with the titer of 1:1024 (Table 1). Serological test result indicated that these pigs were likely to carry the *Toxoplasma* pathogen. The likely reasons for differences in prevalences among different areas could be many, such as difference in the protection and management of stray cats (which are the important final host for *T. gondii*) as well as difference in the management and animal welfare for pigs.

Comparing with other survey areas from neighboring provinces, the present survey data show that 30.6% is a little higher than Sichuan (29.5%) (Shu et al. 2011), and it is slightly lower than that in Guizhou (33.3%) (Ou et al. 2003) and Hubei (35.2%) (Jiang et al. 2007). The prevalence of toxoplasmosis was almost same in Chongqing and the surrounding provinces, the primary reasons could be the frequent trading of live pigs among these areas.

Anyway, the results of the present study show that *T. gondii* infection in pigs in Chongqing was relatively high, and consumption of pork may be a risk factor for human infection with *T. gondii* in this municipality. Therefore, it is important that improved integrated measures for the control toxoplasmosis should be practice to reduce the prevalence levels in the surveyed areas.

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