Seroprevalence of *Toxoplasma gondii* infection in zoo and domestic animals in Jiangxi Province, China

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**Abstract** — *Toxoplasma gondii* is a zoonotic protozoan parasite that infects a wide range of warm-blooded animals throughout the world. In the present study, antibodies to *T. gondii* were determined using a commercial indirect hemagglutination (IHA) test in wild animals in a zoo. Three of 11 giraffes (*Giraffa camelopardalis*) (27%), 1 of 5 wolves (*Canis lupus laniger*) (20%), 1 of 6 hippopotamuses (*Hippopotamus amphibious*) (17%), and 2 of 9 tundra swans (*Cygnus columbianus*) (22%) were found to be positive. No antibodies were detected in leopards (*Panthera pardus*), wild geese (*Anser cygnoides*), and Eastern grey kangaroos (*Macropus giganteus*). Domestic species from 13 counties of Jiangxi Province, China were also investigated by an indirect hemagglutination (IHA) test. Thirty-five of 340 goats (10%), 94 of 560 water buffaloes (17%), and 4 of 35 cattle (11%) were found to be seropositive. This is the first report of *T. gondii* infection in animals kept in zoos and domestic animals in this province.

**Key words:** *Toxoplasma gondii*, Zoo animals, Domestic animals, Prevalence.

Résumé – Séroprévalence de l’infection par *Toxoplasma gondii* chez des animaux de zoo et domestiques dans la province de Jiangxi en Chine. *Toxoplasma gondii* est un protozoaire parasite zootonique qui infecte une large gamme d’animaux à sang chaud à travers le monde. Dans la présente étude, les anticorps dirigés contre *T. gondii* ont été déterminés en utilisant un test commercial d’hémagglutination indirecte (IHA) chez des animaux sauvages gardés dans un zoo. Trois (27 %) parmi 11 girafes (*Giraffa camelopardalis*), 1 (20 %) parmi 5 loups (*Canis lupus laniger*), 1 (17 %) parmi 6 hippopotamuses (*Hippopotamus amphibious*) et 2 (22 %) parmi 9 cygnes siffleurs (*Cygnus columbianus*) ont été trouvés positifs. Aucun anticorps n’a été détecté chez des léopards (*Panthera pardus*), des oies sauvages (*Anser cygnoides*) et des kangourous (*Macropus giganteus*). Les espèces domestiques provenant de 13 comtés de la province de Jiangxi, en Chine, ont également fait l’objet d’une enquête par hémagglutination indirecte. Trente-cinq chèvres parmi 340 (10 %), 94 buffles d’eau parmi 560 (17 %) et 4 bovins parmi 35 (11 %) ont été retrouvés séropositifs. Ceci est le premier rapport sur l’infection par *T. gondii* chez les animaux gardés dans des zoos et les animaux domestiques de cette province.

**Introduction**

*Toxoplasma gondii* is an intracellular protozoan parasite that infects a broad range of warm-blooded animals worldwide [4]. Despite the wide distribution of *T. gondii*, limited information is available on this parasite in wild and domestic animals in China [1]. A study was therefore designed to determine the seroprevalence of *T. gondii* in zoos and domestic animals in Jiangxi province, China.

Jiangxi province is located in the southeast of China (northern latitudes of 24°29′–30°04′ and eastern longitudes of 113°34′–118°28′). This province has an abundance of domestic and wild animals given its subtropical, humid monsoon climate, with average annual precipitation of 1341–1940 mm.

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Table 1. Prevalence of Toxoplasma gondii infection in zoo animals determined by indirect hemagglutination in Jiangxi province, China in 2016.

| Species                  | No. tested | No. positive | Prevalence % |
|--------------------------|------------|--------------|--------------|
| Giraffe (Giraffe camelopardalis) | 11         | 3            | 27.3         |
| Wolf (Canis lupus laniger)  | 5          | 1            | 20.0         |
| Hippopotamus (Hippopotamus amphibious) | 6          | 1            | 16.7         |
| Swan (Cygnus columbianus)   | 9          | 2            | 22.2         |
| Leopard (Panthera pardus)   | 3          | 0            | 0            |
| Wild goose (Anser cygnoides) | 2          | 0            | 0            |
| Kangaroo (Macropus giganteus) | 3          | 0            | 0            |
| Total                     | 39         | 7            | 17.9         |

Materials and methods

Serum samples

Blood samples were collected from 39 zoo animals and randomly selected domestic animals from different farms (Tables 1 and 2). Blood samples were collected from the caudal vein by local veterinary practitioners. After collection, each of the blood samples was centrifuged at 1000 × g for 10 min, and serum was separated and stored at −20 °C until further analysis.

Determination of antibodies against T. gondii

Each of the serum samples was tested for antibodies against T. gondii by employing a commercial indirect hemagglutination test (IHA, Lanzhou Veterinary Research Institute of the Chinese Academy of Agricultural Sciences) according to the manufacturer’s instructions. The test was considered positive when a layer of agglutinated erythrocytes formed in wells using the serum dilutions of 1:64 or higher, and positive and negative controls were included in each test.

Statistical analysis was performed by chi-square testing with SPSS (Statistical Analysis System, Version 18.0). The differences were considered statistically significant when \( p < 0.05 \).

Results and discussion

Antibodies to T. gondii were found in 7 out of 39 zoo animals (17.9%) (Table 1). The data for domestic animals are shown in Table 2.

The present study reported a prevalence of 12.1% for T. gondii infection in goats in Jiangxi province, which was in the same range as the prevalence of infection reported in goats (13.4%) in the Hubei and Hunan provinces of China [2, 4], and significantly higher than the prevalence in the northeastern part of the country (8.92%) [5].

The prevalence of T. gondii infection in buffaloes and cattle was 16.8% and 11.4%, respectively, which was lower than the prevalence of T. gondii infection observed in yaks from the same family (21.7% and 29.1% in 2012 and 2013) on the Qinghai-Tibetan plateau of China [3]. As more than three million head of cattle are farmed in this province, there is a high risk of transmission to other animals.

Previously, numerous studies were conducted on the seroprevalence of T. gondii in humans. However, limited information is available regarding the seroprevalence of this protozoan in wildlife, especially in zoological gardens in China, with two reports concerning the Shanghai and Beijing zoological gardens [6, 7]. High levels of T. gondii infection are found in felids. Since this protozoan can be shed by felids, this might have contributed to the spread of T. gondii in the zoo. Therefore, the personnel working in the zoo or the people visiting the zoo should be aware of the procedures required to reduce the potential zoonotic threat of T. gondii [7].

The prevalence of T. gondii infection in zoo animals (17.9%) and in domestic buffaloes (16.8%), cattle (11.4%), and goats (10.3%) in Jiangxi province indicates T. gondii exposure in several animal species. Currently, no information is available on clinical toxoplasmosis in animals in this province. Further studies are needed to determine the prevalence of viable T. gondii in cattle and buffalo tissues because these animals are considered resistant to this protozoan [1].

Conflict of interest

None of the authors have any conflict of interest.

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