RESEARCH NOTE

NEOSPORA CANINUM INFECTION IN CATTLE, COWS AND GOATS IN JIANGXI PROVINCE, CHINA

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Abstract. Neosporosis is caused by *Neospora caninum*, which is responsible for abortion in ruminants causing considerable economic losses world-wide. However, limited information is available regarding *N. caninum* infection in domestic bovines and goats in Jiangxi Province, China. In order to detect antibodies to *N. caninum* in this area, blood samples were obtained from 551 cattle, 35 cows and 330 goats for ELISA determination. Seroprevalence of *N. caninum* in cattle, cows and goats was 7.6%, 6% and 6%, respectively representing a serious threat of economic significance due to the possibility of abortions in these domestic animals.

Keywords: *Neospora caninum*, seroprevalence, ELISA, Jiangxi province, China

INTRODUCTION

Neospora caninum is an intracellular protozoan parasite, which belongs to the phylum Apicomplexa and causes abortions in ruminants (Anastasiaa *et al*, 2013;

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Li *et al*, 2015; Luo *et al*, 2016). Neosporosis, caused by *N. caninum* infection, is one of the most prevalent causes of reproductive failure among dairy cattle world-wide (Iovu *et al*, 2012). In goats, *N. caninum* infection can lead to abortion or neonatal mortality (Corbellini *et al*, 2001). Although *N. caninum* is not recognized as zoonotic, but humans have been shown to be seropositive for this protozoan (Lobato *et al*, 2006).

Jiangxi Province is located in the southeast China, northern latitude of 24°29'-30°04' and eastern longitude of 113°34'-118°28', with an average annual rainfall of 1,341-1,943 mm and average an-

nual temperature of 16.3-19.5°C. The mild climate makes this area abundant of plant and animal resources. There were approximately 3,051,200 bovines and 573,400 goats in Jiangxi Province in 2014 (http://data.stats.gov.cn/easyquery.htm?cn=E0103). However, there is scarce information on seroprevalence of this parasitic infection in cattle, domestic cows and goats in the province. Thus, this study was carried out to rectify this lack of information.

MATERIALS AND METHODS

Serum samples

Blood samples were gathered from caudal vein by practiced veterinarians from 551 cattle, 35 cows and 330 goats in 13 counties of Jiangxi Province, China in 2016 (Table 1). Blood samples were centrifuged at 1,000g for 15 minutes and serum samples stored at -20ºC until used.

ELISA determination

A commercial ELISA kits (IDEXX Neospora X2; IDEXX Lab, Westbrook, ME) was employed to measure anti-$N.$ $caninum$ antibodies (Abs) in serum samples (Li et al, 2015). S/P values were computed using the following formula: S/P = ($A_{650\,nm}$ of sample – average $A_{650\,nm}$ of negative controls)/(average $A_{650\,nm}$ of positive controls - average $A_{650\,nm}$ = of negative controls). Value of (average $A_{650\,nm}$ of positive controls – average $A_{650\,nm}$ of negative controls) must be ≥0.150 and that of (average $A_{650\,nm}$ of negative controls) must be ≤0.200 for the assays to be valid.

Data analysis

Chi-square test was employed for statistical analysis of $N.$ $caninum$ seroprevalence using Statistical Package for Social Science, version 18.0 (IBM, Armonk, NY). Difference is considered statistically significant when p-value <0.05.

RESULTS

A total of 21/330 (6%) goat serum samples were tested positive for $N.$ $caninum$ Abs, with seropositivity ranging from 0 to 18.2% in each county, and no significant differences was found among 9 counties of Jiangxi Province (Table 1). The seorprevalence in cattle and cows was 7.6% and 6%, respectively, with regional seropositivity in cattle ranging from 0 to 17% in each county, and similar to the situation in goats; there are no statistically significant differences among 12 counties (Table 1). Seropositivity of cows was limited to one district.

Indirect fluorescent antibody test (IFAT) (Sigma, St. Louis, MO) was used to confirm the ELISA-positive samples (data not shown) (Liu et al, 2015).

DISCUSSION

$N.$ $caninum$ was first discovered and described in 1988, and since then it was reported in many animal species world-wide (Li et al, 2015). Previous studies reported prevalence of $N.$ $caninum$ infection of 2.3% in dairy goats in Romania (Iovu et al, 2012) and 3.9% in goats in Hubei Province, China (Luo et al, 2016), lower than that (seroprevalence) from the current study, which is lower than the prevalence (7.23%) in Qinghai Province, China (Liu et al, 2015). The present seroprevalence result of cows and cattle are in line with the prevalence of $N.$ $caninum$ infection in yaks (5.7%) in Tibet and Sichuan (7.4%), China (Li et al, 2015), but lower than previous reports (13.3%) of $N.$ $caninum$ infection in dairy and breeding cattle under intensive or semi-intensively management in Ethiopia (Asmare et al, 2013) and in Algerian cattle (19.6%) (Ghalmi et al, 2012). Different geography, climate and environment might contribute to these differences (Luo et al,

Table 1

Seroprevalence of *Neospora caninum* infection in cattle, cows and goats by ELISA, Jiangxi Province, China in 2016.

County	Goat[a]	Cattle[b]	Cow
	Prevalence, % (positive samples/ total samples)	Prevalence, % (positive samples/ total samples)	Prevalence, % (positive samples/ total samples)
Pingxiang	5.8 (3/52)	0 (0/15)	6 (2/35)
Ji'an	10 (2/20)	11 (13/118)	-
Xinyu	15 (3/20)	6 (2/33)	-
Jingdezhen	0 (0/20)	17 (6/35)	-
Yichun	5 (1/20)	9 (4/45)	-
Nanchang	18 (6/33)	4 (3/80)	-
Shangrao	0 (0/10)	9 (3/35)	-
Yingtan	-	7 (1/15)	-
Ganzhou	5 (1/20)	3 (1/35)	-
Jiujiang	4 (5/135)	-	-
Fuzhou	-	4 (1/25)	-
Gaoan	-	3 (2/60)	-
Yudu	-	11 (6/55)	-
Total	6% (21/330)	7.6 (42/551)	6 (2/35)

[a]No significant differences in seroprevalence of *N. caninum* infection among different counties ($p = 0.097$; $\chi^2 = 14.480$). [b]No significant differences in the seroprevalence of *N. caninum* infection among different counties ($p = 0.243$; $\chi^2 = 13.665$).

2016). In addition, the number of dogs in the study area might be a contributing factor because dog is the definitive host of *N. caninum* (Liu *et al*, 2015).

The remarkable growing economy in developing countries increases the demand for livestock products in domestic and regional markets (Asmare *et al*, 2013), especially in China with a population of over 1.38 billion (National Bureau of Statistics of China; http://data. stats.gov.cn/easyquery.htm?cn=C01). The positive samples detected in the current study demonstrates neosporosis in cattle, cows and goats in Jiangxi Province could cause a considerable economic impact to livestock industry. As neosporosis in non-pregnant cows rarely causes overt clinical disease but can lead to abortion or give rise to diseased or sub-clinically infected calves during pregnancy (Romero-Salas *et al*, 2010). As regards abortion in cattle, *N. caninum* is considered one of the main causes (Liu *et al*, 2015). Although *N. caninum* may not appear to cause frequent losses in pregnant goats, this may be an underestimation (Anastasiaa *et al*, 2013). In our study, seroprevalence of goats was comparable to those in cattle and cows.

In conclusion, *N. caninum* infection (seropositivity) in domestic cattle, cows and goats in Jiangxi Province represents a serious threat that can cause significant economic loss due to abortion. Further

studies should be conducted to isolate and identify genotype(s) of this parasite in this province.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

Anastasiaa D, Elias P, Nikolaos P, Charilaos K, Nektarios G. *Toxoplasma gondii* and *Neospora caninum* seroprevalence in dairy sheep and goats mixed stock farming. *Vet Parasitol* 2013; 198: 387-90.

Asmare K, Regassa F, Robertson LJ, Skjerve E. Seroprevalence of *Neospora caninum* and associated risk factors in intensive or semi-intensively managed dairy and breeding cattle of Ethiopia. *Vet Parasitol* 2013; 193: 85-94.

Corbellini LG, Colodel EM, Driemeier D. Granulomatous encephalitis in a neurologically impaired goat kid associated with degeneration of *Neospora caninum* tissue cysts.

J Vet Diagn Invest 2001; 13: 416-9.

Ghalmi F, China B, Ghalmi A, Hammitouche D, Losson B. Study of the risk factors associated with *Neospora caninum* seroprevalence in Algerian cattle populations. *Res Vet Sci* 2012; 93: 655-61.

Iovu A, Gyorke A, Mircean V, Gavrea R, Cozma V. Seroprevalence of *Toxoplasma gondii* and *Neospora caninum* in dairy goats from Romania. *Vet Parasitol* 2012; 186: 470-4.

Li K, Han ZQ, Shahzad M, Li JK. Seroepidemiology of *Neospora caninum* infection in yaks (Bos grunniens) in Tibet and Hongyuan of Sichuan, China. *Cattle Pract* 2015; 23: 142-3.

Liu ZK, Li JY, Pan H. Seroprevalence and risk factors of *Toxoplasma gondii* and *Neospora caninum* infections in small ruminants in China. *Prev Vet Med* 2015; 118: 488-92.

Lobato J, Silva DA, Mineo TW, *et al.* Detection of immunoglobulin G antibodies to *Neospora caninum* in humans: high seropositivity rates in patients who are infected by human immunodeficiency virus or have neurological disorders. *Clin Vaccine Immunol* 2006; 13: 84-9.

Luo HQ, Li K, Zhang H, *et al.* Seroepidemiology of *Toxoplasma gondii* and *Neospora caninum* infections in goats in Hubei province, China. *Trop Biomed* 2016; 33: 285-9.

Romero-Salas D, Garcia-Vazquez Z, Montiel-Palacios F, *et al.* Seroprevalence of *Neospora caninum* antibodies in cattle in Veracruz, Mexico. *J Anim Vet Adv* 2010; 9: 1445-51.