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Short Communication

Serological Survey of Bovine Viral Diarrhoea Virus among Yaks (*Bos poephagus grunniens*) in Hongyuan of Sichuan, China

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Authors' Contributions
JKL and KL designed the study. KL, ZQH, HZ, XQW, HQL, YFL and GQ performed the trial. KL analyzed the data. KL wrote the manuscript.

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Prevalence, BVDV, ELISA, Yak, Hongyua.

ABSTRACT

A serological detection by employing commercial enzyme-linked immunosorbent assay (ELISA) kit to test the prevalence of BVDV (Bovine Viral Diarrhea Virus) in yaks in Hongyuan, Sichuan province, a cold climate and high altitude area of China. Totally, 516 yak serum samples were randomly got during 2012 to 2014. BVDV was found highly prevalent among the adult yaks (51.1%; 95% CI: 46.5-55.6) and calves (60.5%; 95% CI: 43.4-76.0), respectively. The prevalence of BVDV infection in 2012 to 2014 was 45.3% (95% CI: 38.6%-52.1%); 56.0% (95% CI: 49.7-62.2) and 60.5% (95% CI: 43.4-76.0), respectively with a significant difference in the three years ($P<0.05$). The current result reveal a growing prevalence of BVDV infection in yaks in this area.

A pestivirus named Bovine Viral Diarrhea Virus (BVDV) infecting cattle and other farm animals world widely, with a significant economic losses in cattle production (Baker, 1995). This virus was reported of having adverse effects on cow and calf herds causing reproductive wastage, rising of morbidity and mortality, and reducing weaning weight, which makes BVD listed as a globally notifiable disease by the World Organization for Animal Health (OIE). BVDV leads to diarrhea, respiratory disease, reproductive disorders, mucosal disease and congenital malformations in all ages cattle (Oğuzoğlu *et al*., 2012). In spite of the low mortality (<1 %), the morbidity causing by this virus disease can arrive to 100% in animal herds. Persisted infected animals are the principal way that BVDV is spread and maintained within a herd. Also, the infecting animals may appear to be asymptomatic, but shedding this virus to other animals (Abutarbush and Alqawasmeh, 2010).

Yaks are mainly live in China and other Central Asia countries including Bhutan, Nepal, India, and uncommonly elsewhere in the world. China has approximately 140 million yaks accounting for 90 % of the whole yak population (Li *et al*., 2014). The ancient domestic animal yak is used as working animal and providing meat and milk products on the remote Qinghai-Tibetan Plateau (Li *et al*., 2014, 2015). High prevalence of BVDV infecting cattle herds have been reported in some countries, such as China, India (Mishra *et al*., 2008; Gong *et al*., 2014). However, limited information is available about the prevalence of BVDV on the Qinghai-Tibetan plateau yaks, especially yaks from Hongyuan area. Hongyuan of China, is a plateau area located in the east of China Tibetan plateau. The current research was to explore the infection rate of BVDV in yaks in Hongyuan, which may provide a foundation for the execution of control strategies against BVDV infection in this area and elsewhere.

Materials and methods

Totally, 516 bloods were achieved from the coccygeal or jugular vein of yaks during 2012 to 2014 in Hongyuan with the northern latitudes and eastern longitudes of this region is 31°51′-33°19′ and 101°51′-103°23′, respectively with an average altitude of 3600 m and an average annual temperature of 1.1°C. Serums were separated by

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employing centrifugation at 3,000×g for 20 min, and then stored at -20°C until further analysis (Li *et al.*, 2017).

Serum samples were tested for antibodies (Ab) against BVDV with highly conserved p80 protein of pestiviruses of a commercial indirect ELISA kit (IDEXX BVDV Total Ab, USA), under the guidance of the manufacturer's instructions. When S/P value ≤ 0.20 was classified as negative for BVDV Ab and ≥ 0.20 but ≤ 0.30 was considered suspected and the assay should be retested. Additionally, the OD value of average control was considered negative if the value was ≤ 0.250. Samples with S/P values ≥ 0.30 were considered as positive for BVDV Ab.

Statistical analysis was calculated be employing chi-square test with Statistical Analysis System (SPSS; Version 18.0). Uni-variate logistic regression analysis was preformed to determine the significantly associated variable with BVDV antibodies and to identify potentail risk factors by calculating odds ratios (OR) and 95% CI. The difference was recognized to be statistically significant when P<0.05.

Results and discussion

In the current study, the prevalence of BVDV were detected to be 51.7% (257/516; 95% CI: 47.3-56.1) (Table I). 51.1% (95% CI: 46.5-55.6) in the adult yaks and 60.5% (95% CI: 43.4-76.0) in calves, respectively (Table I). Though, BVDV is initially isolated from cattle, it can infect other animal species including pig, sheep, goat and even wild animals through crossing the species barrier, which bring out obvious economic losses (Ames, 2005). Scott *et al*. (2013) found that the seroprevalence of BVDV was 71% and 40% in South African kudu and Namibian eland, respectively. Mishra *et al*. (2009) reported an overall prevalence of 23.4% and 16.9% of this disease in sheep and goats in India, respectively. Previously, Casaubon *et al*. (2012) and Albayrak *et al*. (2013) reported BVDV infected Swiss wild ruminants (1.7%) and in northern Turkey wild boar (5.4%). The possible reasons of the prevalence difference in different areas could be manifold, as different areas located in different geographical with a different climate and environment, which may influence the presence of BVDV (Li *et al*., 2015). Importantly, BVDV infection rate of 30.4% in Bactrian camels was reported in western china (Gao *et al*., 2013b). On Qinghai-Tibetan plateauIn, inhabit numerous of wild animals, such as chiru, white lipped deer, argali, Bactrian camels and free ranging yaks ensuring ample opportunity for BVDV cross-species transmission. Although, scarce knowledge about the infection of BVDV in wild animals (except Bactrian camels) on this plateau, the current presented high infection rates demonstrated that this common ecological niche was thought to be a possible avenue of BVDV infection.

The infection rate of BVDV in current study differs from that found in other epidemiologic surveys on the Qinghai-Tibetan Plateau. A report published by Gao *et al*. (2013a) elaborated 53.65% and 72.14% in Tibet and Qinghai, respectively. The possible reasons of BVDV prevalence varies among same plateau could be that the herd size and breeding managements were changing with time. The BVDV infection rate in 2012 to 2014 was 45.3% (95% CI: 38.6%-52.1%); 56.0% (95% CI: 49.7-62.2) and 60.5% (95% CI: 43.4-76.0), respectively with a significant difference in the three years (P<0.05) (Table I). Actor of year was demonstrated to be risk factor influencing the prevalence significantly. In different years, yaks in 2013 (56.0%) presented over 1.5 times (OR=1.542; 95% CI=1.074-2.214, *P*<0.05) higher risk of infection by comparison with yaks in 2012 (45.3%%); while yaks in 2014 (60.5%) no significant difference was found compared yaks in 2012 (*P*>0.05) (Table I). In other studies, Gao *et al*. (1999) and Xue *et al*. (2010) reported that BVDV infection rate in yak herds by the neutralization test was 38.46% and 42.3% in Sichuan, respectively. These observations indicate that number of yaks infecting BVDV were rapid increasing and widespread in Sichuan

Table I.- Prevalence of anti-BVDV in Hongyuan and risk factors associated with BDVD infection in yaks (n=516).

Variables	No. tested	No. positive	Prevalence(%) (95% CI)	OR (95% CI)	P- value
Year[a]					
2012	221	100	45.3% (38.6%-52.1%)	Reference	
2013	257	144	56.0% (49.7-62.2)	1.542 (1.074-2.214)	0.019
2014	38	23	60.5% (43.4-76.0)	1.855 (0.919-3.745)	0.081
Growing stage					
Adults	478	244	51.1% (46.5-55.6)	Reference	
Calves	38	23	60.5% (43.4-76.0)	1.470 (0.749-2.887)	0.260
Total	516	267	51.7% (47.3-56.1)		

[a], there was a significant difference of the prevalence of BVDV in yaks among different years (P<0.05, χ^2=6.791).

and should be aroused the concern of the local government and the appropriate measures should be taken to control the disease. There was no difference in the prevalence in yaks of different ages, as the prevalence of BVDV infection in the younger yaks was not significantly different with that in adult ones (P>0.05), though, Thomson (1991) published that BVDV was commonly isolated from diarrheic calves aging less than 2 months in Colorado.

Conclusion

In conclusion, a high prevalent (51.7%) of BVDV infection in yaks and a growing trend of BVDV infection in yaks was discovered in this area. Infections with BVDV in yak populations may have a negative impact on health and welfare, also may transmit this varus to other wild animals on the high plateau. Therefore, BVDV control programs should also be considered planning.

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Statement of conflict of interest

Authors have declared no conflict of interest.

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