



Meta-analysis of prevalence of bovine herpes virus 1 in cattle in Mainland China

Xuelong Chen^{a,1}, Xin Wang^{b,1}, Yanping Qi^{a,1}, Xiaobo Wen^a, Chengxu Li^a, Xingbo Liu^a, Hongbo Ni^{a,*}

^a College of Animal Science and Veterinary Medicine, Heilongjiang Bayi Agricultural University, Daqing, Heilongjiang Province 163319, PR China

^b College of Food Science, Heilongjiang Bayi Agricultural University, Daqing, Heilongjiang Province 163319, PR China

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ABSTRACT

Bovine herpesvirus 1 (BHV-1), an important pathogen of cattle, can cause severe clinical syndromes including respiratory disease, genital disease, and late-term abortions, as well as neurological and systemic disease in cattle. For assessing the prevalence of BHV-1 infection in mainland China, a systematic review and meta-analysis was conducted. In this systematic review and meta-analysis, we searched English and Chinese literature databases for published paper regarding the prevalence of BHV-1 in cattle in China from inception to May 20, 2018. Search strings included if they reported the cattle samples of more than 30 cattle and provided information that allowed us to establish the prevalence of BHV-1. Moreover, we excluded repeated studies, reviews, other hosts studies, as well as studies with inconsistent data, incomplete information or only provided prevalence data, and out of mainland China data. We extracted how many cattle have BHV-1 infection from the obtained studies, moreover, and calculated pooled prevalence of BHV-1 infection in cattle. The data of 41 articles (including data on 43,441 cattle) are compliant with the standards. The pooled prevalence of BHV-1 in cattle in China was 40%, the pooled prevalence of BHV-1 in cattle from Northeast China (24%) was significant lower than those from other regions. In addition, the prevalence of BHV-1 was associated with publication time of paper, detection methods, age of cattle, and clinical symptoms (pneumonia, abortion etc.). Our findings suggest that BHV-1 is common in cattle in mainland China. It is necessary to monitor the prevalence of BHV-1 in cattle and the powerful and effective regulatory measures should be taken out to prevent the spread of BHV-1.

1. Introduction

BHV-1, the causative agent of infectious bovine rhinotracheitis (IBR), infectious pustular vulvovaginitis (IPV) and infectious balanoposthitis (IBP), has attracted global attention since it was first reported as a cause of infectious bovine rhinotracheitis in cattle in California, USA, in 1953 (Durham, 1974; Raaperi et al., 2014; Tikoo et al., 1995). The disease associated with infection by BHV-1, an OIE-listed B disease, may show several clinical syndromes including respiratory disease, genital disease, and late-term abortions, neurological and systemic disease in cattle. The diseases due to BHV-1 infection are not often life-threatening, but BHV-1 bears a rather wide host range, which it may take a major impact on animal trade and costs more than 3 billion dollars annually in the cattle industry worldwide (Bowland and Shewen, 2000; Nelson et al., 1972; Newcomer et al., 2017). BHV-1 infection is proven to be highly variable in incidence and prevalence

under differential geographical regional and breeding managements (Ackermann and Engels, 2006; Muylkens et al., 2007; Nandi et al., 2009).

In China, BHV-1 was first time reported in 1981 from an imported cow (Zhou et al., 1981). Animal import is considered to be an important source for BHV-1 infection and spread, but direct evidence is scant (Wang et al., 1991, 2010). With the increase of the number of imported cows (286,486 cows in 2015–2016) and China's cowherd size (14.69 million in 2016), the infection and spread of BHV-1 was common (Mo and Liu, 2017), therefore the investigation of BHV-1 infection has significant socio-economic and public health importance. Several previous reports have revealed some levels of prevalence of BHV-1 in Chinese cattle ranged from 5.4% to 68.7%, these data is restricted because of the limited sampling area and size (Pi et al., 2014; Su et al., 2016; Yan et al., 2008; Zhong et al., 2012). Furthermore, in the last decade, increasing demand for beef and dairy products have promoted

* Corresponding author.

E-mail address: nihongbo72@163.com (H. Ni).

¹ These authors have contributed equally to this work.

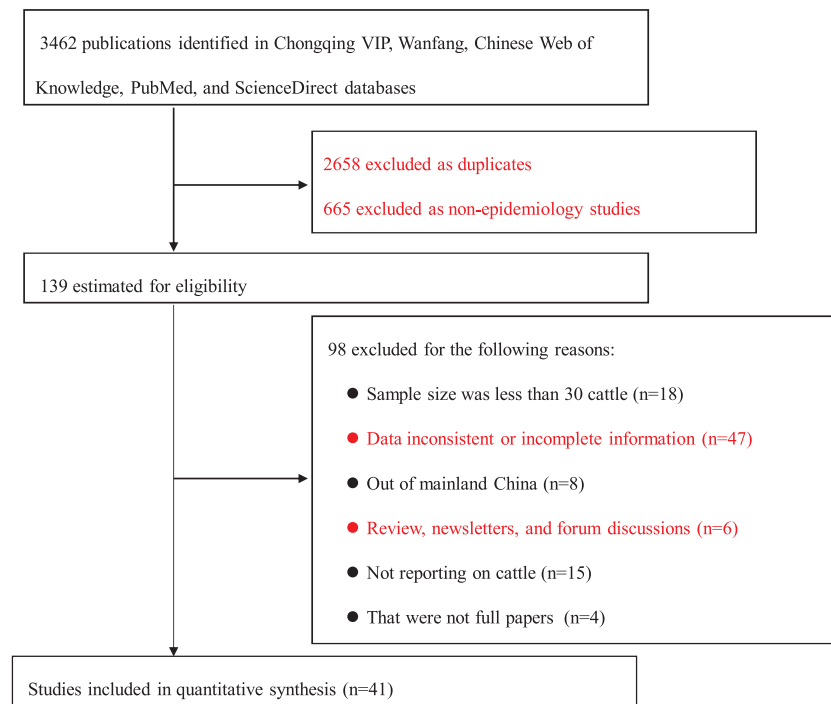


Fig. 1. Flow diagram of the selection of eligible studies.

investments in cattle ranching in mainland China and increased the frequency of cattle transport. Understanding changes in epidemiology of BHV-1 infection and prevalence can facilitate prevention and control of diseases due to BHV-1 infection, and evaluation for benefit of vaccination, so it is necessary to analyze and summarize the overall situation of BHV-1 in China. To date, the prevalence of BHV-1 infection has not been systematically assessed in mainland China. Therefore, we conducted this systematic review and meta-analysis and investigated the potential related factors to evaluate the incidence of infection associated with BHV-1 infection in mainland China.

2. Methods

2.1. Search strategy

Based on the MOOSE guideline (Stroup et al., 2000), we identified epidemiological studies on BHV-1 in China published in English or Chinese between January 1, 1979 and May 20, 2018. The search strategy comprised of a search of English databases (including PubMed and Science Direct) and a search of Chinese databases (including VIP, CNKI, and WANFANG Data). We used the MeSH terms “BHV or BHV-1 or BoHV-1 or IBRV”, “epidemiology or incidence or prevalence”, “Cow or Cattle or Calves or Bovine or Heifer”, “China or Chinese”, and these terms’ variants and combinations.

2.2. Data management

All identified studies from the searches were independently assessed for eligibility and inclusion by 2 different authors, the manual revision was conducted on all displayed publications and first selections were based on information in the titles and/or abstracts. Selected publications had to be available for downloading and had to contain extractable data in English or Chinese about the presence of BHV-1 in cattle in mainland China. The study was a controlled, primary study, so we did not contact authors of original studies for additional information. No attempt was made to identify unpublished reports. All discrepancies were reviewed by the third author PS.

2.3. Selection criteria

Eligible studies had to have reported any of the epidemiological data related to BHV-1 in cattle populations of Chinese subjects, and the following exclusion criteria in filtering the identified publications was applied:

- Non-cattle studies, sampling site is out of mainland China, and sample size < 30 cattle
- Non-research based publications such as press releases, newsletters, forum discussions, etc.
- Non-epidemiological studies such as basic science research for BHV-1.
- Studies that did not disclose when the data was collected, sample size, or denominator for each reported prevalence or rate.

2.4. Data extraction

Standardized data-collection form was used to extracted data. Information was recorded as follows: first author, publication year, geographical region of study, diagnostic tests (i.e. ELISA, PCR, etc.), total number of tested cattle and number of BHV-1 cattle.

The quality of the eligible publications was estimated based on the criteria derived from the Grading of Recommendations Assessment, Development and Evaluation method. The quality of the publications was graded by using a scoring approach. Studies were awarded one point each if the research objective was clearly described, the test method clearly pointed out, the subjects categorized into different subgroups, and sampling method described in detail. Up to four points could be assigned to each study. The papers with total score of three or four points were considered as high quality, two points were deemed as moderate quality and scores of one or zero were marked as low quality.

2.5. Statistical analysis

The pooled prevalence of BHV-1 infection in cattle of the obtained studies were calculated by meta-analysis. Because there was clear heterogeneity in the obtained studies, random-effects model was used to

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