FAILURE OF VACCINATION IN THE CONTROL OF BVDV

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Introduction

Bovine viral diarrhea (BVD) is one of the most important infectious viral diseases of cattle, caused by bovine viral diarrhea virus (BVDV), with an enormous economic and animal welfare impact on beef and dairy industries. This pathogen has a worldwide distribution and infects livestock and wildlife ruminants. Poland introduced a voluntary BVDV eradication program in early 2018.

Goal

The aim of this study was to assess the host response of vaccinated calves in herds where PI individuals were born despite the vaccination and to determine whether the presence of PI calves could mount higher antibody titers than the vaccine alone when discrepancies in the subtypes of the vaccine strain and the persistent strain of BVDV are encountered.

Methods

Five herds were included in the study. All samples came from 12 months old heifers except herd K where additionally 4 months old calves (K1) were included. In three herds vaccinations were introduced after PI animals identification and removal. In two other herds (OS1, OS2) vaccination was done without PI removal. A killed vaccine based on BVDV-1a was used in all herds. Serial dilutions of serum samples were tested for neutralizing antibodies against reference strains BVDV-1a, BVDV-2a and two field strains BVDV-1b, BVDV-1d. The products of the standard RT-PCR were purified and sequenced. Phylogenetic analysis was done by the neighbor-joining statistical method with the Kimura two-parameter model using MEGA software.

Results

High titers (80-90% of all titers) for vaccine strain were predominant in herds K, L and OS1 while in herd A it was only 17%. In case of field strains high titers for homologous subtypes were between 63% and 90%. Surprisingly in two herds with BVDV-1d, high titers against BVDV-2a were identified in 23% and 35% of all samples with positive titers. Level of high titers in 4 months old calves from herd K1 was the lowest reaching only 30% for both vaccine and field strain of BVDV (colostral immunity). Within the positive samples, 41.4% did not have a predominant titer against one specific subtype of BVDV. Only in 16.5% of positive samples, BVDV-1a (vaccine strain) predominated and for 31.6%, the titer against the BVDV subtype detected in PI animals was the dominant one. Two viral subtypes different from vaccine strain, namely BVDV-1b (A, OS1, OS2) and BVDV-1d (K, L), were identified in vaccinated herds.

Conclusions

Despite vaccination with BVDV-1a vaccine in all herds tested, different subtypes were identified in newly born PI animals. The choice of vaccine should be based on dominant viral subtypes present in the vaccinated herd. Cross neutralization studies did not provide clear distinction between antibodies for vaccine and field strains of BVDV.

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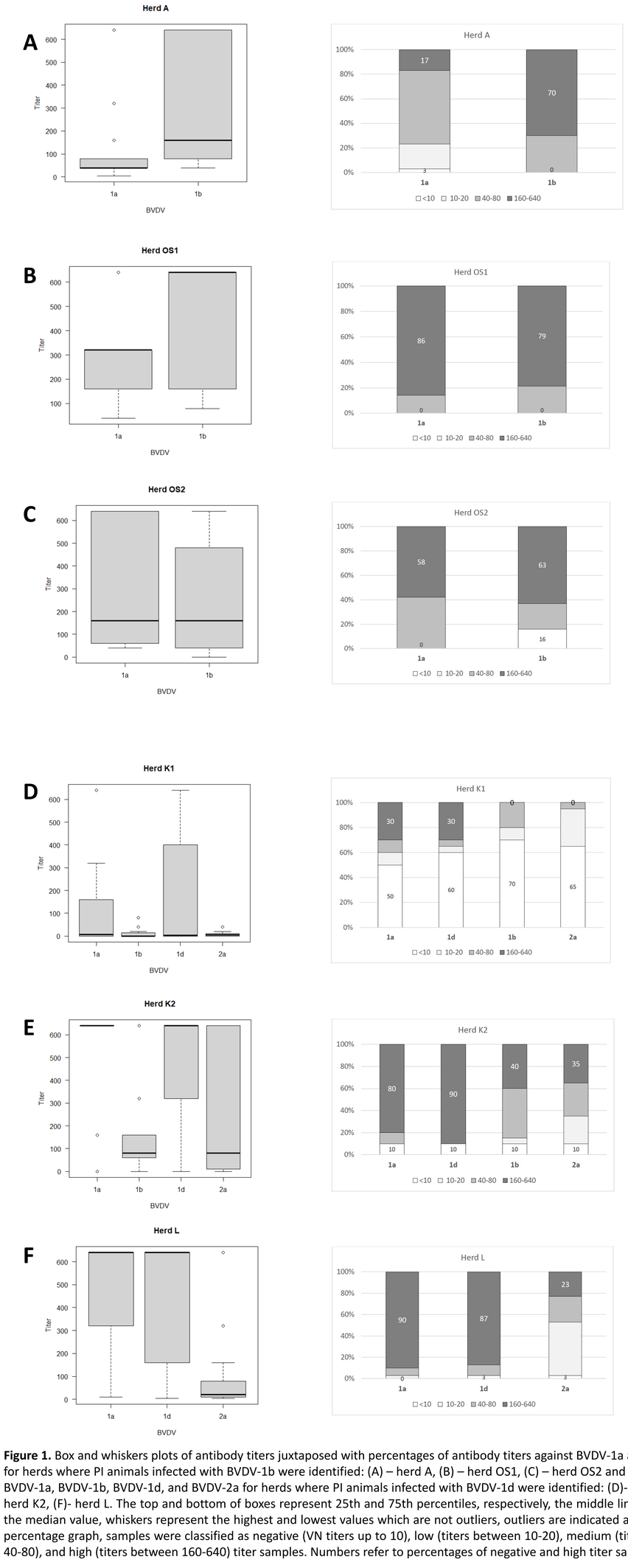

Figure 1. Box and whiskers plots of antibody titers juxtaposed with percentages of antibody titers against BVDV-1a and BVDV-1b for herds where PI animals infected with BVDV-1b were identified: (A) – herd A, (B) – herd OS1, (C) – herd OS2 and titers against BVDV-1a, BVDV-1b, BVDV-1d, and BVDV-2a for herds where PI animals infected with BVDV-1d were identified: (D)- herd K1, (E)- herd K2, (F)- herd L. The top and bottom of boxes represent 25th and 75th percentiles, respectively, the middle line represents the median value, whiskers represent the highest and lowest values which are not outliers, outliers are indicated as circles. In a percentage graph, samples were classified as negative (VN titers up to 10), low (titers between 10-20), medium (titers between 40-80), and high (titers between 160-640) titer samples. Numbers refer to percentages of negative and high titer samples.