Evaluation of Calf Performance when Cows Grazing Native Rangeland are Vaccinated for Bovine Viral Diarrhea Virus and Infectious Bovine Rhinotracheitis Using Either a Modified Live or Killed Vaccine

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Introduction

Bovine viral diarrhea virus (BVDV) is a pathogen associated with gastrointestinal, respiratory, and reproductive diseases of cattle worldwide. Vaccination programs to reduced instances of BVDV are proven to be effective. Additionally, vaccination of cows and heifers prior to breeding may create immunological memory cells in the offspring that are beneficial in preventing BVDV. The immunity is believed to be mediated through Th17 cells. Th17 cells are proinflammatory cells that secrete IL-17A, IL-17F, IL-21, and IL-22 and provide immunity by drafting neutrophils and macrophages to infected tissues (Ouyang et al., 2008). Mandal et al. (2011) reported that these cells differentiate in progeny of only pregnant dams with an immunological “memory” phenotype. In addition to antiviral vaccination protocols, there growing evidence gastrointestinal microbiota play a key role in the development and maintenance of the immune system. Furthermore, the development of intestinal Th17 cells requires the presence of the intestinal microbiota (Burkett et al., 2019).

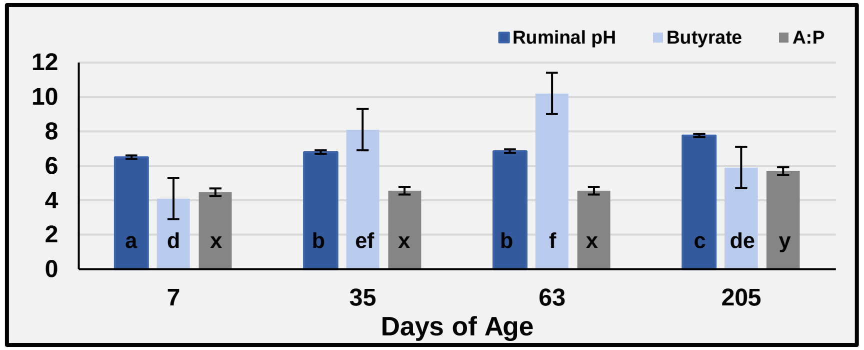
Hypothesis and Objective

The objective of this study was to determine if administration of a modified-live viral vaccine (MLV) or killed viral vaccine (KV) to the dam would impact the growth and rumen fermentation end products of the calf. We hypothesized calves from dams vaccinated with MLV would have improved calf performance and ruminal characteristics.

Materials and Methods

- Fifty-eight crossbred Angus x Hereford 2015-heifers were randomly assigned to receive either a modified live viral vaccine (Bovishield 5 Gold FP/ VL5, Zoetis Inc., Parsippany-Troy Hills, NJ) or killed viral vaccine (Cattlemaster 4 FP/ VL5, Zoetis Inc.) at 60 days of age, and annually at pregnancy diagnosis.
- Twenty cows were randomly selected from 2015-born animals and their progeny were selected to examine dam vaccination treatment on calf performance.
- Rumen samples were collected from calves via orogastric tubing (Lodge-Ivey et al., 2009) at day 7, 35, 63, and 205 d days of age
- Volatile fatty acids were analyzed using procedure described by May and Galyean (1996).
- Data were analyzed utilizing the MIXED procedures of SAS 9.4 (SAS Inst. Inc., Cary, NC), with repeated measures for volatile fatty acids, and ruminal pH.
- A P-value ≤ 0.05 was considered significant.

Figure 1. Ruminal pH, butyrate, and Acetate:Propionate ratios from 7-d of age through weaning at 205-d of progeny from cows receiving a lifetime regimen of KV or MLV vaccine. A day effect was observed for all analyses (*P* < 0.01).



abc Ruminal pH values with differing letters differ by calf day of age.
def Ruminal butyrate values (mmol/100mol) with differing letters differ by calf day of age.
xy Ruminal A:P ratio with differing letters differ by calf day of age.

Table 1. Major volatile fatty acid proportions and total VFA from 7-d of age through weaning at 205-d of progeny from cows receiving a lifetime regimen of KV or MLV vaccine.

Day	7		35		63		205			P-value[2]		
Treatment[1]	KV	MLV	KV	MLV	KV	MLV	KV	MLV	SEM	Day	Trt	Day × Trt
Acetate, mol/100mol	75.6	75.3	73.7	72.1	68.7	68.8	74.2	75.2	3.6	0.18	0.92	0.98
Propionate, mol/100mol	18.9	19.1	15.7	16.5	14.8	16.1	18.7	12.4	2.5	0.35	0.61	0.28
Total VFA, mM	31.9^{c}		55.1^{b}		77.5^{a}		47.3^{b}		4.9	0.01	0.33	0.34

[1] Treatment of dam, either killed viral (KV) or modified-live viral (MLV).
[2] Data considered significant at *P* < 0.05
abc Total VFA with differing letters differ by calf day of age

Figure 2: Cow body condition at calving. No differences observed between vaccine treatments.

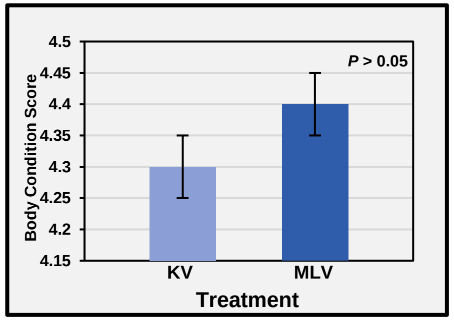


Figure 3: Calf birth weight of third calf. No significant differences in calf birth weight by dam treatment.

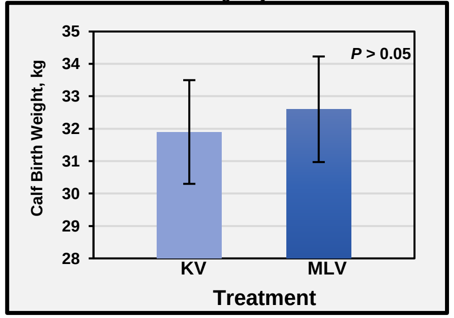
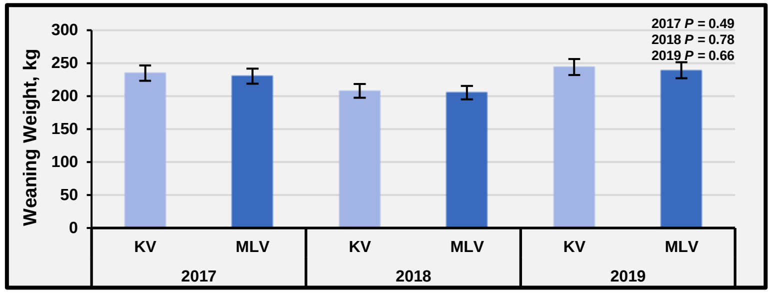


Figure 4. Weaning weights of calves born to cows having received only a MLV vaccine or KV vaccine since branding (2015-born). No significant difference was observed between vaccine treatments or by year (*P* > 0.05).



Conclusions

- A treatment nor day of age by treatment interaction was observed for calf ruminal pH (*P* = 0.20) or volatile fatty acid concentrations (*P* ≥ 0.28).
- Calf ruminal pH increased with age (*P* < 0.0001;, Figure 1)
- Butyrate concentrations were significantly lower at 7 days of age (*P* = 0.01; Figure 1)
- Acetate:Propionate ratio was highest at 205-d of age (*P* < 0.0001; Figure 1)
- Cow body condition score did not differ between treatments (*P* > 0.05; Figure 2)
- Calf birth weight (*P* = 0.47; Figure 3) and weaning weight (*P* ≥ 0.49; Figure 4) were not impacted by vaccination type.
- Results indicate growth and ruminal characteristics of progeny are not impacted by dam’s vaccination type but are influenced by calf age. Therefore, we reject our hypothesis.

Implications

- Research results indicate that vaccination type of the dam is not related to calf performance.
- With respect to progeny growth, producers can utilize either vaccination type on the dam with appropriate fetal protection.
- Impacts of dam vaccination on calf immunity have not been evaluated and require further research.

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