The Association Between Bovine Corona Virus Seroconversion, Treatment Rates and Weight Gain in Feedlot Calves

Annette O'Connor,[1] Wayne Martin,[1] Eva Nagy[2]
[1] *Department of Population Medicine, University of Guelph, Guelph, Ontario Canada*
[2] *Department of Pathobiology, University of Guelph, Guelph, Ontario Canada*

Introduction

The relationship between bovine corona virus (BCV) titres and disease occurrence, and weight gain, in feedlot calves was investigated. 202 calves were enrolled in the study and followed for the first 28 days on feed. Outcome variables examined were risk of treatment for bovine respiratory disease (BRD) and total weight gain. Titres at day zero and change in titre to BCV and bovine viral diarrhoea virus (BVDV) were measured to examine this effect.

Methods and Materials

The calves were purchased at Western Canada sales and transported to one location in Ontario, Canada. Processing took place within 24-48 hours after arrival in Ontario, Canada. At processing, calves with temperatures > 104.5° F received tilmicosin (10 mg/kg) and those < 104.5° F received oxytetracycline (20 mg/kg). The calves were allocated, using systematic random allocation, to four treat vaccine groups, Group 1 : Pneumo-Star®[a], Group 2 : Somnu star®[a] Group 3 : Somnu Star Ph®[a] and Group 4 : control, no vaccine. In addition, all calves received a modified-live 4 way viral vaccine (IBR, BVDV, PI-3, BRSV), an 8-way clostridial vaccine, anthelmentics and growth implants on arrival.

From day 1 to day 7, calves were selected for treatment based on appearance (dull, rapid respiration, off feed), however, only animals with rectal temperature > 104.5° F and no signs referable to systems other than the respiratory tract received antibiotic therapy. From days 8-28, depressed animals were treated regardless of rectal temperature. 28 days after arrival, the calves were weighted, castrated, and dehorned. Blood samples were collected on day zero and day 28.

Serological and Statistical Analysis

Paired samples were analyzed for BCV antibody titres using a BCV virus neutralization test[2] and for BVDV antibody titres[1]. In the statistical analysis, titres were expressed as the $\log_2$ of the reciprocal of the highest antibody dilution that caused a 50% reduction of plaques relative to the control (BVDV) and the highest dilution that caused a complete inhibition of virus replication in 50% of wells (BCV). Because Log_2 0 is undefined, 0.5 was added to all titres. Change in titre was calculated as $\log_2$ (day 28 titre/day 0 titre). Negative changes in titre were set equal to 0.5.

Multivariable logistic regression was used to predict the odds of calves being treated, at least once, for respiratory disease. Multivariable least squares linear regression was used to determine factors affecting weight change during the study period. Independent variables evaluated included vaccine group, antibiotic used at processing (oxytetracycline = referrent), initial titre to BCV and BVDV, change in titre to BCV and BVDV and initial weight. Treatment for respiratory disease during the study period was included as a variable in the weight gain model.

Results and Discussion

Twenty-six animals were treated once, and 3 treated twice, for BRD during the study period. 50 animals received tilmicosin at arrival and 152 received oxytetracycline.

At processing, 69% and 94% of calves had detectable titres to BVDV and BCV respectively. Thirty five percent of calves seroconverted (4 fold increase in titre) to BVDV, and 87% of calves seroconverted to BCV during the study period. The high level of seroconversion to BCV is consistent with other studies.[3,4] Average titres and titre changes are given in Table 1.

Table 1. Arrival titre and change in titre for Bovine Corona Virus and Bovine Viral Diarrhea Virus (GMT ± sem)

	N	BVDV titre : day 0	Change in BVDV titre	BCV titre : day 0	Change in BCV titre
No BRD	171	3.7 ± 1.15	11.4 ± 1.18	57.3 ± 1.16	990.6 ± 1.21
BRD	29	4.3 ± 1.44	6.4 ± 1.48	65.8 ± 1.44	440.1 ± 1.9

The lowest dilution tested for BCV was 1:4 and 1:2 for BVDV.

The results of the logistic modelling indicated no association of BVDV titres with risk of BRD. There was an interaction between the effects of BCV titres on arrival and titre change with BRD risk. However, both increased BCV titres on arrival and BCV titre change were sparing for BRD; that BCV titre on arrival is sparing has been reported[3]. Calves receiving tilmicosin were at decreased risk of being treated for disease during the study period (Table 2). Lighter animals at arrival were at increased risk of being treated for disease (Table 2).

Table 2. Odds ratio and confidence intervals for variables predicting the risk of being treated for BRD during the study period

	Odds Ratio (e^{β})	95% confidence interval ($e^{(\beta \pm 1.96 * se\beta)}$)
Antibiotic at processing	0.29	1.013 - .083
Weight at arrival	0.99	1.00 – 0.98

Initial body weight and total gain are shown in Table 3. Calves with lower initial weights and those treated for disease were likely to have lower gains during the study period. The overall combined effect of BCV titre at day 0 and weight on arrival (necessary to consider these together because of significant interaction) was such that, calves with lower than average weight on arrival had increased weight gains of 2-4 lbs with increasing BCV titres on arrival; whereas calves with above average weight on arrival had lower weight gains with increasing BCV titres at day 0. Increased weight gains with higher titres on arrival has been previously reported[3] (Table 4).

Table 3. Initial body weight and total gain during the study period (lbs)

	n	Initial body weight	Total Gain
Untreated	171	538.7 ± 3.8	61.9 ± 6.05
Treated	29	520.0 ± 10.15	75.8 ± 2.53

Table 4. Parameter estimates, standard error and P values for least squares model of weight gain

	Parameter estimate	Std error of estimate	P > |T|, T for Ho parameter = 0
Intercept	14.21		
Weight at day 0	1.13	0.108	0.0001
Log_2 BCV titre at day 0	21.32	8.87	0.0172
Treated for BRD (yes/no)	-17.22	6.63	0.0109
Interaction between weight and titre to BCV at day 0	-0.0426	.016	.0109

Conclusion

Weight and the antibiotic used at processing, significantly influenced the likelihood of treatment for disease. Higher levels of antibody to BCV at arrival result in higher weight gains in light calves, when the disease occurrence is controlled. A large titre increase to BCV, associated with low initial titres may have an energy cost, which affects gain, but does not manifest itself as disease.

References

1. J.W. Allen, L. Viel, K.G. Bateman, S. Rosendal, and P.E. Shewen. Can J Vet Res **56**, 281 (1992).
2. P.S. Carman and M.J. Hazlett. Can Vet J **33**, 812 (1992).
3. S.W. Martin, E. Nagy, P.E. Shewen, and R.J. Harland. Can J Vet Res **62**, 257 (1998).
4. J.S.L.L.A.A.G. Storz. J Am Vet Med Assoc. **208**, 1452 (1996).

[a] Biowest , Research Drive, Saskatoon, Saschawan