# Length of Weaning Period But Not Timing of Vaccination Affects Feedlot Finishing Performance and Carcass Characteristics of Fall-Weaned, Ranch-Direct Beef Calves

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## Introduction

Bovine respiratory disease decreases profitability associated with cattle feeding. The cost of respiratory disease includes death loss, expenses associated with treatment, and reduced growth performance. Respiratory disease also decreases carcass weights, USDA quality grade, and ribeye area of feedlot cattle. Decreased carcass weights, fat thickness, and ribeye area have been associated with treatment of apparent respiratory disease when compared to animals not treated, whereas reduced incidence of the disease resulted in improved carcass merit. Preshipment weaning and vaccination has been found not only to prepare calves for improved performance in feedlots, but also to reduce incidence and severity of respiratory disease.

Previous KSU research reported that length of the preshipment weaning period influenced carcass characteristics and time on feed during finishing. Therefore, we hypothesized that vaccination strategy and the length of the preshipment weaning period would interact to influence calf performance during finishing as well as subsequent carcass characteristics. The objective of our experiment was to compare the effects of respiratory disease vaccination administered prior to weaning on the ranch of origin or after feedlot arrival for calves weaned 45, 15, or 0 days before feedlot arrival.

## Experimental Procedures

Angus x Hereford calves (n = 437; average initial weight 458 $\pm$ 54 lb) were used for this experiment. Calves originated from the Kansas State University Commercial Cow-Calf Unit herds in Manhattan (n = 263) and Hays (n = 174). At the time of maternal separation, calves were 175 to 220 days of age. All calves were dehorned and castrated (if needed) prior to 60 days of age.

Approximately 60 days prior to maternal separation, calves were weighed, stratified by birth date, and randomly assigned to a preshipment weaning period treatment (i.e., 45, 15, or 0 days). Within each weaning period treatment, calves were randomly assigned to 1 of 2 vaccination treatments. One group was vaccinated 14 days prior to maternal separation and again at weaning. The second group was vaccinated on the day of arrival at the feedlot and again 14 days later. Initial and booster vaccinations against IBR, BVD, PI3, and BRSV were administered using a modified-live product (Bovi-Shield Gold FP, Pfizer Animal Health, Exton, PA).

Calves were treated for internal and external parasites using Dectomax (Pfizer Animal Health, Exton, PA) and vaccinated against clostridial diseases (Vision 7 with SPUR,

Intervet Inc., Millsboro, DE) at the time of maternal separation. Calves at both locations were immediately transported a short distance (<15 miles) to a central home-ranch weaning facility.

Calves were maintained in dirt pens (4 pens per treatment) and fed a common weaning diet during the preconditioning period. The byproduct-based diet was formulated to allow for weight gain of 2 lb/day at a dry matter intake of 2.5% of body weight.

All calves were individually weighed and transported 4 hours from their respective weaning facilities to an auction market in Hays, KS, on November 5, 2008. Calves from both origins were commingled and maintained on the premises for 12 hours to simulate pathogen exposure typically encountered by market-ready calves. On November 6, calves were shipped 5 miles to the feedlot at the Agricultural Research Center–Hays. Upon arrival at the feedlot, calves were weighed individually and assigned to a receiving pen based on weaning and vaccination treatments. The cattle were adapted to a sorghum grain/silage-based receiving diet and fed for a 60-day receiving period.

Calves were monitored for symptoms of respiratory disease at 7:00 a.m. and 2:00 p.m. daily during the experiment. Calves with clinical symptoms of disease (Table 1) were removed from home pens and evaluated. Animal caretakers weighed, measured rectal temperatures, and assigned clinical illness scores (Table 1) to these calves. Calves that presented a clinical illness score greater than 1 and a rectal temperature greater than 104° F were treated according to the schedule described in Table 2. Cattle were evaluated 72 hours post-treatment and re-treated based on observed clinical signs.

Following the receiving phase, calves were adapted to a common finishing diet over a 21-day period (Table 3). Steers remained in their respective receiving pens during finishing. After 165 days on feed, steers were scanned ultrasonically to determine subcutaneous fat thickness over the 12th rib. Steers were assigned to 1 of 3 harvest dates based on this scan to meet an average carcass endpoint of 0.45 inches of fat depth over the 12th rib. Calves were transported approximately 3 hours to a commercial abattoir on their respective harvest date. At the abattoir, lungs were examined for lesions and livers were examined for abscesses. After carcasses were chilled for 48 hours, carcass characteristics were measured by a trained evaluator unaware of treatments. Carcass measurements included 12th rib fat thickness; ribeye area at the 12th rib; kidney, pelvic, and heart fat; USDA maturity grade; USDA yield grade; USDA quality grade; and marbling score.

## Results and Discussion

Average daily gain during finishing was greater ($P<0.01$) for calves weaned for 45 or 15 days before shipping compared to calves weaned for 0 days before shipping (Figure 1), whereas average daily gain was similar ($P=0.26$) between calves vaccinated for respiratory disease-causing organisms before shipping and those vaccinated for disease-causing organisms at feedlot arrival (Figure 2). Calves weaned 45 days before shipping required fewer ($P=0.02$) days on feed than calves weaned 15 or 0 days before shipping (Figure 3). Longer weaning periods were associated with improved average daily gain and translated into fewer days on feed. This finding is consistent with previous Kansas State University experiments. Consequently, calves weaned 45 days before shipping

had greater (P<0.01) harvest weights than calves weaned 15 or 0 days before shipping (Figure 4). Timing of respiratory disease vaccination did not affect feedlot growth performance in this experiment.

Hot carcass weight was greater (P<0.02) for calves weaned 45 and 15 days prior to shipping than for calves weaned 0 days before shipping (Table 4). This increase was attributed to greater feedlot performance. Marbling score, USDA yield grade, 12th rib fat thickness, ribeye area at the 12th rib, and kidney, pelvic, and heart fat were similar (P≥0.22) between weaning and vaccination treatments (Tables 4 and 5). Deposition of internal or external fat for our ranch-direct calves was not influenced by preshipment weaning length or timing of vaccination. Likewise, incidence of liver abscesses was similar (P<0.47) between weaning and vaccination treatments. Incidence of lung lesions was not affected (P>0.81) by weaning treatment; however, cattle vaccinated for respiratory disease after arrival in the feedlot tended (P<0.09) to have greater incidence of lung lesions than cattle vaccinated for respiratory disease before shipping. Deferring BRD vaccination until feedlot arrival may allow subclinical respiratory disease incidence to occur in such animals.

## Implications

A preconditioning period was found to increase steer average daily gain and harvest weight. Therefore, this increase in growth decreased days on feed but had minimal effect on carcass traits. Carcass weight, carcass merit, and growth performance during finishing were similar between calves weaned for 45 days or 15 days before shipping. Preshipment respiratory disease vaccination did not improve growth performance or carcass merit of ranch-direct cattle relative to vaccination deferred until feedlot arrival. Length of preshipment weaning period had greater effects on performance and carcass merit than vaccination timing. Deferred respiratory disease vaccination potentially caused an increase in observed lung lesions upon slaughter.

**Table 1. Scoring system used to classify the severity of clinical illness**

| Clinical illness score | Description | Clinical appearance |
|---|---|---|
| 1 | Normal | No abnormalities noted |
| 2 | Slightly ill | Mild depression, gaunt, +/- cough |
| 3 | Moderate illness | Severe depression, labored breathing, ocular/nasal discharge, +/- cough |
| 4 | Severe illness | Moribund, little response to human approach |

**Table 2. Treatment schedule used to treat calves diagnosed with bovine respiratory disease complex**

| Treatment | Drug | Dose | Route of injection |
|---|---|---|---|
| 1st Pull | Baytril[1] (enrofloxacin) | 5 mL/cwt | Subcutaneous |
| 2nd Pull | Nuflor[2] (florfenicol) | 6 mL/cwt | Subcutaneous |
| 3rd Pull | Biomycin 200[3] (oxytetracycline) | 5 mL/cwt | Subcutaneous |

[1] Bayer Animal Health, Shawnee Mission, KS
[2] Intervet/Schering-Plough Animal Health, Summit, NJ
[3] Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO

**Table 3. Average ingredient and nutritional composition of the finishing diet**

| Ingredient | %, dry matter basis |
|---|---|
| Ground sorghum grain | 80.86 |
| Sorghum silage | 14.81 |
| Soybean meal | 3.23 |
| Limestone | 0.50 |
| Rumensin 80[1] | 0.30 |
| Ammonium sulfate | 0.11 |
| Salt | 0.10 |
| Tylan[1] | 0.09 |
| | |
| Nutrient composition | |
| Crude protein, % | 13.43 |
| Calcium, % | 0.32 |
| Phosophorus, % | 0.33 |
| NEm, Mcal/lb | 0.86 |
| NEg, Mcal/lb | 0.57 |

[1] Elanco Animal Health, Greenfield, IN

**Table 4. Carcass characteristics of beef calves following ranch-of-origin weaning periods lasting 0, 15, or 45 days**

| | Length of weaning period, days | | | | |
|---|---|---|---|---|---|
| Item | 0 | 15 | 45 | SEM | P-value |
| Hot carcass weight, lb | 741[b] | 763[c] | 781[d] | 9.884 | 0.02 |
| Marbling score[a] | 47.9 | 46.6 | 49.1 | 1.033 | 0.22 |
| USDA yield grade | 3.3 | 3.2 | 3.4 | 0.081 | 0.33 |
| 12th rib fat thickness, in. | 0.54 | 0.54 | 0.54 | 0.018 | 0.20 |
| Ribeye area, in.$^2$ | 12.3 | 12.4 | 12.5 | 0.177 | 0.74 |
| Kidney, pelvic, and heart fat, % | 2.66 | 2.56 | 2.64 | 0.081 | 0.56 |
| Calves with ≥1 liver abscess, % | 18.68 | 23.38 | 25.35 | - | 0.47 |
| Calves with ≥1 lung lesion, % | 34.38 | 32.14 | 29.73 | - | 0.81 |

[a] Marbling score: 30 = Slight$^{00}$, 40 = Small$^{00}$, 50 = Modest$^{00}$; ex. 55 = Modest$^{50}$.
[bcd] Treatment means within row that share common superscript are similar.

**Table 5. Carcass characteristics of beef calves vaccinated against respiratory disease pathogens prior to shipping or at feedlot arrival**

| | Vaccination timing | | | |
|---|---|---|---|---|
| Item | Preshipment | Feedlot arrival | SEM | P-value |
| Hot carcass weight, lb | 763 | 759 | 7.304 | 0.73 |
| Marbling score[a] | 47.4 | 48.4 | 0.763 | 0.36 |
| USDA yield grade | 3.3 | 3.3 | 0.060 | 0.59 |
| 12th rib fat thickness, in. | 0.52 | 0.54 | 0.014 | 0.23 |
| Longissimus area, in.$^2$ | 12.4 | 12.4 | 0.132 | 0.90 |
| Kidney, pelvic, and heart fat, % | 2.59 | 2.65 | 0.060 | 0.50 |
| Calves with ≥1 liver abscess, % | 24.79 | 19.67 | - | 0.63 |
| Calves with ≥1 lung lesion, % | 27.20 | 37.21 | - | 0.09 |

[a] Marbling score: 30 = Slight$^{00}$, 40 = Small$^{00}$, 50 = Modest$^{00}$; ex. 55 = Modest$^{50}$.

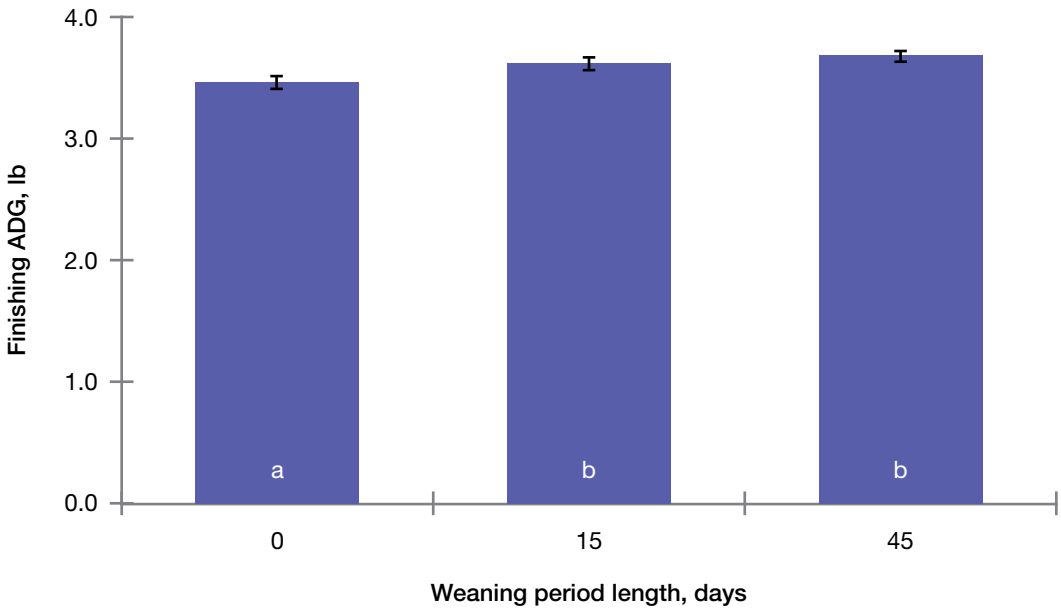


**Figure 1. Effect of the length of ranch-of-origin weaning period on finishing average daily gain (ADG) of beef steers.**

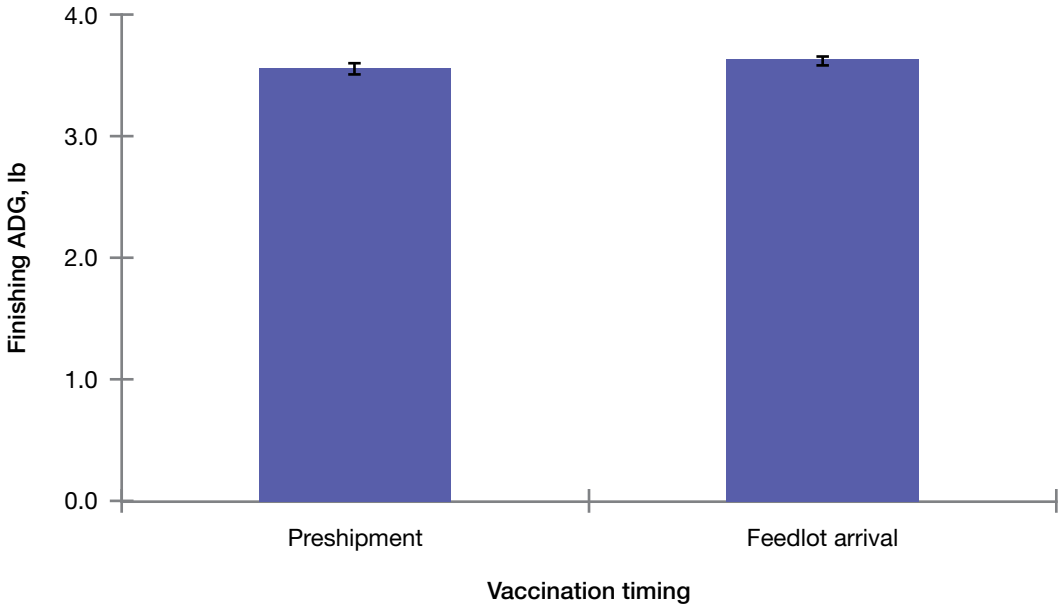


**Figure 2. Effect of respiratory disease vaccination timing on finishing average daily gain (ADG) of beef steers.**

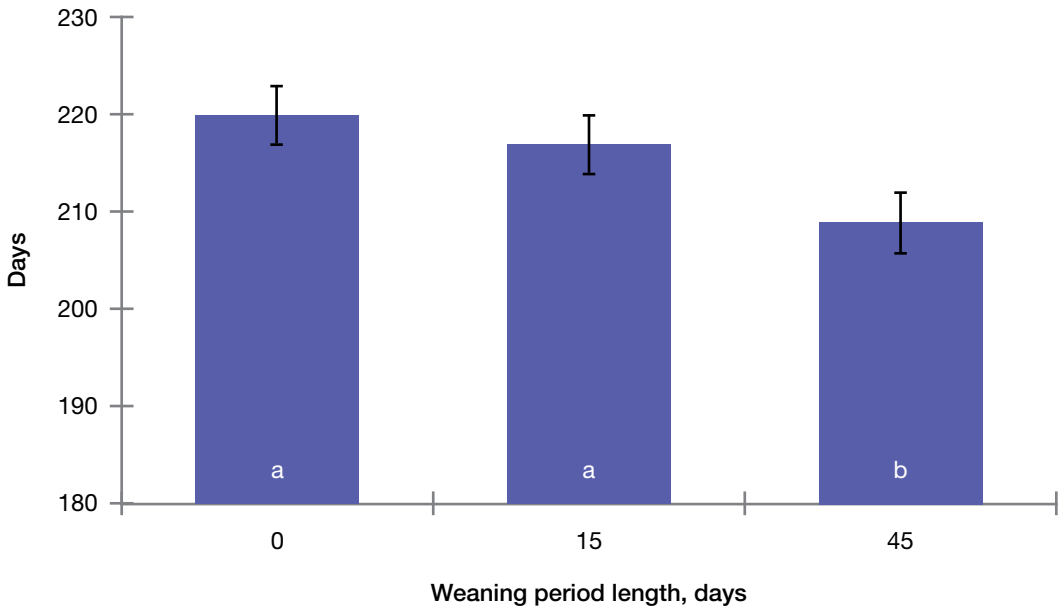


**Figure 3. Effect of length of ranch-of-origin weaning period on days on feed until harvest.**

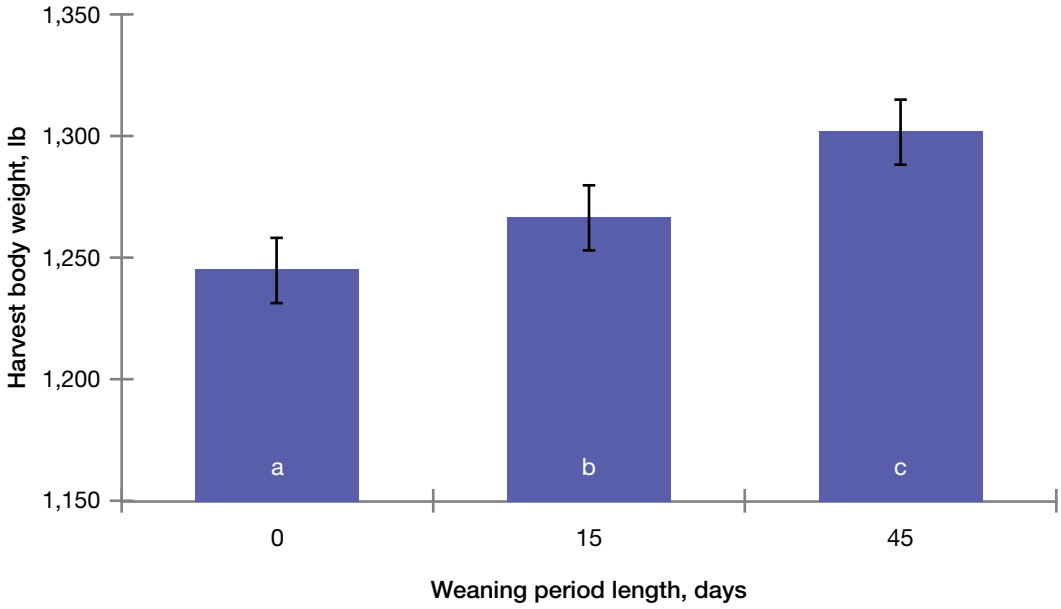


**Figure 4. Effect of length of ranch-of-origin weaning period on harvest body weight of beef steers.**