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Length of the Weaning Period Affects Postweaning Growth, Health, and Carcass Merit of Ranch-Direct Beef Calves Weaned During the Fall

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Introduction

Bovine respiratory disease (BRD) is the most economically devastating feedlot disease. Risk factors associated with incidence of BRD include (1) stress associated with maternal separation, (2) stress associated with introduction to an unfamiliar environment, (3) poor intake associated with introduction of novel feedstuffs into the animal's diet, (4) exposure to novel pathogens upon transport to a feeding facility and commingling with unfamiliar cattle, (5) inappropriately administered respiratory disease vaccination programs, and (6) poor response to respiratory disease vaccination programs. Management practices that are collectively referred to as preconditioning are thought to minimize damage to the beef carcass from the BRD complex.

Preconditioning management reduces the aforementioned risk factors for respiratory disease by (1) using a relatively long ranch-of-origin weaning period following maternal separation, (2) exposing calves to concentrate-type feedstuffs, and (3) producing heightened resistance to respiratory disease-causing organisms through a preweaning vaccination program. The effectiveness of such programs for preserving animal performance is highly touted by certain segments of the beef industry.

Ranch-of-origin weaning periods of up to 60 days are suggested for preconditioning beef calves prior to sale; however, optimal length of the ranch-of-origin weaning period has not been determined experimentally. The objective of this study was to test the validity of beef industry assumptions about appropriate length of ranch-of-origin weaning periods for calves aged 160 to 220 days and weaned during the fall.

Experimental Procedures

A total of 433 polled, spring-born calves (average body weight (BW) at weaning = 506 ± 81 lb; average birth date = 04/1/2007 ± 22 days) were used for this experiment. One set of calves (n = 265) originated from the Kansas State University Commercial Cow-Calf Unit. The second set (n = 168) originated from the Kansas State University Agricultural Research Center at Hays (ARCH). Bulls were castrated at least 120 days prior to the study. At each location, calves were blocked by sex and age and assigned randomly to treatments that corresponded to the length of time between separation from their dam and shipping: 60, 45, 30, 15, or 0 days. Calf age on the day of maternal separation averaged 160, 175, 190, 205, and 220 days of age for calves weaned 60, 45, 30, 15, and 0 days prior to shipping, respectively. The study was initiated on August 29 (75 days before shipping), and the common shipping date for all treatments was November 7 (day 0). Average calf age on the common shipping day was similar among treatments. Body condition score of cows at both locations was measured 75 days before and 14 days after the common shipping date.

All calves were given an initial modified-live vaccination for IBR, BVD, PI3, BRSV, (Bovi-Shield Gold FP, Pfizer Animal Health, Exton, PA) and clostridial disease (Vision 7 with SPUR, Intervet Inc., Millsboro, DE) 2 weeks prior to separation from their dam. They were also individually identified with a color-coded ear tag corresponding to treatment at that time.

On the day of maternal separation, all calves were revaccinated for IBR, BVD, PI3, BRSV, and clostridial diseases by using the products previously described; calves were also treated for internal and external parasites with Dectomax (Pfizer Animal Health) and weighed. Calves at both locations were immediately transported a short distance (< 15 miles) to a central home-ranch weaning facility.

Calves were maintained in earth-floor pens (4 pens/treatment) at their respective home-ranch weaning facilities for a period of days corresponding to their treatment assignment. Calves were fed a common weaning ration (Table 1) during that period. The ration was formulated to achieve an average daily gain (ADG) of 2.0 lb at a dry-matter intake of 2.5% of BW.

Calves were monitored for symptoms of respiratory disease at 7:00 a.m. and 2:00 p.m. daily during the weaning phase of the experiment. Calves with clinical signs of BRD (Table 2), as judged by animal caretakers, were removed from home pens and evaluated. Each calf with clinical signs of BRD was weighed, had a rectal temperature measured, and was given a clinical illness score (Table 2). Calves that presented with a clinical illness score greater than 1 and a rectal temperature > 104.0°F were treated according to the schedule described in Table 3. Cattle were evaluated 72 hours posttreatment and re-treated on the basis of observed clinical signs.

Calves from all treatments and both origins were individually weighed and shipped approximately 180 miles from their respective weaning facilities to an auction market located at Hays, KS, on day 0. Calves from both locations were commingled with respect to gender, treatment, and BW and maintained on the premises of the auction market for 14 hours. The purpose of this step was to simulate pathogen exposure typically encountered by market-ready calves. Calves were shipped 5 miles directly to the ARCH feedlot from the auction market.

Upon arrival at the ARCH feedlot, cattle were individually weighed and assigned randomly to a receiving pen on the basis of treatment and gender. Cattle were fed a receiving ration for a period of 56 days after arrival at the ARCH. Feed intake was measured daily. Calves were monitored for symptoms of respiratory disease, and clinical illness was treated as in the home-ranch weaning phase (Tables 2 and 3). Body weights were measured at 28-day intervals during this receiving phase.

Following the receiving period, replacement heifers were removed, and cattle were placed on a common finishing ration (Table 4). Weights were taken every 60 days throughout the finishing period until slaughter. Cattle were fed to reach an average endpoint of approximately 0.6 in. of backfat at the 12th rib and placed into one of three slaughter groups. Once steers and heifers reached the targeted carcass endpoint, as determined by ultrasound, they were transported 120 miles to a commercial abattoir. At the abattoir, livers were examined for abscesses, and lungs were examined for lesions. After carcasses chilled for approximately 48 hours, they were ribbed and graded. Carcass measurements including 12th rib fat thickness, 12th rib loin eye area, and marbling score were collected with digital imaging software. By using these measurements, yield grade and quality grade were assigned according to USDA guidelines. Kidney, pelvic, and heart fat were determined by difference in carcass weight after removal of all internal fat by dissection.

Results and Discussion

Calf BW was similar ($P>0.8$) among treatments at the beginning of the trial. Calf ADG during the 60 days preceding shipping tended to increase linearly ($P=0.09$) with longer weaning periods (Figure 1). Similarly, calf BW at shipping tended to increase linearly ($P=0.06$) with successively longer weaning periods (Figure 2). This probably occurred because calves were consuming a more energy-dense diet in the weaning facility than what was possible for herd mates that remained with their mothers on pasture. We concluded that under the conditions of our study, successively longer ranch-of-origin weaning periods improved calf BW and ADG prior to shipping. Incidence of undifferentiated fever during the 14-day period following maternal separation was greater ($P<0.01$) for calves on the 60-day weaning treatment than for those on the 45-, 30-, or 15-day weaning treatments (Figure 3). Reasons for the greater incidence of undifferentiated fever seen in the calves on the 60-day weaning treatment were unclear but may have been related to significant variation in daytime and nighttime temperatures that occurred during the first 14 days after maternal separation for that treatment.

Feed intake (dry-matter basis) during the first 30 days following shipping was less ($P<0.01$) for calves weaned 0 days than for those weaned 60, 45, 30, or 15 days prior to shipping (Figure 4). More experience consuming dry diets from a feed bunk prior to shipping translated to greater feed intake at the feedlot. Previous experience with concentrate-based feeds may benefit recently received calves in some circumstances; however, ADG and gain efficiency (G:F) in our study were similar ($P>0.12$) among treatments during the first 30 days in the feedlot. Calf BW 30 and 60 days after shipping increased linearly ($P<0.01$) with successively longer weaning periods. This indicates that treatments retained their relative ranks in body size from shipping to the end of the receiving period. Incidence of undifferentiated fever during the first 15 days after shipping was greater ($P<0.01$) for calves weaned 0 days than for those weaned 60, 45, 30, or 15 days (Figure 6).

Calf BW increased linearly ($P<0.02$) with longer weaning periods from feedlot receiving through 114 days on feed; however, calf BW was similar ($P>0.09$) between treatments from day 114 until harvest. Dry-matter intake during the first 30 days on feed was less for calves weaned 0 days than for those weaned 60, 45, 30, or 15 days; however, dry-matter intake was similar ($P>0.3$) among treatments from day 30 in the feedlot to harvest. Calf ADG and G:F were similar (P>0.2) among treatments from feedlot receiving to 232 days on feed; however, ADG and G:F tended to increase linearly (P<0.06) with longer weaning periods from day 232 to harvest.

Days on feed decreased linearly (P=0.05) with successively longer weaning periods (Figure 7). This probably occurred because calves were slightly larger and more mature physiologically at the time of feedlot placement as length of the ranch-of-origin weaning period increased. Yield grade (Figure 8) and kidney, pelvic, and heart fat increased linearly (P 0.04), whereas fat thickness tended to increase linearly (P=0.06) with successively longer weaning periods. Dressing percentage, hot carcass weight, marbling, and loin eye area were similar (P>0.15) among treatments. Liver and lung scores at harvest also were similar (P>0.3) among treatments. The increase in undifferentiated fever for cattle weaned 0 days before shipping was not associated with significant damage to the lungs or a reduction in marbling score as has been reported by researchers working with market-sourced cattle. Differences in carcass characteristics among treatments may have occurred because calves weaned for longer periods of time were larger and more mature at the time of feedlot arrival.

Implications

In general, there was a great deal of similarity among weaning treatments in terms of health performance and growth performance during finishing. Carcass merit was also similar among treatments. This finding calls into question the validity of beef industry assumptions about the appropriate length of ranch-of-origin weaning periods for cattle that are moved quickly from their ranch of origin to a feedlot and not commingled with market-sourced cattle. Ranch-direct calves that are properly vaccinated before exposure to market conditions may not require ranch-of-origin weaning periods longer than 2 weeks for optimal health and growth performance during receiving and finishing. Although 2 weeks may be appropriate from the standpoint of sickness and ADG, an increase in calf BW prior to shipment to a feedlot or auction market may add value to calves that are sold after a brief ranch-of-origin weaning period.

Table 1. Ingredient and nutritional composition of the weaning diet

Ingredient	Dry-matter basis (%)
Extender pellets (alfalfa)	41.82
Corn gluten feed	18.22
Wheat midds	14.68
Cracked corn	10.78
Cottonseed hulls	7.68
Dried distillers grain	3.01
Molasses	1.67
Limestone	1.85
Nutrient composition	% of dry matter
CP	15.31
Ca	0.56
P	1.43
NE_m, Mcal/kg	1.44
NE_g, Mcal/kg	0.85

Diet also included salt, zinc sulfate, and Rumensin 80.

Table 2. 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, near death, little response to human approach

Table 3. Treatment schedule used to treat calves diagnosed with bovine respiratory disease complex

Treat	Drug	Dose	Route of injection
1st Pull	enrofloxacin (Baytril)	5 mL/CWT	Subcutaneous
2nd Pull	florfenicol (Nuflor)	6 mL/CWT	Subcutaneous
3rd Pull	oxytetracycline (Biomycin 200)	5 mL/CWT	Subcutaneous

Table 4. Average ingredient and nutritional composition of the finishing diet

Ingredient	Dry-matter basis (%)
Rolled milo	59.43
Sorghum silage	25.47
Soybean meal	11.04
Limestone	2.08
Ammonium sulfate	0.42
Nutrient composition	% of dry matter
CP	15.90
Ca	1.01
P	0.33
NE_m, Mcal/kg	1.75
NE_g, Mcal/kg	1.13

Diet also included salt, Rumensin 80, Tylan 40, and trace minerals.

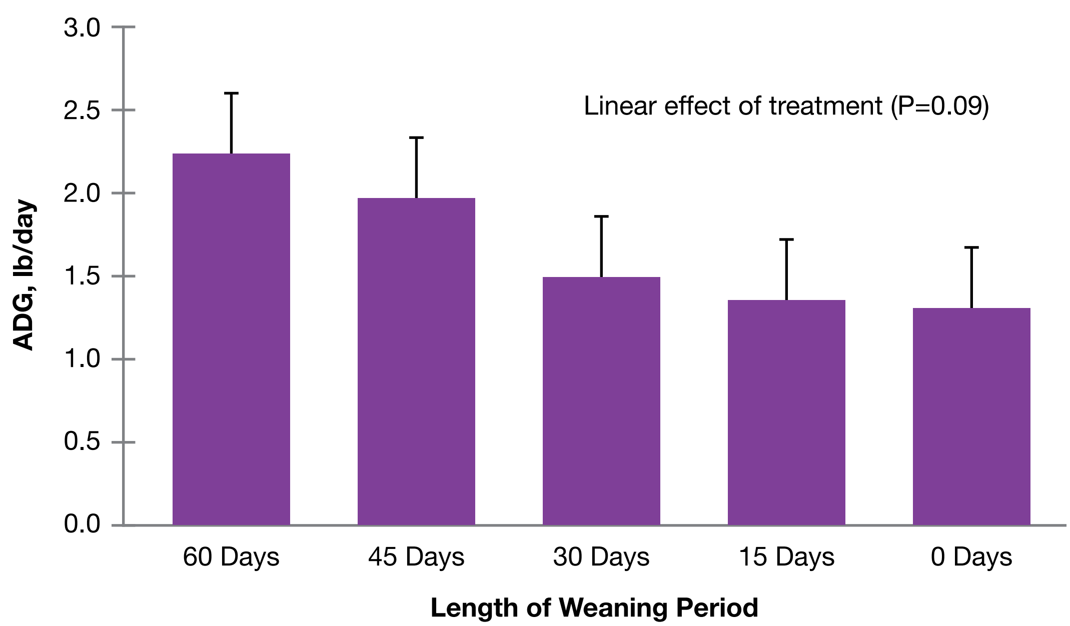


Figure 1. Effect of length of the ranch-of-origin weaning period on average daily gain (ADG) of calves during the 60 days prior to shipment to feedlot.

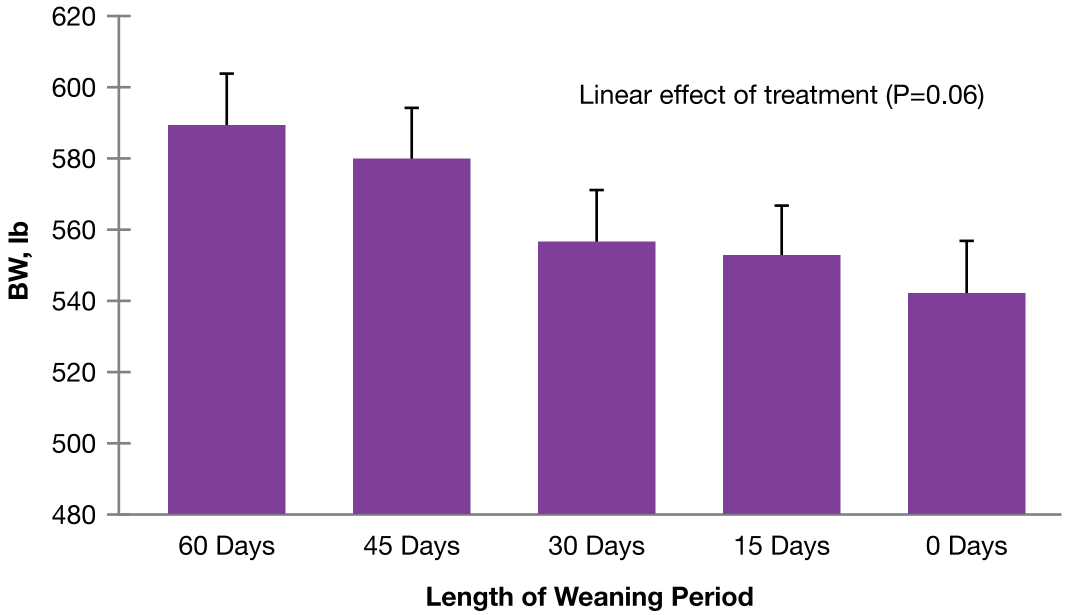


Figure 2. Effect of length of the ranch-of-origin weaning period on body weight (BW) of calves on the day of shipment to a commercial auction market.

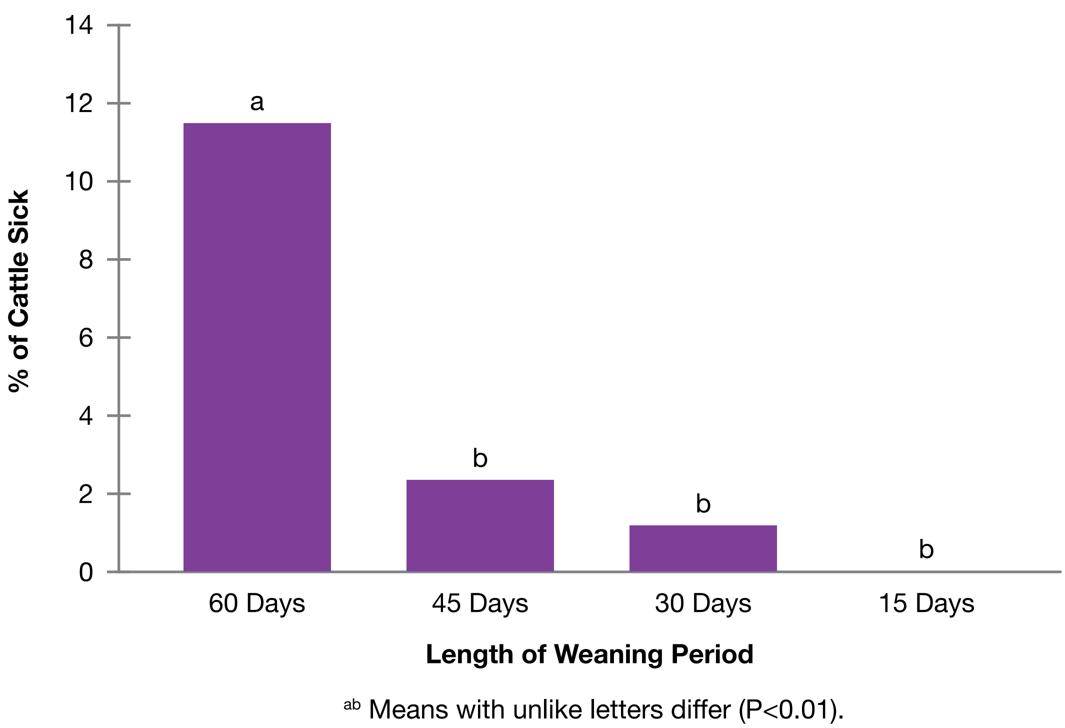
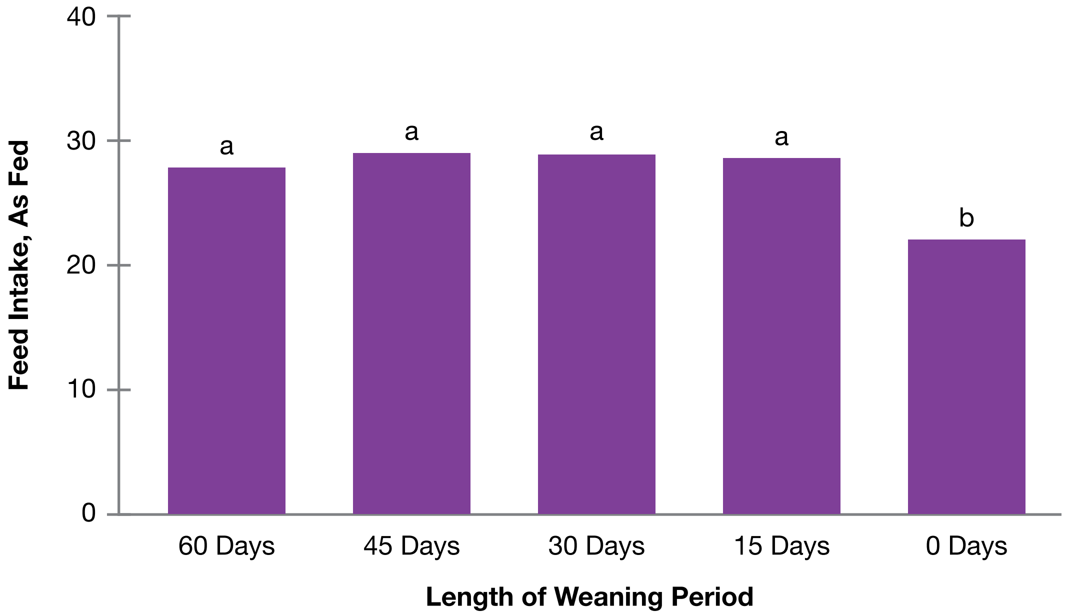


Figure 3. Effect of length of the ranch-of-origin weaning period on incidence of undifferentiated fever in calves during the first 14 days after maternal separation prior to shipment to a commercial auction market.



[ab] Means with unlike letters differ (P<0.01).

Figure 4. Effect of length of the ranch-of-origin weaning period on feed intake by calves during the first 30 days after feedlot arrival.

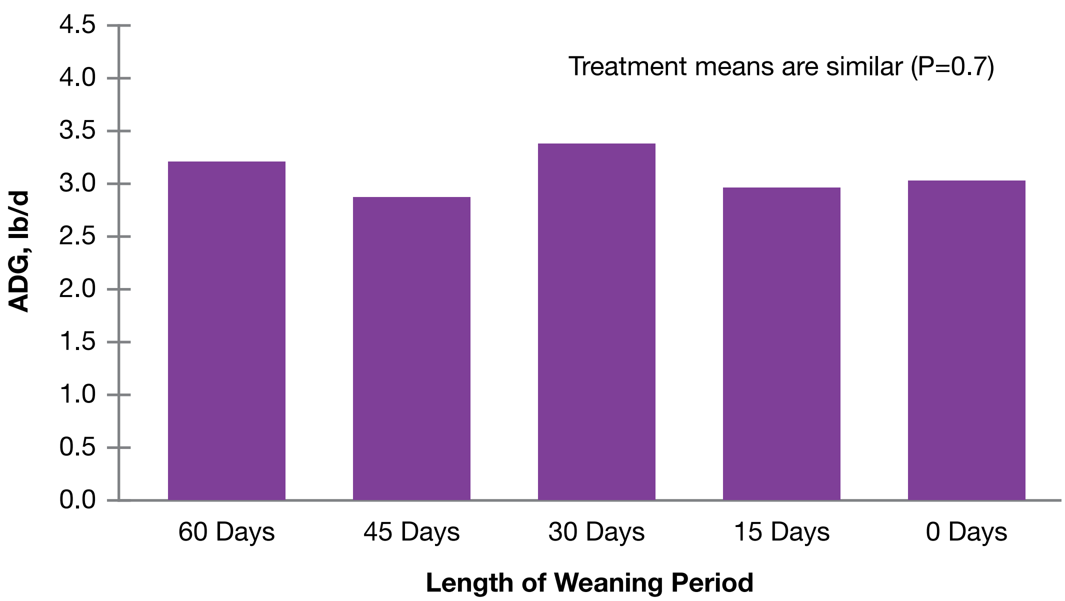


Figure 5. Effect of length of the ranch-of-origin weaning period on average daily gain (ADG) of calves during the first 30 days after feedlot arrival.

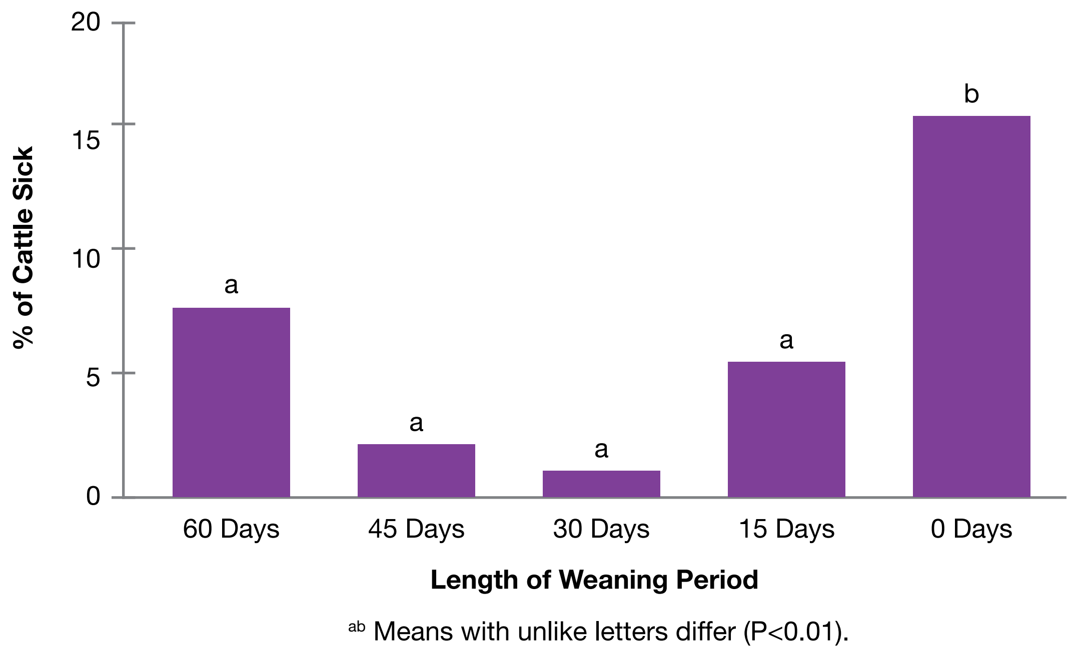


Figure 6. Effect of length of the ranch-of-origin weaning period on incidence of undifferentiated fever in calves during the first 15 days after feedlot arrival.

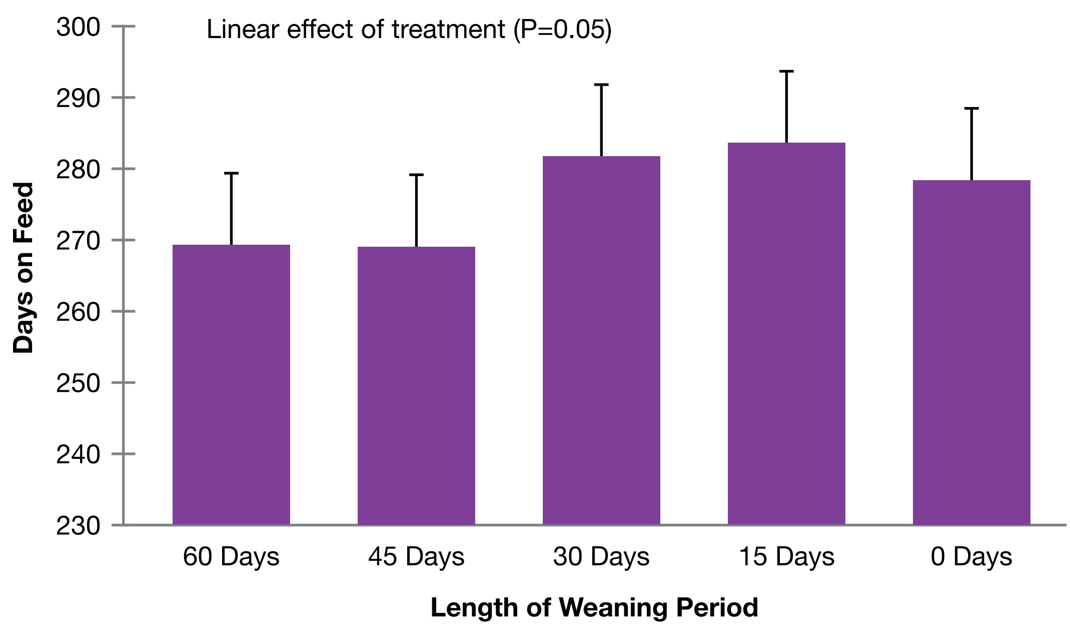


Figure 7. Effect of length of the ranch-of-origin weaning period on days on feed from feedlot arrival to harvest.

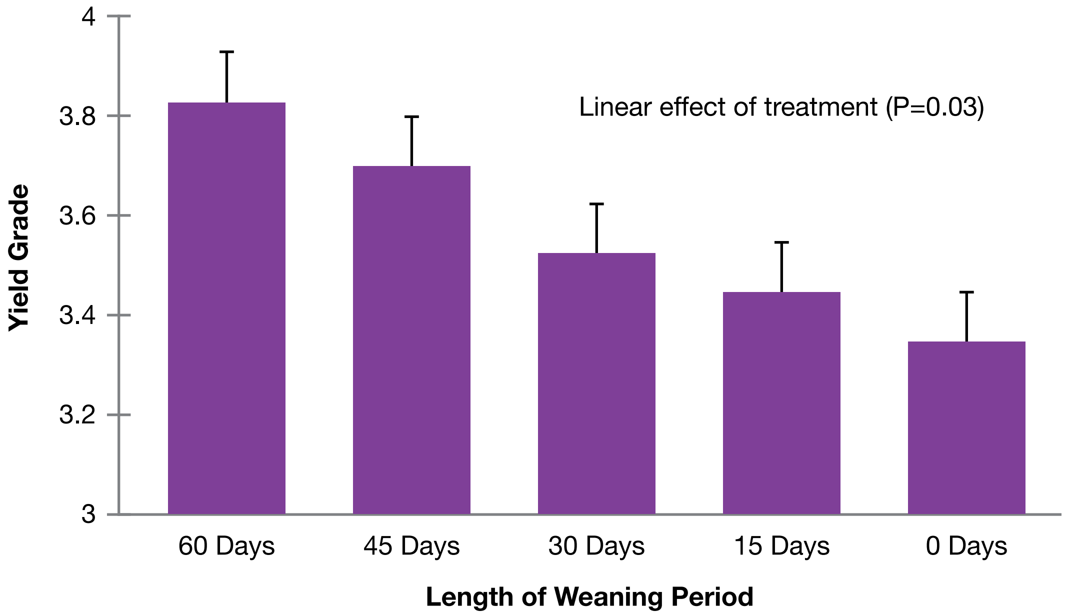


Figure 8. Effect of length of the ranch-of-origin weaning period on USDA yield grade of calves.