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Effects of Feeding Vitamin D on Feedlot Performance, Carcass Traits, and Meat Tenderness of Finishing Steers

B.A. Berry, D.R. Gill and R. Ball

Story in Brief

Feedlot performance, carcass characteristics, and meat tenderness of steers fed supplemental vitamin D for 5 d followed by 2 d increased calcium supplementation during the 7 d prior to harvest were characterized. Steers were fed either 0 or 6,000,000 IU of vitamin D from d 133 to d 137 of a finishing trial. Vitamin D-fed cattle subsequently received increased levels of calcium until harvest 2 d later. Vitamin D had no effect on tenderness in this trial, however skeletal maturities were less advanced. Feedlot performance was greatly altered for cattle supplemented with vitamin D due to decreased feed consumption. It is possible that muscle calcium pools were deleted due to decreased intake leading to a masking of vitamin D effects on tenderness. These results do not suggest that feeding Vitamin D should be recommended as a tool to improve tenderness.

Key Words: Vitamin D_3, Beef Cattle, Tenderness

Introduction

Smith et al. (1995) estimated that lack of tenderness in beef cuts costs the beef industry $250 million annually. Although methods to improve tenderness could prove somewhat costly, beef producers would certainly benefit from these methods. Steak tenderness was also ranked as the second most important factor in the 1995 National Beef Quality Audit. Given the importance of improving tenderness in beef cattle, research in this area can benefit the industry greatly. Vitamin D_3 supplementation has been shown to increase tenderness (Swanek et al., 1997; Karges et al., 1999). Although the mechanism by which Vitamin D_3 increases tenderness has not been demonstrated, Swanek et al. (1999) hypothesized that increased Vitamin D may increase tenderization via increased calcium levels in muscle tissue at harvest. This increased muscle pool then activates proteolytic enzymes that degrade certain muscle proteins. The objective of this study was to test the efficacy, as well as effects on performance and carcass traits, of feeding elevated levels of Vitamin D to cattle prior to harvest in order to increase tenderness.

Materials and Methods

Animals and Diets. Crossbred Angus x Senepol steers (n = 124, BW = 1265 ± 113 lb), stratified into five weight blocks for an implant experiment (Berry, 2000), were used to investigate the efficacy of feeding supplemental vitamin D_3 for 5 d pre-harvest followed by increased supplemental calcium. Two blocks, containing each implant treatment within the block, were randomly assigned to receive a diet formulated to contain 6,000,000 IU

vitamin D/hd/d and twice the amount of calcium of the control diet. The remaining three blocks continued to receive the control diet. Although cattle in different blocks had different initial weights, blocks were assumed to have linear growth. Vitamin D was removed from the diet 2 d prior to harvest and the calcium level remained elevated. Diets are listed in Tables 1 and 2.

Steers were housed (5 steers/pen) in 25 partially covered pens (5 pens/block) with the majority of the pen being uncovered and the cement pads and bunks being covered. All steers received the control ration for the 132 d prior to the experiment. Feed was delivered daily at approximately 7:00 a.m. and 1:00 p.m. All animals were weighed on d 133 prior to the diet change. These weights received a 4% pencil-shrink and were used in calculating daily gains and feed conversions. Final weights were calculated by dividing hot carcass weights by the mean dressing percentage from both treatments.

After 140 d on feed, steers were harvested at Excel Corporation in Dodge City, KS. Following a 0°C, approximately 36-h chill period, Oklahoma State University personnel collected USDA quality and yield grade (USDA, 1997) carcass measurements. Loin strips were removed from the right side of the carcass by plant personnel for Warner-Bratzler shear force evaluation and transported to Oklahoma State University where they were subsequently cut into three 1-in steaks. One steak from each strip was aged at 0°C for 7 d prior to being placed in a -80°C freezer and two steaks were aged at 0°C for 14 d prior to placement in a -80°C freezer. Steaks were tempered overnight at 0°C, cooked in an impingement oven to a 70°C core temperature and allowed to cool to room temperature prior to shear force evaluation. Six, 1.25 cm core samples were removed from each steak and shear force pressure was evaluated using a Series IX Automated Materials Testing System 3.0.

Statistical Analysis. Data were analyzed ordinary least squares (SAS, 1996) as a completely randomized design. Pen served as the experimental unit for gain, dry matter intake, and efficiency data with steer being used for carcass traits. Interactions between implant treatment and vitamin D were tested and removed from the model due to insignificance. All feedlot performance models were evaluated using pen as the error term.

Results and Discussion

Feedlot performance data are presented in Table 3. Dry matter intake declined ($P<.002$) as steers were fed supplemental vitamin D. This depression led to decreased ($P<.003$) daily gain and lower ($P<.02$) gain:feed. Steers receiving vitamin D had less advanced ($P<.02$) skeletal maturities with all other carcass traits being similar between treatment

groups. Carcass trait data are presented in Table 4. Cattle that were fed vitamin D prior to harvest tended to have less (P<.16) tender steaks. These results are in contrast with research by Swanek (1999), who found that supplemental vitamin D increased tenderness. However, it is possible that the severe intake depression during the 7 d prior to harvest depleted muscle calcium stores. It is also important to note that due to reduced intake, steers fed vitamin D consumed approximately 4,800,000 IU/hd/d of vitamin D rather than the formulated 6,000,000 IU/hd/d.

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Table 1. Feedstuff and energy content of diets fed during 140-d feeding period.

	% Diet DM		
Diet	Control[a]	Vitamin D[b]	Calcium[c]
Corn, whole-shelled	86.50	85.41	86.73
Cottonseed hulls	5.09	5.08	4.98
Supplement	8.39	9.5	8.30

NEm, Mcal/cwt	96.98
NEg, Mcal/cwt	62.15
Crude protein, %	12.49

[a]Diet fed to all steers d 0 to 132 and control steers d 133 to 140.

[b]Diet fed to vitamin D treatment steers d 133 to 137.

[c]Diet fed to vitamin D treatment steers d 138 to 139.