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M.J. Daniel

A.M. Arnett

Michael E. Dikeman

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Vitamin A restriction during finishing benefits beef retail color display life

Abstract

Because the beef industry commonly uses marbling as an indicator of meat palatability, determining the most cost effective methods of increasing quality grade in cattle is a high priority. Previous research showed that weaning calves at around 90 instead of 200 days of age can be beneficial in reducing cow production costs and increasing marbling in feedlot steers. Other studies demonstrated that high levels of vitamin A inhibit development of intramuscular fat. Vitamin A restriction is used commonly in Japanese cattle to increase marbling scores; this stimulated interest in applying this restriction in U.S. beef production systems. However, little research has been conducted to determine the effect that vitamin A restriction might have on other meat quality components. Therefore, our objective was to determine the effects of feeding high and restricted levels of vitamin A to early and traditionally weaned calves during finishing on color display life, lipid oxidation, and sensory attributes of two beef muscles.

Keywords

Cattlemen's Day, 2008; Kansas Agricultural Experiment Station contribution; no. 08-212-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 995; Beef; Cattle; Marbling; Vitamin A

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VITAMIN A RESTRICTION DURING FINISHING BENEFITS BEEF RETAIL COLOR DISPLAY LIFE

M. J. Daniel, M. E. Dikeman, and A. M. Arnett

Introduction

Because the beef industry commonly uses marbling as an indicator of meat palatability, determining the most cost effective methods of increasing quality grade in cattle is a high priority. Previous research showed that weaning calves at around 90 instead of 200 days of age can be beneficial in reducing cow production costs and increasing marbling in feedlot steers. Other studies demonstrated that high levels of vitamin A inhibit development of intramuscular fat. Vitamin A restriction is used commonly in Japanese cattle to increase marbling scores; this stimulated interest in applying this restriction in U.S. beef production systems. However, little research has been conducted to determine the effect that vitamin A restriction might have on other meat quality components. Therefore, our objective was to determine the effects of feeding high and restricted levels of vitamin A to early and traditionally weaned calves during finishing on color display life, lipid oxidation, and sensory attributes of two beef muscles.

Materials and Methods

Angus crossbred calves (n=46) were weaned at either 137 ± 26 days or 199 ± 26 days of age, placed in the feedlot, and either supplemented with seven times the NRC recommended level of vitamin A (6911.6 IU/lb) or restricted to no supplemental vitamin A. Calves were harvested in two kill groups when they reached approximately 0.40 inches of backfat. After chilling and grading, strip loins and shoulder clods were retrieved from carcasses. Three 1.0-inch *Longissimus lumborum*

and *Triceps brachii* steaks were cut after 14 days of aging. One steak was packaged immediately in PVC overwrap and placed in a retail display case for 7 days. Visual color scores and instrumental color values were evaluated on each day of display. Thiobarbituric acid reactive substances (TBARS) were analyzed on display steaks on day seven to quantify the amount of lipid oxidation. The other two steaks were vacuum packaged and frozen for Warner-Bratzler shear force (WBSF) determinations and trained sensory panel analysis. Steaks were thawed at 36°F overnight, cooked to an internal temperature of 158°F, and chilled overnight at 32°F. Eight 0.5-inch cores were removed parallel to the muscle fibers for WBSF. Each core was sheared perpendicular to the direction of the muscle fibers using the WBSF attachment on the Instron Universal Testing Machine with a 50-kg compression load cell and a cross head speed of 250 mm/min. Sensory steaks were cut into 0.5 by 0.5 by 1 inch cubes and evaluated by six to eight trained panelists on an 8-point scale for tenderness, flavor, juiciness, connective tissue, firmness, and off-flavor intensity with 8 = extremely desirable and 1 = extremely undesirable.

Results and Discussion

Display color scores are presented in Figures 1 and 2. Steaks from calves supplemented with high vitamin A had less desirable color scores ($P < 0.05$) than steaks from calves restricted in vitamin A on all days of display for the *Longissimus lumborum* steaks and on days 2 through 6 for *Triceps brachii* steaks. Discoloration scores (data not shown) were

less desirable ($p < 0.05$) for high vitamin A steaks on days 3 through 6 in the *Longissimus lumborum* muscle and on days 4 and 5 in the *Triceps brachii* muscle. Also, a*, b* and saturation index values were numerically lower (less desirable) in the high vitamin A steaks on all days of display for the *Longissimus lumborum* muscle but were statistically significant only on days 3, 2, and 3, respectively (data not shown).

Lipid oxidation (Figure 3), measured by TBARS values, was higher ($P < 0.05$) for both muscles after 7 days of display in steaks from calves supplemented with high vitamin A. There were no differences ($P > 0.05$) in WBSF values between the treatments for either mus-

cle. Also, there were no differences ($P > 0.05$) in sensory panel traits for the *Triceps brachii* muscle. However, *Longissimus lumborum* steaks from steers supplemented with high vitamin A had lower ($p < 0.05$) scores for myofibrillar tenderness and connective tissue amount (data not shown).

Implications

Vitamin A restriction during finishing has potential to increase retail color display life and reduce lipid oxidation of beef *Longissimus lumborum* and *Triceps brachii* steaks without negatively affecting cooked meat sensory attributes.

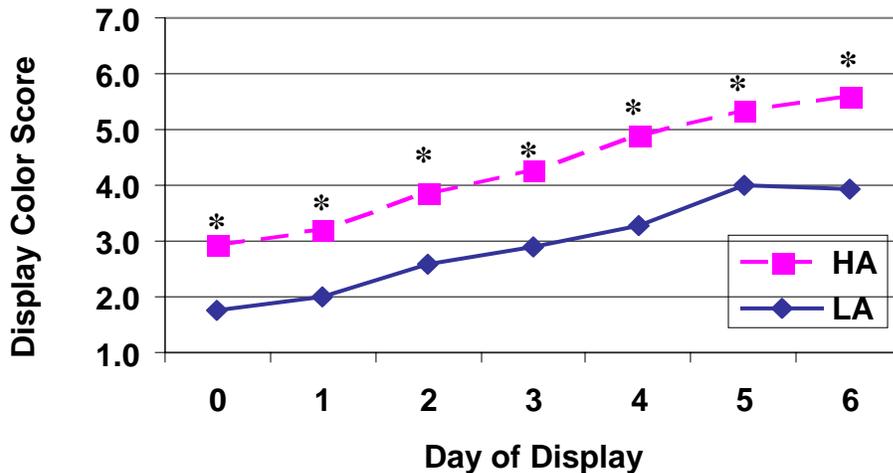


Figure 1. Display Color Scores for *Longissimus lumborum* Steaks.

Display Color Score: 1 = most desirable; 8 = least desirable.

*Means differ ($P < 0.05$).

HA = Supplemented with 6911.6 IU/lb vitamin A; LA = No supplemental vitamin A.

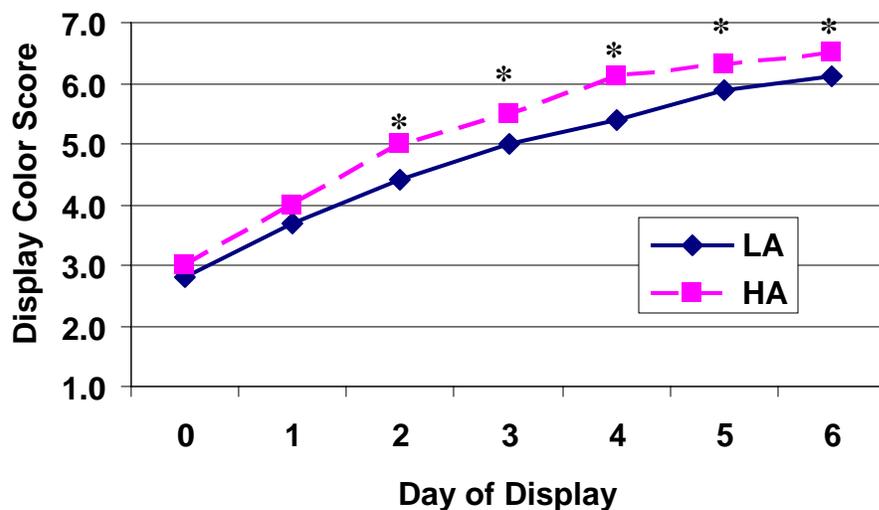


Figure 2. Display Color Scores for *Triceps brachii* Steaks.

Display Color Score: 1 = most desirable; 8 = least desirable.

*Means differ (P<0.05).

HA = Supplemented with 6911.6 IU/lb vitamin A; LA = No supplemental vitamin A.

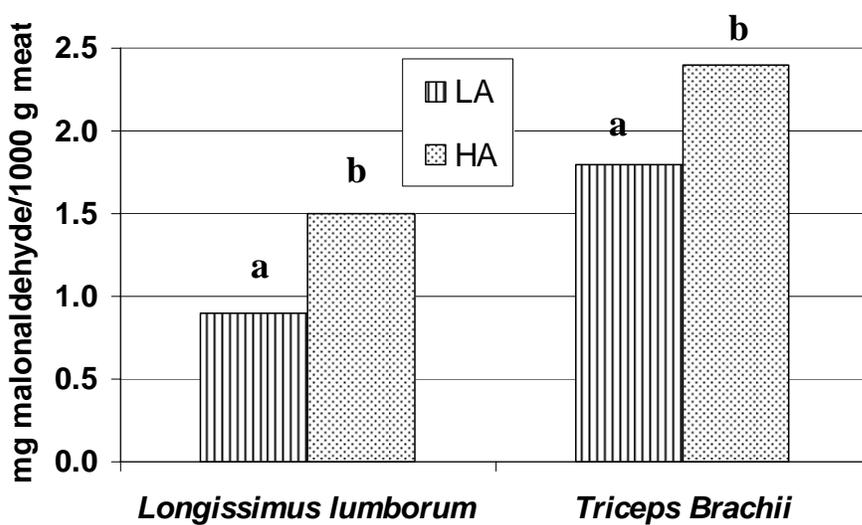


Figure 3. Lipid Oxidation of *Longissimus lumborum* and *Triceps Brachii* Steaks.

^{ab}Means with different superscripts differ (P<0.05).

HA = Supplemented with 6911.6 IU/lb vitamin A; LA = No supplemental vitamin A.