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Katherine I. Domenech
University of Nebraska-Lincoln

Michael D. Chao
University of Nebraska-Lincoln

Joe Buntyn Buntyn
University of Nebraska-Lincoln

Ty B. Schmidt
University of Nebraska-Lincoln, tschmidt4@unl.edu

Chris R. Calkins
University of Nebraska-Lincoln, ccalkins1@unl.edu

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Impact of Supplementing Cattle with OmniGen-AF at the Receiving or Finishing Phase on Beef Shelf-Life

Katherine I. Domenech, Michael D. Chao, Joe Buntyn, Ty Schmidt and Chris R. Calkins

Summary

A patented proprietary product, OmniGen-AF, was evaluated to extend beef steak shelf-life at 8, 22 and 29 days of aging. The three treatment groups included a control group with no supplementation, OmniGen-AF supplementation for 28 d after receiving, and supplementation for 210 d during finishing. The inclusion of OmniGen-AF had no effect on tenderness or visual discoloration under retail display conditions and minimal effects on fatty acid composition. Although color stability seemed to be unaffected by the supplementation, feeding OmniGen-AF throughout the entire feeding period tended to decrease oxidation. Supplementing cattle with a greater concentration of OmniGen-AF or increasing the antioxidant components in the feed supplement could be explored to further maximize beef shelf-life following long periods of aging.

Introduction

Supplements used in beef rations for finishing cattle balance nutrients that are essential for proper nutrition and performance. OmniGen-AF (Phibro Animal Health, Quincy, IL) is a patented proprietary product shown to augment the innate immune function in cattle. Supplementing cattle with OmniGen-AF also poses a potential opportunity for the incorporation of antioxidants via phenolic-rich compounds that might extend beef shelf-life by slowing the development of brown color during retail display. The extension of beef shelf-life ultimately benefits the beef industry as a whole as it promotes greater color and lipid stability with greater aging times. These have proven to be strong drivers for consumer purchasing decisions. Thus, the objective of this research was to assess the impact of feeding OmniGen-AF on beef shelf-life.

Procedure

A total of 288 steers were sorted into three treatment groups (96 hd/treatment): a control group that received no OmniGen-AF supplementation and two groups supplemented with OmniGen-AF either at receiving (first 28 d at the feedlot) or all through finishing (210 d). At both the receiving and finishing phases, OmniGen-AF was top dressed at 4 g/100lb BW/hd/d. Cattle were sorted 8 hd/pen for a total of 12 pens/treatment. After harvest, 24 USDA low Choice carcasses were selected within each dietary treatment (n = 72) and strip loins from the left and right sides were obtained. Vacuum packaged loins were aged 8, 22 and 29 days (33°F). At 8 days of aging, part of the left loins were fabricated into 1-inch steaks for visual discoloration and tenderness and ½-inch steaks for thiobarbituric acid reactive substances (TBARS) was used as a measure of oxidation. The remaining portions of the loins were vacuum packaged and aged up to 22 days at which point the fabrication process was repeated. The remaining commercially vacuum packaged strip loins (right sides) were kept intact until 29 days of aging at which time the same fabrication strategy was followed. At all aging periods the steaks were placed in Styrofoam trays, overwrapped with oxygen-permeable film, and placed in retail display conditions (36°F) for 4 and 7 days. Steaks at day 0 of retail display were immediately vacuum packed and stored in an ultra-low freezer (-112°F) until analysis.

Tenderness (Warner-Bratzler Shear Force—WBSF)

The 1-inch frozen steaks were thawed for 24 hours (33°F) and a thermocouple was placed in the geometric center. The steaks were grilled on Hamilton Beach electric grills until they reached an internal temperature of 160°F (cooked on one side until 95°F and flipped once to finish cooking). The cooked steaks were placed on trays, covered with plastic film, and kept in

a cooler for 24 hours (33°F). Six cores were taken parallel to the muscle fiber orientation of each steak and sheared to determine tenderness.

Visual discoloration (discoloration score)

Visual discoloration was assessed daily for all samples placed in retail display. The steaks were evaluated on a percent scale where 0% meant no discoloration and 100% meant complete discoloration.

Objective color (L, a*, b* scores)*

During retail display, objective color was assessed daily with a Minolta Colorimeter (CR-400, Minolta Camera Company, Osaka, Japan). The D65 illuminant setting was used with an 8 mm illumination area and a 2° standard observer. Values of L* (scale from 0 = black to 100 = white), a* (positive values = red to negative values = green), and b* (positive values = yellow to negative values = blue) were recorded with an average of six readings per samples.

Lipid oxidation (TBARS)

Frozen samples were diced into small pieces, with no subcutaneous fat, and flash frozen in liquid nitrogen. The frozen pieces were powdered in a Waring metal cup blender and 5 g of powdered sample was weighed to conduct the TBARS protocol.

Fatty acid profile

Frozen samples were diced into small pieces, with no subcutaneous fat, and flash frozen in liquid nitrogen. These were then powdered in a metal cup blender and 1 g of powdered sample was weighed out to conduct fatty acid determination by gas chromatography. The chromatography was done using a Chromopack CP-Sil (0.25 mm × 100 m) column with an injector temperature of 518°F and a detector temperature of

572°F. The head pressure was set at 40 psi with a flow rate of 1.0 ml/min and a temperature programming system was used. The fatty acids were identified by their retention times in relation to known standards and the percent of fatty acid was determined by the peak area in the chromatograph.

Statistical analysis

The Proc Glimmix procedure in SAS (SAS Inst., Inc., Cary, N.C.) was used to determine the effects of dietary treatment, aging period, retail display and their interactions. Repeated measures were used to analyze discoloration and objective color data. All means were separated with the LS MEANS statement and the TUKEY adjustment with an alpha of 0.05 and tendencies were considered at an alpha level of 0.10.

Results

There were no differences in tenderness (data not shown) due to dietary treatments ($P = 0.31$). As expected, tenderness did improve as aging and retail display time progressed ($P < 0.0001$). In terms of discoloration, there was a significant age by retail display interaction where at 4 days of retail display samples aged for 22 days had a greater discoloration in relation to samples aged for 8 and 29 days. Usually, prolonged aging periods will result in greater discoloration. However, beginning at 4 days of retail display, samples with the longest aging period (29 day age) were less discolored than those at 22 day age, but not different to samples aged for 8 days (Figure 1). This could be due to the fabrication of the samples where at 8 days of aging one side of the loins were fabricated and the remaining portion of the loins were re-vacuum packaged and fabricated on day 22 of aging. Samples for 29 days of age remained intact under commercial vacuum packaging until the day of fabrication. Light, oxygen, and residual oxygen exposure in the loin portions that were re-packaged and fabricated for 22 days of age could explain the increased discoloration in comparison to loins that remained under commercial packaging for a longer aging period.

The discoloration data coincided with the objective L^* , a^* , and b^* color data that also suggested that samples aged for 22 days were lighter (greater L^*) and less red

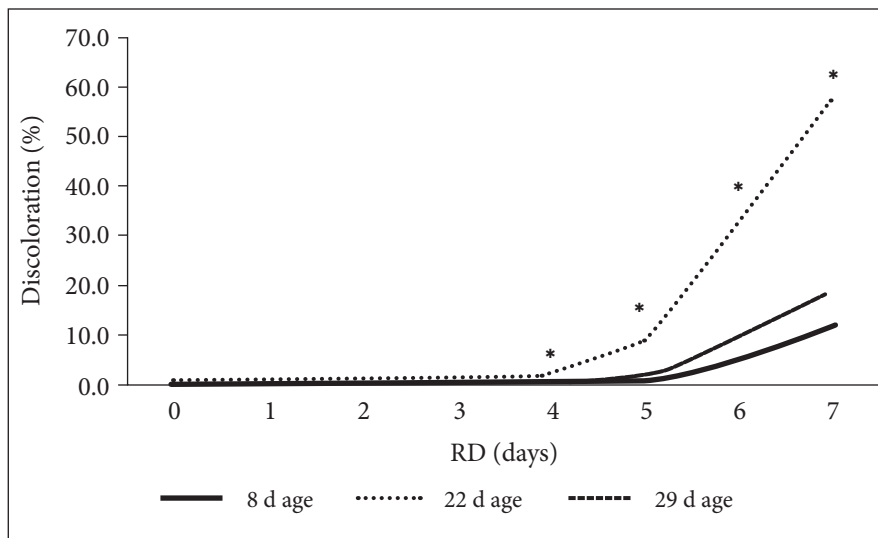


Figure 1. Percent discoloration of beef strip steaks in retail display as impacted by day of aging by day of retail display interaction ($P < 0.0001$)
*Indicate differences ($P < 0.05$)

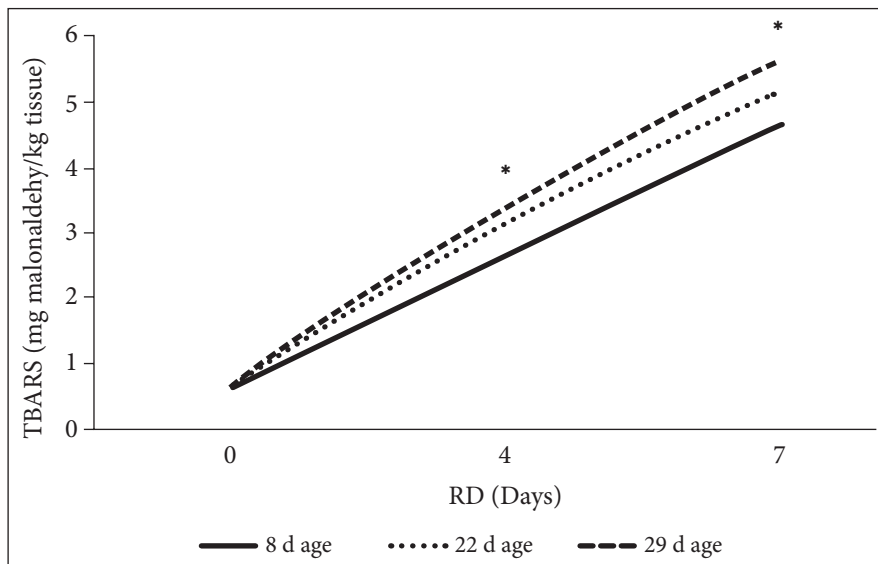


Figure 2. Lipid oxidation (TBARS) tendency of an age by retail display interaction from strip steaks placed under retail conditions ($P = 0.10$)
*Indicate differences ($P < 0.05$)

(lower a^*) than samples aged for 8 or 29 days (data not shown).

Oxidation measured via TBARS did not confirm greater lipid oxidation at 22 days of aging over samples aged for 29 days. A tendency ($P = 0.10$) for an age by retail display interaction was observed (Figure 2). At 0 days of retail display there were no differences according to aging periods but at 4 and 7 days of retail display there was a gradual but significant increase in oxidation from 8 to 22 to 29 days of age (2.66,

3.02, 3.26 mg malonaldehyde/kg tissue, respectively). In general, as retail display progressed, TBARS values increased from 0.66 mg malonaldehyde/kg tissue at day 0 of retail display to 3.09 and 5.19 mg malonaldehyde/kg tissue at days 4 and 7 of retail display respectively. Treatment was not involved in any interactions; however, there was a tendency ($P = 0.10$; Figure 3) for cattle receiving OmniGen-AF during the finishing phase to have a less lipid oxidation in comparison to those receiving the

supplementation at the receiving phase or those never being supplemented (2.80 vs. 3.07 and 3.06 mg malonaldehyde/kg tissue, respectively).

Dietary supplementation altered the proportion of palmitic acid (16:0), linoleic acid (18:2TT), saturated fatty acids (SFA) as well as the ratio of saturated and unsaturated fatty acids (SFA:UFA; Table 1). On a percentage basis, palmitic acid (16:0), total saturated fatty acids, and the ratio of saturated and unsaturated fatty acids were found to be greater in cattle supplemented with OmniGen-AF at the receiving phase, lowest for cattle having OmniGen-AF supplementation all through the finishing phase, and intermediate for cattle on the control diet with no OmniGen-AF supplementation (Table 1). Linoleic acid (18:2TT) however, was found to be greater in the non-supplemented control group (0.21%), intermediate in the receiving phase supplemented group (0.15%), and lowest for the finishing phase supplemented group (0.13%).

According to these data, the inclusion of OmniGen-AF had no effect on color stability under retail display conditions. However, cattle supplemented throughout the finishing phase tended to have greater lipid stability in relation to cattle only supplemented at the receiving phase or cattle that were never supplemented. Hence, supplementation with OmniGen-AF poses potential benefits with longer exposure times in terms of retarding lipid oxidation and thus extending beef shelf-life. Future research can explore the potential benefits of supplementing cattle with a greater concentration of OmniGen-AF or potentially increasing the antioxidant components in the feed supplement to maximize shelf-life of beef aged for long periods of time.

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 Katherine I. Domenech, graduate student
 Michael D. Chao, graduate student
 Joe Buntyn, graduate student
 Ty Schmidt, assistant professor
 Chris R. Calkins, professor, University of Nebraska-Lincoln Department of Animal Science

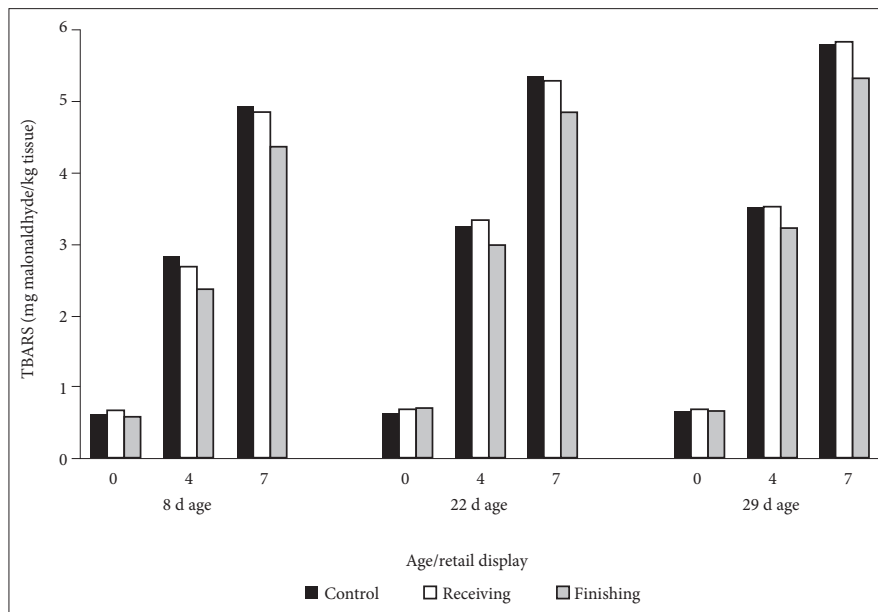


Figure 3. Lipid oxidation (TBARS) dietary treatment tendency for decreased lipid oxidation with cattle supplemented with OmniGen-AF through the finishing phase ($P = 0.10$)

Table 1. Fatty acid changes due to dietary treatment on a percentage basis

Fatty Acid (%) ^a	Dietary Treatment ^b			P-value
	Control	OmniGen-AF at Receiving	OmniGen-AF at Finishing	
16:0 (Palmitic)	24.17 ^{ef}	24.64 ^e	23.62 ^f	0.05
18:2TT (Linoleic)	0.21 ^e	0.15 ^{ef}	0.13 ^f	0.02
SFA ^c	41.92 ^{ef}	43.01 ^e	41.56 ^f	0.04
SFA:UFA ^d	0.74 ^{ef}	0.77 ^e	0.73 ^f	0.04

^aFatty acids reported as percent of the total fatty acids identified via gas chromatography

^bControl: no OmniGen-AF supplementation / OmniGen-AF at Receiving: first 28 d at the feedlot / OmniGen-AF at Finishing: all 210 d at the feedlot. OmniGen-AF was top dressed at 4 g/100lb BW/hd/d.

^cSFA = Saturated fatty acids (Account for the sum of all saturated fatty acids identified)

^dSFA:UFA = Saturated fatty acids : Unsaturated fatty acids (Ratio of the sum of all saturated and unsaturated fatty acids identified)

^{e,f}Different letters indicate differences within each row ($P < 0.05$)