1999 Animal Science Research Report

EFFECTS OF INCLUDING AGRADO IN FINISHING DIETS FOR BEEF CATTLE IN RETAIL CASE-LIFE OF GROUND BEEF AND TOP LOIN STEAKS

Pages 67-71

Authors:

C.E. Walenciak, B.A. Gardner, H.G. Dolezal and F.N. Owens

Story in Brief

Steers (n=120) were randomized into two groups; control and supplemented with 150 ppm AGRADO™ dry matter, a feed additive with antioxidant properties, for 123 d to evaluate its effect on the case-life of ground beef and longissimus steaks and sensory characteristics of longissimus steaks. Strip loins (n=120) and shoulder clods (n=32), representing four pens of AGRADO™ and four pens of control, were collected. Shoulder clods were coarse ground, adjusted to 85 ± 2% lean, then fine ground onto styrofoam trays, overwrapped with oxygen permeable film, and placed in a retail case (1.6°C; 200 fc light). Two steaks (2.54 cm thick) were removed from strip loins 14 d postmortem for case-life and sensory panel evaluation. A Minolta colorimeter was used to determine L*, a*, and b* values. No differences were noted between treatments for L*, a*, or b* values or visual panel scores for ground beef or top loin steaks. Ground beef from AGRADO™ supplemented steers had lower thiobarbituric acid reactive substances (TBARS) than control for all days of display. There were no differences between treatments for juiciness, cooked beef fat flavor, tenderness, connective tissue amount, or off flavors. Steaks from steers supplemented with AGRADO™ had lower sensory panel scores for flavor intensity. Results indicate that supplementing AGRADO™ in the finishing diets of steers inhibited lipid oxidation of ground beef and decreased flavor intensity, but did not affect case-life, tenderness, juiciness, or overall desirability of longissimus steaks.

Key Words: Case-Life, Beef, Lipid Oxidation

Introduction

Numerous factors can alter the value of beef, but none influences consumer selection of beef more than eye appeal. Consumers continue to prefer beef that has a bright, cherry-red color of lean. The National Cattlemen's Beef Association reported that deviation from a bright cherry-red color of lean is responsible for an annual loss of $520 million to the beef industry, simply due to shortened case-life (Wheeler et al., 1996). In an attempt to capture a portion of this annual loss, researchers have explored the possibility of enhancing retail case-life through dietary supplementation of antioxidants such as AGRADO™ .

Previous work (Krumsiek and Owens, 1998) indicates that ground beef and longissimus steak case-life may be enhanced by supplementing AGRADO™

to the finishing diets of steers for 28 d prior to harvest. The current study was conducted to verify these conclusions and to further evaluate the effects of AGRADO™ on beef quality.

Materials and Methods

Carcass Sampling. Steers (n=120) supplemented with either 0 or 150 ppm AGRADO^{tm} during a 123-d feeding trial at Continental Beef Research in Lamar, CO, were transported to the Dodge City, KS Excel beef processing facility for harvest. Carcasses were chilled at approximately 0^{o}C for 36 h after which carcass grade data including ribeye area, preliminary fat thickness, adjusted fat thickness, carcass weight, percentage kidney, pelvic and heart fat, marbling score, skeletal maturity, and lean maturity were collected. Strip loins from the left side of each carcass (n=120) and shoulder clods (n=32), representing four pens of AGRADO^{TM} and four pens of control cattle, were obtained, vacuum packaged, and transported to the Oklahoma State University Food and Agricultural Products Research and Technology Center.

Meat Preparation. Ground beef case-life was determined using composite samples of the shoulder clods of three animals from each of eight pens. After
5 d of postmortem aging, the shoulder clods were ground through a 1.27 cm diameter plate (coarse grind) into eight allotments (one allotment/pen). Each allotment of ground beef (85 ± 2% lean) was ground a second time through a 0.32 cm diameter plate directly onto individually identified retail trays (4s-styrofoam), overwrapped with oxygen permeable film, and placed in a retail case (4^{o}C; 200 fc of light). Vacuum packaged strip loins were aged for 14 d at 4^{o}C. Two steaks (2.54 cm thick) were removed and identified for either 1) retail case-life or 2) sensory evaluation. Steaks utilized for retail case-life evaluation were placed directly on a tray (17s-styrofoam), overwrapped with an oxygen permeable film, and placed in a retail case (4^{o}C). Steaks used for sensory evaluation were individually identified, vacuum packaged, blast frozen, and maintained at -10^{o}C.

Case-life. A total of 12 retail packages from each allotment of ground beef were used; four samples (replications) were used for case-life evaluation and eight samples for rancidity determinations. Three trained retail evaluation panelists rated ground beef samples and longissimus steaks for lean color (1=extremely dark brown; 8=bright cherry-red), percent discoloration (1=100%; 7=none), and overall acceptability (1=extremely undesirable; 7=extremely desirable). Objective color measurements were determined using a Minolta CR-300 Colorimeter to determine L* (lightness), a* (redness), and b* (yellowness) values. All measurements were taken at 8:00 a.m. and 5:00 p.m. for six consecutive display days. Data were analyzed using analysis of variance as a split plot to test for main effects and display

time effects of including AGRADO™ in the diet (AGRADO™ vs control).

Sensory Panel. Twenty-four hours prior to evaluation, steaks, selected randomly, were placed on metal trays, the vacuum was released, and steaks were tempered at 5°C. Steaks were broiled at 177°C in an impingement oven to a final internal temperature of 70°C (a medium degree of doneness) and served immediately to panelists. Seven trained panelists evaluated each steak for juiciness (8=extremely juicy; 1=extremely dry), cooked beef fat flavor (2=very strong; 0=none detectable), overall tenderness (8=extremely tender; 1=extremely tough), connective tissue (8=none; 1=abundant), flavor intensity (8=extremely intense; 1=extremely bland), and off flavors (4=none; 1=intense).

TBA Analysis. Two packages from each allotment of ground beef were removed from the retail case after being displayed for 0, 2, 4, and 6 d, with each package being analyzed separately as a replication. The degree of rancidity can be assessed by monitoring the accumulation of thiobarbituric acid (TBA). Thiobarbituric acid (TBA) was determined using procedures outlined by Witte et al. (1970) and analyzed as an objective indicator of ground beef rancidity. These values are reported as thiobarbituric acid reactive substances (TBARS); values represent mg malondialdehyde (MDA) equivalents per kg of ground beef.

Results and Discussion

Case-Life. No extension (P>.05) of retail case-life was detected by either the color evaluation team or objective L*, a*, or b*values for top loin steaks (Figure 1). These results do not support previous conclusions that case-life of beef from cattle supplemented with AGRADO™ is prolonged. Differences from the previous trials (Krumsiek and Owens, 1998) include 1) feeding AGRADO™ throughout the entire feeding period (123 d) in this study rather than for a shorter period of time (28 to 56 d) prior to harvest, and 2) no supplemental vitamin E was provided to cattle receiving AGRADO™ or controls in previous trials.

TBA Analysis. A significant reduction (P<.05) in TBARS accumulation for ground beef from AGRADO™ supplemented steers was evident (Figure 2); values remained much lower throughout the 6-d evaluation period. The TBARS values for ground beef samples indicate that including AGRADO™ in feed for finishing cattle retarded oxidative degradation of muscle tissue during the retail display period.

Sensory Panel. During sensory evaluation of steaks, no significant differences in juiciness, cooked beef fat, overall tenderness, connective tissue, or off flavors were detected between treatment groups. However, the steaks from steers supplemented with AGRADO™ had reduced flavor

intensities. This reduction in flavor intensity, even though both treatments were classified as "slightly intense", supports the TBARS difference noted by Krumsiek and Owens (1998) and earlier with ground beef, indicating that steaks from cattle fed AGRADO™ had a reduced rate of oxidative rancidity during display.

Implications

The decreased TBARS and the decreased flavor intensity support previous findings that rancidity of unsaturated fatty acids of beef is retarded when AGRADO™ is included in the diets of feedlot cattle. Feeding of vitamin E and application of vitamin C to meat will stabilize color and prolong color retention of displayed beef, particularly from Holstein cattle, and appears to retard fat rancidity as well. Retarding oxidative rancidity is important for preventing distasteful meat flavor and would be more important for beef richer in polyunsaturated fatty acids (grass-fed beef; cow beef) where off-flavors of meat can be a major problem. Retarding rancidity also would be more important for cattle that have less saturated depot fat. This would include cattle fed diets supplemented with unsaturated fatty lipids (vegetable oils and blends), certain breeds of cattle (Holstein) whose depot fat is less saturated, and products retained for a longer time prior to sale (as with exported beef). As saturation of lipid also differs with anatomical location, certain meat cuts would be more susceptible to rancidity than others, and ground beef, having greater surface exposure, would be more susceptible to rancidity than intact beef cuts. To meet consumer desires for less saturated fat in meat products, certain segments of the beef industry have a strong interest in producing beef richer in polyunsaturated fatty acids. Because higher amounts of unsaturated fatty acids will increase the potential for rancidity, feed additives to retard rancidity may become necessary.

Literature Cited

Krumsiek C.L. and F.N. Owens. 1998. Okla. Agri. Exp. Sta. Res. Rep. P-965:16.

Wheeler, T.L. et al. 1996 J. Anim. Sci. 74:1853.

Witte, V.C. et al. 1970. J. Food Sci. 30: 582.

Acknowledgments

The authors thank Iliana Pruneda, Kris Novotny, Solutia Inc., St.Louis, MO, Excel Beef, Dodge City, KS, and Continental Beef Research, Lamar, CO, for their cooperation in this project.

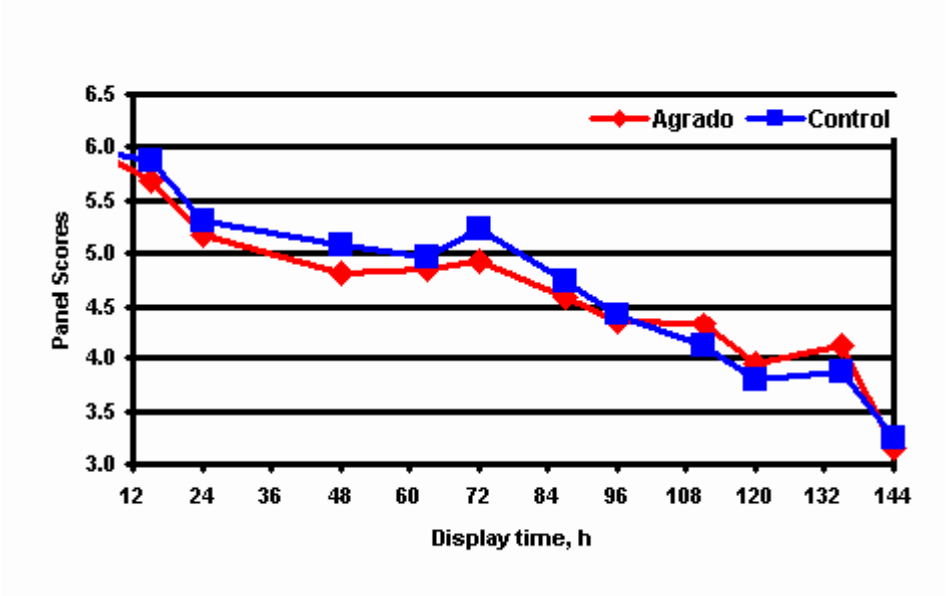

Figure 1. Ground beef lean color scores stratified by treatment and hours of display.

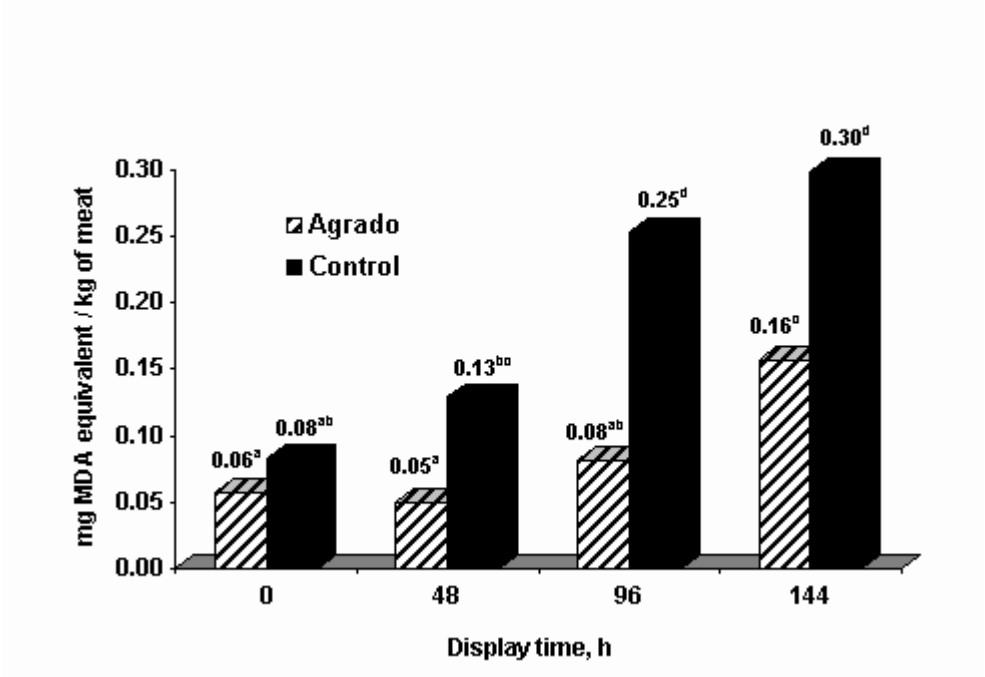

Figure 2. Ground beef TBARS concentrations stratified by treatment and hours on display.

[a,b,c]Means with a common superscript are not different (*P*>.05).