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Agrado™ for Finishing Cattle: Effect on Shelf Life of Beef

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Story in Brief

Seventy-five feedlot cattle in 15 pens were fed high concentrate diets supplemented with either 0 or 136 ppm Agrado (30 and 45 cattle, respectively) for 28 d prior to harvest. Ribeye steaks and ground beef that had been aged 13 d were displayed for 10 d in a cold room to assess the influence of Agrado feeding on meat color retention. Shelf life of both ground beef samples and ribeye steaks was evaluated using visual appraisal by a panel of six people, electronically with a color reflectance meter, and chemically by measuring thiobarbituric acid equivalents (ground beef only). According to visual estimates, shelf life was greater (6 vs 2 d for ground beef; 4 vs 3 d for ribeye steaks) for beef samples obtained from cattle that had been fed Agrado. Agrado appears to be a viable and economical means for cattle producers to feed to extend the shelf life of beef. Agrado should enlarge the time window during which beef will retain desirable visual appeal for consumers.

(Key Words: Cattle, Agrado, Shelf Life, Rancidity, Discoloration.)

Introduction

Feeding vitamin E, an antioxidant, at concentrations 10 to 100 times the amounts required nutritionally has resulted in steaks that exhibited superior lean color, less surface discoloration, more desirable overall appearance, and less lipid oxidation during retail display (Sanders et al., 1997). Unfortunately, vitamin E is rather costly; cost for supplementation is between $3 and $4 per animal. Whether other more economical antioxidants might extend shelf life of fresh beef products has received limited attention. Bartov and Bornstein (1977) found that supplementing ethoxyquin at 75 or 100 mg/kg stabilized abdominal fat and meat of broiler carcasses. Whether Agrado, a chemical mixture that includes ethoxyquin, when fed to animals acts directly as an antioxidant or enhances absorption, activity, or stability of vitamin E is not certain. If Agrado is present in tissue and acts directly or indirectly as an antioxidant, it should reduce metmyoglobin formation and extend the shelf-life of meat products like beef. The object of this study was to determine the impact of feeding Agrado at approximately 150 ppm of the diet on shelf life of beef retail cuts.

Materials and Methods

Carcass Sampling. On June 17, 1997 the 75 cattle used for evaluating Agrado were loaded onto two semitrailer trucks and transported to Excel Inc., Dodge City, KS and harvested. Following exsanguination and hide removal, the animal identification tag was transferred from the ear to the carcasses to maintain identity of each carcass in the meat cooler. A 3-in section from the posterior end of the *Longissimus* muscle (Ribeye) was removed, deboned, and trimmed of excess external fat to form steaks for case life evaluation. This ribeye section, identified with the animal's slaughter order number, was vacuum packaged and transported under refrigeration to Oklahoma State University for processing. These samples were aged at 4°C in the OSU Food Technology and Processing Center in Stillwater, OK for 13 d after harvest prior to preparation of meat cuts.

Meat Preparation. On June 30, 1997, the rib sections were processed for evaluation of case life. Two steaks, 2.5 cm thick, were sliced from each rib section; one of these was packaged in a meat tray containing an absorption pad. Each steak was covered with oxygen permeable, clear wrap. The remaining portion of the ribeye section was ground, first with a 3/8 die and then with a ¼ inch die, using a mechanical meat grinder; samples were composited with ground beef from all other cattle receiving the same treatment. This ground beef was formed into 114-g patties and wrapped in the same manner as the ribeye steaks. Eight patties from each treatment were prepared for the case life study. An additional ten patties were packaged from each

treatment for chemical; these were also vacuum packaged but they were removed from display and frozen each day. Subsequently, these samples were assayed for rancidity by the thiobarbituric acid (TBA) procedure (Witte et al., 1970)

Shelf Life Measurement. The steaks and ground beef were displayed continuously for 10 d in an environment simulating a commercial meat case. This consisted of a continuously lighted cold room. Meat packages were placed on two 1.2 x 1.8 m meat cutting tables. For lighting, eight 3000 Kelvin fluorescent bulbs were held in fixtures suspended above the tables at a distance of about .6 m to provide precisely 150 lumens at the meat surface on all tables. Ambient temperature, monitored continuously, was maintained at 1.1°C except during the defrost cycle that occurred every 8 h when temperature was allowed to rise to 4.4°C for about 5 min. Each day, colors of steaks and ground beef were monitored visually and electronically. For visual appraisal, lean color and discoloration were monitored daily by a six member panel between 8:00 and 9:00 a.m. Lean color and percent discoloration of the ribeyes and ground beef patties were evaluated independently. Steaks were evaluated for color by each panel member using an 8-point discrete scale; steps in this scale represented 1) Extremely Dark Brown or Green, 2) Very Dark Brown, 3) Dark Red or Brown, 4) Moderately Dark Red, 5) Slightly Dark Red, 6) Cherry Red, 7) Moderately Bright Cherry Red, and 8) Bright Cherry Red. Ground beef was evaluated for percent of the surface that was discolored. Colors were evaluated initially when processing and packaging were completed (d 0) and for the next 10 consecutive days. Location of each sample on the table was changed each day to avoid panelists identifying sample by location. One extra ground beef patty from each treatment was removed from display each day, vacuum packaged, and frozen for further analysis.

Statistical Analysis. Means from individual animals (or replicate samples for ground beef) were used for statistical analysis of shelf life data. For shelf life data, measurements on individual meat patties or steaks were averaged across panelists within day for statistical analysis. This means that variation among steaks or beef patties within treatment served as the error term. For all shelf life data, statistical comparisons were calculated within each display day. To appraise relative shelf life, plots of mean values against display day were evaluated visually to approximate the time lag necessary to cause the two curves to overlay each other. Electronic color measurements were also averaged across the three sites within each steak or each meat patty for statistical analysis within each display day. In cases where repeat observations were not available (TBA values and microbial counts for ground beef), values were regressed across display day; slope and intercept of regression lines were compared to appraise treatment effects.

Results and Discussion

Shelf Life Measurements. On the first day after display began, both steaks and ground beef from cattle fed Agrado had less bright red color than steaks from cattle not fed Agrado. But thereafter, color scores were higher (brighter red) for meat from cattle fed Agrado. For steaks, color score reduction was delayed by about 1 d for steaks from cattle fed Agrado. The duller red values initially followed by brighter red values later suggests that Agrado present in the tissues is delaying oxygen uptake and thereby reducing the oxygenation of myoglobin; this in turn will delay deterioration of oxymyoglobin to metmyoglobin and browning. Color differences were much more dramatic for ground beef than for steaks; for ground beef, color deterioration was delayed by 4 to 5 d for cattle fed Agrado (Figure 1). These Visual differences were confirmed by electronic color measurements based on Minolta a* values, an index of redness of an object. With the ground beef, browning typically began in very small area that spread gradually over the total surface. These darkened areas became apparent much sooner and spread was much faster within ground beef patties from steers fed the control diet than for steers receiving Agrado.

Degree of rancidity can be sensed through accumulation of thiobarbituric-like (TBA) substances. The TBA values for ground beef samples (Figure 2) again reflect lower oxidative degradation for beef samples from cattle fed this antioxidant.

In a previous report, including Agrado in the diet for 28 d prior to harvesting feedlot cattle increased rate and efficiency of gain slightly; it reduced lean maturity (ribeye color was brighter) but increased carcass fatness slightly. Flavor, tenderness, juiciness, and overall acceptability of steaks aged 13 d and frozen prior to evaluation by an untrained taste panel were not altered by feeding Agrado.

Implications

Shelf life, the time period before discoloration of steaks and ground beef displayed in a commercial meat case, was extended by adding Agrado to the diet as measured visually by an untrained panel, electronically as measured with a color reflectance meter, and chemically as measured by concentrations of thiobarbituric acid-like substances. Agrado appears useful as a feed additive to extend the shelf life of beef and thereby enlarge the time window during which beef will retain desirable visual and olfactory appeal for beef consumers.

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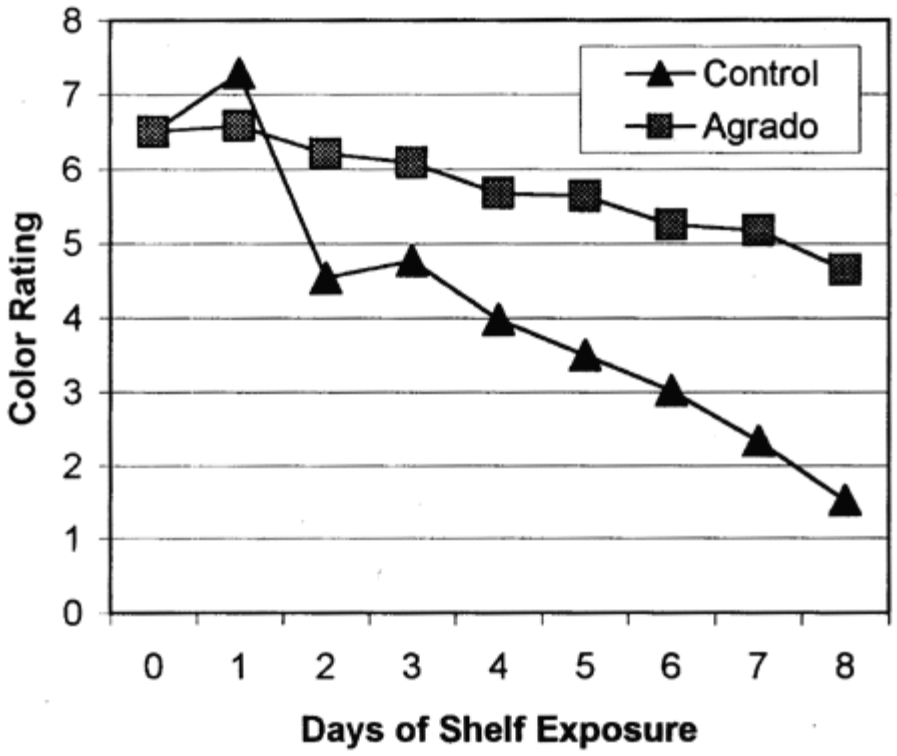

Figure 1. Ground beef color score at various days in the meat case.

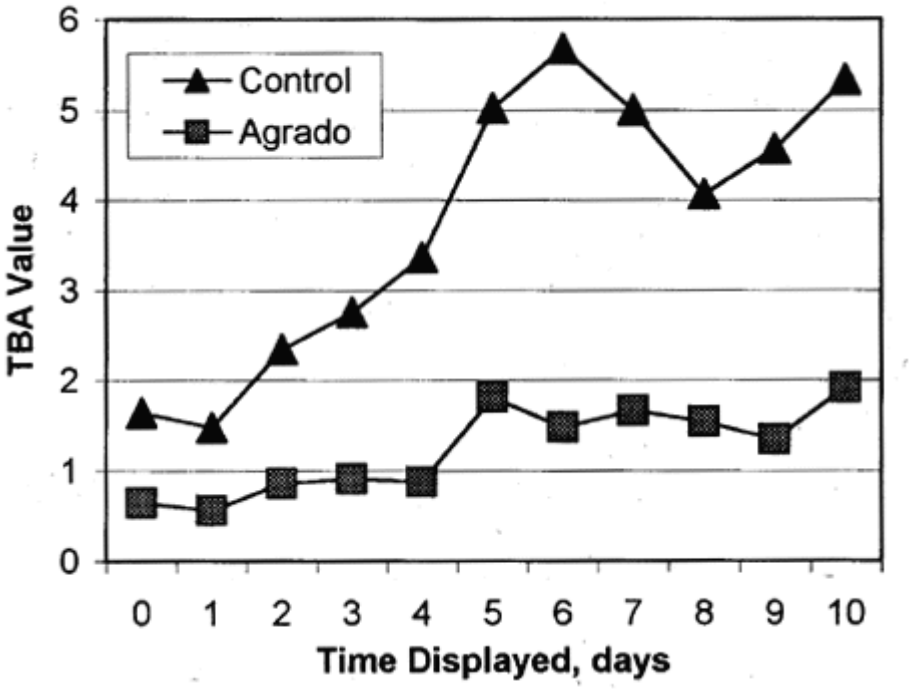

Figure 2. Thiobarbituric acid equivalent concentrations in ground beef @ various days in the meat case.

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