RELATIONSHIP BETWEEN DIETARY FAT SOURCE AND BEEF DISPLAY LIFE

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Abstract – This research aimed to evaluate the effects of feeding different fat sources with modified distillers grains (MDGS) on beef display life. Steers were fed either a corn, 40% full-fat MDGS, 40% de-oiled MDGS, or 38% de-oiled MDGS plus 2% corn oil diet. Results suggest that feeding MDGS increases C18:2 and PUFA content of beef in addition to reducing color and lipid stability. Addition of corn oil to de-oiled MDGS decreased redness and increased discoloration and lipid oxidation in comparison to corn diets.

Key Words – discoloration, fatty acid composition, lipid oxidation.

I. INTRODUCTION

Feeding distillers grains to cattle increases the concentrations of polyunsaturated fatty acids (PUFA) in meat (1). It is well stablished that beef with higher concentrations of PUFA is more likely to have increased lipid and myoglobin oxidation. This is important because lipid and myoglobin oxidation lead to off-flavor development and discoloration of retail-displayed beef, reducing display life (2). The ethanol industry appears to have evolved in removal of oils from distillers grains, reducing its amount of energy per kilogram on a dry matter basis. There is an interest in adding the oil back to cattle diets when the economics support such a move. It is unknown if adding corn oil is equivalent to feed full-fat or de-oiled distillers grains. A deeper understanding of the phenomenon described here could help improve beef shelf-life and the way the animals are fed. Research was conducted to determine the effect on beef display life due to feeding de-oiled modified distillers grains plus solubles (MDGS) with corn oil added back.

II. MATERIALS AND METHODS

Initially, 256 steers were fed for 134 d on either a corn control, 40% full-fat MDGS, 40% de-oiled MDGS, or 38% de-oiled MDGS plus 2% corn oil diet. Cattle were grouped 8 per pen for a total of 32 pens. Twenty four low Choice carcasses (3 head/pen) were randomly selected within each treatment (n=96) and strip loins from both sides were collected and aged at 1°C for 2, 9, 16, or 23 d. After each aging period, loins were fabricated into steaks for fatty acid profile, lipid oxidation, objective color and visual discoloration determination. Steaks were placed on foam trays, overwrapped with oxygen permeable film and placed under retail display (RD) conditions for 4 and 7 d at 3°C. Fatty acid (FA) composition was measured on d 2 samples via gas chromatography (3) with modifications (4, 5). Lipid oxidation was evaluated at all aging periods at 0, 4 and 7 d of RD by the thiobarbituric acid reactive substances (TBARS) protocol (6). Color measures were obtained daily during RD for 7 d using a Minolta CR-400 colorimeter. Visual discoloration was evaluated daily by a five-person panel. A percentage scale was used where 0% meant no discoloration and 100% meant complete surface discoloration. Color data were analyzed as a split-split-plot repeated measures design with dietary treatment as the whole-plot, aging period as the sub-plot and retail display d as the repeated measure. The TBARS data were analyzed as a split-split plot design. Fatty acid composition was analyzed as a completely randomized design. Pen was considered the experimental unit. Data were analyzed using the PROC GLIMMIX procedure of SAS. All means were separated with the LS MEANS statement and the TUKEY adjustment was used with an alpha level of 0.05.

III. RESULTS AND DISCUSSION

Differences were found in the amount of linoleic acid (C18:2), α-linolenic acid (C18:3) and PUFA between dietary treatments. The C18:2 content was lowest for beef from cattle fed corn ($P = 0.0026$) in comparison to all other dietary treatments (406.60 mg/100 g vs. 549.61 mg/100 g for the full-fat MDGS, 555.89 mg/100 g for the de-oiled MDGS, and 565.68 mg/100 g for the de-oiled MDGS plus oil group). The C18:3 content was least for steaks from cattle fed corn (13.59 mg/100 g) and greatest for the de-oiled MDGS plus oil (17.97 mg/100 g). Full-fat MDGS and de-oiled MDGS

had intermediate values (15.99 mg/100 g and 14.05 mg/100 g, respectively) and did not differ from either of the other groups. Beef from cattle fed corn had the lowest amount (P = 0.01) of PUFA (577.41 mg/100 g) in comparison to all other dietary treatments (729.68 mg/100 g for the full-fat MDGS, 731.75 mg/100 g for the de-oiled MDGS, and 751.96 mg/100 g for the de-oiled MDGS plus oil group). A two-way interaction between aging and RD for lipid oxidation was found (P < 0.0001). Increased TBARS values were seen as aging and retail display progressed. Dietary treatment had an effect on lipid oxidation (P = 0.0059). The corn diet had the lowest amount of lipid oxidation (2.27 mg/kg) in comparison to the de-oiled MDGS and de-oiled MDGS plus oil, which had the greatest amounts (2.71 and 2.70 mg/kg, respectively). Full fat MDGS was not statistically different from any other dietary treatment (2.46 mg/kg). For all three color scales, age by retail display time interactions were detected (P < 0.0001). In general, L* values increased and a* and b* values decreased as aging and retail display time increased, regardless the dietary fat source. The L* and b* values were not different among treatments in any of the display periods. Steaks from steers fed de-oiled MDGS had lower a* values when compared to cattle fed corn (P < 0.05) at d 6 and 7 of RD. Steaks from steers fed de-oiled MDGS plus oil had numerically lower a* values when compared to cattle fed corn (P < 0.05) at d 7. A two-way interaction between aging time and retail display for discoloration was observed (P < 0.0001). At all aging periods discoloration increased as retail display time increased, regardless the dietary fat source. A significant decline in purchasing decisions with 20% surface discoloration on retail displayed beef has been reported by Hood et al. (7). The 20% discoloration threshold for steaks aged for 9 d was first met by steaks from the de-oiled MDGS treatment at d 6 of RD, and at d 7 for the de-oiled MDGS plus oil and full fat MDGS treatments. Steaks from animals fed corn that were aged for 9 d had 14.72% discoloration at d 7 and therefore did not reach the discoloration threshold. Steaks aged for 16 d first met the 20% discoloration threshold at d 6 of RD for all dietary treatments. Steaks aged for 23 d first met the discoloration threshold at d 6 of RD for all dietary treatments, except for de-oiled MDGS, which met the discoloration threshold at d 5 of RD. A two-way interaction between treatment and retail display for discoloration was found (P = 0.0006). Steaks from cattle fed de-oiled MDGS had greater discoloration than steaks from cattle fed corn at d 6 and d 7 of RD (41.32% vs 31.39% at d 6, and 65.16% vs 49.82% at d 7, respectively). Steaks from cattle fed de-oiled MDGS plus oil and full fat MDGS tended to have greater discoloration (P < 0.10) than steaks from cattle fed corn at d 7 of RD (58.64% vs 58.06% vs 49.82%, respectively). However, discoloration scores for the de-oiled MDGS plus oil and full fat MDGS treatments did not differ statistically from de-oiled MDGS or corn.

IV. CONCLUSION

Feeding MDGS resulted in increased C18:2 and PUFA content of the meat in comparison to corn finishing diet. Results suggest that with prolonged aging periods and retail display, feeding MDGS to cattle has the potential to reduce color and lipid stability compared to corn and thus reduce shelf life.

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