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Summary

Distillers grains use while wintering on cornstalks during summer grazing and during the finishing period was evaluated to determine the effects of lifetime exposure to distillers grains on meat characteristics. Finishing diets with distillers grains increased discoloration in steaks following six days of retail display for steaks aged seven days, and after four days of retail display for steaks aged 21 days. Supplementation during summer grazing increased discoloration when cattle were not finished using distillers grains. There were no differences in oxidative rancidity among dietary treatments. Supplementing with distillers grains prior to finishing was not additive in impacting the color stability and overall shelf life of retail beef when cattle were finished using distillers grains. However, polyunsaturated fatty acids fed during the backgrounding phase can affect beef quality.

Introduction

Distillers grains plus solubles (DGS) are commonly fed as an energy source replacing corn in beef diets. Previous research has shown that a portion of the corn oil is protected from rumen biohydrogenation (*2007 Nebraska Beef Cattle Report,* pp. 39-42), and there is a linear increase in polyunsaturated fatty acids (PUFA) in the meat as the level of DGS inclusion in finishing diets increased (*2009 Nebraska Beef Cattle Report,* pp.118-119). Increased PUFA resulted in higher oxidation and decreased color stability of the retail beef in as little as three days after being placed in the retail case. (*2008 Nebraska Beef Cattle Report*, pp. 122-123). Decreased color stability is caused by the PUFA being more readily oxidized than the monounsaturated or saturated fatty acids. The increased oxidation results in a decreased retail shelf-life and a potential loss of retail value. Supplementing DGS to cattle backgrounded on cornstalks or grazing pasture throughout a yearling beef production system is economically beneficial (*2014 Nebraska Beef Cattle Report,* pp. 39-42). However, supplementing DGS would increase the total amount of dietary PUFA to which the animal is exposed and there is little research evaluating this effect on the quality of retail beef. The objective of this study was to determine if the feeding of DGS during the backgrounding and grazing periods was cumulative towards increasing discoloration and reducing shelf-life of beef.

Procedure

Heifers (n = 228) were allocated to one of eight dietary treatments in a current study (*2014 Nebraska Beef Cattle Report,* pp. 39-42). Heifers grazed cornstalks during the winter while being supplemented either a high (5 lb DM) or low (2 lb) amount of DGS daily. During the summer grazing period, half of the heifers from each previous treatment either received a DGS supplement at 0.6% of body weight or no DGS supplement. During the finishing phase of the yearling system, the heifers were fed either a 40% DGS (DM basis) or 40% Sweet Bran® based finishing diet (Figure 1). Feeding these two different finishing diets would change the amount of unsaturated fatty acids capable of reaching the small intestine. Strip loins, (11-13 per treatment), were collected and aged for 7 or 21 days. After aging, loins were cut into three 1-inch thick and two ½-inch thick steaks. The same loins were utilized for both the 7 and 21 day aging by vacuum packaging the remainder of the loin following cutting the 7 day aging period steaks. The first 1-inch steak was trimmed of all external fat and frozen at -112°F to avoid oxidation for laboratory analyses of 0 day oxidative rancidity (TBARS). The second and third 1-inch steaks were trimmed to

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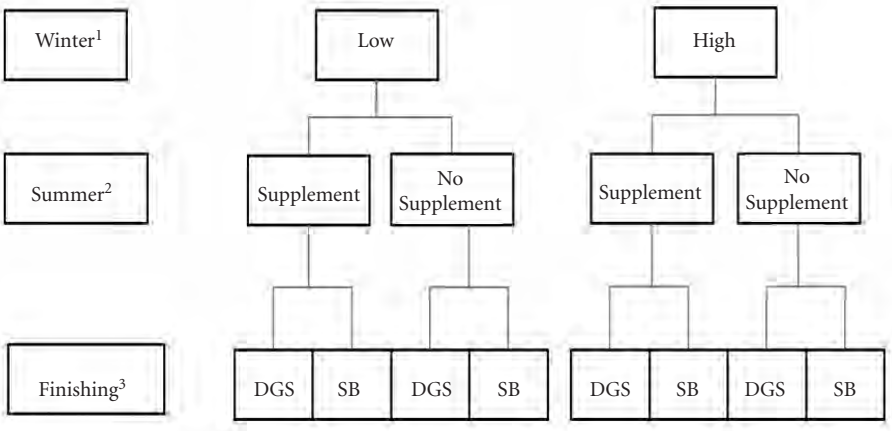


[1]Received 2 lb DM (Low) or 5 lb (High) level of distillers grains supplementation during winter corn stalk grazing period.
[2]Received no supplement (No Suppl) or a distillers grains supplement (Suppl) at 0.6% of body weight during summer grazing period.
[3]Received a finishing diet consisting of either 40% Sweet Bran (SB) or 40% distillers grains (DGS).

Figure 1. Treatments for heifers fed distillers grains throughout a yearling beef production system

Table 1. Effects of summer supplementation and finishing diet on average percent discoloration across 7 days of retail display for strip steaks aged 7 and 21 days from heifers fed distillers grains throughout a yearling beef production system.

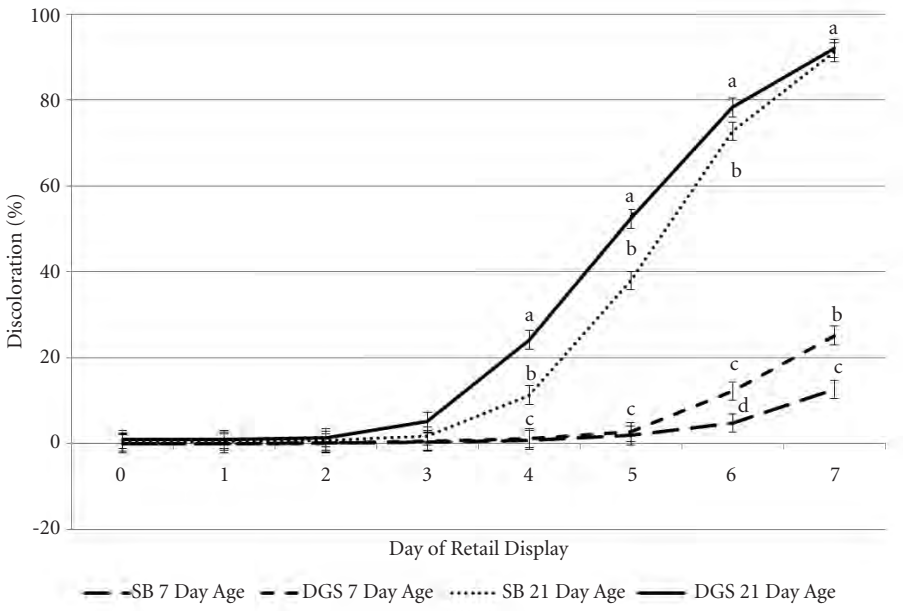
	Sweet Bran[1]		DGS			*P*-value		
	No-Suppl[2]	Suppl	No-Suppl	Suppl	SEM	Summer	Finishing	S x F[3]
Discoloration (%)	12.88[a]	16.73[b]	18.61[c]	18.55[bc]	0.77	0.014	< 0.001	0.014

[a,b,c]Means in the same row having different superscripts are significantly different at $P \leq 0.10$.
[1]Received a finishing diet consisting of either 40% Sweet Bran or 40% distillers grains.
[2]Received no supplement or a distillers grains supplement at 0.6% of body weight during summer grazing period.
[3]Interaction between summer supplementation level and composition of finishing diet.

¼- inch of fat with the second steak being packaged and stored at -4°F for 0 day Warner Bratzler Shear Force (WBSF). The third 1-inch steak and the two ½-inch steaks were then packaged on Styrofoam trays and covered with oxygen-permeable film and placed on table in a cooler maintained at 32-36°F under artificial lighting to simulate retail case display. Visual color evaluations were made by five individuals daily and based on the percent discoloration of the steak from 0% (not discolored) to 100% (completely discolored). Following the fourth day of retail display, one of the ½-inch steaks was vacuum packaged and stored at -4°F for TBARS laboratory analysis. At the conclusion of the seven day retail display simulation, the remaining 1-inch steak was vacuum packaged and stored at -4°F for WBSF and the ½-inch steak for TBARS laboratory analysis. For WBSF analysis, steaks were grilled to 95°F then turned and grilled until they reached 160°F at their center. After cooking, steaks were cooled overnight at 39°F at which point cores (½-inch in diameter) were removed with a drill press parallel to the orientation of the muscle fibers. Then, six cores from each steak were sheared on an Instron Universal Testing Machine with a Warner-Bratzler blade. Laboratory analysis of oxidative rancidity was measured by thiobarbituric acid reactive substances (TBARS) as described by Senaratne et al. (*2009 Nebraska Beef Cattle Report*, pp. 113-115).

Results

Visual color evaluations showed the expected increased rate of discoloration that is associated with aging steaks 21 days versus 7 days ($P < 0.01$) and with retail display days ($P < 0.01$). Within aging period, there was no effect ($P > 0.10$) of finishing diet for the retail days 1-5 for those steaks aged 7 days and days 1-3 for those aged 21 days. However, there was an increased rate of percent discoloration for those feed the DGS ($P < 0.01$) during the finishing phase on days 4, 5, and 6 for the 21-day aged steaks and days 6 and 7 for the 7-day aged steaks (Figure 2). The effect of the finishing diet carries over into the interaction between summer supplementation and the finishing diet (Table 1) where there was a difference in the average steak discoloration between the supplemented and non-supplemented cattle when finished on a Sweet Bran based diet ($P = 0.01$), but no difference between either supplementation strategy when DGS was used in the



[a,b,c]Means in the same day of retail display having different superscripts are significantly different at $P \leq 0.10$.

Figure 2. Effects of finishing diet, retail display, and aging on discoloration of strip steaks from heifers fed distillers grains throughout a yearling beef production system.

Table 2. Effects of retail display and aging on amount of malondialdehyde ppm (mg/kg) (oxidative rancidity) of strip steaks from heifers fed distillers grains throughout a yearling beef production system.

Day of retail display	7-day age	21-day age
0	1.45[a]	2.02[a]
4	3.22[b]	5.33[b]
7	5.96[c]	7.72[c]

[a,b,c]Means in the same column having different superscripts are significantly different at $P \leq 0.10$.

Table 3. Tenderness of steaks from heifers fed distillers grains throughout a yearling beef production system.

	DGS[1]				Sweet Bran								
	Low[2]		High		Low		High			*P*-Value			
	No-Suppl[3]	Suppl	No-Suppl	Suppl	No-Suppl	Suppl	No-Suppl	Suppl	SEM	Winter	Summer	Finish	Int[4]
WBSF, kg	3.09[c]	3.46[a]	3.24[bc]	3.24[bc]	3.38[ab]	3.44[ab]	3.18[bc]	3.36[bc]	0.09	0.167	0.016	0.168	0.052

[a,bc]Means in the same row having different superscripts are significantly different at $P \leq 0.10$. Lower score indicates more tender.
[1]Received a finishing diet consisting of either 40% Sweet Bran or 40% distillers grains.
[2]Received Low (2 lb) or High (5 lb) level of distillers grains supplementation during winter corn stalk grazing period.
[3]Received no supplement or a distillers grains supplement at 0.6% of body weight during summer grazing period.
[4]Winter, summer, and finishing phases interaction.

finishing diet ($P = 0.95$). Thus, feeding DGS prior to the finishing phase was not cumulative in impacting the color stability and overall shelf life of the retail beef when cattle were finished using DGS. When they were finished on Sweet Bran, however, supplementing with DGS during the summer was detrimental to color stability. There was no interaction between winter supplementation and finishing diet for discoloration ($P = 0.39$). The effects of aging ($P < 0.01$), days of retail display ($P < 0.01$), and the interaction of aging and retail display ($P < 0.01$; Table 2) on TBARS correspond to the percent discoloration data; however, there were no significant differences ($P > 0.15$) for oxidation due to any of the dietary treatments. Generally while all samples were relatively tender, cattle supplemented with DGS during the summer were slightly, but significantly, less tender (Table 3) than cattle that were not supplemented ($P = .016$). This effect was most noticeable when cattle were finished on DGS. Although significant, the magnitude of the tenderness is not likely to be meaningful to consumers.

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