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Abstract

We evaluated the effect of varying levels of Dakota Goldï›š-brand dried distiller's grains with solubles (DDGS) on meat quality characteristics including sensory traits and display color stability. Rib cuts from heifers from a 153-day feeding trial were selected randomly so that each level of DDGS had 10 steaks in a seven-day retail display color study, and 10 steaks that were cooked for evaluation by a trained sensory panel. Color reflectance value L* (lightness) exhibited an interaction (P<0.05) between diet and day, as well as a quadratic effect (P<0.05). Diet had no effect on a* (redness) or b* (yellowness) values, but a* and b* for all treatments decreased with longer display (P<0.05). A trained sensory panel detected small but significant (P<0.05) linear improvements in myofibrillar tenderness and overall tenderness as DDGS increased. The effect on sensory traits or display color stability were too small to warrant the feeding of DDGS to improve these traits.

Keywords

Cattlemen's Day, 2002; Kansas Agricultural Experiment Station contribution; no. 02-318-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 890; Beef; Color; Sensory; Dakota Gold dried distiller's grains with solubles

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THE EFFECT OF DAKOTA GOLD®-BRAND DRIED DISTILLER'S GRAINS WITH SOLUBLES OF VARYING LEVELS ON SENSORY AND COLOR CHARACTERISITICS OF RIBEYE STEAKS

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Summary

We evaluated the effect of varying levels of Dakota Gold®-brand dried distiller's grains with solubles (DDGS) on meat quality characteristics including sensory traits and display color stability. Rib cuts from heifers from a 153-day feeding trial were selected randomly so that each level of DDGS had 10 steaks in a seven-day retail display color study, and 10 steaks that were cooked for evaluation by a trained sensory panel. Color reflectance value L* (lightness) exhibited an interaction ($P<0.05$) between diet and day, as well as a quadratic effect ($P<0.05$). Diet had no effect on a* (redness) or b* (yellowness) values, but a* and b* for all treatments decreased with longer display ($P<0.05$). A trained sensory panel detected small but significant ($P<0.05$) linear improvements in myofibrillar tenderness and overall tenderness as DDGS increased. The effect on sensory traits or display color stability were too small to warrant the feeding of DDGS to improve these traits.

(Key Words: Color, Sensory, Dakota Gold Dried Distiller's Grains with Solubles.)

Introduction

Dakota Gold-brand dried distiller's grain with solubles (DDGS) is a corn by-product of alcohol production. Starch has been removed, so fiber, fat, and protein have been concentrated, and it is well suited as an alternative ingredient in typical cereal grain-based diets for finishing cattle. DDGS also contains antioxidants including tocopherols (vitamin E), melanoidin (brown pigments formed during drying) and a unique fatty acid profile. These differences from conventional cattle diets led us to determine if adding Dakota Gold-brand DDGS in varying levels to diets of finishing heifers would impact meat quality attributes such as sensory and display color stability of beef steaks.

Experimental Procedures

Wholesale ribs were taken from heifers fed six different levels of Dakota Gold-brand DDGS (0, 15, 30, 45, 60 and 75%) during a 153-day finishing trial. Sixty rib cuts (10 per diet treatment) were deboned, vacuum packaged, and aged for two weeks. After aging, ribs were cut into six, 1-inch-thick steaks. Steaks for sensory analysis were vacuum packaged and stored at -40º F until used. Steaks for the display study were immediately put onto Styrofoam trays on absorbent Dri-Loc pads, and wrapped in polyvinyl chloride film. Steaks were displayed in a 35ºF case using Philips Ultralume 30 fluorescent lights at 150 foot candles. Reflectance was measured with a HunterLab Miniscan XE Spectrophotometer. CIE L*a*b* values for illuminant A and percent reflectance from 400 to 700 nm at 10 nm increments were measured. Each steak was scanned at three locations on the longissimus dorsi muscle and measurements were averaged. Hue angle, saturation index, and 630/580 nm ratios were calcu-

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lated. Scans were taken at 0, 3, and 7 days, with steaks being rotated around the case twice daily. Digital pictures were taken on day 1 and day 7 for visual comparison.

Sensory analysis was conducted by a professional panel at Kansas State's Sensory Analysis Center. All panelists were oriented twice on flavor, texture, and aroma attributes, which they scored for each steak on an 8 point scale to the nearest 0.5. Steaks were thawed and cooked on a Wells charbroiler to a target internal temperature of 160ºF, measured with internal thermocouples. Steaks were trimmed of external fat, then cut into equal size cubes and assigned a random number. Initially, six steaks were tested per day, each steak representing a treatment, but after two days, panelists evaluated 12 samples a day, with each treatment being represented twice. Panelist's scores were analyzed by SAS using a mixed model for differences among the diets.

Results and Discussion

Color is the first quality element that a consumer observes. It may be the sole motive behind the purchase of one steak over another. Ideally, the heme pigment in a steak is in the oxymyoglobin form and is visually perceived to be a bright cherry red color. If oxidation occurs, metmyoglobin, a brown pigment, forms, and the steak will be perceived as being of less desirable quality. Oxygen, lipid oxidation, presence of antioxidants, and microbial contamination can all effect which pigment is observed. We used the CIE L*a*b* instrumental color system to measure color change over time (Table 1). The L* value (lightness) exhibited a treatment by day interaction ($P<0.05$) with a quadratic effect ($P<0.05$). A dietary effect was not found for a*(redness) or b*(yellowness), but these decreased with longer display ($P<0.05$). Over the 7-day display period, steaks slowly turned less red, which is the usual pattern of discoloration. Hue angle was not affected by diet ($P>0.05$), but the increase with longer display confirms the discoloration.

Trained sensory panel evaluation found differences ($P<0.05$), in myofibrillar tenderness and overall tenderness (Table 2). Myofibrillar tenderness showed a linear improvement as DDGS increased ($P<0.05$). Overall tenderness showed a similar linear trend. Other sensory attributes—connective tissue amount, juiciness, flavor intensity, and off flavor intensity—were not different ($P>0.05$). As none of these levels of Dakota Gold-brand DDGS had an effect on fat oxidation as measured by thiobarbituric acid reactive substances (TBARS), the lack of consistent flavor differences was expected ($P>0.05$). Neither were there differences due to DDGS levels in other off flavors, such as metallic, rancid oil, organ, sour, serumy, earthy, and grassy. Our panelists are trained to detect differences the average consumer would not be able to detect. Therefore, the small improvements we observed in sensory traits and display characteristics are too small to warrant feeding DDGS on that basis alone.

Table 1. Color Data for Steaks In a 7-Day Retail Display Study

	Dried Distiller's Grains with Solubles[a]								
Item	0%	15%	30%	45%	60%	75%	SEM	Linear	Quadratic
Day 0									
L*[1]	45.7	45.8	46.9	45.7	45.0	44.0	0.86	0.13	0.02
a*[2]	31.9	32.3	31.9	32.7	32.1	31.9	1.06	0.17	0.28
b*[2]	24.1	24.7	24.4	25.4	24.4	23.8	0.74	0.53	0.47
Saturation[2]	39.9	40.7	40.1	41.4	40.3	39.8	1.18	0.24	0.32
Hue Angle[2]	37.5	37.4	37.4	37.7	37.4	36.6	1.42	0.06	0.32
630/580[2]	6.2	6.4	6.2	6.5	6.4	6.6	0.30	0.80	0.10
Day 3									
L*[1]	45.0	45.2	46.1	45.5	45.3	43.0	0.86	0.13	0.02
a*[2]	28.0	29.0	27.1	27.0	26.5	28.3	1.06	0.17	0.28
b*[2]	21.2	22.0	20.9	20.9	20.4	21.8	0.74	0.53	0.47
Saturation[2]	35.1	36.4	34.2	34.2	33.5	35.7	1.18	0.24	0.32
Hue Angle[2]	37.4	37.2	37.4	36.7	37.5	37.2	1.42	0.06	0.32
630/580[2]	4.6	4.8	4.3	4.2	4.1	4.9	0.30	0.80	0.10
Day 7									
L*[1]	44.6	44.8	46.0	45.7	45.4	42.9	0.86	0.13	0.02
a*[2]	19.5	18.8	17.6	16.3	15.0	16.9	1.06	0.17	0.28
b*[2]	16.3	15.6	15.9	15.1	14.6	16.1	0.74	0.53	0.47
Saturation[2]	25.5	24.4	23.8	22.3	21.0	23.5	1.18	0.24	0.32
Hue Angle[2]	41.5	40.4	42.0	41.8	44.2	44.6	1.42	0.06	0.32
630/580[2]	2.6	2.5	2.2	2.0	1.8	2.3	0.30	0.80	0.10

[a]Dakota Gold-brand dried distillers grains with solubles.
[1]Diet × Day interaction (P<0.05).
[2]Day interaction (P<0.05).

Table 2. Sensory Panel Evaluations of Ribeye Steaks from Heifers Fed Diets Containing Varying Levels of Dakota Gold Brand DDGS

	Dried Distiller's Grains with Solubles[1]								
Items[2]	0%	15%	30%	45%	60%	75%	SEM	Linear	Quadratic
Myofibrillar Tenderness	6.35[c]	6.58[ab]	6.43[b]	6.64[ab]	6.74[a]	6.62[ab]	0.100	0.008	0.330
Juiciness	6.22	6.18	6.26	6.35	6.33	6.28	0.120	0.225	0.583
Flavor Intensity	6.42	6.61	6.51	6.65	6.68	6.50	0.100	0.199	0.033
Connective Tissue Amount	6.93	7.19	7.11	7.11	7.16	7.17	0.090	0.076	0.226
Overall Tenderness	6.26[b]	6.72[a]	6.55[a]	6.66[a]	6.76[a]	6.76[a]	0.110	0.001	0.135
Off-Flavor Intensity	7.70	7.67	7.57	7.66	7.68	7.54	0.090	0.155	0.948
TBARS[3]	0.06	0.07	0.07	0.07	0.07	0.07	0.004		

[1]Dakota Gold-brand dried distillers grains with solubles.
[2]1=extrememly tough, dry, bland, abundant connective tissue, extremely tough, or intense; 8=extremely tender, juicy, intense, no connective tissue, tender, none.
[3]Thiobarbituric acid reactive substance, expressed as ppm of malonaldehyde.
[a,b]Means within same row without common superscript are different (P<0.05).