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Wet Distillers Grains Diets Supplemented with Vitamin E Affect Sensory Attributes of Beef *m. longissimus lumborum*

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Summary

The effects of feeding 0% or 40% wet distillers grains plus distillers solubles (WDGS) with or without vitamin E (E) supplementation on sensory attributes (tenderness, juiciness, connective tissue content, and off-flavor intensity) of 7-day and 28-day aged beef strip steaks during retail display were investigated by a trained panel. Feeding WDGS or E did not influence tenderness, juiciness, or connective tissue ratings. However, feeding WDGS significantly increased the off-flavor intensity of 7-day aged beef following retail display. Feeding WDGS increased the incidence of livery off-flavor. The protective ability of vitamin E supplementation against livery flavor production was significant in beef aged 28 days. Therefore, feeding WDGS increased livery and off-flavor intensities and vitamin E supplementation helped to reduce livery flavor when steaks were aged for 28 days.

Introduction

Feeding wet distillers grain plus solubles (WDGS) increases levels of polyunsaturated fatty acids (PUFA) in beef (de Mello et al., 2008 *Nebraska Beef Report*, pp. 108-109; Senaratne et al., 2009 *Nebraska Beef Report*, pp. 110-112). Increased PUFA in beef can have detrimental effects on sensory attributes of beef, such as discoloration and off-flavor production during retail display. Bright redness of beef is the indicator of freshness to consumers. Also, due to elevated levels of PUFA in beef, lipid and myoglobin are rapidly oxidized and subsequently deteriorate beef color and flavor profile.

Dietary vitamin E supplementation to cattle prior to slaughter is an

effective strategy to control color and lipid oxidation of beef during retail display. Parallel studies with this meat also proved that dietary vitamin E supplementation mitigates increased lipid oxidation and color deterioration during retail display of aged beef due to WDG and distillers soluble feeding (Senaratne et al., 2009 *Nebraska Beef Report*, pp. 113-115 and 116-117). The purpose of this study was to evaluate effects of vitamin E supplementation on sensory attributes of short- and long-term aged beef during retail display from cattle fed WDGS diets.

Procedure

Thirty-six strip loins (*m. longissimus lumborum*; IMPS # 1180A; NAMP, 2007) used for this study were from a subset of strip loins (both USDA Choice and Select grades) from the study described by Senaratne et al. (2009 *Nebraska Beef Report*, pp. 110-112). Strip loins from animals fed 0 and 40% WDGS with or without vitamin E diets were selected. Two 1-inch thick steaks were removed from each strip loin after 7 and 28 days of aging at 32 to 36°F. The first steak was immediately vacuum-packaged and stored at -4°F to use as the 0 day retail displayed sample. The second steak was overwrapped with an oxygen permeable polyvinyl chloride film and placed on a table in a cooler at 0 to 36°F under continuous 1000 to 1800 lux warm white fluorescent lighting to provide simulated retail display conditions. After 7 days of retail display, steaks were removed from simulated retail display conditions, vacuum-packaged, and stored at -4°F until they were used as the 7 day retail displayed samples for the taste evaluation.

Steaks from 0- and 7-day retail display were thawed for 24 hours at 39°F. Thawed steaks were grilled on a Hamilton Beach indoor-outdoor grill, turning over once at 95°F, until

they reached an internal temperature of 160°F. Internal temperature was monitored using an OMEGA thermometer with a type T thermocouple. Cooked steaks were kept warm in a countertop warmer prior to cubing not more than 15 minutes before serving. Steaks were cubed into 0.5 × 0.5 × 1 in pieces using a plexiglass sample sizer. During taste panel sessions, panelists were allocated to individual ventilated booths lighted with red fluorescent lights to remove visual differences among steak pieces. At each taste panel session, panelists evaluated 8 samples (2 from each dietary treatment) served in random order. Each sample was evaluated based on 8-point hedonic scales for tenderness; juiciness (8 = extremely desirable; 7 = very desirable; 6 = moderately desirable; 5 = slightly desirable; 4 = slightly undesirable; 3 = moderately undesirable; 2 = very undesirable; 1 = extremely undesirable); connective tissue (8 = none; 7 = trace amount; 6 = slight amount; 5 = small amount; 4 = modest amount; 3 = moderate amount; 2 = slightly abundant; 1 = abundant amount); and off-flavor intensity (8 = extremely intense; 7 = very intense; 6 = moderately intense; 5 = slightly intense; 4 = slightly mild; 3 = moderately mild; 2 = very mild; 1 = extremely mild). Panelists evaluated the presence or absence of off-flavors (metallic, sour, oxidized, livery, bitter, and charred) in each sample.

Taste panel data were analyzed using analysis of variance (ANOVA) in the GLIMMIX procedure of SAS as a 2 × 2 factorial design (2 levels of vitamin E: with and without and 2 levels of WDGS: 0% and 40%) for 2 aging periods and retail display days separately. Least square means were calculated using LSMEANS of SAS and mean separation was conducted using DIFF and LINES of SAS at the

(Continued on next page)

Table 1. Least square means of taste panel rating of 7- and 28-day aged strip loin (*m. longissimus lumborum*) from cattle fed different dietary regimes after 0 and 7 days of retail display.

	Retail display (d)	Supplemented with E		Non-supplemented with E		SEM	P-values		
		0 WDGS	40 WDGS	0 WDGS	40 WDGS		E	WDGS	E × WDGS
7-day aged									
Tenderness	0	5.90	5.59	5.66	5.68	0.15	0.59	0.31	0.27
	7	5.87	6.04	6.31	5.97	0.14	0.21	0.52	0.10
Connective tissue	0	5.32	5.16	5.14	5.23	0.15	0.72	0.79	0.40
	7	5.46	5.62	5.68	5.48	0.15	0.76	0.85	0.23
Juiciness	0	5.19	5.10	5.09	4.88	0.12	0.17	0.20	0.58
	7	4.98	5.14	5.32	5.15	0.12	0.16	0.96	0.18
Off-flavors	0	2.17	2.41	2.33	2.35	0.07	0.48	0.05	0.16
	7	2.37	2.36	2.36	2.55	0.08	0.26	0.26	0.22
28-day aged									
Tenderness	0	6.37	6.23	6.42	6.47	0.12	0.22	0.68	0.40
	7	6.56	6.22	6.20	6.36	0.12	0.35	0.45	0.06
Connective tissue	0	5.86	5.83	5.99	5.72	0.13	0.90	0.27	0.37
	7	6.09	5.69	5.85	5.84	0.12	0.69	0.12	0.12
Juiciness	0	5.18	5.21	5.53	5.25	0.11	0.11	0.28	0.22
	7	5.27	5.16	5.21	5.18	0.11	0.86	0.56	0.67
Off-flavors	0	2.66	2.61	2.55	2.51	0.10	0.32	0.66	0.99
	7	2.73	2.98	2.98	3.10	0.12	0.12	0.14	0.55

WDGS = wet distillers grains plus distillers soluble; 0 and 40% on DM basis.
E = vitamin E.

significance levels of $P \leq 0.05$.

Results

Neither vitamin E supplementation, WDGS nor their combination significantly affected tenderness, connective tissue content, and juiciness ratings of 7- and 28- day aged steaks after 0 and 7 days of retail display (Table 1). There were no significant differences in off-flavor ratings, except for samples from cattle fed 40% WDGS without vitamin E following 7 days of retail display. These trends, though significant ($P = 0.12$ to 0.26), followed the results for frequency of livery flavor, in which samples from cattle fed WDGS had the highest numerical frequency of livery off-flavor scores following retail display, which was significant after 7 days of aging (Figure 1a; $P < 0.05$), and fol-

lowed the same trend after 28 days of aging (Figure 1b; $P = 0.03$). A parallel study with this meat documented that WDG feeding increases level of polyunsaturated fatty acids (PUFA) (2009 *Nebraska Beef Report*, pp. 110-112). Furthermore, mineral analysis of this meat described by Senaratne et al. (2010 *Nebraska Beef Report*, pp. 104-106) showed that inclusion of distillers solubles in the diet increased the level of Fe, which can act as a transitional metal ion in inducing lipid oxidation. Therefore, increased levels of PUFA and Fe may cause production of off-flavor compounds in beef from animals fed WDGS diets, compared to corn diets. In addition, Senaratne et al. (2009 *Nebraska Beef Report*, pp. 113-115 and 116-117) showed that vitamin E supplementation to cattle significantly reduced lipid oxidation and discoloration of beef. There were

no significant effects of vitamin E supplementation, WDGS, or their interaction on frequency scores of metallic, sour, oxidized, bitter, and charred off-flavors in strip steaks of both aging and retail display groups by the panelists (data not shown).

These data suggest that feeding WDGS may compromise the flavor stability of beef, especially following a period of retail display, and that feeding vitamin E provides some protective effect against these changes. The beneficial effect of E appears strongest when beef is aged 28 days.

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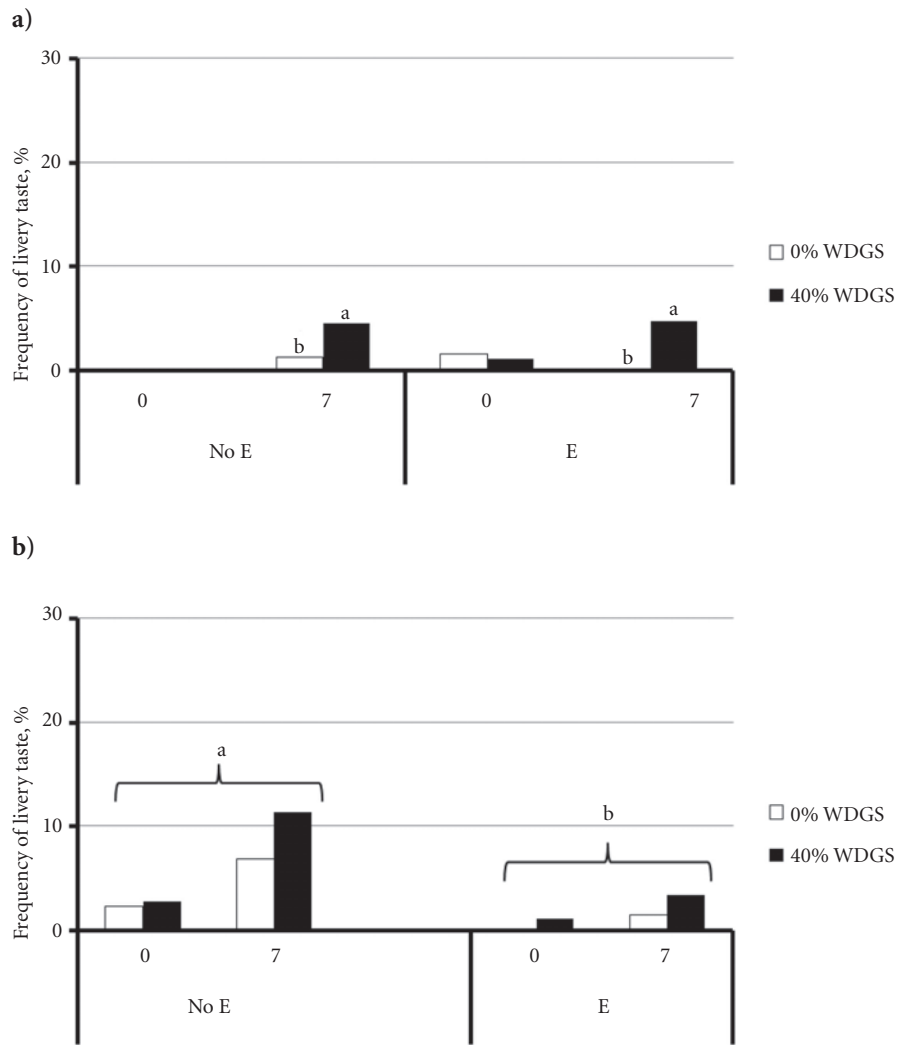


Figure 1. Frequency of livery flavor identified by panelists of a) 7-day aged and b) 28-day aged strip loin (*m. longissimus lumborum*) steaks from animals fed diets containing 0%, 40% WDGS with or without E supplementation during simulated retail display conditions.
^{a,b}Means in the same graph with different superscripts significantly differ ($P \leq 0.05$).