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Abstract

Approximately 16% of cattle slaughtered in the United States are cows. When these cows are removed from the herd, they are typically in thin condition. Steaks from these cows are considered tougher than those from young steers and heifers but could potentially be improved with alternative management practices, such as high concentrate feeding. Feeding high-concentrate diets, implanting, and feeding β-agonists prior to harvest have been shown to improve performance and carcass meat yields. However, the effect on steak tenderness of feeding Zilmax (zilpaterol hydrochloride; Intervet Inc., Millsboro, DE) to mature cows is unknown. Therefore, the objective of this study was to determine the effects of concentrate feeding, implanting, and feeding Zilmax on tenderness of strip loin and knuckle steaks from cull cows fed for 70 days.

Keywords

Cattlemen's Day, 2009; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1010; Kansas Agricultural Experiment Station contribution ; no. 09-168-S; Beef; Cattle; Steak tenderness

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Management Practices Affect Tenderness of Strip Loin but Not Knuckle Steaks from Fed Mature Cows[1]

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Introduction

Approximately 16% of cattle slaughtered in the United States are cows. When these cows are removed from the herd, they are typically in thin condition. Steaks from these cows are considered tougher than those from young steers and heifers but could potentially be improved with alternative management practices, such as high-concentrate feeding. Feeding high-concentrate diets, implanting, and feeding β-agonists prior to harvest have been shown to improve performance and carcass meat yields. However, the effect on steak tenderness of feeding Zilmax (zilpaterol hydrochloride; Intervet Inc., Millsboro, DE) to mature cows is unknown. Therefore, the objective of this study was to determine the effects of concentrate feeding, implanting, and feeding Zilmax on tenderness of strip loin and knuckle steaks from cull cows fed for 70 days.

Experimental Procedures

Sixty cull cows were assigned to one of five treatments: (1) grass fed on pasture (G), (2) concentrate fed (C) a grain sorghum-sorghum silage diet, (3) concentrate fed and implanted (CI) with Revalor-200 (200 mg of trenbolone acetate and 20 mg of estradiol; Intervet Inc.), (4) concentrate fed and fed Zilmax beginning on day 38 of the feeding period for 30 days followed by a 3-day withdrawal (CZ), and (5) concentrate fed, implanted, and fed Zilmax (CIZ). Cattle were fed for 70 days before slaughter and carcass data collection. Implanted cows were implanted on day 0 in the right ear with Revalor-200 per the manufacturer's instructions. Zilmax was fed at the end of the feeding period for 30 days prior to a required 3-day withdrawal before harvest. Seven cows were removed from the study because of health, pregnancy, or death. Removal was not related to treatment.

Cattle were humanely harvested at a commercial abattoir, where left sides were fabricated into boneless, closely-trimmed subprimal cuts according to guidelines of the North American Meat Processors Association (NAMP, 2006) approximately 72 hours postmortem. Steaks were cut from the strip loin and knuckle subprimals after aging in a vacuum package for 14 days. Two steaks from each subprimal were randomly assigned to Warner-Bratzler shear force (WBSF) testing and sensory panel evaluation. Steaks were weighed prior to cooking, cooked to an internal temperature of 104° F, turned, and cooked to a final internal temperature of 158° F. Following a 30-minute cooling period, steaks were reweighed to determine cooking loss percentages. Steaks were chilled at 32° F overnight, and eight 0.5-in.-diameter cores were removed parallel to the muscle fiber direction for WBSF determination using the Instron Universal Testing Machine

[1] Funded by the Beef Checkoff

with a 110-lb compression load cell and a crosshead speed of 9.84 in./minute. Sensory steaks were thawed in a refrigerator for 24 hours and cooked according to the procedures described previously. Following cooking, steaks were cut into 0.5 × 0.5 × 1-in. pieces for evaluation by a trained seven-member sensory panel. Steaks were scored on a scale of 1 to 8 for tenderness, flavor, juiciness, connective tissue content, and off-flavor intensity, where 8 = extremely tender, extremely intense, extremely juicy, none, none and 1 = extremely tough, extremely bland, extremely dry, abundant, abundant, respectively.

Data were analyzed as a completely randomized design by using the MIXED procedure of SAS. The model statement contained the respective response variables and treatment. Means were separated ($P<0.05$) by using the least significant difference procedure when the respective F-tests were significant ($P\leq0.05$).

Results and Discussion

Sensory panelists scored strip loin steaks from CIZ cows lower ($P<0.05$; tougher) for myofibrillar tenderness than steaks from CI, C, and G cows (Table 1). In addition, steaks from CZ cows received lower ($P<0.05$) scores than steaks from C and G cows. No differences were noted for juiciness or beef flavor among treatments. The amount of detectable connective tissue scored by sensory panelists was greater ($P<0.05$; lower score) for strip loin steaks from CIZ cows than for steaks from CI, C, and G cows. Steaks from CZ cows received lower ($P<0.05$) scores for detectable connective tissue than steaks from C cows. Sensory panelists scored strip loin steaks from CIZ cows lower ($P<0.05$; tougher) for overall tenderness than those from CI, C, and G cows, and steaks from CZ cows were scored lower ($P<0.05$) than steaks from C and G cows. Off-flavors were highest ($P<0.05$) for steaks from G cows. Strip loin WBSF values were highest ($P<0.05$; tougher) for steaks from CIZ cows than for steaks from cows in all other treatments. The WBSF values of steaks from the CZ cows were higher ($P<0.05$) than those of steaks from C, G, and CI cows. Cooking losses for strip steaks were similar ($P>0.05$) among all treatments.

Sensory panelists did not find any differences ($P>0.05$) in myofibrillar tenderness, connective tissue amount, or overall tenderness of knuckle steaks due to treatment (Table 2). However, steaks from CI cows were less juicy ($P<0.05$; lower score) than steaks from C and G cows. Beef flavor was scored higher ($P<0.05$) for steaks from the CI and G cows than for steaks from CIZ and CZ cows. A treatment difference trend ($P=0.07$) was observed by sensory panelists for off-flavor of knuckle steaks, with steaks from G cows having the most detectable off-flavor. Knuckle steaks from all treatments had similar ($P>0.05$) WBSF values and cooking losses.

Implications

A combination of concentrate feeding, implanting, and feeding Zilmax offers an opportunity to increase boneless, subprimal meat yields but would be expected to decrease tenderness of strip loin but not knuckle steaks from fed mature cows. All cow treatments resulted in steaks that were rated slightly tough to slightly tender. Therefore, postmortem tenderization protocols might be needed for all treatments to assure acceptable tenderness ratings.

Table 1. Sensory panel traits, Warner-Bratzler shear force (WBSF), and cooking loss means for steaks from the strip loin

	Treatments[1]						
Trait	CI	CIZ	CZ	C	G	SE	P-value
Myofibrillar tenderness[2]	4.5^{ab}	3.7^{c}	4.0^{bc}	5.1^{a}	4.9^{a}	0.26	<0.01
Juiciness[3]	5.3	5.6	5.5	5.5	5.6	0.13	0.36
Beef flavor[4]	5.6	5.4	5.6	5.6	5.4	0.10	0.34
Connective tissue[5]	5.8^{ab}	5.0^{c}	5.4^{bc}	6.1^{a}	5.8^{ab}	0.23	0.01
Overall tenderness[2]	4.7^{ab}	3.8^{c}	4.2^{bc}	5.3^{a}	4.9^{a}	0.25	<0.01
Off-flavor[6]	7.6^{a}	7.5^{a}	7.4^{a}	7.3^{a}	6.9^{b}	0.15	0.02
WBSF, lb	9.8^{c}	14.7^{a}	12.1^{b}	9.1^{c}	9.9^{c}	0.72	<0.01
Cooking losses, %	25.3	25.6	26.4	26.3	22.9	1.20	0.26

1 CI = fed concentrate and implanted with Revalor-200; CIZ = fed concentrate, implanted with Revalor-200, and fed Zilmax for 30 days before slaughter; CZ = fed concentrate and fed Zilmax; C = fed concentrate; G = grazed native pasture.
2 Scale: 8 = extremely tender, 1 = extremely tough.
3 Scale: 8 = extremely juicy, 1 = extremely dry.
4 Scale: 8 = extremely intense, 1 = extremely bland.
5 Scale: 8 = none, 1 = abundant.
6 Sale: 8 = none, 1 = extremely intense.
abc Within a row, means without a common superscript letter differ (P<0.05).

Table 2. Sensory panel traits, Warner-Bratzler shear force (WBSF), and cooking loss means for steaks from the knuckle

	Treatments[1]						
Trait	CI	CIZ	CZ	C	G	SE	P-value
Myofibrillar tenderness[2]	4.7	4.7	4.4	4.7	4.1	0.25	0.33
Juiciness[3]	5.0^{b}	5.3^{ab}	5.3^{ab}	5.4^{a}	5.6^{a}	0.17	0.04
Beef flavor[4]	5.9^{a}	5.4^{b}	5.4^{b}	5.5^{ab}	5.7^{a}	0.07	<0.01
Connective tissue[5]	5.9	5.7	5.6	5.3	5.3	0.21	0.13
Overall tenderness[2]	4.9	4.8	4.5	4.7	4.2	0.25	0.19
Off-flavor[6]	7.4	7.6	7.4	7.4	7.1	0.12	0.07
WBSF, lb	9.9	12.2	12.3	11.3	11.4	1.10	0.37
Cooking losses, %	30.9	32.0	31.7	32.7	29.3	2.30	0.82

1 CI = fed concentrate and implanted with Revalor-200; CIZ = fed concentrate, implanted with Revalor-200, and fed Zilmax for 30 days before slaughter; CZ = fed concentrate and fed Zilmax; C = fed concentrate; G = grazed native pasture.
2 Scale: 8 = extremely tender, 1 = extremely tough.
3 Scale: 8 = extremely juicy, 1 = extremely dry.
4 Scale: 8 = extremely intense, 1 = extremely bland.
5 Scale: 8 = none, 1 = abundant.
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ab Within a row, means without a common superscript letter differ (P<0.05).