2014

The Effects of Diet and Cooler Aging on Specific Flavor Notes in Beef

Kimberly A. Varnold
University of Nebraska–Lincoln

Chris R. Calkins
University of Nebraska–Lincoln, ccalkins1@unl.edu

Rhonda K. Miller Miller
Texas A&M University

Galen E. Erickson
University of Nebraska–Lincoln, gerickson4@unl.edu

The Effects of Diet and Cooler Aging on Specific Flavor Notes in Beef

Kimberly A. Varnold
Chris R. Calkins
Rhonda K. Miller
Galen E. Erickson[1]

Summary

Crossbred steers (n = 64) were grazed on warm- or cool-season grass-dominated pastures, without or with energy supplementation of wet distillers grains with solubles (WDGS), and were finished on a corn-based diet with or without 35% WDGS. Finishing on corn increased desirable flavor notes and decreased undesirable flavor notes in both L. dorsi *and* B. femoris *steaks. In addition, grazing on warm-season grasses increased the prevalence of undesirable flavors but was often dissipated by the addition WDGS supplementation. Longer aging periods tended to increase the prevalence of undesirable flavors, especially in* B. femoris *steaks. It is recommended producers provide WDGS supplementation, especially when grazing on warm-season grasses, and finish on an all corn diet in order to create a favorable flavor palate.*

Introduction

Flavor is an important attribute when describing beef desirability. Beef flavor is not made up of just one element but of many different flavor notes combined. Specific flavor notes in beef can be changed by the diet fed to cattle and by the amount of time the meat is aged.

Jenschke et al. (*Journal of Animal Science*, 2008, 86:949-959) found that when low levels of alfalfa are fed, the prevalence of a bloody flavor becomes stronger. Senaratne et al. (*2010 Nebraska Beef Cattle Report*, pp. 101-103) showed a higher degree of liver and/or off-flavor in meat from cattle fed wet distillers grains with solubles as opposed to corn. These differences were only found after the meat had been aged in a retail display for seven days, showing that aging periods also may play a role in flavor development.

The objective of this study was to evaluate how beef flavor notes are affected in two different muscles from cattle grazing different forages post-weaning, with or without supplement, finished on either corn or 35% wet distillers grains plus solubles (WDGS) diet, and aged for 7 or 28 days.

Procedure

Crossbred steers (n = 64) were allowed to graze from April 17, 2012, until Oct. 10, 2012, (177 days) on warm-season grasses at the Barta Brothers Ranch in the Eastern Sandhills of Nebraska or on cool-season pastures near Ithaca, Neb., without or with energy supplementation of WDGS (0.6% BW/ day). After the grazing period, cattle were finished on a corn-based diet with or without 35% WDGS for 119 days to an average live weight of 1,427 lb. Cattle were harvested at Greater Omaha Packing, Co. in Omaha, Neb.

Six carcasses from each treatment (n = 48) that graded USDA Choice or Select were identified and *Longissimus dorsi (L. dorsi)* and *Biceps femoris* (*B. femoris*) muscles from each side of each carcass were collected and aged under vacuum for 7 and 28 days. Upon fabrication, one steak was cut from each subprimal, placed on a Styrofoam tray, wrapped with oxygen-permeable overwrap film, and placed under simulated retail display for seven days. At the end of retail display, steaks were vacuumed packaged and frozen until further use in flavor lexicon taste panels at Texas A&M University.

All lexicon panels were approved by the Institutional Review Board. An expert, trained descriptive attribute sensory panel with over 23 cumulative years of experience in evaluating beef flavor and aromas was used. The panel underwent ballot development, training, and validation sessions to assure consistent rating and identification of individual aroma and flavor attributes.

During training and testing, steaks were cooked on a Hamilton Beach Health Smart® grill (model 31605A, Hamilton Beach/Proctor-Silex, Inc., Southern Pines, N.C.) to an internal temperature of 70°F. Aromas and flavor aromatics were evaluated using the Spectrum® Universal 16-point scale where 0 = none and 15 = extremely intense. Traits evaluated were browned, bloody, fat, metal, liver, green hay, umami, overly sweet, sweet, sour, salty, bitter, sour aroma, barnyard, burnt, heated oil, chemical, apricot, asparagus, cumin, floral, beet, chocolate, green grass, musty, medicinal, petroleum, smoked/charred, smoked wood, spoiled, dairy, buttery, cooked milk, sour milk, refrigerator stale, warmed over, soapy, painty, fishy, and cardboardy. Browned, fat, umami, sweet, salty, chocolate, smoked wood, and buttery were considered desirable flavors and the others were considered undesirable.

Data were analyzed using the Mixed procedure in SAS (SAS Institute, Inc., Cary, N.C.) with differences determined at $P \leq 0.05$. Whenever there was a three- or four-way interaction, the LSmeans were reanalyzed using the GLIMMIX procedure with the slicediff option in order to more accurately study differences.

Results

Lexicon scores for *L. dorsi* steaks had two significant ($P \leq 0.04$) three-way interactions — grass type, finishing diet, and aging period — for fat scores and supplementation, diet, and aging period for bloody scores.

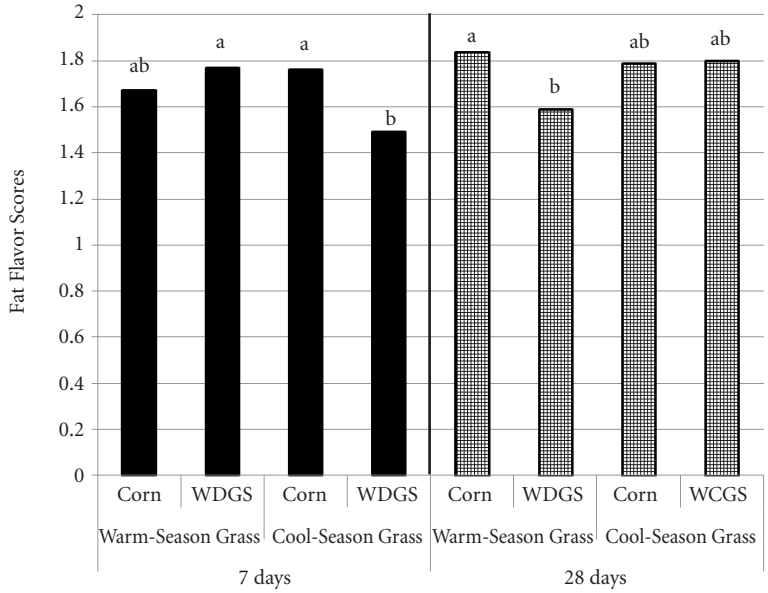
(Continued on next page)

At seven days aging, the prevalence of fat flavor was weaker ($P = 0.02$) when cattle were grazed on cool-season grasses and finished on WDGS than when they were grazed on cool-season grasses and finished on corn or grazed on warm-season grasses and finished on WDGS (Figure 1). Conversely, when the meat was aged for 28 days, meat from cattle grazed on warm-season grasses had a stronger fat flavor when finished on corn instead of WDGS, with no differences within cool-season grass grazing.

For bloody flavor, of seven-day aged *L. dorsi* steaks, not supplementing and finishing on WDGS caused the highest scores ($P = 0.04$) compared to all other supplementation and finishing diet combinations (Figure 2). Following the 28 day aging periods, there were no differences in bloody flavor scores between any supplementation and finishing diet combinations. It would appear that the longer aging allows flavor differences caused by supplementation and finishing diet to dissipate. In addition, following the seven day aging period, beef from cattle finished on WDGS had low scores for fat flavor and high scores for bloody flavor. This suggests that desirable flavors are weaker at a shorter aging period while undesirable flavor are more intense. After a longer aging period it would appear that these differences are reduced.

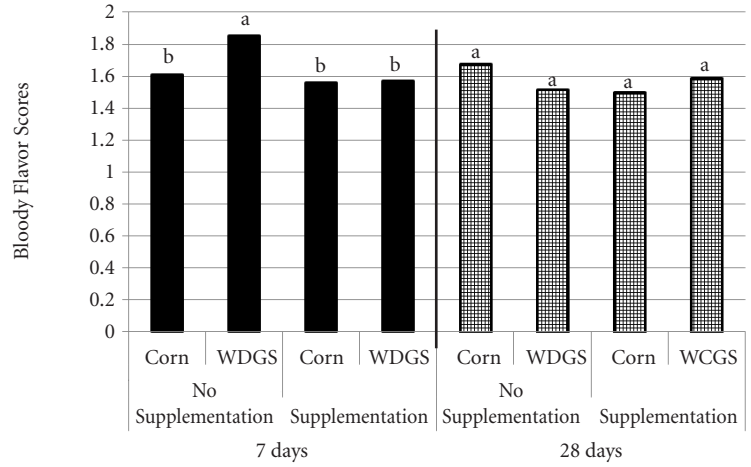
Not supplementing while grazing on warm-season grasses caused the highest liver flavor scores in *L. dorsi* steaks ($P = 0.03$) compared to all other grass type and supplementation combinations (Figure 3). Grazing on warm-season grass and aging to 28 days also caused higher liver scores (Figure 4). Clearly, grass type is a key factor in the development of liver flavor, an undesirable flavor, in beef.

Finishing on corn significantly increased ($P = 0.04$) the sweet flavor intensity and decreased ($P = 0.002$) warmed over flavor (Table 1). Thus, corn tended to promote desirable flavors while dissipating undesirable flavors. Liver flavor was not influenced by finishing diet ($P = 0.56$).



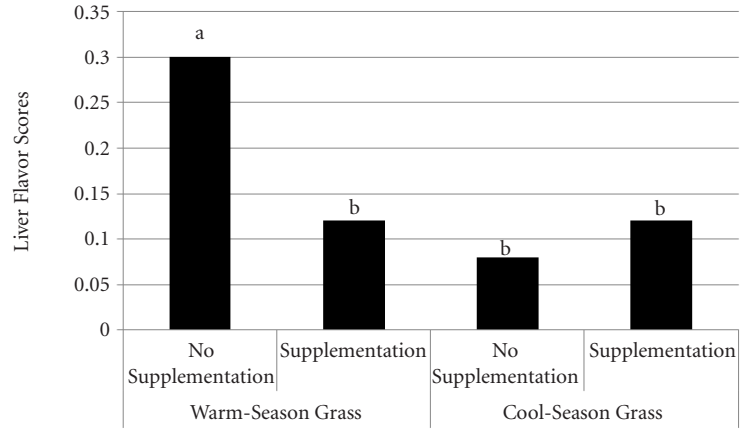
[ab]Means within the same aging period with the different superscripts are significantly ($P \leq 0.05$) different

Figure 1. The effect of grass type, finishing diet, and aging period on the LS means of fat flavor scores when separated by aging period in *L. dorsi* steaks ($P = 0.02$).



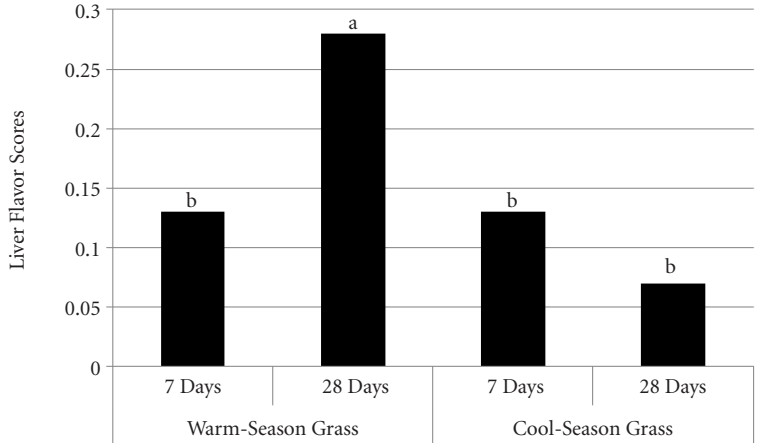
[ab]Means within the same aging period with the different superscripts are significantly ($P \leq 0.05$) different

Figure 2. The effect of supplementation, finishing diet, and aging period on the LS means of bloody flavor scores when separated by aging period in *L. dorsi* steaks ($P = 0.04$).



[ab]Means with different superscripts are significantly ($P \leq 0.05$) different

Figure 3. The effect of grass type and supplementation on the LS means of liver flavor scores in *L. dorsi* steaks ($P = 0.03$).



[ab]Means with different superscripts are significantly ($P \leq 0.05$) different

Figure 4. The effect of grass type and aging period on the LS means of liver flavor scores in *L. dorsi* steaks ($P = 0.04$).

Table 1. The effect of finishing diet on the LS means for select beef lexicon scores for *L. dorsi* steaks.

	Finishing Diet			
Trait	Corn	WDGS[1]	SEM	*P*-value
Brown	1.88	1.76	0.07	0.20
Bloody	1.59	1.63	0.04	0.43
Fat	1.77	1.66	0.05	0.10
Metal	1.70	1.73	0.04	0.59
Liver	0.14	0.17	0.04	0.56
Sweet	1.07[a]	0.94[b]	0.04	0.04
Sour	1.33	1.39	0.04	0.25
Salty	1.40	1.36	0.03	0.37
Bitter	1.12	1.11	0.03	0.99
Burnt	0.12	0.09	0.02	0.52
Smoked Wood	0.01	0.01	0.01	0.98
Buttery	0.08	0.09	0.02	0.91
Sour Milk	0.07	0.03	0.02	0.28
Warmed Over	0.06[b]	0.24[a]	0.04	0.002
Painty	0.004	0.000	0.003	0.32
Fishy	0.01	0.03	0.01	0.13

[1]WDGS = Wet distillers grains with solubles.
[ab]Means within the same treatment and the same row with different superscripts are different ($P \leq 0.05$).

For *B. femoris* steaks, the least desirable flavor notes were associated with warm-season grasses (liver, bloody, metallic, and sour), most of which were improved with supplementation. Aging increased painty, sour milk, and bitter flavors (Table 2). For this muscle, it appears that longer aging periods actually promote undesirable flavors, which is different from what was seen in *L. dorsi* steaks. Muscles from the round, such as the *B. femoris*, contain less marbling. The marbling in the *L. dorsi* steaks could be masking any off-flavors that are present, even after aging. Since there is less marbling in *B. femoris*, any undesirable flavors that are magnified due to aging would be even stronger because there is nothing there to hide them.

These data suggest that beef flavor is best established with cool season grasses, feeding WDGS as an energy supplement during grazing, and finishing on corn. Shorter aging periods appear to reduce off-flavor development.

[1]Kimberly A. Varnold, graduate student; Chris R. Calkins, professor, University of Nebraska–Lincoln (UNL) Department of Animal Science, Lincoln, Neb; Rhonda K. Miller, professor, animal science, Texas A&M University, College Station, Tex; Galen E. Erickson, professor, UNL Department of Animal Science, Lincoln, Neb.

Table 2. The effect of grass type and aging period on LS means for select beef lexicon scores for *B. femoris* steaks

	Grass Type				Aging Periods			
Trait	Warm-season	Cool-season	SEM	*P*-value	7 Days	28 Days	SEM	*P*-value
Brown	1.67[b]	1.83[a]	0.06	0.04	1.70	1.80	0.06	0.19
Bloody	1.77[a]	1.62[b]	0.05	0.02	1.70	1.68	0.05	0.80
Fat	1.72	1.72	0.05	1.00	1.70	1.74	0.05	0.55
Metal	2.01	1.91	0.04	0.09	1.95	1.98	0.04	0.57
Liver	0.38[a]	0.17[b]	0.05	0.0004	0.23	0.32	0.04	0.16
Sweet	0.83	0.90	0.04	0.23	0.90	0.83	0.04	0.23
Sour	1.53[a]	1.37[b]	0.04	0.01	1.40	1.50	0.04	0.09
Salty	1.37	1.41	0.03	0.34	1.43	1.35	0.03	0.10
Bitter	1.41	1.41	0.04	0.94	1.30[b]	1.52[a]	0.04	<0.0001
Burnt	0.15	0.20	0.03	0.27	0.14	0.22	0.03	0.10
Smoked Wood	0.008	0.000	0.004	0.16	0.008	0.000	0.004	0.16
Buttery	0.05	0.04	0.01	0.84	0.04	0.05	0.01	0.84
Sour Milk	0.09	0.09	0.03	1.00	0.05[b]	0.13[a]	0.03	0.05
Warmed Over	0.54	0.59	0.06	0.53	0.51	0.62	0.06	0.23
Painty	0.02	0.06	0.02	0.07	0.01[b]	0.07[a]	0.02	0.01
Fishy	0.05	0.04	0.02	0.50	0.03	0.07	0.02	0.09

[ab]Means within the same treatment and the same row with different superscripts are different ($P \leq 0.05$).