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Abstract

In a previous study, eighteen strip loins from USDA Select and premium Choice carcasses were cooked on a Magikitch'n® belt grill to determine tenderness at nine different endpoint temperatures. That study revealed that optimum Warner-Bratzler shear force (WBSF) values occurred in strip loin steaks cooked to 131°F, but current WBSF protocol requires steaks to be cooked to 158°F. Therefore, trials employing trained sensory panels (TSP) were conducted to determine the relationship of WBSF with TSP tenderness from steaks cooked to 131 and 158°F on the belt grill. As expected, panelists found steaks cooked to 131°F more tender than those cooked to 158°F. The relationship of WBSF with TSP ratings for tenderness was not significant (P>0.05) when both steaks were cooked to 158°F. When both steaks were cooked to 131°F, however, there was a moderate relationship (r = -0.52) of WBSF with TSP tenderness. The relationship of WBSF from steaks cooked to 131°F with TSP ratings for tenderness from steaks cooked to 158°F was the strongest (r = -0.66). More research is needed to determine the feasibility of cooking steaks to 131°F, rather than 158°F, to improve WBSF determination.

Keywords

Cattlemen's Day, 2004; Kansas Agricultural Experiment Station contribution; no. 04-242-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 923; Beef; Warner-Bratzler shear force; Strip loin steaks; Sensory panel

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RELATIONSHIP OF WARNER-BRATZLER SHEAR FORCE AND TRAINED SENSORY PANEL TENDERNESS OF STRIP LOIN STEAKS COOKED TO 131 AND 158°F

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Summary

In a previous study, eighteen strip loins from USDA Select and premium Choice carcasses were cooked on a Magikitch'n® belt grill to determine tenderness at nine different endpoint temperatures. That study revealed that optimum Warner-Bratzler shear force (WBSF) values occurred in strip loin steaks cooked to 131°F, but current WBSF protocol requires steaks to be cooked to 158°F. Therefore, trials employing trained sensory panels (TSP) were conducted to determine the relationship of WBSF with TSP tenderness from steaks cooked to 131 and 158°F on the belt grill. As expected, panelists found steaks cooked to 131°F more tender than those cooked to 158°F. The relationship of WBSF with TSP ratings for tenderness was not significant ($P>0.05$) when both steaks were cooked to 158°F. When both steaks were cooked to 131°F, however, there was a moderate relationship ($r = -0.52$) of WBSF with TSP tenderness. The relationship of WBSF from steaks cooked to 131°F with TSP ratings for tenderness from steaks cooked to 158°F was the strongest ($r = -0.66$). More research is needed to determine the feasibility of cooking steaks to 131°F, rather than 158°F, to improve WBSF determination.

Introduction

Determining tenderness of steaks is important to beef research. Studies in genetics, nutrition, management, and meat science all depend on accurate tenderness measurement. The most popular and efficient method for determining beef tenderness is the Warner-Bratzler shear force (WBSF), in which greater force indicates tougher steaks. Another popular method for determining tenderness is by trained sensory panel (TSP) evaluation, but this method is costly and time consuming when a large number of samples need to be evaluated. Therefore, it is pertinent to ensure that WBSF determinations and TSP values are closely related.

In a previous study, we cooked strip loin steaks to nine different endpoint temperatures on a belt grill for WBSF determination. The minimum WBSF for strip loin steaks occurred at an endpoint temperature of 131°F. Nevertheless, current research protocols to evaluate tenderness require steaks to be cooked to 158°F for WBSF and TSP determinations. The higher endpoint temperature has the potential to decrease mean tenderness and increase the variation in steak tenderness. Our objective was to determine the correlation between WBSF and TSP values of strip loin steaks cooked on a belt grill to 131°F or 158°F.

Experimental Procedures

Eighteen wholesale beef strip loins (*longissimus lumborum*) from USDA Select and Choice (Certified Angus Beef) carcasses were purchased and transported to the Kansas State University meat laboratory. The meat was aged at 34°F until 14 days postmortem and then frozen at -35°F. One-inch thick steaks

were cut on the band saw, vacuum packaged, and stored frozen until cooking.

After thawing overnight at 39°F, steaks were cooked on a Magikitch'n® belt grill to one of nine endpoint temperatures (104, 113, 122, 131, 140, 149, 158, 167, or 176°F). Cooked steaks were then refrigerated at 34°F overnight before six 0.5-in cores were taken parallel to the muscle fibers and sheared once with the Warner-Bratzler shear attachment on an Instron Universal Testing Machine. The WBSF peak-force measurements from steaks cooked on the electric belt grill to 131 or 158°F were used in the current study.

Steaks prepared for tenderness determination by TSP were randomly allotted to endpoint temperatures of 131 or 158°F. After thawing overnight at 39°F, steaks were cooked on a Magikitch'n® belt grill set at 199°F. Two cubes from each steak were served to a six-member TSP and were scored on an eight-point scale for tenderness (1=extremely tough and 8=extremely tender).

Results

Steaks cooked to 131°F had lower WBSF values and greater TSP tenderness scores than those cooked to 158°F (Table 1). Moreover, steaks cooked to 131°F had a smaller standard deviation for both WBSF and TSP tenderness scores.

Steaks from USDA Select carcasses were tougher ($P<0.05$) than USDA Choice steaks according to the trained sensory panel determinations. Nevertheless, WBSF scores were not significantly different ($P>0.05$) for the two quality grades (Table 2).

The correlation coefficients of WBSF values and TSP scores for steaks cooked to 131 and 158°F are presented in Table 3. The relationship between WBSF values from steaks cooked to 158°F and TSP scores for steaks cooked to 158°F was not significant ($P>0.05$). However, the relationship of WBSF values from steaks cooked to 131°F were significantly correlated with TSP scores of steaks cooked to 131 and 158°F ($r = -0.52$ and -0.66, respectively). The TSP scores of steaks cooked to 131°F were moderately well correlated with the TSP scores from steaks cooked to 158°F ($r = 0.60$). However, the WBSF values of steaks cooked to 131°F and those cooked to 158°F were not significantly related ($P>0.05$).

Discussion

In a previous study, we found that WBSF values of strip loin steaks cooked to 131°F were lowest and had a smaller standard deviation than those from steaks cooked to 158°F.

As with WBSF, trained sensory panelists found steaks cooked to 131°F to be more tender than those cooked to 158°F. The standard deviation was lower for steaks cooked to 131°F. Lower endpoint temperatures require less cooking time and less opportunity for variation to be introduced during the cooking process.

Our study indicated that the relationship between WBSF and TSP tenderness was not significant when steaks had been cooked to 158°F. Researchers have found that the relationship between WBSF and ratings of TSP tenderness ranges from non-significant to well related ($r = -0.90$). Our steaks were cooked on a belt grill. The belt grill is a relatively new cooking method and has been proven to be less variable in WBSF values than the forced-air convection oven or open-air electric grill.

We also found that there was a significant relationship between WBSF and TSP ratings of tenderness when steaks were cooked to 131°F. Moreover, the relationship of WBSF from steaks cooked to 131°F with TSP scores for steaks cooked to 158°F was stronger. The

lower endpoint temperature created less variation in the WBSF measurement, and panelists are more familiar with the flavor and texture of steaks cooked to 158°F. Therefore, it is recommended that more research be conducted to investigate the relationship between WBSF values from steaks cooked to 131°F and TSP scores.

Table 1. Warner-Bratzler Shear Force and Trained Sensory Panel (TSP) Scores for the Tenderness of Strip Loin Steaks Cooked to 131 and 158°F*

	Mean	SD	Min	Max	n
Warner-Bratzler shear force (lb)					
131°F	5.43[a]	1.19	3.53	9.15	23
158°F	7.19[b]	1.34	4.95	9.58	26
Trained sensory panel tenderness[c]					
131°F	6.19[a]	0.58	4.67	7.00	29
158°F	5.54[b]	0.76	3.92	7.17	26

*Mean, standard deviation (SD), minimum (min.), and maximum (max.) values and number of observations (n).
[a,b]Means differ between temperatures ($P<0.05$).
[c](1=extremely tough; 8=extremely tender).

Table 2. Mean Values for Warner Bratzler Shear Force and Trained Sensory Panel Scores for the Tenderness of Strip Loin Steaks from USDA Choice and Select Carcasses

	Choice	Select
Warner-Bratzler shear force (lb)	6.09	6.57
Trained sensory panel tenderness[c]	6.20[a]	5.60[b]

[a,b]Means within a row differ ($P<0.05$).
[c](1=extremely tough; 8=extremely tender).

Table 3. Correlation between Trained Sensory Panel (TSP) Scores for the Overall Tenderness of Strip Loin Steaks and Warner-Bratzler Shear Force (WBSF) Values*

	TSP 158°F	WBSF 131°F	WBSF 158°F
TSP 131°F	0.60[a] (21)	-0.52[a] (22)	-0.03 (22)
TSP 158°F		-0.66[a] (16)	-0.37 (19)
WBSF 131°F			0.06 (17)

*Coefficients and number of comparisons (in parentheses) from steaks cooked to 131 and 158°F.
[a]$P < 0.05$.