Comparison of the Palatability of Five Different Beef Product Lines

M.R. Genho, K.E. Belk, J.A. Scanga, and G.C. Smith

SUMMARY

Brand C (a guaranteed tender beef product line) was compared to four different product lines of commodity and branded beef [USDA Commodity Choice (CC), USDA Commodity Select (CS), a lean branded product (Brand B) and an upper 2/3 choice branded product (brand A)] by evaluating their palatability characteristics using Warner-Bratzler shear force (WBS) and trained sensory panel evaluation. A total of 500 steaks were evaluated with 100 steaks from each product line. Brands C and A, and CC were similar in WBS and trained taste panel tenderness assessment ($P > 0.05$). Brand B and CS steaks were both tougher than Brand C steaks based on WBS force and trained taste panel tenderness assessment ($P < 0.05$).

Key Words: Branded Beef, Palatability, Tenderness

INTRODUCTION

Beef tenderness has been implicated as the most important palatability trait in the assessment of beef quality (Clare et al., 1997; Huffman et al., 1996) as well as an attribute for which consumer's are willing to pay a premium (Boleman et al., 1997). In order to realize these premiums, beef products must be effectively segregated by level of palatability. Brand C is an existing branded beef program that guarantees the tenderness of its products. Thus, the objective of this experiment was to compare the palatability traits of Brand C steaks with those of four existing product lines using Warner-Bratzler shear force and trained sensory panel evaluation.

MATERIALS AND METHODS

Sampling

A total of 500 top loin steaks (> 1.5 in thick) were collected from retail stores by Agri-West International Inc. (San Antonio, TX) such that each of five product lines was equally represented (resulting in n = 100 per product line). The five product lines represented were USDA Commodity Choice (CC), USDA Commodity Select (CS), and Brands A (an upper 2/3 choice branded product), B (a lean branded product) and C (a guaranteed tender branded product). Sample steaks were obtained so that two steaks (one for Warner-Bratzler shear force assessment and one for sensory panel evaluation) were removed from each of 250 original strip loin subprimal cuts (50 strip loin subprimal cuts per product line x 2 steaks from each subprimal x 5 product lines = 500 total sample steaks). Following collection, samples were labeled, frozen, and shipped from Agri-West International Inc. to the Colorado State University (CSU) Meat Laboratory. Following arrival at the CSU Meat Laboratory, each frozen steak was cut to a thickness of exactly 1.0 in using a band saw, vacuum packaged, and frozen for subsequent cooking and tenderness evaluation.

Cooking

Prior to cooking, each frozen, processed, and vacuum packaged steak sample was tempered to approximately 35ºF over a 24 hr period and raw internal temperature and raw weight were measured for each sample. Steaks were then cooked to a medium (158ºF) degree of doneness (AMSA, 1995) on a MagiKitchen™ belt grill. Following cooking, steaks were removed and cooked internal temperature and cooked weight were obtained for each sample.

Warner-Bratzler Shear Force

Immediately following cooking, the first steak sample (of two) originally removed from each strip loin subprimal was cooled to room temperature in preparation for subsequent Warner-Bratzler shear force analysis. A total of six to eight cores were removed from each cooled sample steak using a mechanical coring device. Removal was accomplished parallel to the orientation of the muscle fibers. Each core was sheared once with a Warner-Bratzler shear (WBS) force instrument. Shear force for each sample steak was determined by computing the mean shear force for all cores associated each steak.

Sensory Panel Evaluation

Immediately following cooking, the second steak sample (of two) originally removed from each strip loin subprimal was cut into 0.5 in x 0.5 in x 1.0 in samples and presented to a trained eight member panel for sensory analysis. Samples were evaluated for juiciness, myofibrillar tenderness, connective tissue amount, overall tenderness, and flavor intensity by the trained sensory panel (AMSA, 1995) using 8-point rating scales (where 1=extremely dry, extremely tough, abundant, extremely tough, and extremely bland, respectively).

Analysis

Warner-Bratzler shear force and cooking loss data were analyzed using analysis of variance procedures (SAS, 1997). Sensory panel data were analyzed using mixed model analysis of variance procedures with panel and product within panel as random variables and end-point degree of doneness as a covariate (SAS, 1997). Pair-wise tests were performed to determine the significance levels of differences between products with respect to sensory panel attributes and WBS force values (á = 0.05).

RESULTS

Mean WBS force values (Table 1) differed among the five product lines ($P < 0.05$). Although Brand A steaks had the lowest numeric mean WBS value, Brand A steaks did not differ ($P > 0.05$) statistically from Brand C or CC mean steak WBS values. Mean shear force values for CS and Brand B

steaks were greater ($P < 0.05$) than the mean WBS value for Brand C steaks.

Similarly, variance, as measured by standard deviations (SD), for WBS values for the five product lines (Table 1) tended to differ. Interestingly, although Brand A had the lowest mean WBS value, Brand C had the smallest SD for WBS values. These data suggest that Brand C top loin steaks tended to have the most consistent WBS values, while Brand B top loin steaks tended to have the most variable WBS values.

Cooking loss, measured in percent weight loss during cooking, was similar for CC and Brand C steaks (.20) but was less ($P < 0.05$) for Brand A, CS, and Brand B (Table 2). Despite statistical differences in mean cooking loss, the differences among the five product lines suggested little practical significance. Mean end-point degree of doneness (ºF) was greater ($P < 0.05$) for Brand C and CS (158.0 and 157.9 ºF, respectively) compared to Brand A, CC, and Brand B (Table 3). Since steak cookery was standardized by cooking time and belt grill temperature rather than by end-point degree of doneness, differences in end-point degree of doneness could be explained by dissimilarities in heat transfer among steaks from the five product lines.

Analysis of trained sensory panel mean ratings for muscle fiber tenderness, overall tenderness, and connective tissue amount displayed the same trends) for tenderness as those indicated by evaluation of WBS values (Table 4). Brand A steaks resulted in the highest mean rating for muscle fiber tenderness, overall tenderness, and connective tissue (6.5, 6.5, and 6.4, respectively) but did not differ ($P > 0.05$) from Brand C (6.4, 6.3, 6.3, respectively) or CC (6.3, 6.3, 6.3, respectively) in any of any of these three palatability traits. With respect to juiciness, Brand A steaks elicited higher taste panel ratings ($P < 0.05$) than any other product. This difference in juiciness could be explained by the fact that Brand A had the lowest mean end-point degree of doneness (Table 3). Finally, mean flavor intensity ratings were larger ($P < 0.05$) for Brand A and CC (5.8 and 5.7, respectively) than for Brand C, Brand B, or CS (5.5, 5.4, and 5.5, respectively; Table 4).

IMPLICATIONS

Brand C, Brand A, and CC were statistically similar in tenderness assessment by WBS force and by trained taste panel evaluation. Brand B and CS steaks were both tougher than Brand C steaks based on WBS force and trained taste panel tenderness assessment. In addition, shear force for brand C steaks tended to be the most consistent of the five product lines evaluated. Therefore, brand C steaks were effectively segregated into a unique palatability group and should be offered at a premium to brand B and CS steaks while being similar in eating quality to brand A and CC steaks.

LITERATURE CITED

AMSA 1995. Research guidelines for cookery, sensory evaluation, and instrumental tenderness measurements of meat. American Meat Science Association and National Live Stock and Meat Board, Chicago, IL.

Boleman, S. J., S. L. Boleman, R. K. Miller, J. F. Taylor, H. R. Cross, T. L. Wheeler, M. Koohmaraie, S. D. Shackelford, M. F. Miller, R. L. West, D. D. Johnson, and J. M. Savell. 1997. Consumer Evaluation of Known Categories of Tenderness. J. Anim. Sci. 75:1521-1524.

Clare, T. L., S. P. Jackson, M. F. Miller, C. T. Elliot, and C. B. Ramsey. 1997. Improving Tenderness of Normal and Callipyge Lambs with Calcium Chloride. J. Anim. Sci. 75:77-385.

Huffman, K. L., M. F. Miller, L. C. Hoover, C. K. Wu, H. C. Brittin, and C. B. Ramsey. 1996. Effect of beef tenderness on consumer satisfaction with steaks consumed in the home and restuarant. J. Anim. Sci. 74:91-97.

SAS. SAS 1997. The SAS system for Mixed Models. SAS Inst. Inc., Cary, NC.

Table 1. Mean Warner-Bratzler shear force values (lb) for top loin steaks from five different product lines.

Product Line	N	Mean	SD	Min.	Max.
Brand A	50	5.94[c]	1.14	4.62	11.22
USDA Commodity Choice	50	6.38[c]	1.32	4.18	9.68
USDA Commodity Select	50	7.04[b]	1.39	4.40	10.78
Brand B	50	7.48[a]	1.61	4.84	10.78
Brand C	50	6.16[c]	0.95	4.62	9.46

[a,b,c] Means, in a column, lacking common superscript letters, differ ($P < 0.05$).

Table 2. Mean cooking loss (%) for top loin steaks from five different product lines.

Product Line	N	Mean	SD	Min.	Max.
Brand A	50	0.18[a]	0.03	0.11	0.25
USDA Commodity Choice	50	0.20[b]	0.03	0.14	0.31
USDA Commodity Select	50	0.19[a]	0.03	0.10	0.25
Brand B	50	0.18[a]	0.03	0.11	0.23
Brand C	50	0.20[b]	0.03	0.14	0.24

[a,b] Means, in a column, lacking common superscript letters, differ ($P < 0.05$).

Table 3. Mean end-point degree of doneness (ºF) for top loin steaks from five different product lines.

Product Line	N	Mean	SD	Min.	Max.
Brand A	50	156.7[a]	2.93	148.8	163.0
USDA Commodity Choice	50	157.1[a]	3.54	146.0	167.0
SDA Commodity Select	50	157.9[b]	2.62	151.0	164.4U
Brand B	50	157.6[a]	3.37	149.5	166.0
Brand C	50	158.0[b]	2.77	152.7	162.5

[a,b] Means, in a column, lacking common superscript letters, differ ($P < 0.05$).

Table 4. Least squares means ± SE for trained sensory panel ratings (8-point scale) of top loin steaks from five different product lines (n = 50).

Product Line	Juiciness[a]	Fiber Tenderness[a]	Connective Tissue[a]	Overall Tenderness[a]	Flavor Intensity[a]
Brand A	6.1^{b} ± .08	6.5^{b} ± .10	6.4^{b} ± .11	6.5^{b} ± .10	5.8^{b} ± .07
USDA Commodity Choice	5.8^{c} ± .08	6.3^{bc} ± .11	6.3^{bc} ± .11	6.3^{bc} ± .11	5.7^{b} ± .07
USDA Commodity Select	5.6^{c} ± .08	6.1^{cd} ± .10	6.1^{c} ± .10	6.1^{c} ± .10	5.5^{c} ± .07
Brand B	5.6^{c} ± .08	5.9^{d} ± .10	5.8^{d} ± .11	5.8^{d} ± .10	5.4^{c} ± .07
Brand C	5.7^{c} ± .08	6.4^{b} ± .10	6.3^{bc} ± .11	6.3^{bc} ± .11	5.5^{c} ± .07

[a] 1 = extremely dry, extremely tough, abundant, extremely tough, and extremely intense, respectively.
[b,c,d] Least squares means, in columns lacking common superscript letters, differ ($P < 0.05$).