

Evaluation of the Palatability, Tenderness, and Composition of Certified Piedmontese Beef¹

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SUMMARY

This study was conducted to compare Certified Piedmontese Beef (CPB), a new, emerging branded beef product, to two established branded beef products (one Choice product and one "natural" product), and USDA Select steaks, in order to determine if lean and "healthy" beef products (such as Certified Piedmontese Beef) would be accepted by consumers. The Choice branded product was one from a USDA Certified, branded beef program marketing high quality, highly palatable products, targeted toward consumers who demand a consistently tender, juicy, flavorful product. The "natural" product was one of a USDA Certified branded beef program marketing a "natural" product, produced with no growth promotants, antibiotics, or pesticides, and has no herbicide residues. Differences in Warner-Bratzler Shear Force ratings, trained sensory panel responses, and compositional analysis were evaluated. No significant differences were found in the WBS values between CPB and the other two branded products. In addition, no significant differences were found among all four product lines for any taste panel tenderness attributes. These results indicate that further development and continued marketing of lean beef products that are tender, will be met with consumer approval.

Key Words: Branded Beef, Tenderness, Warner-Bratzler Shear Force

INTRODUCTION

In the United States, branded and certified beef programs have been developed to target a variety of

consumer demands (Ishmael, 1999). A number of branded programs seek to target specific consumer demands. For example, branded beef programs have been established to market high quality, highly palatable products, targeted toward consumers who demand a consistently tender, juicy, flavorful product; "natural" products, produced with no growth promotants, antibiotics, or pesticides, and has no herbicide residues; and lean products, targeting the health conscious consumers.

With branded beef programs such as the aforementioned gaining popularity among consumers, it seems reasonable to pursue a branded beef program that emphasizes characteristics from several branded programs in a single product. Research has been conducted to determine the most desirable genetic background for cattle to ensure product palatability, compliance with "natural" production methods, and thus provide consumers with a lean, low-fat, palatable product. Research has been conducted focusing on the genetic background needed to produce leaner and heavier muscled cattle that produce meat products rated by a trained sensory panel as acceptable. Studies (Wheeler *et al.*, 1996, Tatum *et al.* 1990) have determined that Piedmontese cattle best fit these specifications. Thus, the pursuit of a branded beef program designed to provide a lean, "natural", tender product, has led to the development of Certified Piedmontese Beef, a USDA Process Verified branded beef program. Certified Piedmontese Beef, marketed as "Better Beef", is a program with the following specifications: USDA Process Verified, source verified, at least 50% Piedmontese, less than 18 months of age, on high energy feed at least 90 days, fed 500 IU/hd/d of vitamin E, no hormones administered, no antibiotics administered in finishing, no animal by-products or fecal material in finishing ration.

OBJECTIVES

This study was designed to compare Certified Piedmontese Beef steaks to three different established, consumer approved product lines, evaluating WBS ratings, trained sensory panel responses, and compositional analysis. The goal was to determine if the development of a lean, healthy, branded beef product would be met with consumer acceptance and demand.

METHODS AND MATERIALS

Sample collection. One hundred and twenty strip loins (NAMP (North American Meat Processors) 180), representing CPB (n=30), the branded Choice product (n=30), the branded "natural" product (n=30), and USDA Select (n=30) commodity product, were collected from commercial marketing channels and shipped to CSU. Strips were aged (35 °F) in vacuum bags for 14 days from package date, followed by freezing (-20 °F) of the strip loins until further evaluation. Frozen strip loins were sawed, generating a 0.47 in. thick section that was sent to the University of Florida for α -tocopherol analysis; the remaining portion was sawed into steaks (1 in thick) and utilized for WBS determination, trained sensory panel conducted at Colorado State University, and compositional analysis (Food Safety Net Services, San Antonio, TX).

Warner-Bratzler Shear Force.

Steaks were tempered (35 °F) for 24 hours and then cooked on a Hobart Char Broiler (model CB 51, Hobart Corp., Troy, OH). Steaks were cooked to a medium degree of doneness, (158 °F), and a well-done (176 °F) degree of doneness.

After cooking, steaks were allowed to cool to room temperature (70 °F), six to ten 0.5 in. cores were removed from each steak parallel to muscle fiber orientation, and peak Warner-Bratzler shear force determined for each core (AMSA, 1995). The peak force from each core was averaged to obtain the mean, peak shear force value for each steak.

Trained Sensory Panel. Steaks cut from the anterior end of the strip loin were used in a trained sensory panel evaluation. Steaks were tempered (70 °F) for 24 hours, weighed, and then cooked on a MagiKitchen electric conveyor grill, (model TBG-60, MagiKitchen, Quakertown, PA) to an internal temperature of 158 °F (medium) and 176 °F (well-done). Steaks were re-weighed after cooking and the cooking loss, or the weight lost between the raw and cooked state, determined.

Approximately twenty warm samples per steak (0.5 in cubes) were served to a panel of at least 8 trained panelists who were served 10-12 randomized samples per session. The panelists scored the samples for juiciness, muscle fiber tenderness,

¹This research was funded by a grant from Leachman Cattle Company of Billings, Montana.

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connective tissue amount, overall tenderness, and flavor intensity, using an 8-point hedonic scale where 1=extremely dry, extremely tough, abundant, extremely tough, and extremely intense, and 8=extremely juicy, extremely tender, none, extremely tender, and extremely bland, respectively. The scores reported by each panelist were then averaged for each sample, giving a mean score for each of the 5 categories evaluated.

Nutritional Analysis. A portion of each strip loin was analyzed for total cholesterol content, and proximate analysis (moisture, fat, protein) was performed. Food Safety Net Services, San Antonio, TX performed the analyses, according to the guidelines set forth in the Analytical Chemists' Official Methods of Analysis (1990).

- **tocopherol Analysis.** A sample of longissimus muscle was obtained from each strip loin, frozen and shipped to the University of Florida for - tocopherol concentration analysis using a modified HPLC procedure described by Njeru et al. (1995).

Statistical Analysis. The General Linear Models procedure of SAS (1996) was used to evaluate the differences among the four product lines for the traits evaluated. Means and standard deviations were computed for all Warner-Bratzler Shear Force Values collected for each product line. With respect to the nutritional and compositional analysis, overall means, standard deviations, and minimum and maximum values were reported.

RESULTS

Warner-Bratzler Shear Force. The mean shear force values (lb) and the standard deviations for the four product lines are presented in Tables 1 and 2, representing steaks cooked to 158 °F and 176 °F, respectively. When comparing the four product lines, steaks from USDA Select strip loins had higher ($P < .05$) shear force values than the other three product lines at either 158 °F or 176 °F end-point temperatures. While the increased end-point temperature resulted in higher shear values and a greater proportion of steaks with WBS above 9.92 kg, the CPB, branded Choice, and branded "natural" products had shear force values that did not differ ($P > .05$), for either degree of doneness.

Trained Sensory Panel. Least square means for trained sensory panel responses for steaks cooked to a medium (158 °F) and a well-done (176 °F) degree of doneness are presented in Tables 3 and 4, respectively. Unlike the shear force tests, the panelists were unable to find differences ($P > .05$) among the four product lines for either degree of doneness. However, as was shown by the shear force analyses, cooking steaks to a well-done degree of doneness resulted in lower tenderness rating than steaks cooked to a medium degree of doneness.

Evaluation of juiciness resulted in no differences ($P > .05$) between the three branded products, however, USDA Select steaks were rated as less juicy ($P < .05$) than the Choice and "natural" branded products, when cooked to 158 °F. The increase in end-point temperature affected all four product lines, as all mean taste panel scores for juiciness were lower for the well-done steaks. When evaluated for beef flavor intensity, no differences ($P > .05$) were found between CPB and the other two branded products. In addition, increased end-point temperature resulted in all four product lines having lower mean scores for beef flavor intensity. Similarly, as with the steaks cooked to a medium degree of doneness, CPB and the other two branded beef products did not differ ($P > .05$) in beef flavor intensity.

Proximate Analysis. Means and frequency distributions of fat percentage, as determined by proximate analysis, are presented in Table 5. The Choice and "natural" steaks had higher fat percentages ($P < .05$) than CPB and USDA Select steaks. It is reasonable to assume that this lower fat percentage of the CPB and USDA Select steaks was due to less intramuscular fat, as the specifications for CPB and USDA Select are similar for marbling scores. This provides an explanation for panelist ratings of juiciness of the CPB and USDA Select steaks when cooked to 176 °F (Table 4). In addition, CPB steaks and USDA Select steaks were found to have less calories from fat compared to the branded Choice and "natural" steaks (Table 6).

In analysis of protein percentage, USDA Select steaks were found to have the highest percentage of protein ($P < .05$), with the branded "natural" steaks

found to have the lowest percentage of protein. In the analysis of carbohydrate percentage (Table 8) among the four product lines, no differences ($P > .05$) were found between CPB and the other two branded beef steaks. Moisture analysis results show that CPB steaks contain the highest percentage of moisture ($P < .05$), which corresponds to its low fat percentage rating among the four product lines (Table 5). CPB and the Choice steaks were found to contain a greater ($P < .05$) amount of cholesterol compared to the branded "natural" steaks and USDA Select steaks.

- **tocopherol Analysis.** CPB was found to contain the highest ($P < .05$) concentration of - tocopherol when compared to the other three product lines. This difference is reasonable, as CPB steaks are from cattle that had been fed 500 IU/hd/d of vitamin E for the last 90 days of feeding.

IMPLICATIONS

Many of today's consumers demand beef that provides a "healthy", tender, and palatable eating experience. Certified Piedmontese Beef has been developed to meet these demands. As the product specifications indicate, the program makes an effort to match the specifications of several products in one. This study did not find a great number of significant differences between CPB and two other established branded products that represent very different consumer demands. When compared to the two branded products and USDA Select commodity product, for tenderness, flavor, juiciness, and fat percentage of the product, CPB fares well. Therefore, it seems that consumers demanding not only palatable, juicy, flavorful products, but also a "natural", low-fat product will be satisfied with Certified Piedmontese Beef. In addition, it seems reasonable that the continued development and marketing of similar product lines would be accepted by consumers as lean and palatable.

REFERENCES

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

AOAC. 1990. Official Methods of Analysis. 15th Edition. Association of Analytical Chemists. Arlington, VA.
 Ishmael, W. BEEF. 1999. Branded Lessons. (November 1999 Issue)
 SAS. 1998. SAS/STAT[®] User's Guide. SAS Inst. Inc., Cary, NC.

Tatum, J. D., K. W. Gronewald, S. C. Siedeman, and W. D. Lamm. 1990. Composition and quality of beef from steers sired by Piedmontese, Gelbvieh, and Red Angus bulls. J. Anim. Sci. 68: 1049-1060.

Wheeler, T. L., V. Cundiff, R. M. Koch, and J. D. Crouse. 1996. Characterization of biological types of cattle (cycle IV): Carcass traits and longissimus palatability. J. Anim. Sci. 74: 1023-1035.

Table 1. Means and Frequency Distributions of Warner-Bratzler Shear Force (WBS) Values for Three Branded Beef Products and USDA Select Strip Loin Steaks (1 in thick) Cooked to a Medium Degree of Doneness (158° F)

Product	WBS (lb)	n	St. Dev.	No. hd. <9.92 lb	No. hd. >9.92 lb	Percent >9.92 lb	Percent Cook Loss
CPB	6.99 ^b	30	.52	29	1	3.33	.18 ^b
Branded Choice	7.32 ^b	30	.70	28	2	6.67	.21 ^a
Branded "Natural"	7.34 ^b	30	.41	30	0	0.00	.20 ^{ab}
USDA Select	8.33 ^a	29	.68	23	6	20.69	.19 ^{ab}

^{a,b} Means, in the same column, lacking common superscript letters, differ (P <.05).

Table 2. Means and Frequency Distribution of Warner-Bratzler Shear Force (WBS) Values for Three Branded Beef Products and USDA Select Strip Loin Steaks (1 in thick) Cooked to a Well-Done Degree of Doneness (176° F)

Product	WBS (lb)	n	St. Dev.	No. hd. <9.92 lb	No. hd. >9.92 lb	Percent >9.92 lb	Percent Cook Loss
CPB	8.14 ^b	30	.69	26	4	13.33	.28 ^a
Branded Choice	8.02 ^b	30	.88	27	3	10.00	.28 ^a
Branded "Natural"	8.14 ^b	30	.68	26	4	13.33	.26 ^b
USDA Select	9.39 ^a	30	.90	20	10	33.33	.29 ^a

^{a,b} Means, in the same column, lacking common superscript letters, differ (P <.05).

Table 5. Means and Frequency Distributions of Fat Percentage, as Determined by Proximate Analysis, for Three Branded Beef Products and USDA Select Strip Loin Steaks

Product	Mean of Fat %	n	St. Dev.	Min. of Fat %	Max. of Fat %
CPB	3.77 ^b	15	1.43	1.10	6.86
Branded Choice	7.06 ^a	15	1.53	4.90	9.67
Branded "Natural"	8.61 ^a	15	2.40	5.52	14.64
USDA Select	4.42 ^b	15	1.16	2.79	6.52

^{a, b} Means, in the same column, lacking common superscript letters, differ ($P < .05$).

Table 6. Means and Frequency Distributions of Calories from Fat^a, as Determined by Proximate Analysis, for Three Branded Beef Products and USDA Select Strip Loin Steaks

Product	Mean of Calories from Fat	n	St. Dev.	Min. of Calories from Fat	Max. of Calories from Fat
CPB	31.80 ^c	15	12.95	9.93	61.70
Branded Choice	63.54 ^b	15	13.78	44.10	87.00
Branded "Natural"	77.48 ^b	15	21.64	49.64	131.70
USDA Select	39.74 ^c	15	10.43	25.07	58.60

^a Calories from fat expressed as calories/100g of product.

^{b, c} Means, in the same column, lacking common superscript letters, differ ($P < .05$).

Table 3. Least Square Means for Trained Sensory Panel Responses for Three Branded Beef Products and USDA Select Strip Loin Steaks Cooked to a Medium (158° F) Degree of Doneness

Product	Juiciness ^a	SEM	Muscle Fiber Tenderness ^c	SEM	Connective Tissue Amount ^d	SEM	Overall Tenderness ^c	SEM	Flavor Intensity ^e	SEM
CPB	5.65 ^{fg}	.09	5.97	.13	6.03	.12	5.94	.12	5.55 ^{fg}	.07
Branded Choice	5.86 ^f	.09	6.07	.13	6.14	.10	6.02	.12	5.74 ^f	.06
Branded "Natural"	5.94 ^f	.09	6.00	.10	5.99	.09	6.01	.09	5.65 ^{fg}	.05
USDA Select	5.52 ^g	.08	6.10	.12	6.52	.29	6.32	.31	5.44 ^g	.06

^a Overall juiciness rating by panelists where: 1 = extremely dry and 8 = extremely juicy.

^b SEM: Standard Error of the Mean for the given trait.

^c Muscle fiber tenderness and overall tenderness ratings by panelists where: 1 = extremely tough and 8 = extremely tender.

^d Connective tissue amount rating by panelists where: 1 = abundant and 8 = none.

^e Intensity of beef flavor rating by panelists where: 1 = extremely bland and 8 = extremely intense.

^{f, g, h} Least squares means in the same column, lacking common superscript letters, differ (P < .05).

Table 4. Least Square Means for Trained Sensory Panel Responses for Three Branded Beef Products and USDA Select Strip Loin Steaks Cooked to a Well-Done (176° F) Degree of Doneness

Product	Juiciness ^a	SEM	Muscle Fiber Tenderness ^c	SEM	Connective Tissue Amount ^d	SEM ^b	Overall Tenderness ^c	SEM	Flavor Intensity ^e	SEM ^b
CPB	4.49 ^h	.09	5.40	.10	5.68	.10	5.40	.11	5.30 ^{fg}	.07
Branded Choice	4.87 ^{fg}	.07	5.70	.11	5.88	.09	5.71	.09	5.49 ^f	.05
Branded "Natural"	5.02 ^f	.08	5.60	.09	5.62	.09	5.50	.08	5.50 ^f	.06
USDA Select	4.67 ^{gh}	.09	5.49	.12	5.79	.11	5.52	.12	5.25 ^g	.06

^a Overall juiciness rating by panelists where: 1 = extremely dry and 8 = extremely juicy.

^b SEM: Standard Error of the Mean for the given trait.

^c Muscle fiber tenderness and overall tenderness ratings by panelists where: 1 = extremely tough and 8 = extremely tender.

^d Connective tissue amount rating by panelists where: 1 = abundant and 8 = none.

^e Intensity of beef flavor rating by panelists where: 1 = extremely bland and 8 = extremely intense.

^{f, g, h} Least squares means in the same column, lacking common superscript letters, differ (P < .05).