

Enhancement Increases Consumer Acceptability of Beef Strip Loin Steaks

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Introduction

Juiciness, tenderness, and flavor have been well documented as the primary drivers for beef eating satisfaction and are large contributors to consumer purchasing decisions. Increased marbling, and therefore increased quality grade, in beef products has been the industry tool for predicting eating experience. In order to increase consumer eating satisfaction, the pork industry has implemented widespread use of enhancement technology in fresh pork products to allow products to remain juicy and tender, despite potential overcooking. Using this enhancement technology in the beef industry could allow lower quality beef (USDA Select and lower) to provide better eating experiences for consumers. A recent study by Woolley (2014) found enhancement decreased the percentage of USDA Select steaks rated unacceptable from more than 40% to less than 5%; however, no research exists that determines if enhancement increases palatability independent of marbling score. Therefore, objectives of this study were to evaluate consumer acceptability of enhanced beef strip loin steaks and to determine if enhancement provides an additive effect to marbling for palatability characteristics.

Key words: enhancement, palatability, marbling

Experimental Procedures

Prime, Low Choice, and Low Select strip loins (n=72; 24 per treatment group; Institutional Meat Purchase Specifications #180) were procured from a beef processor in the Midwest and transported to the Kansas State University Meat Laboratory. Within each quality grade, half were enhanced to 108% of raw weight with a solution formulated to result in 0.35% salt and 0.4% phosphate in the final injected product. Strip loins were then fabricated into approximately 1-inch steaks, vacuum packaged, and frozen. Thawed steaks were cooked to three different degrees of doneness on a clamshell grill (Cuisinart, East Windsor, NJ): rare (140°F), medium (160°F), and very well done (180°F). A total of 252 consumers were used in panels. Each panel consisted of seven consumers and each panelist was served six samples. Panelists recorded their preferences for tenderness, juiciness, flavor liking, and overall like on a 100 point line scale, with anchors at each end and midpoint. The sensory scale was 0 = extremely dry/tough/none/unbeef-like/bland, and 100 = extremely juicy/tender/abundant/beef-like/

intense. Consumers also rated each steak as either acceptable or unacceptable for each palatability trait.

Results and Discussion

As expected, consumers rated non-enhanced Prime and Low Choice steaks higher ($P < 0.05$) for tenderness and juiciness than non-enhanced Low Select steaks (Table 1). Moreover, Low Choice steaks were found to be similar ($P > 0.05$) to Low Select steaks for flavor liking and overall liking. Non-enhanced Low Select steaks were rated lowest ($P < 0.05$) for tenderness and juiciness of all treatments. Conversely, consumers rated the three enhanced treatments—Prime, Low Choice, and Low Select—higher ($P < 0.05$) than all of the non-enhanced products for all palatability traits. Additionally, the enhanced products were similar ($P > 0.05$) for all palatability traits, despite quality grade differences. Prime steaks improved ($P < 0.05$) in overall liking ratings by 20.9% with enhancement, Low Choice steaks' ratings increased ($P < 0.05$) by 30.7%, and Low Select steaks received ($P < 0.05$) the greatest improvement with 37.6% increase in overall liking with enhancement. These results indicate there is no additive effect between enhancement and quality grade on palatability. In terms of degrees of doneness, tenderness, juiciness, and overall liking scores decreased ($P < 0.05$) as degree of doneness increased (rare > medium > very well-done).

For the percentage of steaks rated acceptable (Table 2), consumers preferred non-enhanced Prime steaks over Low Select non-enhanced steaks. However, a similar ($P > 0.05$) percentage of non-enhanced Prime samples were rated acceptable for tenderness, juiciness, flavor liking, and overall liking as non-enhanced Low Choice. The non-enhanced Low Select steaks were found to be the least desirable ($P < 0.05$) across all traits, with 41.5% of steaks rated as unacceptable overall; however, within enhanced steaks a similar percentage ($P > 0.05$) of steaks were rated acceptable for all quality grades. Additionally, a higher percentage ($P < 0.05$) of enhanced steaks from each grade was rated acceptable than all non-enhanced treatments for flavor and overall acceptability, and were only similar ($P > 0.05$) to non-enhanced Prime for tenderness and juiciness. Low Select steaks increased from less than 60% acceptable overall to more than 85% of samples rated acceptable through enhancement. This increase in overall eating satisfaction represents a large opportunity for value capture and improvement in Select beef through the use of enhancement technology. As degree of doneness increased, tenderness, juiciness, flavor, and overall liking scores decreased ($P < 0.05$; rare > medium > very well-done).

Implications

These results indicate there is no additive effect between enhancement and quality grade with respect to palatability. All of the enhanced steaks, regardless of quality grade, were rated better for overall liking in comparison to non-enhanced steaks. Additionally, enhanced steaks, despite differing quality grades, were found to be similar for ratings of tenderness, juiciness, flavor, and overall liking. The enhanced Low Select steaks showed the most improvement in overall liking ratings, with an increase of 37.6%. This shows that it is more effective to enhance lower quality grade products, rather than higher quality products.

Acknowledgments

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Table 1. Least squares means for consumer panel ratings¹ of grilled strip loin steaks of three quality treatments and three degrees of doneness (n=252)

Treatment	Tenderness	Juiciness	Flavor liking	Overall liking
Enhancement				
Non-enhanced				
Prime	63.83 ^b	61.53 ^b	56.02 ^b	57.43 ^b
Low Choice	61.06 ^b	57.77 ^b	51.83 ^{b,c}	52.74 ^{b,c}
Low Select	49.75 ^c	50.29 ^c	48.65 ^c	49.17 ^c
Enhanced ²				
Prime	71.41 ^a	69.86 ^a	67.60 ^a	69.43 ^a
Low Choice	73.46 ^a	71.71 ^a	66.50 ^a	68.94 ^a
Low Select	71.29 ^a	72.46 ^a	67.55 ^a	67.66 ^a
SEM ³	2.48	1.90	2.00	1.98
<i>P</i> - value	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Degrees of doneness				
Rare (140°F)	73.11 ^a	77.15 ^a	62.79 ^a	65.84 ^a
Medium (160°F)	65.63 ^b	65.72 ^b	58.89 ^b	61.36 ^b
Very well done (180°F)	56.65 ^c	48.95 ^c	57.39 ^b	55.49 ^c
SEM	1.67	1.45	1.50	1.44
<i>P</i> - value	< 0.0001	< 0.0001	0.0119	< 0.0001

¹Sensory Scores: 0 = Extremely tough/dry/not acceptable flavor, 100 = Extremely juicy/tender/acceptable flavor.

²Enhanced 108% of raw weight with a water, salt, and alkaline phosphate solution.

³SEM = standard error.

^{a,b,c,d}Least squares means in the same main effect without a common superscript differ ($P < 0.05$).

Table 2. Percentage of grilled strip loin steaks of three quality treatments and three degrees of doneness rated as acceptable¹ by consumers (n=252)

Treatment	Tenderness acceptability	Juiciness acceptability	Flavor liking acceptability	Overall acceptability
Enhancement				
Non-enhanced				
Prime	93.15 ^{a,b}	85.52 ^{a,b}	73.81 ^b	78.37 ^{b,c}
Low Choice	86.59 ^b	79.63 ^b	71.29 ^b	74.06 ^c
Low Select	67.49 ^c	63.97 ^c	60.71 ^c	58.48 ^d
Enhanced ²				
Prime	96.24 ^a	93.72 ^a	88.59 ^a	89.38 ^a
Low Choice	96.09 ^a	93.92 ^a	85.29 ^a	86.61 ^{a,b}
Low Select	93.60 ^a	91.99 ^a	85.69 ^a	85.89 ^{a,b}
SEM ³	4.91	4.79	3.77	4.23
<i>P</i> - value	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Degrees of doneness				
Rare (140°F)	96.49 ^a	96.41 ^a	82.91 ^a	86.79 ^a
Medium (160°F)	91.23 ^b	88.04 ^b	78.24 ^{a,b}	81.45 ^b
Very well done (180°F)	81.92 ^c	62.47 ^c	75.59 ^b	70.66 ^c
SEM ³	2.17	2.76	2.19	2.39
<i>P</i> - value	< 0.0001	< 0.0001	0.0303	< 0.0001

¹Sensory Scores: 0 = Extremely tough/dry/not acceptable flavor, 100 = Extremely juicy/tender/acceptable flavor.

²Enhanced 108% of raw weight with a water, salt, and alkaline phosphate solution.

³SEM = standard error.

^{a,b,c,d}Least squares means in the same section without a common superscript differ ($P < 0.05$).