

Project Summary

Strategies to Improve the Tenderness of Vastus Lateralis Muscles

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Background

The majority of beef carcass value is attributable to cuts from the rib and loin, which are typically used for steak entrees, particularly in foodservice establishments. As a means to increase overall carcass value, research efforts have focused on identifying muscles from the chuck and round with characteristics suitable for use as steak items. Previous work has identified the *rectus femoris* (tip center) as having sufficient tenderness and flavor attributes to substitute or alternative for *gluteus medius* (top sirloin) steaks.

Currently, the *rectus femoris* is marketed as part of a muscle complex that makes up the beef knuckle subprimal. In order for the *rectus femoris* to be economically feasible, purveyors must also be able to use the *vastus lateralis* (tip side). Previous checkoff-funded research has found that the *vastus lateralis* has unacceptable tenderness characteristics to be suitable to consumers as a foodservice steak item. The objective for this project was to develop and evaluate tenderization strategies for beef *vastus lateralis* muscles.

Methodology

Beef knuckles were obtained from a commercial processor, transported to a large purveyor's facility, and aged until 35 days postmortem. Muscles were separated along natural seams to produce *rectus femoris* and *vastus lateralis* muscles. Muscles were assigned to one of four tenderization treatments 1) non-tenderized control, 2) blade tenderized, 3) enhanced up to 15% of initial weight with a solution containing 3% salt and 2% sodium tripolyphosphate, and 4) blade tenderized and enhanced with salt and phosphate solution. After tenderization treatments were applied, muscles were cut into steaks, which were vacuum packaged and frozen until further analysis could be performed.

Steaks were thawed and cooked to a medium degree of doneness before being served to the panel or sampled for slice shear force. Palatability attributes were assessed by an eight-member trained sensory panel. Additionally, tenderness was further assessed using slice shear force. After shearing, slices were retained and used to measure sarcomere length (extent of muscle contraction) and the extent of protein degradation as a result of aging and tenderization treatments.

Findings

Applying blade tenderization and injection treatments improved the tenderness of *vastus lateralis* (tip side) and *rectus femoris* (tip center) steaks. The effects of the salt and phosphate injection treatment were much larger than the effect of blade tenderization. Additionally, blade tenderization and phosphate injection had a synergistic effect on reducing thaw and cooking losses and trained sensory panel juiciness ratings.

Non-injected *rectus femoris* steaks received higher trained sensory panel ratings for overall tenderness than non-injected *vastus lateralis* steaks (Table 1). Similarly, injected *rectus femoris* steaks received higher tenderness ratings than injected *vastus lateralis* steaks. However, *vastus lateralis* steaks injected with a solution containing salt and phosphate received higher overall tenderness ratings than non-injected *rectus femoris* steaks.

Previous research in this lab found that *rectus femoris* steaks were similar in palatability attributes and consumer acceptance to top sirloin steaks. Thus, it appears that injection with a salt and phosphate solution will improve *vastus lateralis* tenderness sufficiently to justify its use as a steak item in foodservice establishments and thus making the *rectus femoris* an economically viable steak item.

Table 1. Least-squares means for the effects of injection and blade tenderization treatments on purge losses and palatability traits of beef *rectus femoris* and *vastus lateralis* steaks

Effect		Total loss, %	Overall tenderness ¹	Juiciness ²	Beef flavor intensity ³
Rectus femoris	Non-injected	25.79 ^y	5.18 ^x	5.53	4.05
Rectus femoris	Phosphate	23.81 ^x	5.93 ^z	5.96	3.75
Vastus lateralis	Non-injected	27.13 ^z	4.50 ^w	5.38	4.13
Vastus lateralis	Phosphate	23.95 ^x	5.59 ^y	5.90	3.85
SEM		0.19	0.05	0.04	0.04
P > F		<0.01	<0.001	0.14	0.70

¹1 = extremely tough; 8 = extremely tender

²1 = extremely dry; 8 = extremely juicy

³1 = extremely bland; 8 = extremely intense

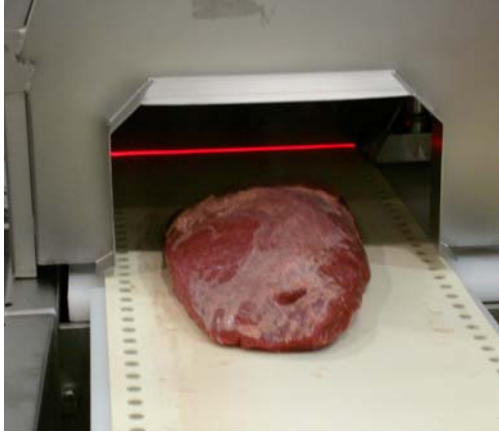
^{wxyz}Least-squares means within a column, within an effect, with differing superscripts, differ ($P < 0.05$).

Implications

Rising beef prices have increased the cost of beef entrees at restaurants. Industry contacts indicate that prices have risen to the point at which consumers will seek other, less expensive protein sources. The development of muscles from the chuck and round that are comparable to traditional “middle meat” cuts would increase overall carcass value and provide more affordable options for cost-conscious consumers.

Previous work indicated that *rectus femoris* aged for 21 to 35 days and blade tenderized was similar in tenderness and consumer acceptance to top sirloin steaks that had been aged for 21 to 35 days and then blade tenderized. However, the *rectus femoris* is currently marketed as part of the knuckle subprimal, which also contains the *vastus lateralis* muscle. Unfortunately, consumers found *vastus lateralis* steaks to be unacceptably tough.

The findings of the current experiment indicate that injection with a salt and phosphate solution can improve tenderness to a level greater than that of blade tenderized *rectus femoris* steaks. Thus, *vastus lateralis* can be made suitable for use as a steak menu item. Enabling the use of *vastus lateralis* and *rectus femoris* steaks by the foodservice segment of the beef industry should improve demand among cost-conscious consumers, improving restaurant profitability and add to carcass value.



Vastus lateralis muscle entering portioning machine



Pre-trimmed *rectus femoris* muscles

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