

## Project Summary

**Effect of needle tenderization, aging time and aging temperature on postmortem proteolysis and tenderness of beef *longissimus lumborum* and *gluteus medius***

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# Effect of needle tenderization, aging time and aging temperature on postmortem proteolysis and tenderness of beef *longissimus lumborum* and *gluteus medius*:

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### Background

Unacceptable tenderness continues to be a challenge in top sirloin and top loin steaks. Extended aging of beef cuts is commonly used by the foodservice segment of the industry to ensure tenderness. Additionally, purveyors cutting steaks destined for foodservice establishments commonly apply needle tenderization but this segment is seeking alternatives to mechanical tenderization. The objective of this project was to determine the effect of higher temperature during refrigerated storage on the extent of postmortem proteolysis and tenderness of beef *longissimus lumborum* and *gluteus medius* and whether needle tenderization interacts with this effect.

### Methodology

Beef, loin, strip loin boneless (IMPS# 180; n=300; *longissimus lumborum*) and beef, loin, top sirloin butt (IMPS# 184; n=300; *gluteus medius*) were obtained from a processing facility and transported to a foodservice purveyor before being randomly assigned to aging times (12,26, or 40 days) and aging temperatures (-0.5 and 3.3°C). After the appointed aging time, one half of the subprimals were subjected to a single pass through a needle tenderizer and cut into 2.54 cm steaks. One steak from each subprimal was used for slice shear force analysis and Western blots of desmin to determine the extent of proteolysis.

### Findings

#### *Longissimus lumborum* (LL)

Slice shear force values of blade tenderized LL steaks were lower than values from non-blade tenderized LL steaks regardless of aging temperature. Aging temperature did not affect slice shear force values of blade tenderized LL steaks. However, increasing aging temperature to 3.3°C resulted in slice shear force values that were 2.7 kg lower than aging LL steaks at -0.5°C. Regardless of aging time, blade tenderized LL steaks had lower slice shear force values than non-blade tenderized steaks. Increased aging time did not affect the slice shear force values of blade tenderized LL steaks. However, each increase in aging time reduced slice shear force values of non-blade tenderized steaks.

When aged at -0.5°C, more than 97% of blade tenderized LL steaks had slice shear force values less than 15 kg. In contrast, 45% of non-blade tenderized steaks aged at -0.5°C had slice shear force values greater than 15 kg. At the higher aging temperature, 100% of blade tenderized steaks had slice shear force values less than 15 kg, while 10.9% of non-blade tenderized steaks had slice shear force values greater than 15 kg. Blade tenderization essentially eliminated the occurrence of steaks with extremely high slice shear force values and increasing aging temperature improves the slice shear force distribution of LL steaks. However, the improvement is minimal in comparison to the effect on blade tenderization.

When comparing the strategies of blade tenderizing steaks aged at -0.5°C and non-blade tenderizing steaks aged at 3.3°C, both strategies resulted in LL steaks with relatively low slice

shear force values. Both treatments resulted in greater than 89% of steaks with slice shear force values less than 15 kg. However, blade tenderized LL steaks aged at -0.5°C had a much greater proportion of steaks with slice shear forces values less than 10kg compared to non-blade tenderized steaks aged at 3.3°C.

#### *Gluteus medius (GM)*

Blade tenderization provided a dramatic decrease in slice shear force values of GM steaks. Increasing storage temperature during aging from -0.5 to 3.3°C caused a modest reduction in slice shear force values. Increasing storage time from 12 to 40 days improved slice shear force values by 2.7 kg. However, no difference was found in slice shear force values of GM steaks stored for 12 or 26 days. Blade tenderization had no effect on desmin degradation. Aging GM muscles at 3.3°C resulted in a higher percentage of desmin that was degraded compared to muscles aged at -0.5°C. Each increase in aging time resulted in a greater proportion of desmin degradation.

Blade tenderization dramatically increased the proportion of GM steaks with lower slice shear force values. Only 1.4% of blade tenderization steaks had slice shear force values greater than 20 kg, while 23.9% of non-blade tenderized GM steaks had slice shear force values greater than 20 kg. The high aging temperature improved the distribution of slice shear force values in GM steaks. However, this effect is minimal in comparison to the effects of blade tenderization. Blade tenderized GM steaks aged at -0.5°C had a greater proportion of steaks with slice shear force values less than 20 kg compared to non-blade tenderized GM steaks aged at 3.3°C. Additionally, none of the blade tenderized steaks aged at -0.5°C had extremely high slice shear force values. This indicates that blade tenderization increased the consistency of GM steaks.

#### **Implications**

Blade tenderization, increased aging temperature and increased aging time all reduced slice shear forces (increased tenderness) values of *longissimus lumborum* and *gluteus medius* steaks. However, increased aging temperature and prolonged aging times are not sufficient to replace blade tenderization as a beef tenderization strategy. Blade tenderization essentially eliminated the occurrence of extremely tough meat.

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