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# AGING, BLADE TENDERIZATION, AND ENZYME INJECTION IMPACTS TENDERNESS OF MUSCLES FROM FED CULL COWS OF KNOWN AGE

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## Introduction

Approximately 16% of the 31 million head of cattle harvested in the United States in 2005 were aged cows. Cow meat is known to be tougher than meat from young steers and heifers, and it typically has a less desirable, darker color. It is generally assumed that cow meat needs to be ground or have some form of post-mortem tenderization applied to be merchandized as a whole muscle product. The knuckle, top sirloin, and top blade muscles have been identified as muscles that potentially can be upgraded to medium-priced steaks. Most cow steaks are fabricated by food-service providers for their customers with different specifications for aging and post-mortem tenderization application. Aging, blade tenderization, and injection enhancement are commonly used on cow meat to increase tenderness. It is unknown if extended aging is needed in addition to the other two methods to improve tenderness. If shorter aging periods can be used without compromising an improvement in tenderness, then aging costs would be greatly reduced. Our objective was to determine the effects of days of aging on tenderness of cow steaks from the knuckle, top sirloin, and top blade that were blade tenderized and injected with an enhancement solution containing an enzyme tenderizer.

## Experimental Procedures

Muscles from 31 cull cows that were fed a high concentrate diet for 60 days were used in this study. The round tip (knuckle), top sirloin (*gluteus medius*), and top blade (*infraspinatus*/flat iron) steaks from the right and left sides were removed and randomly assigned to seven or 28 days of vacuum aging. After aging, the muscles were frozen for further processing. Muscles were subsequently thawed for 36 hours and freeze-thaw loss calculated. They were then blade-tenderized using 1 pass and injected at 10% by weight with a solution containing 0.35% phosphate, 0.5% salt, and 0.023% bromelin. After pumping, muscles were allowed five minutes to drip before they were repackaged (vacuum packaged) and frozen to facilitate band-saw cutting into three 1-inch thick steaks from each muscle. One steak was randomly assigned for Warner Bratzler shear force (WBSF) testing; the other two steaks were used for further lab analysis. Frozen steaks for WBSF were thawed at 36°F, weighed, removed from the package, then reweighed to determine package loss percentages. The steaks were cooked to an internal temperature of 104°F, turned, and cooked to a final internal temperature of 158°F. Following a 30-minute cooling period, steaks were reweighed to determine cooking loss percentages. Steaks were chilled at 32°F overnight and six 0.5-inch cores were removed parallel to the muscle fiber direction. Each core was sheared once perpendicular to the direction of the muscle fibers using the WBSF attachment to the Instron Universal Testing Machine with a 50-kg compression load cell and a cross head speed of 250 mm/min.

Treatments were arranged as a split plot with the whole plot a randomized-complete-block design. The PROC MIXED procedure of SAS (2005) was used to determine if there were any differences among treatments and least square means were separated using the PDIFF option. Age was used as a covariate; if it was determined to be significantly ($P<0.05$) different, PROC GLM was used to determine regression values.

## Results and Discussion

Neither cow age nor days of aging had an effect on tenderness of round tip steaks (Table 1). However, when the *rectus femoris* and *vastus lateralis* were separated, the *rectus femoris* was more ($P<0.01$) tender than the *vastus lateralis*. There were no differences in cooking losses or package losses of round tip steaks due to days of aging. These results suggest that the *rectus femoris* could be used alone as a steak and provide acceptable tenderness and potentially higher value than the whole knuckle.

Top sirloin steak tenderness was not different due to cow age (Table 2). Steaks aged 28 days were more ($P<0.01$) tender than those that were aged for only seven days. Cooking losses and package losses were not different due to aging time or cow age.

Top-blade steak tenderness was not different due to aging days (Table 2). As cow age increased, Warner-Bratzler shear force increased (less tender, $P<0.02$) for the top-blade steaks. We speculate that this may be due to the increase in connective tissue maturation. As animals age, they have more collagen cross-linking, which can increase the toughness of the meat. Cooking loss and package losses in top-blade steaks were not different due to days of aging. Cooking loss was not different due to cow age; however, package loss increased ($P<0.05$) as cow age increased.

## Implications

These results provide evidence for not aging the round tip and flat iron steaks for more than seven days when the combination of blade tenderization and injection enhancement with enzyme is applied to these muscles. This would allow food service providers to distribute this product faster and free needed storage space.

**Table 1. Effects of Days of Aging, Cow Age, and Muscle (*vastus lateralis, rectus femoris*) on Tenderness and Moisture Loss of Steaks from the Knuckle**

| | Days of Aging | | |
|---|---|---|---|
| Item: | 7 | 28 | Cow Age |
| Freeze-thaw loss, % | 4.1 | 4.5 | |
| Vacuum package loss, % | 2.5 | 2.5 | NS[a] |
| Cook loss, % | 34.1 | 32.8 | NS |
| Warner Bratzler Shear, lb | | | |
| Whole Knuckle | 6.5 | 6.3 | NS |
| *Rectus femoris*[b] | 5.8[c] | 5.6[c] | NS |
| *Vastas lateralis*[b] | 7.1[d] | 6.9[d] | NS |

[a]NS = not significant.
[b]Denotes both muscles sampled within the knuckle. Means for muscle with a different superscript letter are different.
[c,d]Means for muscles in a column with different superscript letters are different ($P<0.01$).

**Table 2. Effects of Days of Aging and Cow Age on Tenderness and Moisture Loss of Top Sirloin and Top Blade Steaks (*gluteus medius* and *infraspinatus* muscles, respectively)**

| | Days of Aging | | |
|---|---|---|---|
| Item: | 7 | 28 | Cow Age |
| Top Sirloin | | | |
| Freeze-thaw loss, % | 6.0 | 7.4 | |
| Vacuum package loss, % | 2.5 | 2.5 | NS[a] |
| Cook loss, % | 32.0 | 31.8 | NS |
| Warner Bratzler Shear, lb | 4.7[b] | 3.3[c] | NS |
| Top Blade | | | |
| Freeze-thaw loss, % | 3.7 | 5.0 | |
| Vacuum package loss, % | 3.6 | 3.7 | <0.02 |
| Cook loss, % | 27.6 | 25.4 | NS |
| Warner Bratzler Shear, lb | 3.6 | 3.7 | <0.01 |

[a]NS = not significant.
[b,c]Differing superscripts within a row are different ($P<0.01$).