

# Project Summary

## Quantifying the “Aging Response” for Muscles of the Beef Round

**Principal Investigators: C.L. Dixon, K.E. Belk, D.R. Woerner, J.D. Tatum,  
G.C. Smith, & P.L. Chapman,  
Colorado State University**

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## Background

Tenderness is one of the biggest influencers in a consumer’s approval of a meat product, and most consumers are able to differentiate between tough and tender beef. Postmortem aging has long been established as one of the most effective management practices for improving beef tenderness. However, studies have shown a huge variation between how long a cut is aged before being sold in a retail or restaurant setting, ranging anywhere from two to 91 days. By identifying the minimum aging period required for certain retail beef cuts to reach optimal tenderness, beef eating satisfaction could be increased without having to keep meat products on hand longer than needed.

Using United States Department of Agriculture (USDA) data, Cattle Fax discovered a five-year trend between 1993 and 1998 revealing that the wholesale value of beef ribs and loins had increased only 3 to 5%, while the wholesale value of beef chucks, rounds, and trimmings had decreased 25 to 26%. This prompted the Beef Checkoff to commission a Muscle Profiling study which was conducted in 1999 to identify several muscles from the beef chuck and round that possessed desirable tenderness, flavor, and nutritional attributes and which could be marketed as single-muscle beef cuts.

In 2006, researchers at CSU were commissioned by NCBA to develop aging guidelines for 18 muscles, including the newest Beef Value Cuts chosen from the previously-mentioned Muscle Profiling study. The study resulted in an “Aging Index” that provided standardized wet-aging time recommendations for fresh beef that could be used by packers, retailers, branded beef programs, and/or foodservice operations to better manage beef eating quality. Five additional round muscles (*Adductor*, *Gastrocnemius*, *Gracillis*, *Pectineus*, and *Superficial digital flexor*) have been selected for inclusion as Beef Value Cuts and this study was conducted to develop appropriate wet-aging time recommendations for those muscles.

## Methodology

USDA Select (n = 40) and upper 2/3 USDA Choice (n = 40) beef carcasses were chosen over a 12 week period from a commercial beef packing plant in northeastern Colorado. At two days postmortem, the bottom (Gooseneck) and inside round subprimals were collected from both sides of the selected carcasses. The following five muscles were removed from the subprimals for use in this study: *Adductor*, *Gastrocnemius*, *Gracillis*, *Pectineus*, and *Superficial digital flexor*. Each muscle was cut into seven steaks and randomly assigned one of the following postmortem aging periods: 2, 4, 6, 10, 14, 21, and 28 days. All steaks remained in a fresh-chilled state (2°C) until Warner-Bratzler shear force (WBSF) testing occurred upon the designated day. Upon completion of the designated aging time, steaks were removed from refrigerated storage, cooked on electric grills, and allowed to equilibrate to room temperature. A maximum of six cores were removed for WBSF parallel to the muscle fiber orientation. Peak shear force measurements of each core were recorded and averaged to obtain a single shear force value for each steak. Exponential decay models were used to construct aging curves for each muscle.

## Findings

Shear force values decreased with increasing postmortem time for all muscles except the *Superficial digital flexor*. This could be due to the high amount of connective tissue present in varying densities

throughout the *Superficial digital flexor* muscle. Additionally, a different cooking method may have been needed to better match usual preparation of this muscle. A significant quality grade difference was found in only one muscle, the *Gracilis*. Therefore, all data reported for the remaining four muscles is presented as a combination of Select and premium Choice samples. Aging curves were used to assign aging responses to each muscle based on the amount of WBSF (kg) change from 2 to 28 days postmortem. These responses and the optimal postmortem aging period for each muscle are listed in **Table 1**. Aging responses varied from moderately high to moderately low with all muscles requiring between 14 and 25 days of postmortem aging to achieve the majority of the aging response. The rate of tenderization varied greatly among individual muscles. The *Gastrocnemius* achieved 100% of the aging response by 21 days postmortem, while the *Pectineus* only achieved 78.9% of the aging response by the same day. The *Pectineus* had the lowest 2 and 28 day WBSF, but required the longest time, 25 days, to complete the majority of the aging response. The ranking of the muscles at 28 days postmortem, from lowest to highest WBSF (kg), was as follows: *Pectineus*, *Adductor*, *Gastrocnemius*, premium Choice *Gracilis*, Select *Gracilis*, and *Superficial digital flexor*. Individual muscle tenderness varied greatly, with a range of 48.56 kg in premium Choice samples and a range of 30.83 kg in Select samples. The reason for this substantial variation was due to the extremely high WBSF of the *Superficial digital flexor* (average WBSF = 11.11 kg). Excluding the *Superficial digital flexor*, the range of the remaining muscles was 7.61 and 6.57 kg for Select and upper 2/3 Choice samples, respectively. The *Superficial digital flexor* displayed a significant WBSF range, with the lowest WBSF being 2.83 kg and the highest being 49.88 kg.

### Implications

Upon completion of the individual optimal aging periods, all muscles in this study, except the *Superficial digital flexor*, fall below the threshold that most consumers would consider “slightly tender.” With the addition of this round aging information to the *Industry Guide for Beef Aging*, packers, branded beef programs, retailers, and foodservice operations will be able to better manage postmortem aging practices to increase beef eating satisfaction and value.



**Table 1.** Change in shear force from 2 through 28 d postmortem (aging response, kg) and the length of postmortem aging (d) needed for a majority of this change to occur for five beef muscles

Muscle	Aging response	Aging time <sup>a</sup>
<i>Adductor</i> <sup>o</sup>	1.0	21
<i>Gastrocnemius</i> <sup>o</sup>	1.0	14
Ch <i>Gracilis</i>	1.8	23
Se <i>Gracilis</i>	2.1	23
<i>Pectineus</i> <sup>o</sup>	0.9	25
<i>Superficial digital flexor</i> <sup>bc</sup>	-	-

<sup>a</sup> Aging times for muscles with aging responses  $\geq 2.2$  kg (high), 2.1 to 1.8 kg (moderately high), 1.7 to 1.1 kg (moderate), 1.0 to 0.7 kg (moderately low), and  $\leq 0.6$  kg (low) correspond to the day that at least 96%, 95%, 94%, 90% and 85% of the aging response was completed, respectively.

<sup>b</sup> Grade was not significant for *Adductor*, *Gastrocnemius*, *Pectineus*, and *Superficial digital flexor*, so no distinction was made.

<sup>c</sup> Warner-Bratzler shear force of *Superficial digital flexor* did not decrease with increasing time of postmortem storage.

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***For more information contact:***

National Cattlemen's Beef Association  
 9110 East Nichols Avenue  
 Centennial, Colorado 80112-3450  
 (303) 694-0305