# INDUSTRY GUIDE FOR BEEF AGING: ROUND MUSCLE ADDENDUM

**Round Petite Tender**
***Pectineus***

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**San Antonio Steak**
***Adductor***

# BACKGROUND

Using United States Department of Agriculture (USDA) data, CattleFax 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% (USDA, 2005; Von Seggern et al., 2005). This prompted the Beef Checkoff to commission a Muscle Profiling research effort 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 (Von Seggern et al., 2005). The round accounts for nearly 22% of the weight of a typical beef carcass (Reuter et al., 2002), so utilization of this primal for steak or high-end cuts could significantly increase overall carcass value.

Researchers at Colorado State University (CSU) were commissioned to develop aging guidelines for 17 muscles, including the newest Beef Value Cuts chosen from the Muscle Profiling studies (Gruber et al., 2006). Since most previous tenderness research had performed shear force testing after the meat product had been frozen and thawed (Davis et al., 1979; Shanks et al., 2002), and freezing has been shown to decrease shear values (Shanks et al., 2002), all muscles used in the Gruber et al. (2006) study were exclusively stored under refrigerated conditions (2°C) and were never frozen. This provided insight into postmortem aging effects in fresh beef, independent of the effects of freezing. The study resulted in an "Aging Index" providing standardized wet-aging time recommendations for several beef muscles that could be used by packers, retailers, branded beef programs, and foodservice operations to better manage beef tenderness. Four additional round muscles have been selected for inclusion as beef value cuts including the *Adductor, Gastrocnemius, Gracilis,* and *Pectineus* or fancifully named the San Antonio Steak, Merlot Cut, Santa Fe Cut, and Round Petite Tender, respectively. These exceptionally lean muscles come from the inside round and the bottom round heel and have significant potential to increase the value of one of the largest primals in the carcass.

# HOW THE STUDY WAS CONDUCTED

This study was conducted following a similar protocol to that of the Gruber et al. (2006) study found in the *Industry Guide for Beef Aging* (CBB and NCBA, 2006). Forty USDA Select and 40 premium USDA Choice (the upper two-thirds of the Choice grade) beef carcasses were identified over a 12-week period from a commercial beef packing plant located in northeastern Colorado for use in this study. At two days postmortem, carcasses were individually identified and followed through fabrication to obtain the inside round (IMPS 168) and outside round, heel (IMPS 171F) from both sides of the carcass. The subprimals were transported under refrigeration (2°C) to the CSU Meat Laboratory for further processing into the following muscles: *Adductor, Gracilis, Pectineus,* and *Gastrocnemius* – medial portion only. Due to the small size of the *Gastrocnemius* and *Pectineus*, muscles from both sides of the carcass were used for all muscles. Each pair of muscles was trimmed of fat and connective tissue and further reduced to seven

(2.54 cm) steaks. Sample steaks were individually vacuum packaged and randomly assigned to one of the following postmortem aging periods: 2, 4, 6, 10, 14, 21, and 28 days. Steaks remained in a fresh-chilled state (2°C) until Warner-Bratzler shear force (WBSF) testing was performed on the designated day. Following the completion of aging, steaks were cooked to a peak internal temperature of 72°C on electric grills, and then measured to determine WBSF. Warner-Bratzler shear force assesses the tenderness of meat by measuring the amount of force in kilograms necessary to shear ½-inch core samples from each steak evaluated. Differences in tenderness (WBSF values) caused by the effects of muscle, USDA quality grade, and postmortem aging period were evaluated using statistical methods (PROC MIXED: SAS Inst. Inc., Cary, NC). The *Gracilis* had a significant quality grade difference between USDA Select and premium USDA Choice samples. Quality grade did not affect the *Adductor, Gastrocnemius*, and *Pectineus*, so all results for these muscles are presented as a combination of the USDA Select and premium USDA Choice samples. To characterize the change in tenderness from 2 to 28 days postmortem, "aging curves" were developed for each muscle (PROC NLIN and PROC NLMIXED: SAS Inst. Inc., Cary, NC).

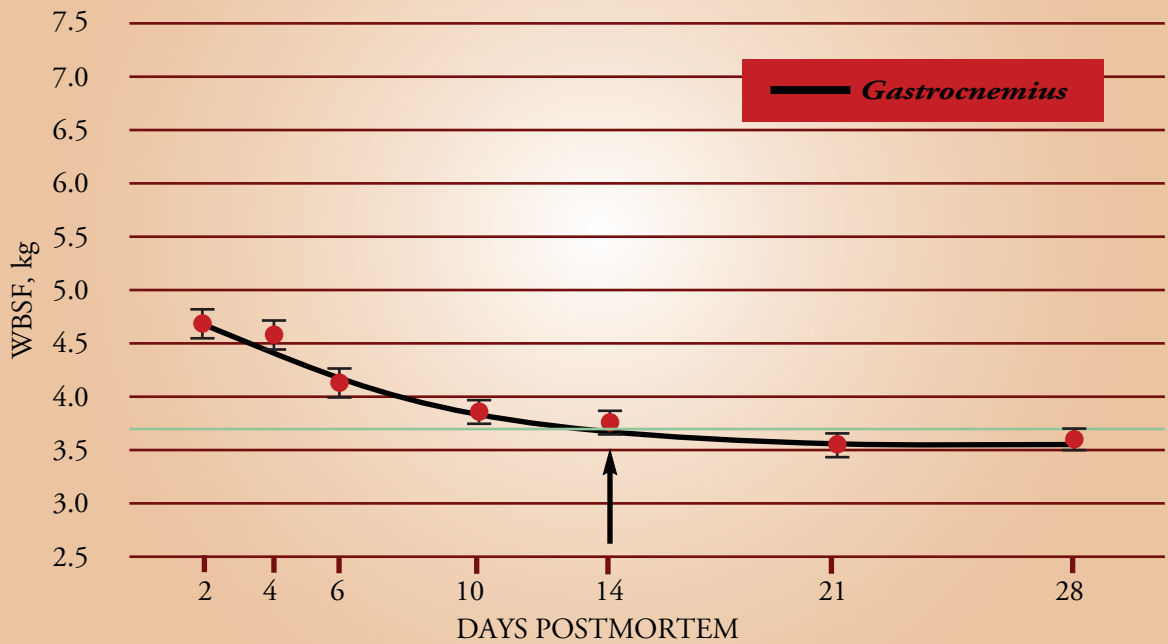
## ASSIGNMENT OF AGING RESPONSES

Optimal postmortem aging periods were established by determining the amount of time (days postmortem) required for a majority of the aging response to be completed. Using the "aging curves" found in Figures 3 through 6, all muscles were assigned an aging response based on the change in WBSF from 2 to 28 days postmortem. Aging responses and periods were also adopted from the Gruber et al. (2006) study. Aging periods correspond to the day that a majority of the aging response is complete. Aging times (days postmortem) for muscles with aging response ≥ 2.2 kg, 2.1 to 1.8 kg, 1.7 to 1.1 kg, and ≤ 0.6 kg correspond to the day that at least 96%, 95%, 94%, 90%, and 85% of the aging response is complete, respectively. Aging responses and periods for all muscles are found in Figure 2. For example, the *Gastrocnemius* muscle in Figure 1 decreased from 4.63 kilogram to 3.63 kilogram from day 2 to day 28 postmortem. Since the muscle had a 1 kilogram decrease in WBSF throughout the aging period, it was assigned a moderately low aging response with an aging period of 14 days.

*Figures 1 and 2 follow on pages 5 and 6. The "aging curves" found in Figures 3-6 follow on pages 9 and 10.*

Figure 1:

**Postmortem Aging Periods – Achieving Targeted WBSF Values**




KEY-
PERCENTAGE OF AGING RESPONSE COMPLETE

| ≤50% | 51% to 74% | 75% to 84% | 85% to 94% | ≥95% |
|---|---|---|---|---|

| Muscle | 2-d WBSF | Aging Response | Days of Postmortem Aging 4 | 6 | 10 | 14 | 21 | 28 |
|---|---|---|---|---|---|---|---|---|
| GS | 4.63 | 1.0 | | | | | | |

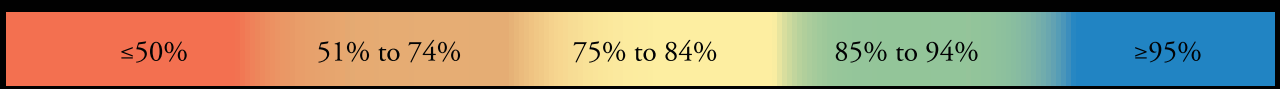
90% - percentage of aging response needed to reach 3.68kg

Figure 2:

## Postmortem Tenderization of the Beef Value Cuts of the Round

***Warner-Bratzler shear force (WBSF) at two days postmortem (kg), the change in shear force through 28 days postmortem (aging response), and a color corresponding to the percentage (%) of that change complete at each of six postmortem aging periods***

KEY - PERCENTAGE OF AGING RESPONSE COMPLETE




| Muscle[a] | Quality Grade | 2-d WBSF | Aging Response[b] | Days of Postmortem Aging 4 6 10 14 21 28 |
|---|---|---|---|---|
| AD | No QG Effect | 4.50 | 1.0 Moderately Low | |
| GS | No QG Effect | 4.63 | 1.0 Moderately Low | |
| GR | Premium Choice | 5.71 | 1.8 Moderately High | |
| GR | Select | 6.30 | 2.1 Moderately High | |
| PC | No QG Effect | 3.76 | 0.9 Moderately Low | |

[a]AD = *Adductor*, GS = *Gastrocnemius*, GR = *Gracilis*, PC = *Pectineus*.
[b]Aging response = WBSF at 2 d postmortem – WBSF at 28 d postmortem.

# CONCLUSIONS

**Tenderness of cooked beef was affected by individual muscle and length of postmortem aging time. The *Gracilis* was the only muscle to show a significant quality grade difference between USDA Select and premium USDA Choice samples. All muscles required 14 to 25 days of postmortem aging to complete a majority of the aging response. The *Adductor*, *Gastrocnemius*, Select *Gracilis*, premium Choice *Gracilis*, and *Pectineus* required 21, 14, 23, 23, and 25 days to complete a majority of the aging response, respectively (Table 1, page 8). Upon completion of the individual optimal aging periods, all muscles fell below the threshold of what most consumers would consider "slightly tender," using the WBSF threshold values reported by Platter et al. (2003). This illustrates the potential for these round muscles to be sold in foodservice operations and retail stores with marketing emphasis being placed on the acceptable tenderness and exceptional leanness of these cuts.**

MerlotC ut
*Gastrocnemius*

# Table 1:

## BEEF ROUND IMPS 158

**Inside Round 168**

***Adductor***
***Gracilis***
***Pectineus***

**Outside Round, Heel 171F**

***Gastrocnemius***

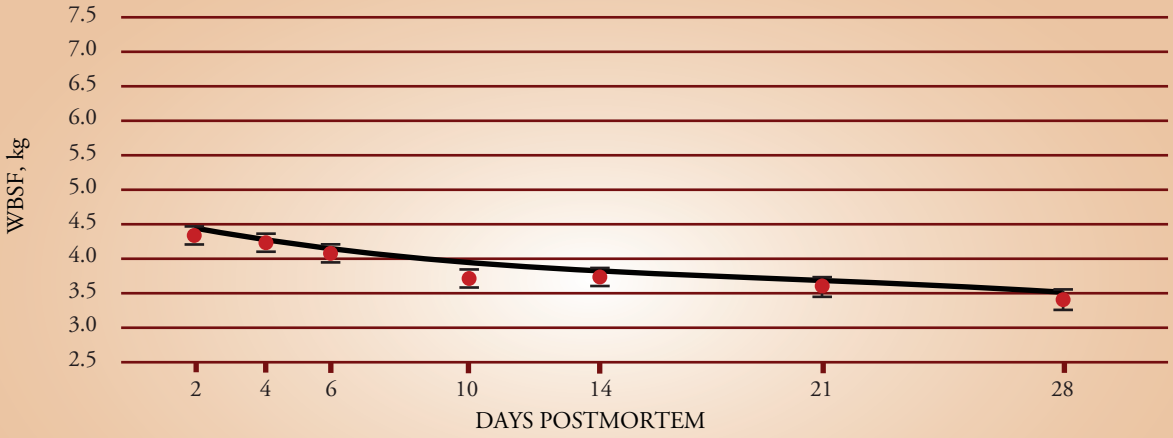
| Wholesale Cut | IMPS | Quality Grade | Muscle | Aging Response[a] | Aging Time[b], d | WBSF at Aging Time, kg |
|---|---|---|---|---|---|---|
| Outside Round, Heel | 171F | Select/Prem. Choice | *Gastrocnemius* | Moderately low | 14 | 3.68 |
| Inside Round | 168 | Select/Prem. Choice | *Adductor* | Moderately low | 21 | 3.62 |
| | | Select | *Gracilis* | Moderately high | 23 | 4.32 |
| | | Prem. Choice | *Gracilis* | Moderately high | 23 | 4.01 |
| | | Select/Prem. Choice | *Pectineus* | Moderately low | 25 | 2.96 |

[a] Aging response: High = ≥ 2.2 kg;
Moderately high = 2.1 to 1.8 kg;
Moderate = 1.7 to 1.1 kg;
Moderately low = 1.0 to 0.7 kg;
Low = ≤ 0.6 kg.

[b] Aging time corresponds to the day that at least 96%, 95%, 94%, 90%, and 85% of the aging response is complete for muscles with high, moderately high, moderate, moderately low, and low aging responses, respectively.

## Figure 3:

**Postmortem Tenderization – *Adductor***

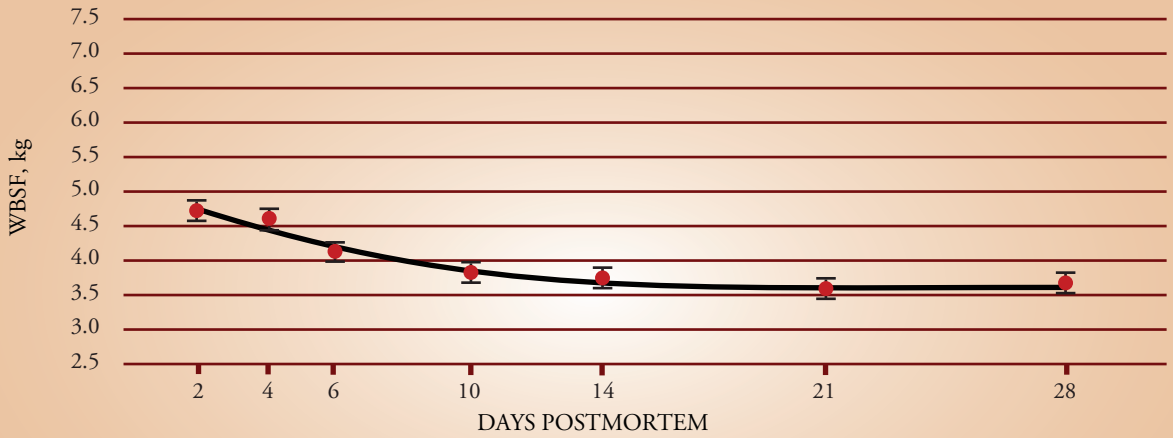



**WBSF of *Adductor* at 2-d postmortem, change in WBSF through 28-d postmortem, and the percentage of that change complete at each of 6 aging periods.**

| | | | Days Postmortem | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Quality Grade** | **2-d WBSF** | **Aging response (kg)** | **4** | **6** | **10** | **14** | **21** | **28** |
| **Select/Premium Choice** | **4.50** | **1.0** | **22.2** | **39.1** | **62.3** | **76.5** | **91.1** | **100.0** |

## Figure 4:

**Postmortem Tenderization – *Gastrocnemius***

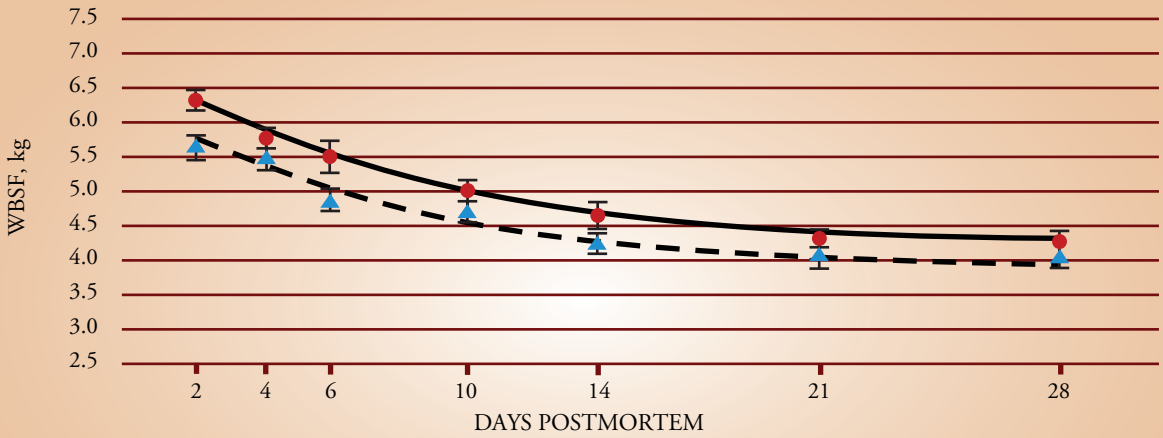



**WBSF of *Gastrocnemius* at 2-d postmortem, change in WBSF through 28-d postmortem, and the percentage of that change complete at each of 6 aging periods.**

| | | | Days Postmortem | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Quality Grade** | **2-d WBSF** | **Aging response (kg)** | **4** | **6** | **10** | **14** | **21** | **28** |
| **Select/Premium Choice** | **4.63** | **1.0** | **24.3** | **44.3** | **73.3** | **91.0** | **100.0** | **100.0** |

## Figure 5:

**Postmortem Tenderization – *Gracilis***

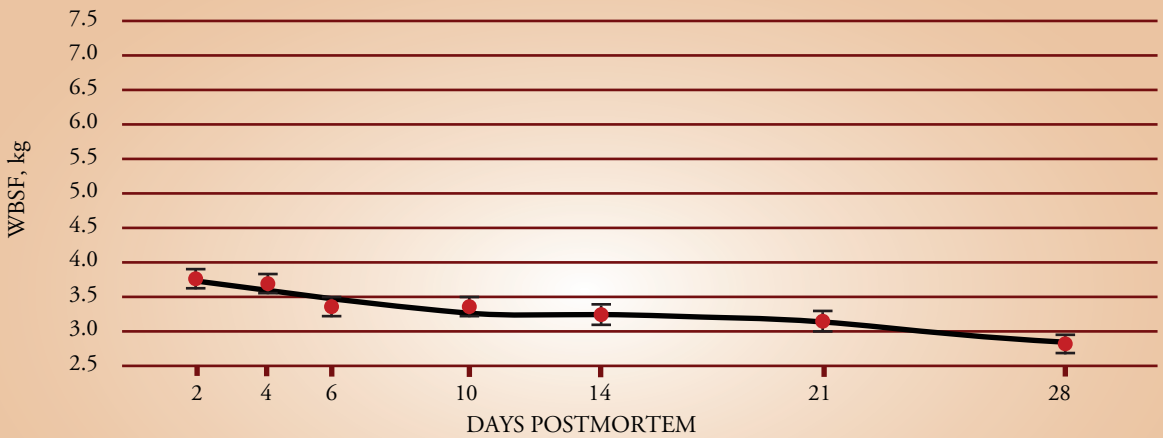



**WBSF of *Gacilis* at 2-d postmortem, change in WBSF through 28-d postmortem, and the percentage of that change complete at each of 6 aging periods.**

| | | | Days Postmortem | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Quality Grade** | **2-d WBSF** | **Aging response (kg)** | **4** | **6** | **10** | **14** | **21** | **28** |
| **Select** | **6.30** | **2.1** | **22.2** | **39.6** | **64.0** | **79.2** | **93.5** | **100.0** |
| **Premium Choice** | **5.71** | **1.8** | **22.1** | **39.5** | **64.0** | **79.2** | **93.4** | **100.0** |

## Figure 6:

**Postmortem Tenderization – *Pectineus***




**WBSF of *Pectineus* at 2-d postmortem, change in WBSF through 28-d postmortem, and the percentage of that change complete at each of 6 aging periods.**

| | | | Days Postmortem | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Quality Grade** | **2-d WBSF** | **Aging response (kg)** | **4** | **6** | **10** | **14** | **21** | **28** |
| **Select/Premium Choice** | **3.76** | **0.9** | **18.4** | **28.3** | **43.0** | **56.5** | **78.9** | **100.0** |

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