

# Round Muscle Profiling: Management of Tenderness and Sensory Improvement of Specific Muscles with Aging

## A.S. Leaflet R2265

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### Summary and Implications

At 7 and 14 d postmortem very little troponin-T degradation (30kDa) was seen in the GR, SAR, and VI. However, star probe measurements of GR (d3 and d7), SAR (d7), and VI (d1 and d7) were lower than the LD. The AD showed very little change in the amount of degraded troponin-T. This is mirrored in the star probe results of the AD where very little change is seen over time. The SM and VL were the only muscles to have star probe values higher than the LD. From this we can see that biochemical and tenderness differences exist between different muscles of the round, and some round muscles display biochemical and tenderness characteristics similar to those of the LD. As a result of this there is the potential to add value to some of the muscles (GR, SAR, and VI) of the round by marketing them as individual cuts.

### Introduction

Lack of consistent tenderness is a major quality problem that significantly impacts the profitability of the beef industry. Conservative estimates indicate tenderness defects cost the beef industry over \$216,000,000 annually (Morgan, 1995). The muscles of the round are particularly prone to being less tender than the higher value cuts of the strip loin and the rib. While muscles of the round traditionally have received similar treatment in regards to aging, differences within tenderness and rate of tenderization will provide insight into adding value to individual cuts from the round. The appearance of 30 kDa troponin-T band in troponin-T western blots is correlated with beef steak tenderness (MFI), sensory tenderness, and low Warner-Bratzler shear force values (Olson and Parrish, 1977). By looking at the appearance of this band in the muscles of the round we can better identify muscles that would be candidates to add values to by marketing as individual cuts. Describing the biochemical characteristics of individual muscles of the round will help to identify the suitability of these muscles for various markets.

## Materials and Methods

Ten beef cattle were slaughtered and the longissimus dorsi (LD) and the round muscles gracillus (GR), adductor (AD), sartorius (SAR), vastus lateralis (VL), and vastus intermedius (VI) were removed. Samples were aged 1, 3, 7, or 14 d. Objective tenderness measurements (star probe) and western blots for troponin-T to determine protein degradation were performed. For troponin-T degradation, two bands (Upper intact band, UI; 30kDa degradation product band, 30kDa) were measured and compared to a reference.

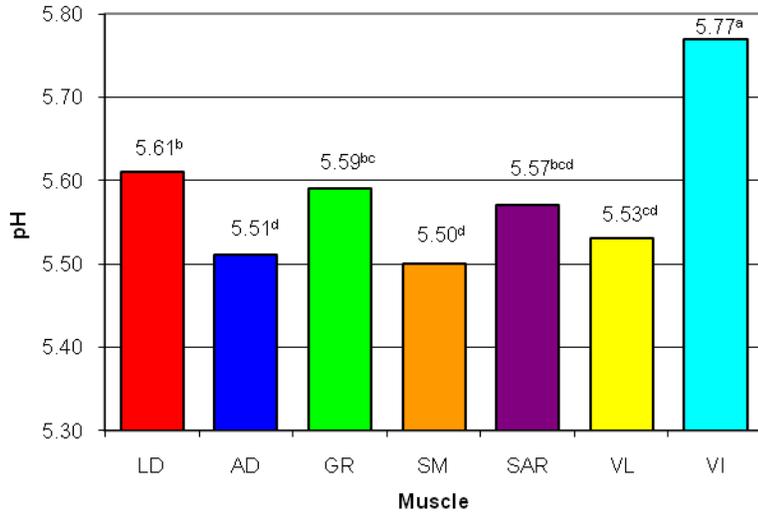
## Results and Discussion

Definition of characteristics of individual muscles from the round will make it possible to consistently add value to individual cuts. Therefore, the objective of this study was to determine the biochemistry underlying the differences in tenderness of specific muscles of the round. On d 1 star probe analysis found that VL required more force to penetrate ( $P=0.04$ ) than VI, SAR, and GR. VI had a lower force ( $P=0.04$ ) than LD. UI band of VI was less intense ( $P<0.01$ ) than AD, GR, and LD. LD had a more intense ( $P<0.01$ ) UI band than all other muscles except the AD. 30kDa was less intense ( $P=0.016$ ) than GR, LD, and VI. On d 3 VL required more force ( $P<0.01$ ) than all other muscles except the AD. AD required more force than GR, SAR, and VI and LD required more force than GR. UI band was less intense ( $P<0.01$ ) for VI than LD, AD, and GR. The UI band from LD was more intense ( $P<0.01$ ) than all other muscles except AD. The 30kDa band of AD and LD were more intense ( $P<0.01$ ) than all other muscles with the exception that LD tended to be more intense ( $P=0.069$ ) than VL. On d 7 LD, AD, and VL all required more force to compress ( $P<0.01$ ) than GR, SAR, and VI. 30kDa band of LD was more intense ( $P<0.01$ ) than all other muscles. On d 14, the VL required more force ( $P<0.01$ ) than all other muscles except AD, and AD required more force ( $P<0.01$ ) than GR, SAR, and VI. 30kDa band of LD was more intense ( $P<0.01$ ) than all other muscles. 30Kda band of AD was more intense ( $P<0.01$ ) than SAR and VI, and VI was less intense ( $P<0.01$ ) than VL. These data show that physical and biochemical differences exist between individual muscles of the round and may provide insight on ways to add value to individual cuts.

## Acknowledgements

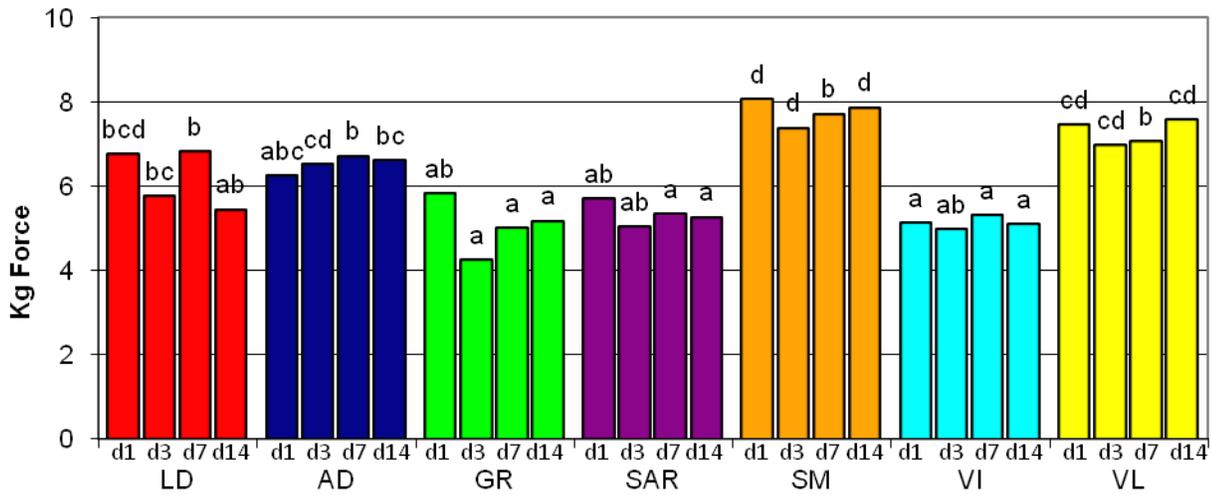
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Figure 1. pH at 24 h postmortem.



<sup>a,b,c,d</sup> means within a day with different superscripts differ ( $P < 0.05$ ).

Figure 2. Star probe values of round muscles.



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**Table 1. 30 kDa degradation product of troponin-T.**

Band <sup>f</sup>	Day	LD	AD	GR	SAR	SM	VI	VL	SE <sup>e</sup>
UI	1	1.37 <sup>b</sup>	1.16 <sup>b</sup>	1.05 <sup>b</sup>	0.94 <sup>b</sup>	1.38 <sup>b</sup>	0.31 <sup>a</sup>	0.89 <sup>b</sup>	0.19
UI	3	1.20 <sup>d</sup>	0.96 <sup>cd</sup>	0.87 <sup>bcd</sup>	0.53 <sup>ab</sup>	0.94 <sup>cd</sup>	0.32 <sup>a</sup>	0.77 <sup>bc</sup>	0.15
UI	7	0.91	0.73	0.88	0.63	0.69	0.59	0.63	0.13
UI	14	0.61 <sup>b</sup>	0.70 <sup>b</sup>	0.73 <sup>b</sup>	0.50 <sup>ab</sup>	0.53 <sup>b</sup>	0.25 <sup>a</sup>	0.59 <sup>b</sup>	0.11
30 kDa	1	0.35 <sup>ab</sup>	0.61 <sup>b</sup>	0.01 <sup>a</sup>	0.27 <sup>ab</sup>	0.44 <sup>b</sup>	0.00 <sup>a</sup>	0.23 <sup>ab</sup>	0.15
30 kDa	3	0.54 <sup>bc</sup>	0.76 <sup>cd</sup>	0.10 <sup>ab</sup>	0.14 <sup>ab</sup>	1.06 <sup>d</sup>	0.03 <sup>a</sup>	0.19 <sup>ab</sup>	0.16
30 kDa	7	1.04 <sup>c</sup>	0.50 <sup>b</sup>	0.29 <sup>ab</sup>	0.23 <sup>ab</sup>	1.27 <sup>c</sup>	0.13 <sup>a</sup>	0.32 <sup>ab</sup>	0.13
30 kDa	14	1.34 <sup>c</sup>	0.54 <sup>b</sup>	0.38 <sup>ab</sup>	0.31 <sup>ab</sup>	1.27 <sup>c</sup>	0.08 <sup>a</sup>	0.52 <sup>b</sup>	0.15

<sup>a,b,c,d</sup> Means within same row with different superscripts differ at P < 0.05.

<sup>e</sup> Pooled standard error of the mean

<sup>f</sup> UI = Upper intact band; 30 kDa = 30 kDa degradation product band.

**Table 2. Correlations between star probe values and troponin-T bands.**

Day	Muscle	Troponin T Band	r	P value
1	AD	UI	0.68	0.029
1	AD	30 kDa	-0.60	0.068
1	GR	UI	0.79	0.006
3	SAR	30 kDa	-0.77	0.024
7	AD	UI	0.55	0.10
7	LD	UI	-0.69	0.028
7	VL	UI	0.63	0.05
14	GR	UI	0.62	0.056