

# Growth Rate of Steers Affects Myofibrillar Fragmentation



## Index of Muscle

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**Objective:** Determine the effect of growth rate on tenderness or tenderness indicators such as myofibrillar fragmentation index (MFI).

### Materials and Methods:

- Steers (7) rapid and (7) slower growth (CGC herd at USDA-ARS-LARRL, Miles City, MT )
- Harvested after steers fed for a minimum of 120 days
- Carcass data (hot carcass weight, fat thickness, ribeye area, internal fat percentage and marbling scores)
- Loin samples were collected at 1 and 7 days postmortem.
  - Samples collected at 1 day PM were divided into four pieces and these pieces were aged at 4°C for 1, 3, 7, 14 and 21 days to evaluate MFI and degradation of troponin T and titin.
  - Myofibril isolation was conducted following the methods of Boles et al. (1992).
  - Myofibril fragmentation index was conducted following the procedures outlined by Culler et al. (1978) modified by Hopkins et al (2004).
- Steaks collected at 7 days were used for shear force measurements.
- Individual animals were used as the experimental unit.
- Planned comparisons between growth rate (fast vs. slow) were conducted.



Table 1. Growth rate affects on carcass composition and tenderness.

	Growth Rate		SEM
	Fast	Slow	
Carcass weight (kg)	331.9 <sup>a</sup>	262.8 <sup>b</sup>	23.6
Fat thickness (cm)	0.58	0.43	0.03
Ribeye area (cm <sup>2</sup> )	82.6 <sup>a</sup>	74.8 <sup>b</sup>	0.4
KPH (%)	1.78	1.64	0.21
Marbling <sup>1</sup>	358	338	13.9
Shear force (kg)	2.6	2.4	0.2

<sup>1</sup> 200 to 299 = traces; 300 to 399 = slight; 400 to 499 = small

<sup>a,b</sup> Means within a row with different superscripts are significantly different at P<0.05.

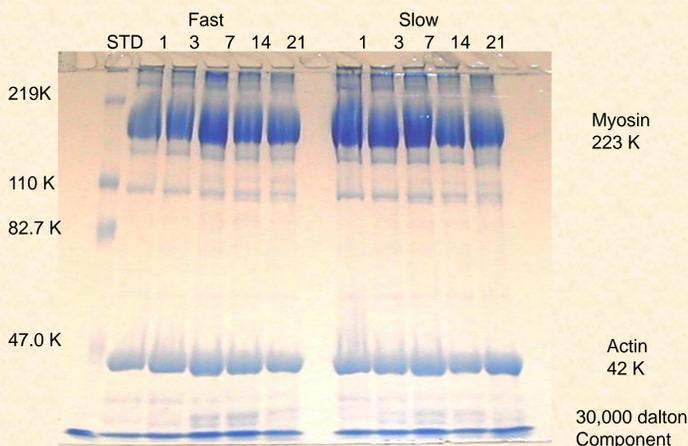


Figure 1. Coomassie brilliant blue stained 10% (37.5:1) gel of SDS-PAGE analysis of beef myofibrils isolated from LD samples aged for 1, 3, 7, 14 or 21 days from steers classified as fast or slow growing.

### Results

- Fast growing animals had larger carcass weights and significantly larger ribeye area than did slow growing animals
- All other carcass traits were similar between animals of different growth rates including quality grade
- There was no statistical difference between the shear force values for the different growth rates.
- MFI of fast growing animals were significantly higher indicating an increase in protein degradation postmortem with a more rapid growth rate.
- A significant difference was also found between day one and day 7 through 21 indicating an increase in fragmentation of the muscle during aging.
- There was no significant interaction between days of aging and growth rate for MFI suggesting the extent of proteolysis was not different between the two growth rates.
- Samples run on SDS-PAGE showed the appearance of the 30,000 dalton component that develops during aging but no difference was seen between different growth rates.

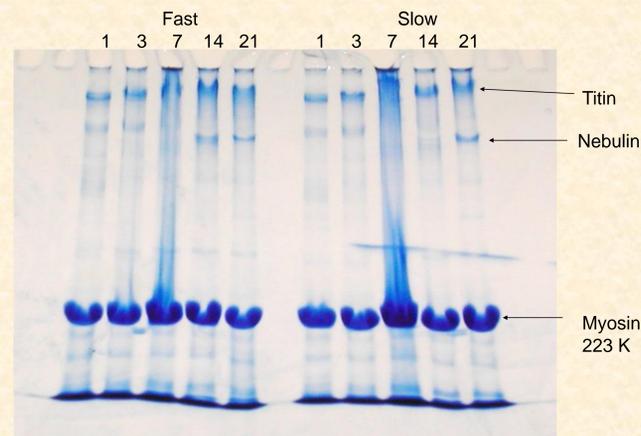


Figure 2. Coomassie brilliant blue stained 5% (100:1) gel of SDS-PAGE analysis of beef myofibrils isolated from LD samples aged for 1, 3, 7, 14 or 21 days from steers classified as fast or slow growing.

Table 3 Effect of growth rate and days of postmortem aging on myofibril fragmentation index (MFI).

		MFI
Growth Rate		
Fast		82.0 <sup>a</sup>
Slow		74.4 <sup>b</sup>
SEM		2.4
Days PM		
1		67.3 <sup>b</sup>
3		76.3 <sup>ab</sup>
7		80.3 <sup>a</sup>
14		81.6 <sup>a</sup>
21		85.7 <sup>a</sup>
SEM		3.8
Growth Rate X Days PM		
Fast	1	78.0
	3	81.6
	7	80.0
	14	86.4
	21	84.2
Slow	1	56.6
	3	70.9
	7	80.5
	14	76.8
	21	87.2
SEM		5.4

<sup>a,b</sup> Means within a column with different superscripts are significantly different at P<0.05.

### References

- Boles, J.A., F.C. Parrish, Jr., T. Huaitt and R.M. Robson 1992. Effect of porcine stress syndrome on the solubility and degradation of myofibrillar/cytoskeletal proteins. *Journal of Animal Science* 70:454-464.
- Culler, R.d., F.C. Parrish, G.C. Smith and H.R. Cross. 1978. Relationship of myofibril fragmentation index to certain chemical physical and sensory characteristics of bovine longissimus muscle. *Journal of Food Science*, 43:1177-1180.
- Hopkins, D.L., L. Martin and A.R. Gilmour. 2004. The impact of homogenizer type and speed on the determination of myofibrillar fragmentation. *Meat Science* 67:705-710.

### Conclusions

Growth rate of the animals did not have a major impact on tenderness indicators used in this study. MFI data suggested that faster growing animals were initially more tender than slow growing animals but the differences were removed after 7 days of aging. More research is necessary to determine if growth rate prior to harvest has an impact on tenderness of beef.