

# TENDERNESS AND SENSORY ATTRIBUTES OF ELEVEN MUSCLES FROM CARCASSES WITHIN THE CANADIAN MATURE BEEF GRADES

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**Abstract – Meat from mature cattle carcasses is often tough, therefore meat from these animals is usually not suitable for sale in retail and may be used in further processed products. The aim of the present study was to determine which muscles from carcasses graded within the Canadian grading standards for mature carcasses have similar eating quality to youthful beef. While the majority of muscles were perceived to be less tender, other sensory characteristics such as juiciness and beef flavour were generally similar, or in some cases better than youthful beef. These data indicate some opportunities exist for improved utilization of cow meat and provide grade and muscle specific guidance to improve eating quality.**

**Key Words – Cull cow, eating quality, meat quality**

## I. INTRODUCTION

In Canada, mature beef carcass grades (D1, D2, D3 and D4) are assigned when the degree of ossification of the spinous processes at the grade site (i.e. between the 12 and 13<sup>th</sup> rib) is >50%. Further differentiation among D grades occurs based on muscling, fat thickness and fat colour. It has been observed that the meat from many muscles of mature carcasses is often darker and therefore may not perform well for retail sale [1]. Additionally, the meat from some muscles of mature carcasses is tougher than youthful beef [2]. As such, meat from mature carcasses is often heavily discounted and used for further processing. By profiling the eating quality attributes from the mature grades more value could be obtained from muscles where the eating quality does not differ largely from youthful beef. Therefore the aim of the present study was to determine the tenderness and sensory characteristics of eleven muscles obtained from mature carcasses within the Canadian grading system.

## II. MATERIALS AND METHODS

Experiments were conducted with mature graded carcasses (D1, D2, D3, D4, n=21 of each grade) and youthful carcasses (A/AA quality grades: n=18) according to Canadian grading standards [3]. The Canadian mature grades are differentiated as follows: D1 carcasses have excellent muscling, white fat and <15mm in grade fat depth; D2 carcasses are allowed to have medium muscling, yellow fat and fat depth of <15mm; D3 carcasses have deficient muscling and <15mm grade fat; D4 carcasses have >15mm grade fat. Eleven muscles were obtained from each carcass: *rectus femoris* (RF; part of the knuckle), *gluteus medius* (GM; top butt), *semitendinosus* (ST; eye of round), *semimembranosus* (SM; part of the inside round), *biceps femoris* (BF; outside round), *longissimus thoracis* (LT; rib-eye), *longissimus lumborum* (LL; striploin), *psoas major* (PM; tenderloin), *infraspinatus* (IF; flat iron), *triceps brachii* (TB; part of the clod), *teres major* (TM; petite tender). These muscles were aged 14 d prior to sensory and shear force analysis. Muscles were cut into 2.5 cm thick steaks and grilled to an internal end-point temperature of 71°C. Sensory analyses were conducted by a 6 member established expert meat panel. Panellists were given samples of 1.3 cm<sup>3</sup> to evaluate for initial tenderness, overall tenderness, juiciness, beef flavour intensity and off-flavour intensity on 8 point descriptive scales. Peak shear force was determined on each core perpendicular to the fibre grain. Data were analyzed with orthogonal contrasts to determine if the shear force and sensory characteristics from muscles in mature were significantly different from those of youthful carcasses

## III. RESULTS AND DISCUSSION

The results suggest that while most meat from cow graded carcasses becomes less tender (Table 1), within these carcasses, some muscles did not become tougher. For example, the PM from mature graded carcasses remains tender

and had higher juiciness, suggesting this muscle is still valuable from the perspective of eating quality; similar results were observed in tenderness comparisons made between USDA select and grain-finished beef cull cows [2]. Additionally, several muscles (LL and IF from D1; PM from D3; LT and LL from D4) received lower scores for overall tenderness, but did not have a significantly higher shear force. This may indicate the extent of toughening for these muscles was not large. While overall tenderness for most muscles across the mature grades decreases, other sensory attributes (i.e. juiciness, flavour intensity and off-flavour intensity) were often similar to those of youthful carcasses (Table 1). In some instances, juiciness or beef flavour intensity were higher in the mature carcasses than in the youthful carcasses. As such, many cuts from mature carcasses would likely have acceptable eating quality with tenderness interventions such as blade tenderization or brine injection applied [4].

Table 1: Sensory characteristics of muscles from Canadian mature carcass grades (D1, D2, D3 and D4). Grades in the “less” or “more” sub-columns for each sensory trait indicate the muscle from that mature grade was significantly lower or higher ( $P < 0.05$ ) than the same muscle from youthful carcasses. The absence of a grade under the sensory characteristic indicates the muscles from that grade were not significantly different from youthful beef.

Muscle	Overall Tenderness		Juiciness		Beef Flavour Intensity	
	less	more	less	more	less	more
<i>Semimembranosus</i>	D1, D2, D3, D4				D3	
<i>Biceps femoris</i>	D1, D2, D3, D4					
<i>Semitendinosus</i>	D1, D2, D3, D4					
<i>Rectus femoris</i>	D1, D2, D3, D4			D1, D2, D3, D4		D4
<i>Gluteus medius</i>	D1, D2, D3, D4			D3		
<i>Longissimus thoracis</i>	D1, D2, D3, D4			D3, D4		D1
<i>Longissimus lumborum</i>	D1, D2, D3, D4			D1, D2, D3, D4	D3	
<i>Psoas major</i>	D3			D1, D2, D3, D4		
<i>Triceps brachii</i>	D1, D2, D3, D4					
<i>Infraspinatus</i>	D1, D2, D3, D4					D1, D4
<i>Teres major</i>	D1, D2, D3, D4			D1, D2, D3, D4		D2, D4

Differences in meat quality exist among the mature quality grades. The largest decreases in tenderness occurred in the D3 carcasses. The present results appear to be consistent with tenderness measures obtained from non-finished beef cows [2]. Quality differences between mature grades suggest that classification of mature carcasses based on muscling and fat depth does serve to partially differentiate carcasses in a manner that relates to meat quality. The information in the present study will allow packers utilizing the Canadian grading system to maximize the value of meat from mature graded carcasses, allowing improved decision making regarding the use of cow carcass meat.

#### IV. CONCLUSION

While the PM from most Canadian mature grades remains tender and retains high eating quality, most muscles would require tenderness intervention to reach the eating quality of youthful beef. Some grade and muscle dependent opportunities exist for improved utilization of cow meat.

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#### REFERENCES

1. Rose, M. N., Garmyn, A. J., Hilton, G. G., Morgan, J. B. & VanOverbeke, D. L. (2010) Comparison of tenderness, palatability, and retail caselife of enhanced cow subprimals with nonenhanced cow and United States Department of Agriculture Select subprimals. *Journal of Animal Science* 88: 3683-3692.
2. Stelzl, A. M., Patten, L. E., Johnson, D. D., Calkins, C. R. & Gwartney, B. L. (2010) Benchmarking carcass characteristics and muscles from commercially identified beef and dairy cull cow carcasses for Warner-Bratzler shear force and sensory attributes. *Journal of Animal Science* 85: 2631-2638.
3. Canadian Beef Grading Agency. (2016). Available from: <http://www.beefgradingagency.ca/index.html>.
4. Pietrasik, Z., Aalhus J. L., Gibson, L. L. & Shand, P. J. (2010) Influence of blade tenderization, moisture enhancement and pancreatin enzyme treatment on the processing characteristics and tenderness of beef semitendinosus muscle. *Meat Science* 84: 512-517.