

A. Mata¹, J. L. Nelson², B. Lobaugh³, K. A. Underly⁴, C. R. Calkins⁵, E. Gibson⁶, and S. J. Wald⁶

¹ Mata Development Group, Colleyville, TX; ² Oklahoma State University, Stillwater, OK; ³ iQ Foods, Fayetteville, AR; ⁴ Range, Inc, Chicago, IL; ⁵ University of Nebraska, Lincoln, NE; and ⁶ National Cattlemen's Beef Association, Englewood, CO - U.S.A.

INTRODUCTION

- Round muscles possess unique properties that make them especially challenging to use for value-added beef items.
- They are lean, often high in connective tissue, and generally low in tenderness.
- To add value, separation of the various muscle groups into component muscles will likely be needed as muscles vary in their sensory traits.
- To facilitate fabrication of the beef round into cuts to which value can be added it is necessary to know the cutting yields.

OBJECTIVE

- To quantify the cutting yield of specific muscles and muscle groups in the beef round. In addition, published tenderness and sensory properties have been combined with ease of fabrication and cutting yield information to suggest candidate muscles for value-adding procedures.

CONCLUSION

On the basis of tenderness, sensory properties and ease of fabrication, several muscles in the round are candidates for development of value-added cuts. These include the *m. gracilis*, *m. pectineus*, *m. sartorius*, *m. rectus femoris*, and the *m. adductor*.

MATERIAL AND METHODS

- Shank-off, semi-boneless beef rounds (NAMP no. 160 except the aitch bone was included, [2]; n = 29) from young, market-weight beef cattle (mean carcass weight = 378.8 kg) were fabricated into major muscle groups.
- Selected muscle groups were then further fabricated into individual muscles and denuded of all fat and heavy connective tissue.
- Muscle groups included the cap-off inside round (*m. adductor* and *m. semimembranosus* together), inside round cap and side muscles (*m. gracilis*, *m. pectineus*, and *m. sartorius*, together and independent of each other), outside round flat (*m. biceps femoris*), heel (*m. gastrocnemius* and *m. superficial digital flexor* together), eye of round (*m. semitendinosus*), and the knuckle (*m. rectus femoris*, *m. vastus medialis*, *m. vastus intermedius*, and *m. vastus lateralis* together).

RESULTS AND DISCUSSION

Table 1. Mean weight and percentage of muscle groups in the beef round

Item	Muscle	Weight, kg	Standard Deviation, kg	Percent of round	Standard Deviation, %
Round, shank-off, semi-boneless		32.66	3.15		
Inside round, cap off, side muscles off	<i>m. adductor</i> and <i>m. semimembranosus</i>	5.77	0.82	17.65	1.46
Inside round cap	<i>m. gracilis</i>	0.89	0.19	2.72	0.42
Inside round cap - side muscle	<i>m. pectineus</i>	0.42	0.07	1.30	0.18
Inside round cap - side muscle	<i>m. sartorius</i>	0.25	0.05	0.77	0.12
Outside round flat	<i>m. biceps femoris</i>	5.36	0.71	16.37	0.89
Eye of round	<i>m. semitendinosus</i>	2.35	0.40	7.18	0.90
Heel	<i>m. gastrocnemius</i> and <i>m. superficial digital flexor</i>	1.88	0.28	5.75	0.55
Knuckle	<i>m. rectus femoris</i> and vastus muscles	4.36	0.50	13.35	0.80
Bone		3.26	0.41	9.98	0.85
Trim		7.00	1.01	21.54	3.10
Purge/cutting loss		1.11	0.21	3.38	0.53

Table 2. Published Warner-Bratzler shear force values for muscles from the beef round.

Muscle	Dry heat cookery		Moist heat cookery		Source
	Shear force, kg	Standard Deviation, kg	Shear force, kg	Standard Deviation, kg	
<i>m. adductor</i>	4.48	1.10	4.47	0.59	[3]
<i>m. semimembranosus</i>	4.30	1.23	4.10	0.70	[3]
<i>m. gracilis</i>	4.12	0.81	3.67	0.61	[3]
<i>m. pectineus</i>	3.70	0.65	4.27	0.73	[3]
<i>m. sartorius</i>	4.45	0.47	4.63	0.48	[3]
<i>m. biceps femoris</i>	4.51	1.33	4.82	1.64	[3]
<i>m. gluteus medius</i>	6.04	1.14	5.12	1.28	[3]
<i>m. semitendinosus</i>	4.72	0.84	5.02	0.72	[3]
<i>m. rectus femoris</i>	3.65	0.75	3.81	0.65	[3]
<i>m. vastus medialis</i>	3.73	0.74	3.88	0.63	[3]
<i>m. vastus intermedius</i>	4.02	0.60	3.53	0.62	[3]
<i>m. vastus lateralis</i>	5.28	1.03	4.82	0.73	[3]
<i>m. gastrocnemius</i>	4.42	1.38	4.42	0.97	[4]

- The outside round flat can be increased in value by removing the ischiatic head of the *m. biceps femoris*.
- The *m. rectus femoris* is one of the top two most tender muscles in the round. This is a steak-quality muscle that merits exploration as a steak item, not just as a convenient beef roast.
- Additional value can apparently be returned by separating the cap and side muscles from the inside round. This includes the *m. gracilis*, a wide, flat muscle with coarse texture.
- The *m. pectineus* is tender and offers a strong opportunity for adding value.
- The *m. sartorius*, because of accessibility and consistency, could be used as a specialized beef cut or in the production of ground round, a popular and relatively high value product in the United States.

REFERENCES

- Von Seggern, D.D., Calkins, C.R., Johnson, D.D., Brickler, J.E., and Gwartney, B.L. 2005. Muscle Profiling: Characterizing the muscles of the beef chuck and round. *Meat Science* 71:39-51.
- Meat Buyer's Guide. North American Meat Processors Association, Reston, VA, USA.
- Calkins, C.R. and Johnson, D.D. 2009. Characterizing muscle properties to develop muscle-specific intervention strategies and improve meat cuts for the consumer. In *Improving the sensory and nutritional quality of fresh meat*. J.P. Kerry and D. Ledward, Eds. Woodhead Publishing, Ltd., Cambridge, UK.
- Calkins, C.R., Pokharel, S., de Mello, A.S., Senaratne, L., and Hinkle, J.B. 2009. Characterizing the beef heel muscle. A final report submitted to the National Cattlemen's Beef Association, Englewood, CO.