

Project Title:	Properties of Cow and Beef Muscles—Benchmarking the Differences and Similarities
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Background

In the past five years, the beef checkoff-funded muscle profiling research projects for fed cattle and mature cows have had enormous impact on the utilization of under-valued beef cuts. The characterization of the physical, chemical and sensory properties of the major muscles led to the development of “Beef Value Cuts,” a successful initiative to promote the use of muscles with unique product potential.

With the release of the cow muscle profiling data came a new set of challenges. Processors are interested in knowing how muscles from beef and dairy cows compare with fed beef on a direct, head-to-head basis. Neither the cow muscle profiling nor the A-maturity¹ muscle profiling research included taste panels on all of the muscles included in this analysis. This information is important to increasing the application of cow muscle profiling results.

The University of Nebraska and University of Florida conducted research projects to achieve the following objectives:

1. Compare the physical dimensions and composition of commercial and fed beef cow muscles, dairy cow muscles, and A-maturity, Select-grade muscles harvested from existing subprimal cuts.
2. Evaluate tenderness and flavor differences among beef cow, dairy cow and A-maturity muscles.

Methodology

University of Florida

Subprimal cuts from both sides of top-tier² carcasses of 30 beef cows and 30 dairy carcasses were obtained. Subprimal cuts were also obtained from 15 A-maturity, Select-grade carcasses. Half of the beef and dairy cow carcasses came from commercially identified animals that had supplemental feeding prior to harvest.

The following muscles were obtained from each carcass:

Teres major
Rectus femoris
Gluteus medius
Infraspinatus
Tensor fascia latae

Triceps brachii lateral head
Triceps brachii long head
Psoas major
Longissimus dorsi

Physical properties determined for each muscle included:

- Physical dimensions after removal from the subprimal—on one side of each animal
- Weights (as a percentage of the subprimal)—on one side of each animal
- Warner-Bratzler shear force value (WBSF)
- Sensory flavor evaluation for intensity, off-flavor presence and off-flavor characterization

One-inch steaks were removed from the center of muscles that had average weights greater than three pounds. Muscles with average weights of three pounds or less were split approximately in half and one half of the muscle was used for sensory analysis and the other half was used for determining shear force values. All muscle portions or steaks were aged for a total of 14 days postmortem and then frozen at -18° C for later analysis.

Panelists evaluated steaks for:

- Overall tenderness
- Beef flavor intensity
- Off-flavor intensity and characterization

University of Nebraska

The same nine muscles that were obtained in the University of Florida portion of this project were also analyzed by University of Nebraska researchers. Muscles were removed from both sides of the carcasses, vacuum packaged and aged from seven to ten days prior to analysis. Carcasses were sourced from the following types of animals:

- Fed dairy cows (n = 15)
- Non-fed dairy cows (n = 15)
- Fed beef cows (n = 15)
- Non-fed beef cows (n = 15)
- A-maturity USDA Select-grade beef (n = 15)

Physical dimensions and cutting yields were measured on muscles from one side of the carcass, which were also used for sensory analysis and shear force determination. Muscles from the other side of the carcass were used to determine proximate composition (moisture, protein, fat and ash), total collagen content, pH, heme iron content and objective color (L*, a*, b*).

Findings

University of Florida

USDA Select carcasses had whiter fat, lighter more youthful colored lean, higher muscling scores and larger ribeye areas than did both the beef and dairy cow carcasses. Except for *longissimus* and *psoas major* muscles, steaks from the seven other muscles sourced from USDA Select carcasses were more tender based on shear force values.

Steaks from all muscles except the *psoas major* from the non-fed beef cow carcasses had higher shear force values than did the other cow carcass types and were less tender based on objective measurements. Sensory panel evaluations for tenderness were similar to the shear force responses for most of the muscles.

Steaks from the *longissimus* from fed beef cows were not different from non-fed and fed dairy cow carcasses in tenderness, suggesting that supplemental feeding cows prior to slaughter does not affect shear force value for all muscles in a similar fashion.

Trained sensory panelists rated the muscles from USDA Select carcasses the highest for

tenderness and steaks from non-fed beef carcasses the lowest. There was a slight difference in flavor intensity between steaks from USDA Select carcasses and steaks from the mature carcass groups. The *psaos major* was scored by panelists as the most tender muscle followed closely by the *teres major*.

As might be expected, the steaks from USDA Select beef carcasses had the least amount of “off-flavors” as identified by the sensory panelists. Steaks from non-fed beef carcasses had the highest incidence of off-flavors, which were most commonly characterized as “grassy.” Steaks from fed beef cow carcasses were described most commonly as “serumy/cow” or “livery” in flavor. Interestingly, off-flavor descriptors did vary across muscle type.

University of Nebraska

Two muscles from fed beef cows, the *infraspinatus* and the *teres major*, performed very similarly, both physically and chemically, to A-maturity USDA Select-grade beef. The majority of muscles from cows did not differ from younger cattle for percent expressible moisture, composition, and total collagen content. There were notable differences, however in pH, objective color (L*, which is a measure of lightness), total pigment content and heme iron content between cow populations and younger cattle.

Implications

University of Florida researchers found that supplemental feed did appear to help the palatability attributes of mature cow beef, especially for the beef cow carcasses. In this study, however the feeding did not make them equal to steaks from USDA Select beef carcasses. Furthermore, diet composition, days on feed or amount of supplemental feeding could not be identified in this study.

University of Nebraska researchers found that based on this study, the *teres major* and *infraspinatus* from fed beef cows performed similarly to the same muscles from A-maturity cattle. However, most muscles from cows were darker in color, had higher pH values and had greater heme content than muscles from younger cattle. Those traits may be undesirable to consumers.

Additional work needs to be conducted to study the influence of supplemental feeding and other variables in closing the palatability gap between young and mature beef in order to increase value and supply of consumer preferred beef products. Post-harvest technologies or enhancements may also be needed to upgrade muscles from cow carcasses to perform more similarly to muscles from A-maturity cattle.