

Project Summary

Determining Proper Use of Beef Chuck and Round Muscles by Sorting into Muscle Families

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Background

As a result of the Checkoff-sponsored Muscle Profiling Study, some muscles from the chuck and round have been identified and proven useful as high quality steaks. Research has also shown that some muscles from those two subprimals are not as acceptable as steak cuts and may be more marketable if they are marinated or sold to consumers precooked.

The objectives of this study were:

1. Determine the optimal use for several muscles or cuts from the chuck and round.
2. Group similar muscles into “families” that have similar characteristics.
3. Determine the properties of value-added beef cuts.
4. Provide information to small beef processors and groups interested in processing beef, so they can determine the feasibility of further enhancement of specific muscles.

Methodology

Boxed beef subprimals (approximately 10 to 15) that were USDA Choice were obtained from a federally inspected packing facility. The following individual muscles were fabricated from either the chuck roll (IMPS/NAMP 116A), brisket (IMPS/NAMP 120), knuckle (IMPS/NAMP 167A) or inside round (IMPS/NAMP 168):

- *Complexus*
- *Serratus ventralis*
- *Vastus lateralis*
- *Vastus intermedius*
- *Rhomboideus*
- *Superficial pectoral*
- *Adductor*
- *Gracillus*
- *Pectineus*
- *Sartorius*

A strip steak (*Longissimus*) was used as a control for some of the tests.

Determining optimal use for each muscle and sorting into families

Characteristics for each muscle were obtained, either from existing literature or via experimentation. A trained sensory panel evaluated muscles for palatability traits. Steaks used in the trained sensory panel evaluations were aged for 15 days.

Panelists evaluated samples using a descriptive eight-point scale to describe tenderness, juiciness and beef flavor intensity. In addition, panelists used a four-point scale to describe the presence of off-flavors. The samples were evaluated in sets of four and the panelists were also asked to rate the similarity/difference between samples within each set with one being extremely similar and eight being extremely different. Similarity scores between muscles that were greater than 700

meant that the trained sensory panelist could not detect significant differences between two muscles.

These data were combined with existing knowledge to place muscles into families. Muscles were sorted into families using the following criteria:

1. Both trained and consumer sensory panels had to rate a muscle at least slightly tender, juicy and flavorful, and consumer panels had to rate them at least slightly acceptable for overall like, for a muscle to be classified into the “fresh steak” or “enhanced steak” family.
2. If a muscle was not rated by trained and consumer panels as at least slightly tender, juicy and flavorful, and by a consumer panel at least slightly acceptable as a fresh steak, but was rated as at least slightly tender, juicy and flavorful, and slightly acceptable by a consumer panel as an enhanced steak, then the muscle was placed in the “enhanced steak” family.
3. If a muscle was enhanced and still was not rated by a consumer panel as at least slightly tender, juicy and flavorful, and slightly acceptable, the steak was considered for precooking or other applications and was not included in the “fresh steak” or “enhanced steak” family.

To provide an objective format for sorting the muscles into families, a methodology was devised to determine how closely related muscles were to each other based on their potential uses. Once a muscle was assigned to a family, the key properties of that family were determined in the following order and with the following methods:

1. Aging requirements:
Steaks were fabricated from each of the muscles, vacuum packaged, aged for five, 10, 15 or 20 days and frozen until they were evaluated for tenderness using Warner Bratzler shear force (WBSF). Shear force values were averaged using all core samples from each steak.
2. Display life:
Steaks were fabricated from each of the muscles and were packaged in foam trays with Saran overwrap and placed in simulated retail display. Objective color scores (L*, a*, b*) were measured daily.
3. Consumer sensory panels:
Steaks were fabricated from each of the muscles and aged for 10 days. Half of the steaks from each muscle were pumped to 110 percent of their initial weight using a solution of 5 percent salt and 3.5 percent phosphate prior to freezing. Samples were frozen for less than 30 days before being used in the consumer taste panel. Each panelist rated 12 samples (one control and one enhanced of each of the *adductor*, *gracillus*, *rhomboideus*, *longissimus*, *superficial pectoral* and *vastus lateralis* for overall like, tenderness, juiciness and flavor on a 10-point scale where one equaled extreme dislike and 10 equaled extreme like. The results were analyzed within each muscle group to determine the change in palatability due to enhancement.

Findings

Table 1 lists the muscle families based on traits that they had in common. Results from the trained and consumer sensory panels indicated that the *complexus*, *pectineus*, *sartorius*, *serratus*,

ventralis and *vastus intermedius* are acceptable as steaks without the need for additional enhancement, tenderization or other palatability interventions.

Enhancement with water, salt and phosphate improved the palatability ratings of the *adductor*, *vastus lateralis* and *gracillus* to a level that was at least acceptable to consumers. Past research has shown that moisture enhancement improves palatability. Based on this project, there appeared to be a threshold that if a muscle had too many negative palatability factors, moisture enhancement cannot improve the muscle to an acceptable level. It is important to also note that even though moisture enhancement improved palatability, most muscles were still rated lower than control *longissimus* steaks. Steaks from the *adductor*, *vastus lateralis* and *gracillus* may be acceptable to consumers as steaks, however they will likely not be as valuable on a monetary basis as *longissimus* steaks.

Table 1. Steaks sorted into “families” based upon optimal use.

Fresh Steak	Enhanced Steak*	Precooked	Other
<i>Complexus</i>	<i>Complexus</i>	<i>Rhomboideus</i>	<i>Rhomboideus</i>
<i>Pectineus</i>	<i>Pectineus</i>	<i>Superficial pectoral</i>	<i>Superficial pectoral</i>
<i>Sartorius</i>	<i>Sartorius</i>		
<i>Serratus ventralis</i>	<i>Serratus ventralis</i>		
<i>Vastus intermedius</i>	<i>Vastus intermedius</i>		
	<i>Adductor</i>		
	<i>Vastus lateralis</i>		
	<i>Gracillus</i>		

*A greater than one point improvement due to enhancement and an average overall like and tenderness score >5 on a 10-point scale.

In general, the muscles examined in this study should be aged at least 10 days before use and there were no apparent differences in display life. Similarity scores that were greater than 700 indicated no significant differences in the ability sensory panelists to differentiate between steaks. This indicated that muscles with scores greater than 700 could be used for similar applications.

Implications

This research can help beef processors better utilize muscles from the chuck and round. The data indicated optimum uses for specific muscles. Similarity values calculated as part of this research will also allow beef processors to group several small muscles together for a similar purpose.

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