

## **Project Summary**

### **A Muscle Profile of Value Added Beef from the Chuck and Round**

**Principal Investigator: J. Chance Brooks, Ph.D.  
Oklahoma State University**

**Study Completed  
May 2003**



*Funded by The Beef Checkoff*

# A Muscle Profile of Value Added Beef from the Chuck and Round: Project Summary

## Background

The chuck and round represent the largest portions of the beef carcass. However, the values of these two primal cuts have declined by approximately 20 to 30 percent. As a result, there has been an ongoing effort to increase the use of cuts from these subprimals, which would subsequently increase their value. Muscle profiling research identified several under-valued and underutilized beef muscles from the chuck and round. Additional research has evaluated the cuts' attributes to determine the various individual muscles' most optimal use and value.

This study takes the research a step further by examining eight cuts that were identified for their potential as foodservice menu items, and as palatable, low-cost steaks. The effect of mechanical tenderization and marinating was determined through Warner-Bratzler shear force values, trained sensory panel evaluations and consumer ratings.

## Methodology

Beef chuck and round subprimals were obtained from a federally inspected beef processing plant and shipped to the Food and Agricultural Products Center at Oklahoma State University. The following table lists the subprimals, and the associated Institutional Meat Purchasing Specifications (IMPS) identification number, and the number of samples obtained per grade:

Shoulder Clod	IMPS 114	n = 35
Chuck Tender	IMPS 116B	n = 35
Knuckle	IMPS 167A	n = 30
Inside Round	IMPS 169A	n = 20
Outside Round	IMPS 171B	n = 20

Four chuck muscles (*infraspinatus*, *triceps brachii*, *teres major*, *supraspinatus*) and four round muscles (*rectus femoris*, *vastus lateralis*, *biceps femoris*, *semimembranosus*) from three USDA quality grades (Choice, Select, Standard) were utilized in this study.

Muscles from each grade were randomly segregated into treatment and control groups. The treated muscles were mechanically tenderized using a needle tenderizer and marinated in a vacuum tumbler. Muscles from both groups were fabricated into seven-ounce steaks, vacuum packaged, aged for 21 days and then frozen.

To evaluate tenderness, Warner-Bratzler shear force values were collected for all muscles, grades and treatment groups.

During the consumer panel evaluations, participants were asked to answer a series of questions pertaining to their demographic makeup and steak purchasing habits. They were then served a meal consisting of a salad, vegetable, bread and three USDA Choice steak samples. The samples were approximately 3.5 ounces each and included a treated steak, a non-treated portion of the same muscle and a portion of untreated Certified Angus Beef top loin steak that had been aged

for 21 days. Panelists ranked the steaks using a nine-point scale for overall like, flavor, juiciness, tenderness, and a five-point scale for purchase intent.

Trained sensory panel evaluations were also conducted. Participants were asked to evaluate samples for tenderness, juiciness, connective tissue amount and overall acceptability using an eight-point scale. Samples were also rated for uncharacteristic flavor on a four-point scale.

Proximate analysis was conducted on samples taken from non-treated muscles from all quality grades to determine moisture, fat and protein content.

Fabrication time and yield data was also compiled for the various cuts. It should be noted that products from USDA Standard cuts were commodity trimmed and products from USDA Choice and Select cuts were closely trimmed.

## **Findings**

### Warner-Bratzler Shear Force

Past research has shown that shear force values of less than 3.0 kg should result in 100 percent consumer satisfaction for tenderness. Treated steaks had the lowest shear force values, indicating improved tenderness. Steaks from the *semimembranosus* and *triceps brachii* had mean shear force values of less than 4.6 kg and 3.9 kg, respectively. This indicates that these steaks should have a 50 percent and 68 percent chance, respectively, of being rated as “slightly tender”.

The *infraspinatus* steaks had shear force values below 3.0 kg, regardless of USDA Quality Grade or treatment, and were the most tender of the muscles evaluated.

### Consumer Panel

Steaks fabricated from the *infraspinatus*, *rectus femoris*, and *teres major* received the highest overall acceptability and tenderness ratings, whereas the *vastus lateralis* had the lowest overall acceptability scores among all muscles evaluated. The *vastus lateralis*, *biceps femoris*, *semimembranosus* and *supraspinatus* received the lowest tenderness ratings among all steaks evaluated by consumers respectively. Overall, treated steaks from the eight muscles ranked significantly higher for all consumer evaluated traits when compared to the non-treated controls.

Non-treated *infraspinatus* steaks were rated similar to Certified Angus Beef steaks for overall acceptability, tenderness, juiciness and purchase intent. In addition the *infraspinatus* steaks received the highest flavor scores.

### Proximate Analysis

Fat level was the most variable component of the proximate analysis and ranged from 1.10 (*rectus femoris*) to 7.15 percent (*infraspinatus*). There was an inverse relationship between fat percentage and moisture level in all cuts. In addition, grade had a significant effect on the percentage of fat in all of the muscles, and as might be expected, muscles receiving higher trained sensory panel and consumer panel scores also had higher fat contents.

### Trained Sensory Panel

Treated steaks received more favorable ratings than their non-treated counterparts for all sensory attributes. *Biceps femoris* steaks had a significant treatment effect for tenderness, with treated steaks receiving a “slightly tender” rating.

Non-treated USDA Choice, Select and Standard *semimembranosus* and *triceps brachii*; and non-treated USDA Choice *supraspinatus* and *vastus lateralis* averaged “slightly tough” tenderness ratings.

Mechanical tenderization and marination greatly improved mean acceptability scores for *semimembranosus* steaks from “slightly undesirable” to “slightly desirable.” Among steaks with a significant grade by treatment interaction for overall acceptability, all *infraspinatus* and *teres major* steaks received a mean score of “slightly desirable” or higher. Other muscles varied greatly by treatment and grade.

### Fabrication Time and Yield Data

The *supraspinatus* had the highest yield of all sub-primals. While the *infraspinatus* and *teres major* performed very well in sensory and tenderness evaluations, they represent only a small part of the shoulder clod. The denuded muscle yield of all muscles from the shoulder clod was markedly lower when compared to other subprimals.

Purge loss varied among the muscles sampled with mean values approaching 0.50 lb for the *semimembranosus* and *supraspinatus*, which could represent substantial loss in value.

Sub-primal fabrication time varied, with the shoulder clod generally taking the longest to fabricate. The *biceps femoris* and *semimembranosus* took the longest to fabricate, but produced the highest number of seven-ounce steaks. *Biceps femoris*, *triceps brachii*, *infraspinatus* and *semimembranosus* muscles were the most labor intensive muscles to fabricate for steak cutters, while *teres major* steaks had the shortest steak fabrication time. The *infraspinatus* was one of the lowest yielding, most labor intensive muscles to fabricate, however it proved to be the most palatable muscle sampled.

### **Implications**

The *infraspinatus*, *teres major*, and *rectus femoris* muscles showed the most potential for being developed into palatable steaks due to their acceptable shear force values and relatively favorable consumer and sensory panel profiles. Conversely, the *vastus lateralis*, *semimembranosus* and *biceps femoris* muscles showed the least potential based on their comparatively poor performance for the same parameters.

While several of these muscles produced steaks with positive attributes, processors need to consider that some cuts only performed well within a specific quality grade. In addition, any value gained might be offset by fabrication requirements and product enhancement methods. More research should be conducted to determine economic advantages of these steaks, especially if they are enhanced.

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***For more information contact:***  
National Cattlemen's Beef Association  
9110 East Nichols Avenue  
Centennial, Colorado 80112-3450  
(303) 694-0305