

Project Title:	In-Home Consumer Evaluations of Individual Muscles from Beef Rounds Subjected to Tenderization Treatments
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Background

For the last several years, the beef industry has focused on identifying and improving underutilized muscles from the round and chuck as a way to increase the value of the entire carcass. Muscle profiling studies funded by The Beef Checkoff program have been successful in identifying and characterizing those underutilized muscles. Palatability is a complex interaction of tenderness, juiciness and flavor, however research has shown that tenderness is the driving economic factor for beef palatability and the attribute that is the most important to consumers. Previous research, including the muscle profiling studies, has shown that muscles from beef rounds are intermediate in tenderness. The inconsistency in tenderness that is often observed in muscles from the round may mean that postmortem tenderization could be used to improve the tenderness of these muscles to meet consumer expectations.

Postmortem tenderization methods such as blade tenderization, enzymatic tenderization and moisture enhancement with salt and phosphate solutions have been shown to be muscle dependent, with the *M. gluteobiceps* and *M. semitendinosus* showing little improvement in tenderness with any of the treatments. In contrast, the *M. semimembranosus*, *M. adductor*, *M. rectus femoris*, and *M. vastus lateralis* showed promising improvements in tenderness after being subjected to any of these procedures.

Several tenderization treatments have been noted as having some potentially negative impacts on other palatability characteristics. For example, increased purge loss and subsequent problems with juiciness have been found with blade tenderized steaks. One of the limitations of objective measures of tenderness, such as Warner Bratzler shear force (WBSF), is that many factors such as cooking method and degree of doneness, are controlled. While these studies offer important information, they may not reflect how steaks from those muscles will perform when they are prepared by consumers using a variety of cooking methods and differing degrees of doneness.

This study was conducted to determine in-home consumer palatability responses for steaks from individual muscles from beef rounds that have been tenderized using blade tenderization or injected with a salt and phosphate solution. A second study was conducted to determine which tenderization treatment, blade tenderization or moisture enhancement, works best with each muscle to optimize palatability based on consumer evaluations.

Methodology

Subprimals were purchased from a local processing facility and shipped to Texas A&M University research facilities. USDA Select beef inside rounds (NAMP/IMPS 169A; n = 67) and knuckles (NAMP/IMPS 167A; n = 66) were randomly assigned to one of three treatments: 1) control, 2) blade tenderization or 3) injection with a salt and phosphate solution. Inside



rounds were separated into *M. semimembranosus* and *M. adductor*, and knuckles were separated into *M. rectus femoris* and *M. vastus lateralis*.

Steaks from each treatment group (control, blade tenderized and injected) within a muscle group, and from both muscles within a subprimal group were assigned randomly to groups for subsequent shipment to consumers. Each shipment had a total of six steaks (two muscles from three treatments). Each shipment also contained a survey with directions, a cooked beef color guide, and a food safety guide.

Consumers were solicited through direct contact by Texas A&M University personnel and 261 out of 395 consumers contacted completed the study. Participants were given a box of steaks and asked to prepare those steaks as they normally would if they had purchased them from the supermarket. The study participants were also asked to identify the cooking method used based on definitions provided by the research personnel. Cooking methods included:

- Outdoor grill
- Indoor grill
- Pan broil
- Pan-fry
- Stir-fry
- Broil
- Oven roasted, uncovered
- Braise and simmer
- Stew

The approximate degree of doneness was determined by consumers, using the National Cattlemen's Beef Association (NCBA) beef steak color guide, which was also included in the box with the steaks. Consumers were asked to evaluate steaks for overall-like, tenderness, juiciness, flavor intensity and flavor desirability using a 10-point scale. Consumers also filled out evaluation forms immediately after each meal and mailed responses back to Texas A&M University upon completion.

Findings

Tenderization Treatments

There were no differences in treatment effects for any of the palatability traits evaluated for the *M. adductor*. For *M. semimembranosus* steaks, the moisture enhanced steaks received the highest ratings for all traits compared to those from the control and blade tenderized treatments. Steaks from the control and blade tenderized treatments did not differ for any of the palatability traits evaluated. Consumers gave *M. rectus femoris* steaks higher palatability ratings if they had been moisture enhanced. They also gave them higher tenderness and juiciness ratings than steaks from the blade tenderized treatment. For the *M. vastus lateralis* steaks, moisture enhanced steaks received higher palatability ratings for all traits compared to both the control and blade tenderized steaks.

In general, the moisture enhancement treatment resulted in improved palatability compared to the blade tenderized treatment and to the controls. In most cases, blade tenderizing did not improve palatability compared to the control steaks.

Cooking Methods

Consumers rated *M. adductor* steaks higher if they had been cooked in a skillet, on a grill or in the oven, than if they had been prepared using moist cooking methods. The researchers concluded that cooking with a moist heat method may reduce the flavor attributes of the *M. adductor* steak to an unacceptable level for consumers. There were no cooking method effects for any of the palatability traits evaluated for the *M. semimembranosus* steaks.

For *M. rectus femoris* steaks, tenderness ratings were higher for those steaks cooked using moist cookery and a skillet than those cooked in an oven or on a grill. *M. vastus lateralis* steaks were given higher ratings for tenderness by consumers if they were cooked with a moist cookery method. Steaks cooked with a moist heat method also created higher ratings for overall like, suggesting that moist heat cookery played an important role in increasing tenderness, and thus the overall tenderness of the steaks.

In general, cooking methods did not provide substantial increases in consumer palatability attributes. For the knuckle steaks (*M. rectus femoris* and *M. vastus lateralis*), moist heat cookery did create an increase in tenderness ratings from consumers over the dry heat methods (grill and oven).

Degree of Doneness

M. adductor steaks cooked in a skillet to a well done and medium well degree of doneness received lower ratings for juiciness than those cooked to medium rare and below. Consumer evaluations of *M. adductor* steaks that were grilled, prepared with moist cookery or roasted in an oven did not differ no matter the degree of doneness. *M. semimembranosus* steaks cooked on a grill to medium rare and below received the highest ratings for juiciness, flavor intensity and desirability. Lower degrees of doneness (medium rare and medium) for *M. rectus femoris* steaks received higher tenderness ratings than steaks cooked to a well-done degree of doneness. Juiciness ratings increased as the degree of doneness decreased. For *M. vastus lateralis* steaks, cooking to medium rare and below increased consumer acceptance levels for all cooking methods except grilling and moist cookery.

Implications

Injecting round muscles with a salt and phosphate solution improved most palatability traits compared to those steaks that were blade tenderized or were not treated. This process may enable marketers of beef rounds to provide products that will more likely meet consumer expectations. For the most part, cooking method and degree of doneness had little influence on consumer palatability ratings. When differences did occur, they were muscle specific, which may allow some opportunity for recommending appropriate cooking methods and degree of doneness for certain muscles.