# Project Summary

**Beyond Longissimus: What is the Impact on Other Muscles of Sorting Carcasses for Tenderness and Retail Color Stability Based on VISNIR Spectroscopy of the Ribeye during Carcass Grading?**

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### Background

The USMARC noninvasive tenderness prediction system allows identification of carcasses that excel in *longissimus* tenderness. This technology was developed using a series of experiments with a total of 2,177 carcasses and has been independently proven effective with an additional 3,738 carcasses (Figure 1). Application of tenderness classification based on *longissimus* slice shear force at 3 days postmortem is effective at creating groups that differ in *longissimus*, *gluteus medius*, and *semimembranosus* tenderness at 14 days postmortem. However, it was not known how effective applying the USMARC noninvasive tenderness prediction system during carcass grading would be at classifying other muscles of the carcass. There are multitudes of ways in which visible/near-infrared (VISNIR) spectroscopy could be applied to classification of beef cuts for tenderness. Undoubtedly, the easiest manner for beef packing companies to apply this technology would be for the system to be applied to the ribeye of carcasses during the carcass grading process and for the results to be applied to the entire carcass. Alternatively, if it was necessary to apply the technology directly to the muscle of interest to achieve sufficient accuracy, the technology could be applied to the surface of cuts during fabrication (or at the end of the fabrication tables) or during portion-control steak-cutting operations.

### Methodology

On each of 5 selection trips, U.S. Choice and U.S. Select beef carcasses were evaluated online immediately following USDA quality grading at a large-scale commercial beef harvesting facility with the USMARC noninvasive tenderness prediction system. Carcasses were selected for inclusion in the study that represented the most tender 10% and least tender 10% of the distribution of predicted slice shear force (PSSF) values observed in carcasses sampled previously in a variety of experiments (Shackelford et al., 2010). Balanced equally among selection trips, 25 U.S. Choice carcasses with low predicted slice shear force values (mean 12.4 kg; maximum = 13.2 kg), 25 U.S. Select carcasses with low predicted slice shear force values (mean 13.0 kg; maximum = 14.2 kg), 25 U.S. Choice carcasses with high predicted slice shear force values (mean 18.7 kg; minimum = 17.5 kg), and 25 U.S. Select carcasses with high predicted slice shear force values (mean 19.1 kg; minimum = 17.5 kg) were selected for inclusion in the study.

Rough (untrimmed) cuts [clod, knuckle, top round, bottom round flat, bottom round eye, strip loin and top sirloin] were obtained from the left side of each carcass and transported (0ºC) to the USMARC abattoir. The following day (i.e., approximately 48 hours postmortem), each rough cut was processed to simulate the trimming and/or muscle separation that might occur during the production of subprimals and/or single-muscle cuts. VISNIR spectra were collected on *teres major* (TM), *infraspinatus* (IS), *triceps brachii* (TB), *semimembranosus* (SM), *adductor* (AD), *gracilis* (GR), *semitendinosus* (ST), *biceps femoris* (BF), *biceps femoris ischiatic head* (BFIH), sirloin cap (*biceps femoris*; BFSC), *gluteus medius* (GM), longissimus (LD), *rectus femoris* (RF) and *vastus lateralis* (VL) muscles. Vacuum-packaged muscles were aged until 14 days postmortem. VISNIR spectra again were collected for each muscle and steaks were cut for slice shear force determination and an adjacent steak was removed from each muscle for color stability evaluation. VISNIR spectra were collected on the surface of SSF steaks. Slice shear force steaks were held (5ºC) overnight, cooked (71ºC) with a belt grill, and slice shear force was determined following the muscle specific procedures of Shackelford et al. (2009).

**Findings**

Online VISNIR tenderness classification of beef carcasses based on evaluation of the ribeye during carcass grading with the USMARC noninvasive tenderness prediction system allows for identification of carcasses that excel in tenderness (lower slice shear force) of *longissimus*, *semimembranosus* (Fig. 1), *gluteus medius* (Fig. 2), *biceps femoris*, *adductor* and *semitendinosus* muscles. Additionally, similar results were obtained with application of VISNIR directly to the exposed *gluteus medius* on the anterior end of top sirloin subprimals either during carcass fabrication or after aging. This suggests that this technology could be utilized by virtually all segments of the industry to control variation in tenderness.

**Implications**

This study greatly enhances the industry's ability to understand the potential impact of implementing the USMARC noninvasive tenderness prediction system. This could lead to more widespread adoption, which could facilitate branded beef programs and ultimately increase consumption of U.S. beef.

VISNIR spectroscopy of gluteus medius steaks

VISNIR spectroscopy of semitendinosus (eye of round) during fabrication

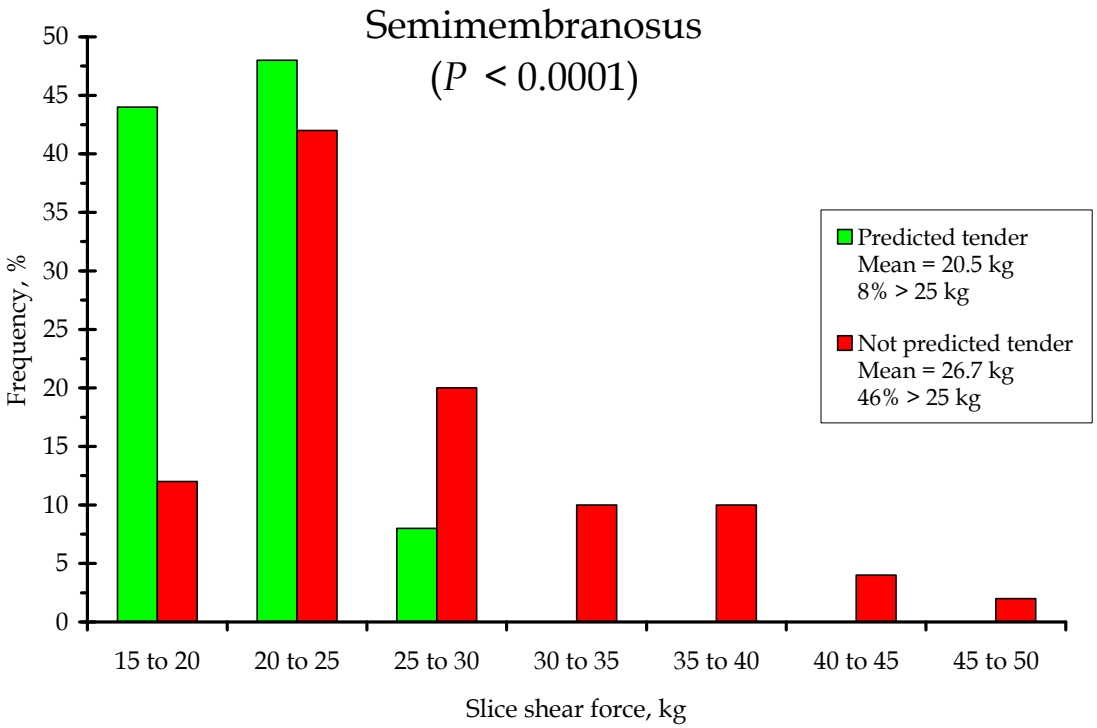


**Fig. 1.**

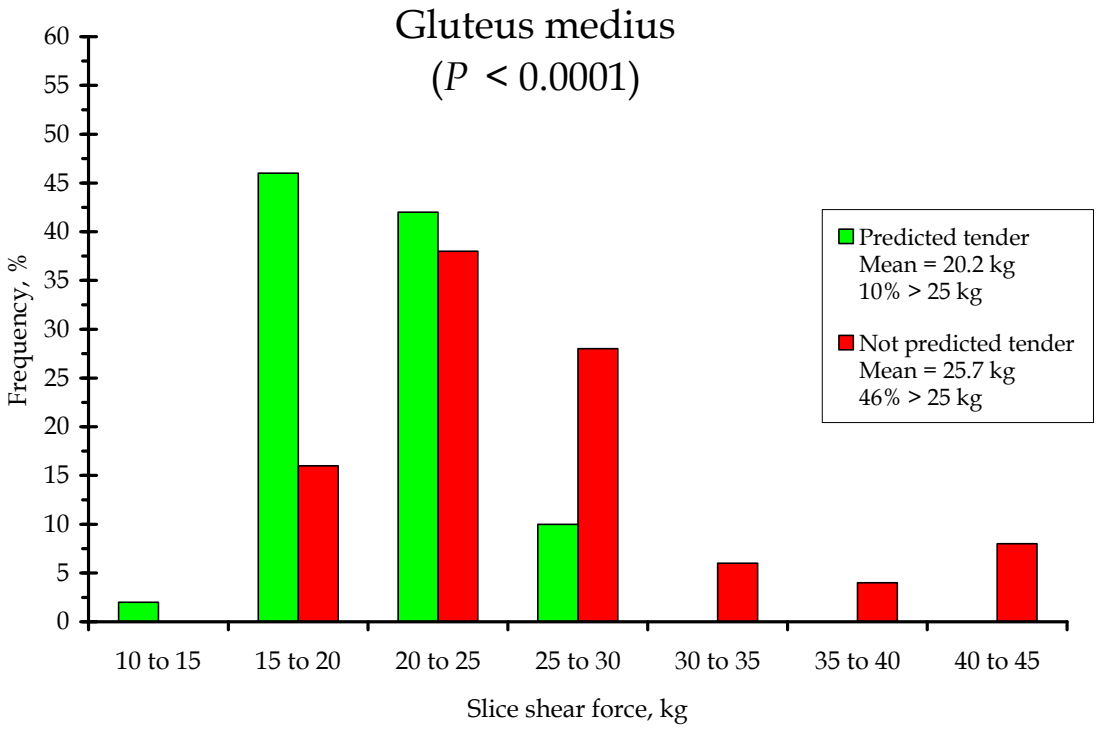


**Fig. 2.**

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