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M. B. Da Silva
Kansas State University, mauricia@ksu.edu

L. D. F. Miranda
Kansas State University, lucas_f.miranda@hotmail.com

K. J. Phelps
Kansas State University, kphelps@ksu.edu

See next page for additional authors

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Authors

M. B. Da Silva, L. D. F. Miranda, K. J. Phelps, S. M. Ebarb, C. L. Van Bibber, T. G. O'Quinn, J. S. Drouillard, and J. M. Gonzalez

Effects of Postmortem Aging Time and Muscle Location on Objective Measures of *Semitendinosus* Steak Tenderness

M.B. Da Silva, L.D.F. Miranda, K.J. Phelps, S.M. Ebarb, C.L. Van Bibber-Krueger, T.G. O'Quinn, J.S. Drouillard, and J.M. Gonzalez

Introduction

Beef tenderness is the most important trait affecting consumer beef eating satisfaction. Cuts from muscles with superior tenderness (tenderloin, ribeye, striploin) are consequently most highly valued, but because of recent record-high beef prices, the need to identify more economical cuts that will meet consumer expectations for tenderness is greater than ever.

The eye of round (*Semitendinosus*) has traditionally been marketed as a lower-value cut, primarily owing to its inherent toughness. Tenderness improves throughout postmortem aging and continues to improve in muscles aged for greater than 35 days. Retail steaks from the *Semitendinosus* receive, on average, 17 days of aging, with almost half (48.5%) receiving less than 14 days. This indicates a significant opportunity for tenderness improvement of *Semitendinosus* steaks through extended aging times.

In many muscles, including the *Longissimus*, tenderness depends on anatomical location. Tenderness is often reduced in regions of the muscle closest to the ends or in close proximity to heavy connective tissue seams. Very little is known about the effects of aging and anatomical location on the tenderness of the *Semitendinosus*.

Warner-Bratzler shear force testing is commonly used to measure beef tenderness objectively. Consumers rate beef with shear values of 9.5 lb as “tender,” so if tenderness of *Semitendinosus* steaks can be improved to meet this threshold, then the eye of round may offer a suitable alternative to higher-valued cuts for consumers and an opportunity for increased value for processors. Thus, the objectives of this study were to evaluate the effects of aging and anatomical location on the tenderness of *Semitendinosus* steaks.

Experimental Procedures

Sixty finishing crossbred steers ($1,417 \pm 43$ lb initial body weight) were blocked by body weight and assigned to 16 pens. The experiment was conducted as a randomized complete block experiment with two treatment factors for 28 days. Treatment factors consisted of supplemental zinc (Zinpro 120, Zinpro, Eden Prairie, MN) and Optaflexx (Elanco Animal Health, Greenfield, IN). For the supplemental zinc factor, steers were

supplemented with Zinpro 120 at either 0 or 360 mg/kg of dry matter daily. For the Optaflexx supplementation factor, steers received Optaflexx at 0 or 400 mg/kg of dry matter daily.

On day 28, steers were harvested at a commercial abattoir. Following 6 days of refrigeration, the *Semitendinosus* from the left side of each carcass was removed and transported back to the Kansas State University Meat Laboratory. Upon arrival, 10, 1-inch steaks were fabricated from different locations of the muscle and numbered, with 1 being more proximal to the carcass and 10 more distal. Steaks were vacuumed-packaged and aged 7, 14, 21, and 42 days at 32°F. Following each aging time, steaks were cooked on clam-style grills (Cuisinart Griddler, Cuisinart, Stamford, CT) to an internal temperature of 160°F for Warner-Bratzler shear force measurements.

Results and Discussion

No significant zinc \times Optaflexx \times day, zinc \times Optaflexx \times location, or zinc \times Optaflexx interactions were detected for objective tenderness ($P > 0.10$). In addition, there was no location \times day interaction ($P > 0.10$) on objective tenderness, which indicates all locations aged at the same rate. Across all aging periods, location within the *Semitendinosus* affected (quadratic, $P < 0.01$; Figure 1) objective tenderness. Steaks from the proximal and distal locations of the muscle had the greatest shear force values, 12.62 and 11.14 lb, respectively. As steaks were analyzed away from these positions, shear force was reduced to one of the lowest shear values at steak number 6 (10.02 lb). As stated above, tenderness of steaks may vary due to anatomical location within the muscle. The tenderness of the steaks from the proximal and distal locations may be tougher than steaks taken from the middle because they are near bone attachment points. As a muscle's location approaches bone, the connective tissue that attaches muscle to the bone may cause steaks in these locations to have a connective tissue profile that inherently reduces tenderness. At a shear force value of 10.02 lb, a consumer would still rate a middle steak from the *Semitendinosus* as tough; however, with continued extended aging, it may be possible to improve tenderness of these steaks to a more acceptable level.

Aging is largely used to improve meat tenderness of beef, which in turn may increase consumers' acceptability of beef products. As expected, aging period had an effect on tenderness (quadratic, $P < 0.01$; Figure 2). Average steak shear force value at day 7 was 11.46 lb. With extended aging to day 42, objective tenderness was improved by 11% to 10.2 lb. Research has established that the calpain proteolytic system plays an important role in postmortem tenderization of beef up to 21 days of aging. This study indicates that steaks continue to age through 42 days of postmortem aging; however, the exact biological mechanism responsible for this improvement is currently not known. The quadratic nature of the reduction in shear force indicates that steaks could still improve in tenderness, but the rate of improvement will not be as great as observed earlier in the aging study. More aging could bring the shear force value of *Semitendinosus* steaks closer to the consumer acceptability level of 9.5 lb, which would create opportunities for retailers and processors to market more affordable steaks to consumers and add value to the *Semitendinosus* muscle.

Implications

The *Semitendinosus* muscle varies in tenderness, with the proximal and distal ends being the toughest. Knowing these differences may help retailers and processors market this muscle more appropriately. Tenderness of the *Semitendinosus* continued to improve up to 42 days of aging, which may help add value to this muscle.

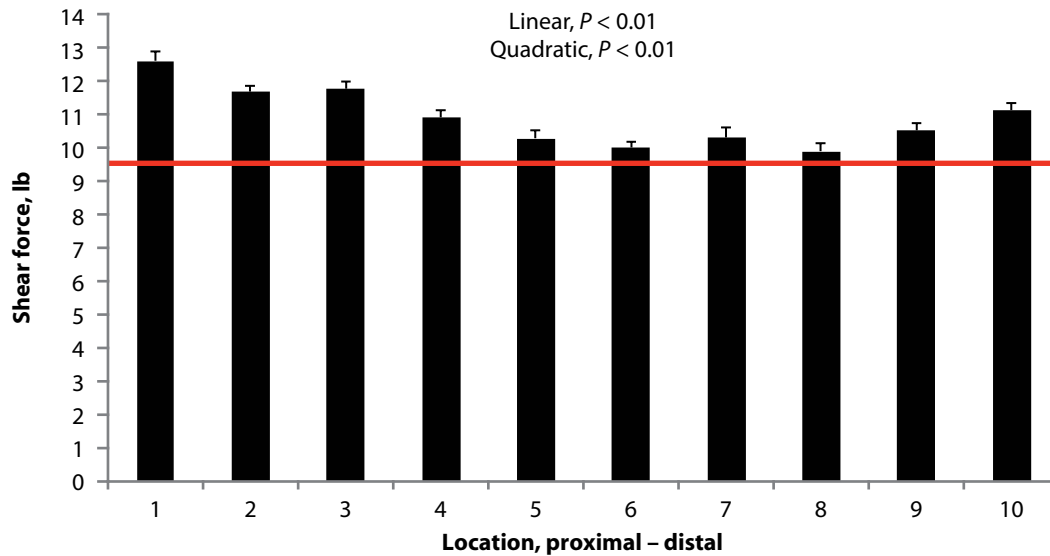


Figure 1. Warner-Bratzler shear force of steaks originating from 10 different locations within the *Semitendinosus* (eye of round). Steaks were cut from the proximal (steak 1) to distal (steak 10) end of the muscle; aged for 7, 14, 21, and 42 days; and cooked to 160°F. Data represent the average shear values of steaks aged during all four periods.

The solid horizontal line indicates the threshold value of Warner-Bratzler shear that is considered “tender” for consumers.

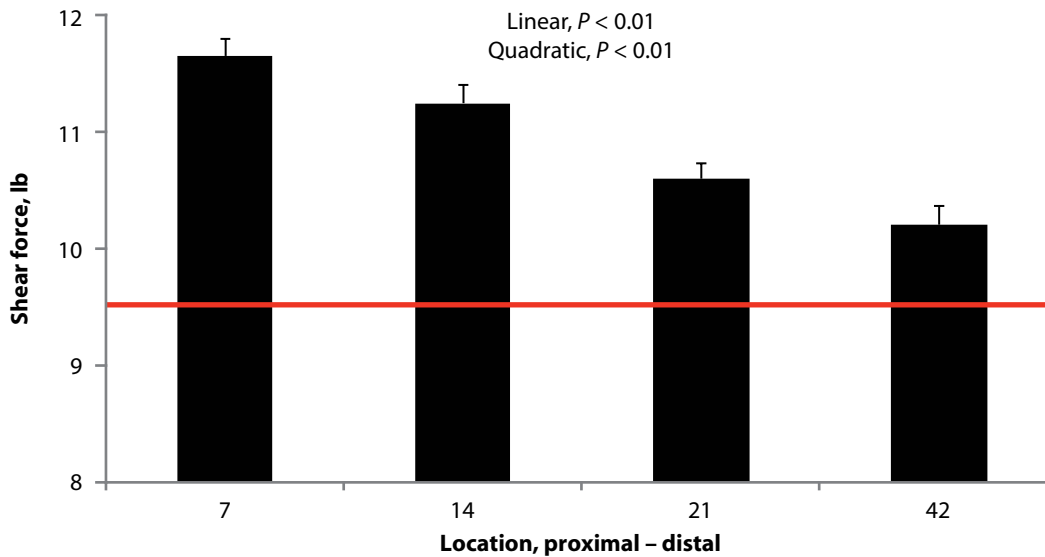


Figure 2. Warner-Bratzler shear force of *Semitendinosus* (eye of round) steaks aged 7, 14, 21, and 42 days. Steaks from 10 locations within the muscle were aged and cooked to 160°F. Data represent the average shear values of the 10 steaks at each of the four aging periods.

The solid horizontal line indicates the threshold value of Warner-Bratzler shear that is considered “tender” for consumers.