Fabrication Method of the Infraspinatus Muscle Affects Warner-Bratzler Shear Force

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Story in Brief

The objective of this study was to determine if fabrication method of the infraspinatus muscle (flat-iron vs. traditional) affected Warner-Bratzler shear force (WBSF) when cooked to “medium-rare” and “medium” degrees of doneness, and to determine differences between anatomical location of flat-iron steaks. Infraspinatus (INF) muscles (n = 30) were randomly assigned to a combination of age (7 or 21 d) and endpoint temperature (150 or 160°F). After aging, each muscle was fabricated into 2 traditional (top-blade) and 2 flat-iron steaks, then frozen. Flat-iron steaks were identified for their anatomical location: the medial portion was closest to the scapula, whereas the lateral portion was covered with subcutaneous fat. Steaks were cooked on a clam-shell grid- dle, and internal temperature was monitored with thermocouples. After cooling to room temperature, 6 cores were removed parallel to the fiber direction and sheared with a WBSF attachment using the Instron Universal testing machine. Traditional steaks had greater (P < 0.05) WBSF values and within-steak standard deviation than flat-iron steaks. Endpoint temperature did not have an effect on the WBSF of either traditional or flat-iron steaks. Medial flat-iron steaks had lower (P < 0.05) WBSF values after 7 d of aging; however, the medial and lateral sides had similar (P > 0.05) WBSF after 21 d of aging. Results of this study indicated that flat-iron steaks were more tender, with less within-steak variation, than traditional top-blade steaks.

Introduction

Recently discovered to be the second most tender muscle in the beef carcass (Calkins and Sullivan, 2007), the infraspinatus (INF) muscle is underutilized due to the large connective tissue that runs through the center. The INF muscle was previously used as part of chuck roasts or ground beef. In order to increase the palatability and marketability of the INF muscle, different methods of fabrication have been developed. The flat-iron is a new method of fabrication where steaks are cut parallel to the length of the muscle, and the connective tissue is removed using a fillet technique. This fabrication method has improved palatability and marketability of this tender muscle. Currently, the INF muscle is marketed as the flat-iron, seen on restaurant menus, in grocery stores, and as part of recipes to promote beef. There is limited research to determine the differences due to anatomical location of the INF muscle and none on flat-iron fabrication.

Most tenderness research protocols require end-point cooking temperatures to be 160°F, which is a “medium” degree of doneness. Nevertheless, the developers of the flat-iron and chefs that have worked with this cut recommend a “medium-rare” degree of doneness (150°F). The objective of our study was to determine if fabrication method (flat-iron vs traditional) affected Warner-Bratzler Shear Force (WBSF) of the infraspinatus steaks cooked to “medium-rare” (150°F) or “medium” (160°F) degree of doneness and to determine differences between anatomical locations of flat-iron steaks.

Experimental Procedures

Thirty INF muscles were purchased from a commercial processor and aged 7 or 21 d from the box date. Each muscle was fabricated into 2 flat-iron steaks and 2 traditional steaks paying close attention to the anatomical location of the muscle. Medial flat-iron steaks were closest to the scapula (Figure 1), whereas the lateral steaks were covered with subcutaneous fat. After fabrication, steaks were vacuumed packaged and frozen at -22°F.

Steaks were thawed overnight at 35.6°F and cooked to 150 or 160°F on a Star Pro-Max 2-sided griddle. Thermocouples were inserted into the geometric center of each steak to monitor the internal temperature. After cooking, steaks were cooled to room temperature, and 5 to 6 half-inch cores were removed parallel to the fiber direction. With a Warner-Bratzler shear force attachment on an Instron Universal testing machine, each core was sheared once and means and standard deviation (SD) were calculated for each steak.

To determine differences between fabrication styles, data were analyzed in a split-plot design, where temperature and post-mortem age were the whole-plot and fabrication style was the subplot. Differences of anatomical location, within the flat-iron steaks, were determined in a split-plot design with temperature and aging in the whole-plot and anatomical location in the sub-plot. The MIXED procedure in SAS (SAS Inst., Inc., Cary, N.C.) was used to analyze the data, and means were separated using a probability of 0.05.

Results and Discussion

Traditional steaks had higher WBSF values than flat-iron steaks (Figure 2, P < 0.05) and higher within-steak SD (P < 0.05). Endpoint temperature and postmortem aging did not have an effect (P > 0.05) on the WBSF on either the traditional or flat-iron steaks. Previous research has not compared flat-iron to traditionally cut INF steaks; however, our results indicate that the new fabrication method created not only more tender steaks, but also less within-steak variation. According to these results, fabrication method can affect the outcome of WBSF data and should be considered when conducting tenderness research on this muscle.

Medial flat-iron steaks had lower WBSF values (Figure 3, P <
0.05) than lateral steaks after 7 d of aging; however, the medial and lateral sides had a similar ($P > 0.05$) WBSF after 21 d of aging. These results indicate that after 7 d of aging, the medial side of the INF was more tender than the lateral side, and the lateral side required an additional 14 d of aging to produce steaks with WBSF comparable to the medial side. In contrast to this study, Searls et al. (2005) aged traditionally-fabricated INF steaks to 14 d and found that there were no differences due to anatomical location. Had they aged the steaks less than 14 d, there may have been differences due to anatomical location in the INF. Although the medial side was more tender after 7 d of aging, in our study, both sides were equally tender after 21 d of aging.

**Implications**

This study showed that when fabricating the *infraspinatus* muscle, the more tender steak will be the one fabricated as a flat-iron. The flat-iron method of fabrication would also be more suitable to the consumer since not only is it more palatable and more tender than the traditional method of fabrication, but it does not have the large connective tissue running through the middle of the steak. Thus, the flat-iron would be more marketable to consumers and would not be as underutilized.

**Literature Cited**

Fig. 3. Mean Warner-Bratzler shear force (WBSF) of flat-iron steaks from the medial and lateral portions of the infraspinatus aged 7 and 21 days. a, b Means with different letters differ (P < 0.05).