Evaluation of palatability and muscle composition of novel value-added beef cuts

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\textbf{A B S T R A C T}

The aim of this study was to evaluate the muscle profile of novel added-value beef cuts including the caudal tip of the M. infraspinatus (Bonanza Cut; TIP) and M. subscapularis (SUB) and two traditional sirloin steak cuts, M. gluteus medius (top sirloin; GLM) and M. rectus femoris (sirloin tip; REC). Samples were subjected to Warner-Braztler Shear Force (WBSF), sensory, cooking loss, and proximate analysis. The muscle TIP had superior values of subjective tenderness, juiciness, and slight off-flavor intensity when compared to all other muscles. The TIP and SUB were similar in WBSF. Cooking loss and moisture values of raw samples were lowest for TIP. Results suggest that TIP can provide enhanced eating experience for consumers and improved marketability for the meat industry.

1. Introduction

In the late 1990s, due to the declining value of the beef chuck and round in relation to rib and loin, muscle profiling research was conducted to investigate new possibilities to improve value of cuts from both primalis (Von Seggern, Calkins, Johnson, Brickler, & Gwartney, 2005). Based on physical and chemical characteristics of newly investigated muscles, several overlooked cuts were identified as value-added products (Hildrum et al., 2009; Jung, Hwang, & Joo, 2016). Jung et al. (2016) reported that consumers are willing to pay a premium for tender steaks. Results from studies funded by the Beef Checkoff introduced new value-added cuts from the chuck into the market, including the Flat Iron steak, Delmonico steak, and Denver Cut. These new cuts have similar or superior tenderness when compared to the ribeye (Calkins & Sullivan, 2011; Lepper-Billie, Berg, Germolus, Buchanan, & Berg, 2014). With this understanding, meat processors started isolating muscles for individual sale and were able to elevate the prices of the beef carcass by US $50 to $70/head (Ohman, Wiepand, Gruen, & Lorenzen, 2015). Therefore, improving utilization and value of meat cuts lead to more product options for consumers, cost effective alternatives for foodservice, and positively impacts revenues for the meat industry (Boles & Shand, 2008; Hildrum et al., 2009; Jung et al., 2016; King et al., 2009; Pfeiffer, Voges, King, Griffin, & Savell, 2005; Rhee, Wheeler, Shackelford, & Koohmaraie, 2004; Von Seggern et al., 2005).

In 2013, the M. subscapularis (SUB) was presented to consumers as a novel steak cut. Historically, the beef industry has been marketing SUB as lifter meat (beef rib, blade meat; IMP 109B), which consists of portions of several different muscles that may include M. rhomboideus, M. latisimus dorsi, and M. trapezius. Lifter meat is often used for cubed, shredded or marinated dishes, and is consequently sold at lower prices when compared to steak cuts. Recently, the caudal tip of the M. infraspinatus (Bonanza Cut; TIP) was suggested to be a value-added beef cut due to its tenderness. When separating the rib from the chuck, the caudoventral end of the M. infraspinatus (INF) remains on the rib underneath (medial to) the long head of the M. triceps brachii and M. trapezius. When fabricating ribeyes, M. triceps brachii, M. trapezius, M. latisimus dorsi, and additional fat cover are removed from the beef rib (IMPS 103; NAMP, 2014). Subsequently, the TIP is excised from the top (lateral side) of the scapula cartilage to be commercialized as 85% lean trim. Currently, 85% fresh beef trim is being commercialized in the U.S. at prices ranging from $4.26 to $4.52 per kg (USDA-AMS, 2017a), whereas the top sirloin butt (IMPS 184B) is priced from $11.25 to 12.48 per pound (USDA-AMS, 2017b). The present study evaluated TIP as a possible new value-added cut, compared its sensory attributes with higher priced steak cuts, and investigated the muscle profile of all four muscles in order to determine if new value-added cuts (TIP and SUB) have better quality attributes than traditional sirloin steak cuts (REC and GLM).
2. Materials and methods

2.1. Muscle selection

Beef loin, top sirloin butt (center-cut, boneless; IMPS 184B; n = 15; GLM), beef rib, blade meat (IMPS 109B, containing only SUB; n = 15), individual REC (removed from beef, round, knuckle, full, IMPS 167C; n = 15), and beef trim 85% lean (containing only TIP; n = 15) were procured from a commercial, USDA-inspected beef processing facility. All muscles were obtained from USDA upper 2/3 Choice graded carcasses from Holstein steers, feedlot-procured from a commercial, USDA-inspected beef processing facility. 

2.2. Sample preparation

After 14 d aging at 2 °C, GLM was trimmed of external fat and split into dorsal and ventral portions. Three steaks (2.54 cm thick) from the center of the ventral section were obtained from each sample. Center portion steaks were used for sensory evaluation whereas the caudal steak was used for proximate analysis and the cranial steak was used for WBFSF and cooking loss. In terms of REC, three (2.54 cm thick) steaks were cut from dorsal to ventral muscle orientation. The dorsal steak was used for WBFSF and cooking loss and the ventral steak was used for proximate analysis. The center steak was used for sensory analysis. Due to their size, two whole portions of TIP and one portion of SUB muscles were used for each analysis. Steaks from TIP and SUB were trimmed of heavy connective tissue and additional superficial fat. All steaks were vacuum packaged and frozen at −60 °C until further tests were conducted.

For proximate analysis, raw samples were pulverized with liquid nitrogen (−174 °C) using a blender (51BL32; Waring Commercial, Torring, CT), packaged in BPA free polyethylene bags, and stored at −80 °C for 7d prior analysis. For cooking loss, WBFSF, and sensory evaluation, steaks were thawed for 24 h at 5 °C and grilled on an electric grill (31605A; Hamilton Beach, Washington, NC). Cooking temperature was monitored by a hypodermic needle thermocouple and a digital thermometer (T936; OMEGA Engineering, Inc., Stamford, CT) and an electric grill (31605A; Hamilton Beach, Washington, NC). Brieﬂy, 2 g of pulverized sample was placed in an individual Thermogravimetric Analyzer crucible. For moisture, ramp time, and end temperature were set at 4 °C/min, 26 min and 130 °C, respectively. For ash, ramp rate, ramp time, and end temperature were set at 16 °C, 29 min and 600 °C, respectively. For fat content, 2 g of pulverized sample were placed on Whatman #2 ﬁlter paper envelope and fat % was determined by ether extraction using the Soxhlet procedure (AOAC, 2006). Values of protein (%) were calculated by subtracting moisture, ash, and fat values from 100%.

3. Results and discussion

3.1. Proximate analysis

Proximate values are presented in Table 1. The largest differences were observed for fat content (%). Similar fat values were observed for GLM, SUB and REC (values vary from 3.76 to 4.91), whereas TIP had higher values (13.20%) when compared to all other muscles (P < 0.05). In the present study, it was subjectively observed that TIP had higher marbling when compared to the whole INF. Intramuscular fat accretion can be influenced by anatomical factors including physical activity and size of muscle mass (Hausman, Basu, Du, & Fernyhough-Culver, & Dodson, 2014). Additionally, as the deposition of intramuscular fat increases within a muscle, the increase of adipocytes in different muscle locations occurs independently. Yang, Albrecht, Ender,
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