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Nutrient analysis of the Beef Alternative Merchandising cuts

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A B S T R A C T

The objective of this study was to generate raw and cooked nutrient composition data to identify Quality Grade differences in proximate values for eight Beef Alternative Merchandising (BAM) cuts. The data generated will be used to update the nutrient data in the USDA National Nutrient Database for Standard Reference (SR). Beef Rib, Oven-Prepared, Beef Loin, Strip Loin, and Beef Loin, Top Sirloin Butt subprimals were collected from a total of 24 carcasses from four packing plants. The carcasses were a combination of USDA Yield Grades 2 (n = 12) and 3 (n = 12), USDA Quality Grades upper two-thirds Choice (n = 8), low Choice (n = 8), and Select (n = 8), and two genders, steer (n = 16) and heifer (n = 8). After aging, subprimals were fabricated into the BAM cuts, dissected, and nutrient analysis was performed. Sample homogenates from each animal were homogenized and composited for analysis of the following: proximate analysis, long chain and trans-fatty acids, conjugated linoleic acid, total cholesterol, vitamin B-12, and selenium. This study identified seven BAM cuts from all three Quality Grades that qualify for USDA Lean; seven Select cuts that qualify for USDA Extra Lean; and three Select cuts that qualify for the American Heart Association's Heart Healthy Check.

1. Introduction

A combination of genetic selection and management practices in cattle production has contributed to continuous improvements in maximizing beef carcass yield and quality. As a result, carcass weights and the incidence of oversized carcasses have been gradually increasing (Garcia et al., 2008; McKenna et al., 2002; Moore et al., 2012). The 2005 National Beef Quality Audit (NBQA) reported that more than 5% of carcasses were oversized (Garcia et al., 2008). According to the USDA's National Agricultural Statistics Service, beef carcasses have steadily increased in average dressed weight from 267 kg in 1968 to 351 kg in 2011 (USDA, 2012). The 2011 NBQA reported that average carcass weight and ribeye area have continued to increase since the 2005 NBQA (Moore et al., 2012). Increased carcass sizes result in larger primals and subprimals, especially in oversized carcasses. As hot carcass weight (HCW) and ribeye area (REA) increase, steak thickness must decrease in order to maintain portion size of rib and loin steaks (Dunn, Williams, Tatum, Bertrand, & Pringle, 2000; Leick, Behrends, Schmidt, & Schilling, 2011). However, Bass, Scanga, Chapman, Smith, and Belk (2009) found that REA does not accurately predict the size and dimensions (and ultimately portion size) of many muscles in the beef carcass. Furthermore, their results suggest that a wide range of ribeye area sizes would produce acceptable portion sizes from many muscles within the beef carcass (Bass et al., 2009). In an attempt to offer portion sizes for health-conscious consumers, research funded by The Beef Checkoff, Cattlemen's Beef Board, and the National Cattlemen's Beef Association (NCBA) resulted in the innovation of the Beef Alternative Merchandising (BAM) cuts.

Since the BAM cuts were recently created, nutrient analysis has not been completed to determine their nutrient composition. USDA (2010) provides food composition information for the National Food Survey and provides core data for many commercial and international databases (Merchant & Dehghan, 2006). The Food Safety and Inspection Service (FSIS) specified the SR as the source of nutrient information for labeling of beef products in its mandatory labeling of single-ingredient meats. In addition to labeling, the SR also is used in many other world-wide settings including clinical practice, providing clients with nutritional solutions; in food service, offering accurate nutritional information; in research, providing a quickly searchable database; and in everyday life, providing Americans the nutritional information required to make healthy food choices. The current release of the SR provides food and nutrient composition data for over 500 beef items. Currency of the beef nutrient data is critical to the industry. First, it will allow for the most accurate nutrient data on beef nutrient labels in the meat case, which will provide opportunity for on-pack nutrient claims. More specifically, this research will allow access of the nutrient data for the innovative BAM cuts, so that BAM cuts can be marketed as USDA Lean or Extra Lean and receive the American Heart Association's Heart Healthy Check when appropriate. The objective of this study was to generate raw and cooked nutrient composition data to identify Quality Grade differences in nutrient values for eight Beef Alternative Merchandising (BAM) cuts.

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Table 1
Composite plan of the same BAM cuts for cholesterol, vitamin B12, selenium and fatty acid analysis.

Composite	Animal #	Quality grade[a]	Yield grade	Gender[b]
1	1	U	3	H
	7	U	2	S
	13	U	3	S
	19	U	2	S
2	2	U	2	S
	8	U	3	H
	14	U	2	S
	20	U	2	S
3	3	L	3	S
	9	L	2	S
	15	L	3	H
	21	L	3	S
4	4	L	2	H
	10	L	3	S
	16	L	2	S
	22	L	2	H
5	5	S	2	S
	11	S	3	S
	17	S	2	H
	23	S	2	S
6	6	S	3	S
	12	S	2	H
	18	S	3	S
	24	S	3	H

[a] U = Upper Two-Thirds Choice (Modest^{00} to Moderate^{99}); L = Low Choice (Small^{00} to Small^{99}); Select = (Slight^{00} to Slight^{99}).
[b] H = Heifer; S = Steer.

2. Materials and methods

2.1. Product selection

A total of 24 beef carcasses of nationally representative Quality Grade (QG), yield grade (YG), and sex were selected from four packing plants. Carcasses were a combination of USDA Yield Grades 2 (n = 12) and 3 (n = 12), USDA Quality Grades upper two-thirds Choice (U; n = 8), low Choice (L; n = 8), or Select (S; n = 8), and two genders, steer (n = 16) and heifer (n = 8). Trained university personnel recorded measurements for fat thickness, ribeye area, kidney, pelvic, and heart fat (KPH), marbling score, and maturity on the right and left sides of each carcass. All carcasses had to be A-maturity for lean and skeletal evaluation. After identification, carcasses were followed through fabrication to obtain the following subprimals: Beef Rib, Oven-Prepared (IMPS #107), Beef Loin, Strip Loin, Boneless (IMPS #180), and Beef Loin, Top Sirloin Butt, Boneless (IMPS #184) (North American Meat Processors Association, 2010). Two carcasses, one for rib and strip loin cuts and one for top sirloin cuts, were selected for each animal number to ensure adequate sample amounts to represent all BAM cuts. The paired carcasses had to be of the same gender and fall in the same YG and QG classification. Carcasses that were collected for Beef Rib, Oven-Prepared and Beef Loin, Strip Loin subprimals had a HCW range of 239–446 kg, with a mean ± SEM of 380 ± 10 kg. For those carcasses the marbling score range was 325–685 (Slight 25 to Moderate 85) with a mean ± SEM of 463 ± 21. Carcasses that were collected for Beef Loin, Top Sirloin Butt had a HCW range of 279–467 kg, with a mean ± SEM of 386 ± 8 kg. For those carcasses the marbling score range was 315–635 (Slight 15 to Moderate 35) with a mean ± SEM of 452 ± 18. After fabrication, subprimals from both sides of the carcass were vacuum packaged and transported under refrigeration to the Colorado State University (CSU) Meat Laboratory. Upon arrival, subprimals were stored in the absence of light at 0 to 4 °C until fabrication of the BAM cuts occurred.

2.2. Product fabrication

Fabrication of subprimals into BAM cuts occurred 14 to 21 d postmortem. Subprimals were fabricated into the BAM cuts, as described by the NCBA BAM Training Manual (NCBA, 2010). After fabrication, the steaks, filets, and roasts were vacuum packaged, frozen, and stored at −18 °C for subsequent cooking and/or dissection.

2.2.1. 107 Beef Rib, Oven-Prepared

The Beef Rib, Oven-Prepared (IMPS #107) was fabricated into the Beef Rib, Ribeye, Lip-on (IMPS #112A) as defined in the Meat Buyer's Guide. Briefly, the lip consisting of the *Serratus dorsalis* and *Longissimus costarum* muscles and the intercostal meat were removed from the 112A. The *Longissimus dorsi* (LD), *Complexus*, and ribeye cap, which consisted of the *Spinalis dorsi* (SD), were separated and trimmed of fat and connective tissue. The ribeye cap was cut into the Beef Ribeye,

Table 2
Weighted means ± SEM of raw proximate analysis for BAM[1] rib cuts.

Cut	Effect	Fat (%)	*P* value[2]	Protein (%)	*P* value[2]	Moisture (%)	*P* value[2]	Ash (%)	*P* value[2]
Spinalis dorsi: Ribeye Cap Steak	Quality Grade[3]		0.007		0.01		0.01		0.39
	U	12.92 ± 0.63[a]		18.83 ± 0.24[a]		65.42 ± 0.60[a]		0.91 ± 0.02	
	L	10.66 ± 0.56[b]		19.77 ± 0.21[b]		67.01 ± 0.53[ab]		0.89 ± 0.02	
	S	9.42 ± 0.56[b]		20.06 ± 0.21[b]		68.54 ± 0.53[b]		0.87 ± 0.02	
	Gender		0.06		0.74		0.05		0.28
	Heifers	11.35 ± 0.58		19.72 ± 0.22		66.51 ± 0.55		0.90 ± 0.02	
	Steers	10.25 ± 0.42		19.69 ± 0.16		67.70 ± 0.40		0.88 ± 0.02	
	Yield Grade		0.06		0.13		0.04		0.25
	YG 2	11.39 ± 0.49		19.47 ± 0.19		66.56 ± 0.46[a]		0.90 ± 0.02	
	YG 3	9.84 ± 0.48		19.93 ± 0.18		68.05 ± 0.45[b]		0.87 ± 0.02	
Longissimus dorsi: Ribeye Petite Roast or Ribeye Filet[4]	Quality Grade[3]		0.0007		0.002		0.002		0.09
	U	6.77 ± 0.43[a]		21.81 ± 0.18[a]		69.83 ± 0.42[a]		1.06 ± 0.04	
	L	4.57 ± 0.39[b]		22.87 ± 0.16[b]		71.54 ± 0.38[b]		1.02 ± 0.04	
	S	3.69 ± 0.39[b]		23.03 ± 0.16[b]		72.47 ± 0.38[b]		1.11 ± 0.04	
	Gender		0.12		0.57		0.07		0.36
	Heifers	5.02 ± 0.40		22.84 ± 0.17		71.10 ± 0.39		1.03 ± 0.04	
	Steers	4.48 ± 0.29		22.66 ± 0.12		71.81 ± 0.29		1.09 ± 0.03	
	Yield Grade		0.32		0.32		0.56		0.04
	YG 2	4.86 ± 0.34		22.62 ± 0.14		71.48 ± 0.33		1.11 ± 0.03[a]	
	YG 3	4.45 ± 0.33		22.82 ± 0.14		71.67 ± 0.32		1.03 ± 0.03[b]	

[ab]Within a significant effect, means without a common superscript differ ($P<0.05$).
[1] Beef Alternative Merchandising cuts.
[2] *P* value for a fixed effect was considered significant if $P<0.05$.
[3] U = Upper Two-Thirds Choice (Modest^{00} to Moderate^{99}); L = Low Choice (Small^{00} to Small^{99}); S = Select (Slight^{00} to Slight^{99}).
[4] For samples that originated from the same muscle, only the petite roast samples were analyzed for nutrient composition.