Obtaining Information for Beef Chuck Cuts for a National Nutrient Database in the United States

West S.E. [1], Harris K.B. [1], Haneklaus A.N. [1], Savell J.W. [1], Thompson L.D. [2], Brooks J.C. [2], Pool J.K. [2], Luna A.M. [2], Engle T.E. [3], Schutz J.S. [3], Belk K.E. [3], Douglass L.W. [4]

[1] Texas A&M University, Meat Science Section, Department of Animal Science, College Station, Texas, 77843-2471, USA
[2] Texas Tech University, Department of Animal and Food Sciences, Lubbock, Texas, 79409, USA
[3] Colorado State University, Department of Animal Sciences, Fort Collins, Colorado, 80523-1171, USA
[4] Consulting statistician, Longmont, Colorado, 80501, USA

Abstract— **This study was designed to collect data on selected beef chuck cuts for the United States Department of Agriculture's National Nutrient Database for Standard Reference. Beef arm chucks were obtained to generate retail cuts. Proximate composition and cholesterol analyses were performed on separable lean on both a raw (not reported) and cooked basis. Mean values for protein, total lipid, cholesterol, and energy content on a 100 g basis for the separable lean from cooked retail cuts are presented parenthetically for each cut: America's beef roast (chuck eye) (26.7 g, 8.0 g, 84 mg, 765.0 kj), boneless country-style beef ribs (31.4 g, 11.9 g, 100 mg, 953.0 kj), chuck eye steak (28.0 g, 10.8 g, 87 mg, 899.0 kj), Denver cut (*M. serratus ventralis*) (26.5 g, 12.4 g, 94 mg, 919.6 kj), mock tender steak (33.6 g, 6.5 g, 111 mg, 823.5 kj), shoulder clod steak (28.6 g, 5.9 g, 81 mg, 731.5 kj), short ribs (28.8 g, 15.0 g, 105 mg, 1003.2 kj), top blade steak (28.2 g, 8.8 g, 95 mg, 819.3 kj), and under blade steak (31.4 g, 9.5 g, 107 mg, 915.4 kj). Three cuts met the United States definition of "lean" beef (100 g serving with less than 10 g total fat, 4.5 g saturated fat, and 95 mg cholesterol): (1) shoulder clod steak (2) America's beef roast, and (3) top blade steak. Information on the nutrient content of beef chuck cuts has been added to the Nutrient Database.**

Keywords— **beef, composition, nutrition**

I. INTRODUCTION

The United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference (SR) provides referencing data for diet therapy, nutrition education programs, guidance for pediatric, obstetric, and geriatric populations, as well as a source of information for menu calculations for schools, nursing homes and hospitals. Information in the SR also is used to provide nutrition information for on-package nutrient claims. Because such a large number of people rely on these data, it is imperative the information be current and accurate. This research was designed to provide data for beef cuts that are most often marketed in United States retail cases. With data from this study now provided in the SR, other nutrient databases that use the SR as a reference point also will have access to the most up-to-date nutrient data.

II. MATERIALS AND METHODS

A. Product selection

Beef arm chucks were collected from commercial beef processing plants across the United States. Cattle types and USDA quality grade combinations were selected to represent the current United States cattle herd.

B. Retail cut fabrication

Chucks were fabricated 5-7 d post-mortem into subprimals and retail cuts. Retail cuts included: America's beef roast (chuck eye), boneless country-style beef ribs, chuck eye steak, Denver cut (*M. serratus ventralis*), mock tender steak, shoulder clod steak, short ribs, top blade steak, under blade steak and shoulder pot roast. Retail cuts were vacuum packaged, boxed, and stored in a cooler 0-2°C. At 21 d post-mortem the cuts were transferred to a -40°C freezer and held until analyses were conducted.

C. Retail cut dissection

Prior to dissection, raw retail cuts were thawed for 24 to 48 h at approximately 4°C. Post-cookery, cooked retail cuts were held at approximately 4°C for 24 to 48 h prior to dissection. Trained dissectors weighed vacuum packaged retail cuts and recorded the weight. Bags were opened and drained and initial cut weight was recorded. Internal temperature of the cut was recorded prior to dissection. Retail cuts were dissected into separable lean, separable fat, and refuse. Following the procedures in Wahrmund-Wyle et al. [1] separable lean included all muscle, intramuscular fat, and any connective tissue trained dissectors considered edible. After each dissection, technicians recorded the weights of all dissected components ensuring a 99% recovery of each initial cut weight. Lean components were bagged and refrigerated for same day homogenization.

D. Cooking

Cooking method of braised, grilled or roasted was assigned to retail cuts that were designated for cooking. For all cook methods, samples were thawed at approximately 4°C for 24 to 48 h. Internal temperature was not to exceed 5°C prior to cooking or dissection. A thermocouple was placed at the geometric center of each cut, or thickest portion of the cut. After cooking, samples were chilled uncovered for 12 to 24 h in preparation for dissection.

The braising method of cooking was achieved by pre-heating a 6-Quart Dutch oven at medium heat (177°C). An infrared thermometer was used to check and record the pan surface temperature. Beef samples then were browned in the Dutch oven, and any pan drippings were collected and their volume was recorded. Distilled, deionized water was added at a volume equal to one-third of the thickness of the meat, and that volume was recorded. Liquid was brought to a boil, the pan was covered, and the Dutch oven was placed in a pre-heated conventional oven (120°C), and the samples simmered until they reached an internal temperature of 85°C. The Dutch oven was removed from the oven and internal temperature of the samples was monitored as it rose until a point of decline. Final

internal temperature of the retail cut was recorded with the corresponding time.

Grilling was performed on clam shell-style grills. All grills were preheated to a surface temperature of 195°C. An infrared thermometer was used to check the grill surface temperature. Beef samples were arranged on the grill, evenly spaced, and the grill lid was closed. Product was cooked to an internal temperature of 70°C. Beef samples were removed from the grill and allowed to stand until final internal temperature was reached.

Roasting consisted of preheating the conventional oven to a temperature of 160°C. Infrared thermometers were used to check oven temperatures. Beef samples were placed in a roasting pan with rack in the center of the oven. Samples were roasted to an internal temperature of 60°C. Final internal temperature of the retail cut was recorded with the corresponding time.

E. Homogenization

Beef samples (cooked and raw) were homogenized using a Robot Coupe Blixer batch processor following dissection. The separable lean from the sample was cut into 2.5 cm pieces. Samples were placed in liquid nitrogen until completely frozen. Pieces were transferred to the Robot Coupe. The sample was blended at 1500 rpm for 10 seconds, sides of the bowl were scraped, and the sample then was blended at 3500 rpm for 30 seconds. After homogenization, the resulting powder was weighed and transferred into a freezer bag and stored in a -80°C freezer until later analyses.

F. Proximate analyses

Proximate analysis was performed on all individual retail cuts, and resulting composites. Moisture analysis was performed using the AOAC oven drying method 950.46B [2]. Analyses were performed in triplicate and percent moisture (%MC) was calculated using the formula: $\% \ MC = ((\text{wet weight} - \text{dry weight}) / \text{wet weight}) \times 100$. Analysis of percent ash was performed in triplicate using AOAC method 920.153 [1]. Protein analysis was performed by combustion using AOAC method 992.15 [1] using a nitrogen analyser (N Cube, Elementar, Hanau, Germany). Analyses were

performed in triplicate, and percent protein was calculated by multiplying total percentage nitrogen by a factor of 6.25. Total fat analysis was performed using a modified Folch (Chloroform Methanol) method. Analysis was run in triplicate. Percentage fat was calculated using the formula: % Fat = [(Total volume of Chloroform Methanol/10 x final lipid weight) / sample weight] x 100.

III. RESULTS AND DISCUSSION

Few quality grade and cattle type comparisons resulted in statistical significance. Weighted means for carcass grade selection factors are presented in Table 1 as a means to display overall attributes of the United States cattle population.

Data for America's beef roast, shoulder clod steak, and top blade steak met the USDA definition of "lean" beef (Table 2). Three additional cuts (mock tender steak, under blade steak, shoulder pot roast) were low in fat but did not satisfy the requirements to be identified as "lean" beef (Table 2).

The nutrient content of whole muscle meat is constantly changing due to improvements in production practices, age of animal at harvest, breed type, and retail trends. Both the National Beef Tenderness Survey-1998 *[3]*, and the National Market Basket Survey-2006 *[4]* found that more external fat was trimmed from retail cuts than in previous years. Data from the present study demonstrate how such changes in whole muscle cuts over time can be reflected in the retail products consumers buy on a daily basis.

IV. CONCLUSIONS

Three cuts met the U.S. definition of "lean" beef (100 g serving with less than 10 g total fat, 4.5 g saturated fat, and 95 mg cholesterol): (1) shoulder clod steak (2) America's beef roast, and (3) top blade steak. Information on the nutrient content of beef chuck cuts has been added to the Nutrient Database. These new and updated data will benefit the beef industry by allowing consumers, health professionals, and regulators to make informed dietary decisions.

REFERENCES

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Table 1 Weighted means[a] of carcass grade factors for all USDA quality grades ($n = 72$)

	Carcass grade factors				
	Adjusted PYG[b]	Marbling score[c]	HCW[d], kg	REA[e], cm^2	KPH[f], %
Mean	3.3	428.0	354.1	84.5	1.9
Minimum	2.5	310.0	278.2	68.4	0.0
Maximum	4.0	650.0	400.9	106.5	5.0

[a] Weighted means are based on the following target proportions: USDA quality grades = 1/5 Upper Choice: 2/5 Lower Choice: 2/5 Select; Sex class = 2/3 Steer : 1/3 Heifer; Carcass type = 8/9 Native : 1/9 Dairy; USDA yield grade = 1/2 YG2: 1/2 YG3.
[b] PYG = preliminary yield grade.
[c] Marbling scores: Slight 0 - 99 = 300 – 399; Small 0 - 99 = 400 – 499; Modest 0 - 99 = 500 – 599; Moderate 0-99 = 600 – 699.
[d] HCW = hot carcass weight.
[e] REA = ribeye area.
[f] KPH = kidney, pelvic, and heart fat.

Table 2 Arithmetic means of nutritional components across retail cuts for all USDA quality grades

	Nutritional components			
Retail Cut	Protein, g	Total lipid, g	Cholesterol, mg	Energy content, kJ
America's beef roast (chuck eye)*	26.7	8.0	84.0	764.9
Boneless country-style beef ribs	31.4	11.9	100.0	953.0
Chuck eye steak	27.9	10.9	88.0	873.6
Denver cut (*M. serratus ventralis)*	26.5	12.4	94.0	919.6
Mock tender steak	33.3	6.1	114.0	794.2
Shoulder clod steak*	28.6	5.9	81.0	731.5
Short ribs	28.8	15.0	105.0	1003.2
Top blade steak*	28.2	8.8	95.0	819.3
Under blade steak	31.4	9.5	107.0	915.4
Shoulder pot roast	31.5	6.4	98.0	819.3

* Signifies retail cuts that met the USDA guidelines for "lean" beef. "Lean" beef must contain less than 10 g of fat, 4.5 g of saturated fat, and 95 mg of cholesterol per 100 g of product.