Meat Science 110 (2015) 236–244

Contents lists available at ScienceDirect

Meat Science

journal homepage: www.elsevier.com/locate/meatsci

Nutrient database improvement project: Separable components and proximate composition of raw and cooked retail cuts from the beef loin and round

R.J. Acheson [a], D.R. Woerner [a,*], J.N. Martin [a], K.E. Belk [a], T.E. Engle [a], T.R. Brown [b], J.C. Brooks [b], A.M. Luna [h], L.D. Thompson [b], H.L. Grimes [c], A.N. Arnold [c], J.W. Savell [c], K.B. Gehring [c], L.W. Douglass [d], J.C. Howe [e], K.Y. Patterson [e], J.M. Roseland [e], J.R. Williams [e], A. Cifelli [f], J.M. Leheska [g], S.H. McNeill [f]

[a] Colorado State University, Center for Meat Safety and Quality, Department of Animal Sciences, Fort Collins, CO 80523, United States
[b] Texas Tech University, Department of Animal and Food Sciences, Lubbock TX 79409, United States
[c] Texas A&M University, Department of Animal Science, College Station, TX 77843, United States
[d] Private Consultant, Longmont, CO 80504
[e] United State Department of Agriculture, Beltsville, MD 20705 , United States
[f] National Cattlemen's Beef Association, a contractor to the Beef Checkoff, Centennial, CO 80112
[g] Private Consultant Amarillo, TX 79101, United States
[h] Land O'Lakes Purina Mills , Lubbock TX 79403, United States

ARTICLE INFO

Article history:
Received 22 October 2014
Received in revised form 29 May 2015
Accepted 1 June 2015
Available online 3 June 2015

Keywords:
Beef
Composition
Loin
Nutrition
Retail
Round

ABSTRACT

Beef nutrition research has become increasingly important domestically and internationally for the beef industry and its consumers. The objective of this study was to analyze the nutrient composition of ten beef loin and round cuts to update the nutrient data in the USDA National Nutrient Database for Standard Reference. Seventy-two carcasses representing a national composite of Yield Grade, Quality Grade, sex classification, and genetic type were identified from six regions across the U.S. Beef short loins, strip loins, tenderloins, inside rounds, and eye of rounds (NAMP # 173, 175, 190A, 169A, and 171C) were collected from the selected carcasses and shipped to three university meat laboratories for storage, retail fabrication, and raw/cooked analysis of nutrients. Sample homogenates from each animal were analyzed for proximate composition. These data provide updated information regarding the nutrient status of beef, in addition, to determining the influence of Quality Grade, Yield Grade, and sex classification on nutrient composition.

1. Introduction

In today's society, consumers and producers have increased awareness of the composition and nutritive value of red meat. According to Troy and Kerry (2010), the food industry is scrutinized more today than it has been in the past due to concerns about labeling, health claims, safety, product composition, and sustainability. Conflicting observational studies have targeted the fat and cholesterol content of beef and tried to link these traits to cancer, heart disease, and obesity (Micha et al., 2010; Pan et al., 2012). However, Roussell et al. (2012) indicated that the Beef in an Optimal Lean Diet (BOLD) can reduce total and low density lipoprotein (LDL) cholesterol levels. This study, among others, showed the benefits of including lean beef in a healthy diet (Campbell and Tang, 2010; Layman et al., 2008; Roussell et al., 2012). Up-to-date nutrient information for all beef cuts is essential to drive the research process and provide researchers and dietitians with the necessary nutrient information to make conclusive and comprehensive statements regarding lean beef in the diet. In addition, the nutrient information will be used to update nutrition facts labels on retail beef cuts.

While beef nutrition research hasn't been a priority until recently, beef nutritional information has been available for many decades. Since 1926, the USDA has published beef nutrient data in the USDA National Nutrient Database for Standard Reference (SR). The database is utilized worldwide for food composition comparisons (Merchant & Dehghan, 2006). Updating the SR is an ongoing process since animal management and carcass fabrication procedures are constantly improving, new methods of cooking are used, and new value cuts are created. Conducting research to provide relevant beef nutrient data is important so the values can be included on on-package labels for fresh beef and to identify cuts that are classified as 'lean' or 'extra lean' and potentially use them in the newly redesigned school lunch programs or in other

* Corresponding author at: Department of Animal Sciences, Colorado State University, Campus Delivery 1170, Fort Collins, CO 80523, United States.
E-mail address: dale.woerner@colostae.edu (D.R. Woerner).

http://dx.doi.org/10.1016/j.meatsci.2015.06.001
0309-1740/

institutional dining situations. The overall objectives of this study were to evaluate the effects of carcass characteristics (i.e., USDA Quality Grade, Yield Grade, and sex classification) on retail cut composition and to compare composition data with data currently available in the SR. To accomplish these objectives, carcasses were identified and 10 retail cuts from the loin and round were used for generation of proximate data and homogenate samples for further nutrient analysis and inclusion in the SR.

2. Materials and methods

2.1. Carcass selection

Seventy-two grain-finished beef carcasses from seven different packing plants in six different regions, (Green Bay, WI; Greeley, CO; Dodge City, KS; Tolleson, AZ; Plainview, TX; Omaha, NE; Corpus Christi, TX) of the Unites States were selected to meet the national consist of beef carcasses based on the 2005 National Beef Quality Audit (Garcia et al., 2008). In the United States, USDA Yield Grade and Quality Grade standards are utilized in beef marketing to sort a heterogeneous beef population into more uniform groups based on quality and composition. The USDA Yield Grade serves an estimate of beef carcass red meat yield. The lower the numerical value of the USDA Yield Grade, the higher the expected red meat yield. The USDA Quality Grade standards were designed to reflect the expected eating quality of carcasses based on indicators of marbling and physiological maturity. Carcasses were selected to represent the following characteristics: 67% USDA Choice, 33% USDA Select, 50% USDA Yield Grade 2, 50% USDA Yield Grade 3, 67% steers, 33% heifers; and 11.1% dairy, 88.9% non-dairy. The sampling criteria were restricted to include only A-maturity carcasses and carcasses with appropriate hot carcass weights (299–411 kg). Trained university personnel identified sex classification, genetic type, ribeye area, fat thickness, marbling score, percentage of kidney, pelvic, and heart fat, maturity, and hot carcass weight. Two paired carcasses ("A" and "B") were selected for each sampling criteria to ensure adequate sample amounts to represent all retail cuts. Paired carcasses were matched for degree of marbling (not crossing the grade line) and all other characteristics prescribed in the sampling plan for that particular carcass.

2.2. Subprimal Collection

After selection of carcasses, the left and right side of the loin and round (NAMP # 173, 175, 190A, 169A, and 171C) from each carcass were identified and tagged on the interior and exterior of the needed subprimals to assure identification integrity through fabrication. Carcasses were fabricated according to the plant protocol to obtain the following subprimals: beef loin, short loin (NAMP #173); beef loin, strip loin, bone in (NAMP #175); beef loin, tenderloin, full, side muscle off, defatted (NAMP #190); beef round, eye of round (NAMP #171C); and beef, round, top (NAMP #169A). Subprimals were collected by university personnel who remained on-site during fabrication to help maintain identity of each subprimal. Identity of the original carcass was maintained throughout the entire project. After collection, each subprimal was either individually vacuum packaged or placed in combos and shipped via refrigerated truck to one of the three collaborating universities. Product temperature was verified before loading and upon receipt at each university to ensure that the product was maintained at 0 to 4 °C. Upon reaching their final destination, all subprimals were stored individually vacuum packaged in the absence of light at 0 to 4 °C until fabrication.

2.3. Retail cut fabrication

Between 14 and 21 d postmortem, subprimals were fabricated into pre-identified retail cuts. Before fabrication, weights of individual subprimals were recorded to the nearest 0.1 g. During retail cut fabrication, the short loin (NAMP #173) was fabricated into porterhouse steaks and T-Bone steaks. The strip loin (NAMP #175) was fabricated into top loin steaks. The tenderloin (NAMP #190), eye of round (NAMP #171C), and top round (NAMP #169A) were fabricated into steaks and roasts. A prescribed identification plan was used to determine the location of each steak and roast within the respective subprimal to reduce university variation in cutting procedures. After each subprimal was fabricated into retail cuts, the weight of all remaining lean trimmings, fat trimmings, and refuse were measured and recorded to the nearest 0.1 g. On the date of fabrication, retail cuts were individually identified, vacuum packaged, and frozen (−20 °C) until cooking or raw dissection.

2.3.1. Short loin fabrication

Before cutting individual steaks, the tail on each short loin (NAMP #173) was trimmed to 2.54 cm and the posterior end of the loin was faced. Steaks were cut 2.54 cm thick starting at the posterior end and moving to the anterior end. External fat on the porterhouse and T-Bone steaks were trimmed to 0.32 cm. On porterhouse steaks, the fat was notched under the tenderloin; however, the tenderloin was not denuded. Tails were trimmed to an external fat thickness of 0.32 cm, and if present, the *Longissimus costarum* remained on each steak. Steaks from the short loin were classified according to width of the tenderloin, which was measured perpendicular to the transverse process. Porterhouse steaks were classified as having a minimum tenderloin width of 3.18 cm, while steaks with a tenderloin width from 1.27 to 3.18 cm were designated as T-Bones.

2.3.2. Tenderloin fabrication

Before cutting roasts and steaks from individual tenderloins, the full tenderloin (NAMP #190A) was trimmed to a 0 cm external fat thickness and the silver skin was removed. The tail end of the tenderloin was removed at 2.54 cm in diameter. The side muscle was removed from the tenderloin up to the point where it joined with the *Psoas major*. Three center cut steaks, 3.81 cm in thickness, were removed from the center of the tenderloin. The remaining butt and tail sections from the tenderloin were designated as the tenderloin roasts.

2.3.3. Strip loin fabrication

Before fabrication, the strip loin (NAMP #175) was faced on the anterior end. Boneless top loin steaks (2.54 cm in thickness) were cut starting at the anterior end and ending at the posterior end. External fat trim levels of 0 cm to 0.32 cm were alternated between steaks. The trim level for the first steak was pre-determined to ensure proper alternation and randomization of trim levels across strip loins. Steaks trimmed to 0 cm external fat thickness did not have a tail while steaks trimmed to 0.32 cm external fat thickness had a 1.27 cm tail. Vein steaks were identified and defined as those steaks with *Gluteus medius* present on both sides of the steak. Vein steaks were weighed, but were not further analyzed in this study.

2.3.4. Eye of round fabrication

Before cutting roasts and steaks from each eye of round (NAMP #171C), the subprimal was trimmed to 0 cm external fat thickness and the silver skin on the anterior end of the subprimal was removed. The subprimal was then cut in half and, beginning at the cut surface of each half, three, 1.27 cm thick steaks were cut. The remaining two ends of the subprimal were used as eye-of-round roasts.

2.3.5. Top round fabrication

From the top round (NAMP #169A), the cap muscle (*Gracilis*) and the soft side (*Pectineus, Adductor*, and *Sartorius*) were removed. All exterior fat was trimmed to a 0 cm and the anterior surface was faced before steak cutting. Starting from the anterior side of the top round, four top round steaks, 1.91 cm in thickness, were removed. One top round roast, 5.08 cm in thickness, was cut in the same manner as the top