IMPACT OF BEEF CARCASS SIZE ON CHILLING RATE, PH, DISPLAY COLOR, AND TENDERNESS OF TOP ROUND SUBPRIMALS

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I. OBJECTIVES

The objective of the study was to investigate the impact of beef carcass size on chilling rate, pH decline, retail display color, and tenderness of the beef top round (North American Meat Institute #169A).

II. MATERIALS AND METHODS

Eight beef carcasses identified to be near the US industry average hot carcass (AW; 341–397 kg) and 8 beef carcasses identified as “oversized” (OW; 433–500 kg) were evaluated for the study. Temperature loggers were placed at superficial (2.54 cm from surface) and deep (approximate sagittal center, touching femur bone of respective carcass) locations of the top round, and temperatures were logged continuously for 48 h post USDA inspection. During the initial 12 h, and every 5 h subsequently, pH measurements were observed on all carcasses at a consistent superficial and deep anatomical location of the respective top rounds. Carcasses were fabricated into subprimals at 48 h, and top rounds were aged at 2°C for an additional 12 d. Six steaks were cut from each top round proximally to distally. Steak assignment was systematically rotated to account for steak location. Steaks were assigned to one of the following analyses: color analysis, lipid oxidation using the thiobarbituric acid reactive substances (TBARS) method, and Warner-Bratzler Shear Force (WBSF) tenderness analysis. Steaks for color analysis and TBARS were placed on Styrofoam trays, overwrapped with an oxygen-permeable film, and displayed in a glass-front retail display case at 3°C for a simulated retail display of 4 d. Steaks for color analysis and TBARS were evaluated daily. The steaks allocated to WBSF were tempered for 24 h at 4°C and were subsequently cooked on a two-sided electric grill to an internal temperature of 71°C. Six cores per deep and superficial portion of each steak were removed and sheared perpendicular to the muscle fibers. Calpain samples from the deep and superficial portion were snap frozen on day 2 and 14 and stored at −80°C. Subsequently calpain samples were extracted and evaluated using casein zymography. Data were analyzed using SAS (SAS Institute Inc., Cary, NC), and significance was determined at $P < 0.05$.

III. RESULTS

The superficial anatomical location on the top round of both AW and OW carcasses cooled at a faster rate ($P < 0.01$) than the deep locations. The deep location of OW carcasses had a lower pH and a more rapid ($P < 0.01$) initial pH decline. Quantitative color of steaks from OW carcasses had higher mean L^* (lightness; $P < 0.01$) and b^* (yellowness; $P < 0.001$), and lower a^* (redness; $P < 0.001$), values. There was an interaction of day and carcass weight for TBARS ($P = 0.01$) with AW steaks having greater TBARS values as the retail display progressed. Mean WBSF values were not different ($P = 0.24$). The superficial portion had a

greater percentage of native calpain-2 activity compared to the deep portion ($P = 0.01$), and the AW carcasses had a lower percentage of autolyzed calpain-2 activity compared to OW carcasses.

IV. CONCLUSION

The delayed temperature decline in combination with accelerated pH decline of the deep portion of the top round of OW carcasses occurs at different rates than AW carcasses. This rate change leads to irreversible impacts on steak appearance characteristics and potential eating quality of top round steaks fabricated from OW beef carcasses when compared to AW carcasses.

Keywords: beef, carcass size, pH, temperature, top round