Late Postmortem Electrical Impedance Measurements for the Determination of Pork Muscle Quality.

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The use of late postmortem electrical impedance measurements to detect differences in quality characteristics of pork was investigated. Interrelationships among impedance measurements, ultimate pH (pHu) values, water-holding capacity (WHC), and lightness of porcine longissimus muscle (LM) were quantified using 36 loins. Complex impedance (Z) measured with a tetrapolar electrode configuration (1 kHz and .156 mA), impulse impedance (Py) measured with the Sigma Meatcheck 160, and pHu values were taken between the 10th and last rib approximately 30 h postmortem. Water-holding capacity measured by the 24 h suspended drip loss method and CIE - L* values were evaluated on a 2.54 cm thick chop. Drip loss (DL) measurements were used to classify loins into acceptable (n = 26, DL < 6.0%) and unacceptable (n = 10, DL ≥ 6.0%) categories. The Py and pHu values were greater (P < .05) and Z tended (P = .06) to be greater in the normal category. A predicted 6.0% cutoff point was determined using linear regression of DL on Z, Py, and pHu, respectively. Percentage of correct classification of loins into acceptable and unacceptable WHC groups by Z, Py, and pHu were 83.0%, 78.0%, and 80.5%, respectively. Correlations of Z, Py, and pHu with L* were -.41, -.55, and -.73, respectively, while correlations with DL were -.56, -.75, and -.60, respectively. Results suggest that impedance and ultimate pH measurements may reflect different properties of postrigor muscle. Muscle impedance measurements made in the late postmortem period may be used to determine the WHC of pork.

Key Words: Pork, Muscle, Meat Quality, Electrical Properties

Assessment of Fresh Meat Color With Color Machine Vision.

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Color is one of the most important factors influencing the appearance and attractiveness of meat to consumers. Currently, when fresh pork color is assessed it is a subjective visual evaluation utilizing either the Japanese Pork Color Standards (JPCS) or the National Pork Producers Council Quality Standards (NPPC) as a reference. However, visual inspection often leads to inconsistent results. Color machine vision provides a new approach to achieve a more consistent, objective, and less labor intensive system. In this study, two batches of 79 and 73 pork loin samples were visually scored by a sensory panel using either the JPCS or NPPC reference standards. Representative samples, typical of each color class, were then used to train the color machine vision system. After proper training, the software was used to evaluate quality classes of pork samples based on color. Classification by machine vision was compared with visual panelists scores. Results showed that this system using either the JPCS (90% accuracy) or NPPC (81% accuracy) was able to classify pork loin chops by color. The accuracy of individual sensory panelists in this study ranged from 52 to 85% (JPCS) and 72 to 81% (NPPC). The results demonstrate that color machine vision is more accurate than most single sensory panelists for grading pork samples based on color. Color machine vision has a potential for improving accuracy, consistency, and speed of on-line evaluation of fresh meat quality.

μ-Calpain or m-Calpain: Which One Causes Postmortem Tenderization?

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The calpain system has been implicated as the primary factor causing postmortem tenderization. The present study was done to determine changes in the nature of postmortem (PM) μ-calpain, m-calpain, and calpastatin. Soluble μ-calpain, m-calpain, and calpastatin were partly purified from bovine semimembranosus muscle at-death, 1 d, and 7 d PM. Myofibrils were prepared from the same samples. Calpastatin...
activity decreased to 20-50% of at-death activity by 7 d PM. Western analysis showed that the decrease in calpastatin activity is likely due to degradation of native calpastatin. m-Calpain retained 63% of at-death activity after 7 d PM storage, and equal amounts of m-calpain protein were detected at the different times PM using Western blot analysis. Seven day PM m-calpain was not autolyzed, and had a calcium activity decreased to less than 20% of at-death activity by 1 d PM, and to less than 4% of at-death activity by 7 d PM. Western blot analysis showed that the amount of extractable soluble μ-calpain protein decreased during PM storage but that this protein was intact or in a partly auto- lyzed 76/28 kD form; and furthermore that 50% of total μ-calpain was bound to the myofibril at 7 d PM. The small amount of μ-calpain bound to at-death myofibrils is proteolytically active, but the μ-calpain bound to the 7 d PM myofibrils is almost inactive. The decrease in myofibril-bound and soluble μ-calpain activity during PM storage is likely due to some mechanism other than autolysis. Whatever this mechanism may be, its role in regulating μ-calpain activity, especially the myofibril-bound μ-calpain, may have important consequences in PM tenderization.

Live Animal and Carcass Values Based on BIA Regression Formulas.

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Prediction equations were established for live lambs and their carcasses based on Bioelectrical Impedance Analyzer (BIA) measurements. The complete data set (CDS) (n = 417) had pooled data that contained standard carcass measurements and carcass BIA estimates. Within this set are subgroups: DS2 (n = 247) contained complete cutout data of lambs with identified sires and DS3 included Columbia lambs (n = 182) with identified sires. The established formulas were used to develop within flock expected progeny difference (WFEPD) values on individual sires. DS2 had cutout data of lambs slaughtered at the NDSU Meats Laboratory and processed to trimmed retail product. The weight of the fabricated wholesale cuts, denuded of subcutaneous fat, were used as the dependent variable for CDS. CDS contained cold carcass weight (CCW), fat depth (FAT), bodywall thickness (BW), and ribeye (RE) and were used to develop the multiple regression prediction formula for total retail product (TRP): TRP = 5.8038 + (0.5710*CCW) - (6.2656*FAT) - (6.0953*BW) + (1.2394*RE). This formula produced an R

Tenderness of longissimus muscle (LM) from callipyge lambs is often unacceptable. Commercially acceptable procedures to improve tenderness of callipyge lambs post-harvest need to be evaluated. Our objectives were to determine differences in tenderness of callipyge lambs of widely different genetic backgrounds and to identify post-harvest treatments that improve tenderness of callipyge LM to the level of normal lambs. One hundred forty two spring-born lambs representing three breeds were fed in a single pen at a commercial feedlot. After 60 d on feed, lambs weighing over 58.5 kg were slaughtered and the remaining lambs were slaughtered the following week. Based on a composite of live phenotypic scores, 50% of the callipyge carcasses were electrically stimulated. Standard carcass measurements and weights of closely trimmed cuts were obtained. Post-harvest treatments that were applied to chops from each callipyge carcass were control (C), freezing for 4 d before thawing and aging (F), and CaCl2 injection (I) with aging periods of 7, 14, and 28 d, as well as Hydrodyne (H) treatment with one aging period of 14 d. Chops from normal (N) carcasses were aged 7, 14, or 28 d. Breed influenced ADG and fat thickness, but not Warner-Bratzler Shear (WBS) values. Sex and electrical stimulation also did not affect WBS (P > .05), however, callipyge chops were tougher (P < .01) than normal chops. Treatments were compared to N at 14 d of aging. Shear force values of H chops (3.47 kg), and I chops aged for 14 (3.57 kg) or 28 d (3.12 kg), did not differ (P > .05) from N d 14 chops (3.30 kg). Overall, callipyge lambs were leaner, had larger ribeye areas, less seam fat, and higher yields of wholesale leg and loin cuts. The treatments of H, and I with adequate aging, produced callipyge lamb as tender as N d 14.

Key words: Lamb, Callipyge, Tenderness, Carcass data, Breed

Conception to Consumer: Genetic Selection of Sires for Superior Carcass and Palatability Traits to Improve the Quality and Consistency of Beef.


Consumer demands for consistent, high quality beef dictate that superior sires be identified that produce efficient offspring with high quality, palatable meat. This study was...
designed to determine the effect of 25 sires (Simbrah, Saler, and American) on performance, carcass, palatability, and calpastatin and calpain activity traits of 87 steer progeny. The progeny were fed at a commercial feed lot and did not receive any growth promotants. Steaks from the progeny were aged 3, 7, 14, or 21 d at 3 ± 1°C. Sire effect was significant (P < .05) for skeletal maturity (A19 to A80), overall maturity (A42 to A85), marbling score (traces to modest), adjusted preliminary yield grade (2.3 to 3.7), kidney, pelvic, and heart fat percentage (.7 to 2.8%), and yield grade (1.6 to 3.8). Final weight, ADG, calpastatin, and µ-calpain activity were not affected by sire (P > .05). All sensory traits except sustained juiciness were affected by sire. Additionally, initial tenderness (IT), sustained tenderness (ST), flavor intensity (FI), and overall mouth-feel (OM) showed an age effect (P < .001). No sire by age interactions were found for any traits. Within age groups, a significant difference was found in IT, ST, and OM at 7, 14, or 21 d of aging. After 7 d of aging, 79, 83, and 85% of the steaks were rated acceptable in IT, ST, and OM, respectively. After 14 and 21 d of aging, at least 91 and 95%, respectively, of the steaks were scored acceptable in these traits. Warner-Bratzler shear values showed a sire effect (P < .05) at 3, 7, 14, and 21 d with 70% of the steaks aged 3 d having a shear value of < 3.9 kg. Moreover, 79 and 85% of the 14 and 21-d steaks had shear values < 3.9 kg. These data show a wide range in carcass composition, carcass quality, and palatability among progeny of sires. Eliminating the less desirable sires through these selection tools would improve the consistency and palatability of beef.

Factors Contributing to the Incidence of the Dark Cutting Condition in Beef Carcasses, and Management Strategies to Prevent Reductions in Value Due to the Occurrence of Dark Cutters.

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The 1995 National Beef Quality Audit reported that dark cutters cost $6.08 per steer/heifer slaughtered. This study attempted to develop management strategies to reduce the occurrence and economic losses resulting from dark cutting beef. Beef Longissimus M. samples from carcasses (n = 240) representing three biological types, were simultaneously encompassed for three years and included DMI, ADG, implant strategy, USDA yield and quality grades and numbers of dark cutters. Dark cutters had fewer white muscle fibers (P < .05) and Continental breeds had lower (P < .05) proportions of red fibers. Thus, cattle with fewer glycolytic muscle fibers were more susceptible to stress. Among the feedlot data, a least squares analysis of variance interaction (P < .05) was found between sex, implant strategy, biological type, temperature, precipitation, and live weight, indicating an additive effect. Management strategies were developed that reduced the occurrence among steers by 0.53% (1987 hd) and among heifers by 0.38% (438 hd), as well as variability associated with the occurrence of dark cutters. Thus, different management scenarios made it possible to reduce the occurrence of dark cutting beef.

The Effects of Irradiation, Storage Time, and High and Low Oxygen Transmission Anaerobic Packaging on Raw and Cooked Sensory Attributes and Color of Ground Beef Patties.

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The effects of electron beam irradiation, high and low oxygen transmission anaerobic packaging, and storage time on the raw lean color, raw odor, and cooked sensory attributes of ground beef patties were investigated. Beef trim was coarse ground and split into two groups on day one. Group one was fine ground, pattied, and packaged immediately; group two was treated likewise as a seven-day sample. Patties were held either as controls or irradiated with a 2 kGy dose one day following packaging and stored at 0°C. Sensory evaluations of controls and treated patties were conducted four days after irradiation. Irradiated beef patties had greater (P < .05) raw aroma intensities, raw off-odors, and off-flavors, lower (P < .05) Hunter CIE L*, a* and b* values, and were darker red (P < .05). Seven-day raw beef patties had greater aroma intensities (P < .05), higher b* values and were less juicy (P < .05) than raw one-day beef patties. Irradiated patties had greater (P < .05) off-odors than controls for both one-day and seven-day beef patties. Hunter b* values were also lower (P < .05) for irradiated patties than controls for both one-day and seven-day beef patties. Therefore, only the freshest beef should be irradiated, and the detrimental sensory effects of irradiation were minimized by cooking.

Tenderness and Retail Stability of Hydrodyne-Treated Beef.

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The Hydrodyne tenderization process involves use of a small amount of explosive in water. The acoustical match between meat and water allows enhanced tenderization to occur, in part through substantial damage to muscle structure, when the resulting supersonic shock wave is reflected through the meat. This research was conducted to determine the effects of the Hydrodyne process on tenderness, oxidative rancidity, color, and microbial growth during storage and retail display of beef. Sixteen beef strip loins and 16
top rounds (8 control [C] and 8 Hydrodyne [H] each) were treated 5 days post-mortem. Following shipping, cuts were sampled, repackaged in vacuum, and stored an additional 10 days before sampling during the beginning and end of a 5 day retail display period. Tenderness (shear force) of strip loins improved (P < .05) at day 7 (2.81 kg [H] vs 3.23 kg [C]) but not at day 17 (2.65 kg [H] vs 2.54 kg [C]). No differences were noted in pH, sarcomere length, or purge for either cut. Hydrodyne treatment had no effect on purge, lean color, color uniformity, or surface discoloration scores, rancidity or microbial growth during retail display. Higher L* values (P < .05) were found in Hydrodyne-treated samples from both cuts. These data indicate that Hydrodyne enhances tenderness of beef aged 7 days without compromising the rancidity, color, or microbial stability.

Key Words: Beef, Tenderness, Hydrodyne