Graduate Student Research Poster Competition

M.S. DIVISION

Comparison and Validation of Electromagnetic Scanning Versus Traditional Carcass Measures When Predicting Fat-free Lean in Lamb Carcasses.

B.K. Quandt, C.R. Calkins and K.A. Leymaster
University of Nebraska
A213 Animal Science, Lincoln, NE 68585-0908

This experiment was conducted to compare the accuracy of electromagnetic scanning versus traditional carcass measures when predicting hot and cold fat-free lean in lambs. The prediction equations were developed using 120 wether and ewe cross-bred (Romanov x Dorset) lambs serially slaughtered at 3 week intervals (n=6) from 5 to 9 months of age. These equations were then validated on 66 lambs exhibiting the heavy muscling phenotype characteristic of the callipyge genotype. Fat-free lean, as determined by chemical analysis of the carcass, was defined as water + protein. Hot and cold carcasses were scanned at 2.5 MHz. Cold carcasses were scanned in an upright and side orientation. Peak of the electromagnetic scan curve (Peak) from cold upright carcasses was a better predictor of cold fat-free lean than hot carcass weight (HCW) (R^2=.96, RMSE=.48 kg versus R^2=.91, RMSE=.71 kg). Cold upright Peak and HCW were better predictors of cold fat-free lean than the USDA Yield Grade measurements of HCW and rib fat thickness (RFT) (R^2=.97, RMSE=.44 kg versus R^2=.93, RMSE=.63 kg). The same conclusion can be drawn when comparing the equations hot Peak and HCW to the above carcass measures for predicting hot fat-free lean (R^2=.95, RMSE=.54 kg versus R^2=.93, RMSE=.66 kg). When validated on a heavy muscled population, the variables of Peak and HCW were a more robust predictor of fat-free lean than the equation HCW + RFT (R^2=.96, RMSE=.49 kg versus R^2=.95, RMSE=.57 kg) for carcasses scanned cold in the upright orientation. This trend was also found for the side orientation and for carcasses scanned hot. These data indicate that electromagnetic scanning is a more accurate, robust predictor of fat-free lean in lamb carcasses than traditional carcass measures.

Key Words: Carcass composition, Lamb, Prediction

Prediction of Slaughter Cow Composition Using Animals of Various Genotypes and Body Condition.

F.M. O'Mara, S.E. Williams, J.D. Tatum, G.G. Hilton, T.D. Pringle, G.C. Smith and F.L. Williams
University of Georgia
219 Livestock-Poultry Bldg., Athens, GA 30602-2771

Live animal and carcass traits from 120 slaughter cows were used to identify practical and accurate prediction equations for yield of boneless manufacturing beef of specific fat percentages. Twelve subclasses of cows (n=10) were selected, representing 4 genotypes (British, Continental, *Bos indicus* and Dairy) and 3 body condition classes (Thin, Moderate and Fat). Cows were weighed (LWT) and evaluated live for preliminary yield grade (PYGL), ribeye area adjustment, kidney, pelvic and heart fat adjustment, maturity, marbling, muscling (MUSCL), frame, heaviness of bone (BONE) and body condition (COND). Chilled carcasses were evaluated for preliminary yield grade, adjusted preliminary yield grade (PYGA), ribeye area and adjustment for weight (READJ), estimated kidney, pelvic and heart fat percent and adjustment (KADJ), lean (LMAT) and bone maturity, marbling (MARB), body wall thickness, ribeye width and depth and muscling. Carcass sides were fabricated and total fat percent (TFP) was calculated as total fat (trimmed and chemical)/side weight and total lean percent (TLP) as boneless fat-free lean/side weight. Data were analyzed using maximum R^2 multiple regression (best four variable models are shown). Live trait TFP prediction model included PYGL, COND, MUSCL and LWT, R^2=.830. Carcass trait TFP prediction model included PYGA, KADJ, MARB and hot carcass weight, R^2=916. Live trait TLP prediction model included PYGL, MUSCL, LWT and BONE, R^2=.642. Carcass trait TLP prediction model included PYGA, MARB, READJ and LMAT, R^2=.724. In all models, PYGL or PYGA entered the model first, accounting for the most variation. TFP and TLP prediction models differed for genotypes. These data suggest that TFP and TLP for slaughter cows can be accurately predicted using practical live animal and carcass traits.

Key Words: Cows, Carcass composition, Prediction equations

Hot-fat Trimming and Freeze Chilling Effects on the Microbial Load of Pork Carcasses.

M.A. Carr, L.D. Thompson, M.F. Miller and C.B. Ramsey
Texas Tech University
P.O. Box 42162, Lubbock, TX 79409

This study was designed to determine the effects of hot-fat trimming and carcass chilling method on *Salmonella, Staphylococcus spp.*, lactic acid bacteria (LAB), total coliforms and aerobic plate counts (APC) of pork carcasses. In a two-part study, composited ham, loin, belly and shoulder samples from 30 pork carcasses in a 2 x 2 x 3 factorial study [hot-fat trim (HFT) or non-fat trim (NFT) x normal chill (NC) or freeze chill (FC) x day] had similar APC, averaging 5.5 $\log_{10}$ CFU/g. The NFTNC procedure typically used in the industry, however, produced higher coliform and *Staphylococcus spp.* counts (P<.05). The HFTFC treatment had the lowest LAB counts. Only one sample in 60 tested positive for *Salmonella*. Vacuum packaged hams and loins stored at 4°C for 14 d had similar APC, LAB and *Staphylococcus spp.* counts regardless of trim, chill, or location treatment, averaging 5.7, 6.3 and 1.4 $\log_{10}$ CFU/g, respectively. Coliforms were higher (P<.05) on hams than loins on 2 of the 3 d sampled. The desire to reduce microbial loads on pork carcasses as a food safety issue and the coming implementation of HACCP warrants the use of hot-fat trimming and freeze chilling methods as critical control points or GMP/SOPs in the pork slaughter, processing and packaging industry.

Key Words: Hot-fat trim, Freeze chill, Pork

Improving Tenderness of Lambs from the Normal and Callipyge Phenotypes with Calcium Chloride and Electrical Stimulation.

T.L. Cain, S.P. Jackson, M.F. Miller, C.R. Kerth and C.B. Ramsey
Texas Tech University
T.T.U. Meat Lab, P.O. Box 42162
Lubbock, TX 79409-2162

Effects of 200 mM $CaCl_2$ injection on muscle quality and calpastatin levels of 10 normal and 10 callipyge phenotype crossbred lambs and effects of 550-volt, 60-Hz electrical stimulation on quality traits of 12 callipyge phenotype crossbred lambs were studied. $CaCl_2$ injection increased tenderness and flavor intensity scores in normal and callipyge muscles (P<.05), did not affect chop color during retail display, decreased color uniformity, and increased discoloration and browning over control chops at d 2. Initial calpastatin and m-calpain activities were higher (P<.05), but u-calpain activity was lower (P<.05) in callipyge phenotype muscles than normal muscles. ES sides had a more rapid pH decline (P=.0001) and a brighter red, finer-textured loineye (P<.05) than control sides. At d 14, the triceps *brachii* (TB) muscle had the highest MFI, indicating more tenderness, while *semitendinosus* (ST) and *m. longissimus* (ML) muscles had the lowest MFI (P=.008). At d 14, total soluble protein was higher in TB, *supraspinatus* (SP) and ST muscles than the ML (P=.04). Calpastatin levels were higher (P<.003) in the SP than the ST, SM and TB muscles at d 1. ES lowered mean shear values of all five muscles tested, but only the effect on the ML muscle was significant. Injection of 200 mM $CaCl_2$ improved lamb tenderness and reduced tenderness and juiciness variation. ES induced a more rapid pH decline and improved loineye color, texture, and ML muscle tenderness of callipyge phenotype lambs.

Key Words: Callipyge, Electrical stimulation, Calcium chloride

Ultrasonic Elastography to Predict Beef Tenderness.

L.L. Moore, G.D. Stolowski, R.K. Miller, J. Ophir, R.E. Lacey, J.W. Savell, A.R. Sams, J.F. Taylor, S.K. Davis, J.O. Sanders and J.W. Turner
Texas A&M University
348 Kleberg Center, College Station, TX 77843-2471

Ultrasonic elastography was used to predict chemical and mechanical measures of beef tenderness. Beef carcasses (n=30) were obtained from animals of known genetic background of three breed types (3/4 Angus (A) x 1/4 Brahman (B), 1/4 A x 3/4 B, and F_2 A x B crosses). The right side of each carcass was electrically stimulated. Four muscles (*semimembranosus, semitendinosus, biceps femoris* and *triceps brachii*) were obtained from each side. Additionally, the *longissimus* muscle (Ld) was obtained from the electrically stimulated side. Warner-Bratzler shear force (kg) of steaks at 2, 14, 28 and 42 days post-mortem aging, calpastatin activity (μg/g), sarcomere length (μm), total collagen (mg/g), collagen solubility (%), moisture (%) and lipid (%) were determined. Two gray-scale images, called elastograms, were obtained for each sample using elastography. Stepwise regression was used to determine the ability of textural features extracted from elastograms (*f*1-*f*14) to predict tenderness measurement. Textural features within the Ld muscles predicted shear force at 2 days (R^2=.47), shear force at 14 days (R^2=.40), shear force at 28 days (R^2=.26), lipid (R^2=.25), moisture (R^2=.23) and collagen solubility (R^2=.12). Regression equations for the other muscles had low predictability (R^2=.04 to .39). Textural features used in prediction equations (*f*12, *f*13) tended to be highly correlated to each other, therefore accounting for similar variation in elastograms. Therefore, ultrasonic elastography has potential to predict beef tenderness, but further research into feature extraction techniques are needed.

Key Words: Beef, Ultrasound, Tenderness

Physical and Chemical Attributes of No-Salt Frankfurters.

A.M. Virden and W.J. Means
University of Wyoming
Department of Animal Science, Box 3684
Laramie, WY 82071

Our objective was to use a sodium alginate/calcium carbonate (1.23% of total) and carrageenan (.25%) base system (AC) to replace the texture function of salt in frankfurters. Treatments included a 1.6% NaCl positive control (C), the AC base system alone and with added gellan gum (ACG, .8%) or konjac viscous liquid (ACK, 6.1%). Batters (6.8 kg beef [16.4% fat], and 16.4% ice) were made in a vacuum bowl chopper, stuffed and set for 24 hrs (4°C). Products were processed to 73.8°C. Bowl revolutions needed to achieve an 11.8°C batter temperature differed with ACK requiring less (P<.05) revolution (71) than C (94). Cook yields were similar (P>.05) (95.7%). All hydrocolloid treatments had higher (P<.05) pH's than C. Numerical values for hardness, fracturability, cohesiveness and gumminess were highest for C, intermediate for AC and ACG, and lowest for ACK (P<.05). The AC, ACG and ACK treatments had lower chewiness values than C. Gellan gum was not different from the AC base system.

Key Words: Frankfurter, Beef, Salt, Alginate

Potential Mechanisms by Which α-Tocopherol Maintains Oxymyoglobin Pigment.

J. Lynch[1], C. Faustman[1], J. Buckley[1], J. Kerry[2] and W. Chan[1]
[1]University of Connecticut, Storrs, CT
3636 Horsebard Rd., Ext. U-40, Storrs, CT 06269-4040
[2]University College Cork, Cork, Ireland

The effect of α-tocopherol on maintaining oxymyoglobin (in vitro) was investigated using a Triton X-100 system at 37°C, and at pH 7.2, 6.2 and 5.6. It was found that α-tocopherol delayed oxymyoglobin oxidation, both in the presence and absence of the water-soluble azo-initiator AAPH. The effect, while small, was significant at all pH conditions (P<0.05). The effect of α-tocopherol on the reduction of metmyoglobin was also investigated using a partially purified cytochrome b_5 extract prepared from bovine liver. The presence of α-tocopherol and cytochrome b_5 caused significant reduction of metmyoglobin at pH 5.6 and pH 6.2 after 15 min incubation (P<0.05) but not at pH 7.2. The results of this study suggest that in the absence of biomembranes α-Toc may interact directly with OxyMb, and is capable of reducing MetMb in the presence of a Cyt b_5 containing solution.

Palatability Attributes of Longissimus Steaks from Female Bovine Carcasses Differing in Maturity and Marbling Score.

G.G. Hilton, J.D. Tatum, S.E. Williams, K.E. Belk, J.W. Wise, F.L. Williams and G.C. Smith
Colorado State University
Department of Animal Sciences
Fort Collins, CO 80523

Strip loins from 354 female bovine carcasses were selected to represent 30 skeletal maturity (A, B, C, D, E) x marbling score (slightly abundant and higher, moderate, modest, small, slight, traces and lower) subclasses to identify carcass characteristics and end-point cooking temperatures associated with "critical" differences in palatability. Strip loins were vacuum packaged, stored for 14 d post-mortem at 2°C, and then frozen (–27°C). Five steaks from each strip loin, each cooked to a different end-point temperature (60°C, 66°C, 71°C, 77°C, 82°C), were used for shear force determinations. Two steaks from each strip loin, cooked to 66°C and 77°C, respectively, were used for sensory evaluations. Higher end-point temperatures were associated with higher shear force values and lower ratings for tenderness and juiciness (P<.05). Increased maturity resulted in higher shear force values and lower tenderness ratings (P<.05). The greatest differences were between B and C maturities and between D and E maturities; difference between A and B maturities were not significant. Shear force values and taste panel ratings improved with higher (P<.05) marbling scores; however, differences between adjacent marbling scores were not significant. Fat color score, lean texture score, lean firmness score, longissimus area and kidney, pelvic and heart fat percentage were all correlated (P<.05) with shear force values and taste panel ratings. Steaks with higher marbling scores had a higher incidence of fatty flavor and a lower incidence of grassy flavor (P<.05). Older carcasses produced steaks with a greater (P<.05) probability of having rancid, fishy or grassy flavors.