Graduate Student Poster Competition
Ph.D. Division

The Effect of Calcium Chloride, Sodium Chloride and Phosphate on Various Quality Attributes of Beef Muscle

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Five market steers were used as the source of experimental units. The *longissimus dorsi* muscle (strip loin) was collected from the right side of each carcass 24 hours postmortem. The strip loin was cut into 24 3/4-in steaks, randomized and placed into one of four treatment groups: 1) water, 2) sodium chloride/tripolyphosphate, 3) calcium chloride, 4) sodium chloride/tripolyphosphate/calcium chloride. Each steak was pumped to a 10% weight of each treatment solution. Each treatment group was post-mortem aged for three, nine or thirteen days at 2°C. One steak was used for sensory analysis, and the other one for Warner-Bratzler shear force, water-holding capacity, myofibril fragmentation index (MFI), and sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The sensory panel steaks were frozen and stored at -32°C until they were needed. All other analyses were carried out on fresh meat samples. Based on a difference in Warner-Bratzler shear force values and sensory evaluation for tenderness, the control steaks were less tender than the treated steaks. Both NaCl/phosphate and $CaCl_2$ were similar in tenderness and significantly more tender than the control. The MFI indicated a large improvement in $CaCl_2$-treated steak tenderness. SDS-PAGE results further indicated an increase in titin breakdown and appearance of several unknown bands in the $CaCl_2$-treated samples.

Phosphate Type, Concentration and Preblend Duration to Improve Water-Holding Capacity of Beef Connective Tissue

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Beef connective tissue collected from mechanical desinewing operations is a by-product with low value. Enhancing connective tissue (CT) functionality and value will increase the profitability of desinewing operations. Utilizing pH and ionic strength effects of different polyphosphates could be one method of increasing CT functionality and ultimate value. The objective of this research was to determine preblend conditions that optimize CT water-holding capacity and collagen solubility. Five preblends were manufactured in the first study which utilized a 1:1 CT:solution ratio: control (distilled water), 1% or 3% sodium acid pyrophosphate (SAPP), 1% or 3% sodium tripolyphosphate (STP). These preblends were sampled at 0, 3, 6, 9, 12, 24, 36 and 48 hr (split plot in time treatment design, preblend=whole plot, duration=split plot). A second study utilized a 2 x 6 (SAPP and STP x 0, 1, 2, 3, 4 and 5% concentrations) complete factorial design to determine optimal concentration of each phosphate. In study 1, time had a minimal effect on raw hydration of connective tissue and cooking yield (CT preblends cooked in a water bath to 68.8°C). Time had no ($P>.05$) effect on collagen solubility. Extended preblend duration was not used in Study 2. Phosphate x concentration interactions affected all variables in Study 2. The optimal raw hydration and cooking yield was found to be near 3.5% STP. There was very little effect of SAPP concentration on raw hydration. A slight linear increase in cooking yield ($P>.01$) was noted as SAPP concentration increased. Collagen solubility was maximized at 3.5% SAPP; there was no STP concentration effect ($P>.05$) on collagen solubility. In this experiment, it appears that extended periods of preblending are not necessary for phosphate solutions to affect CT functionality. A 3.5% solution of STP will dramatically increase CT hydration, whereas a 3.5% solution of SAPP will optimize collagen solubility. Future studies need to concentrate on which preblend would be more effective in a finely comminuted meat product.

Growth, Composition and Palatability of Calf- and Yearling-Fed Cloned Steers

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Parallel experiments were conducted to evaluate the impact of calf- versus yearling-feeding on animal growth, performance, carcass and palatability traits of Brangus steers created by nuclear transplantation cloning. Cloned cattle were used to reduce or eliminate the normal animal-to-animal additive genetic variation that can complicate interpretation of research results. In Experiment 1, steers (n=8) were fed as weanling calves (CF; n=4) or yearlings (YF; n=4) to a constant age endpoint of 16 mo. In Experiment 2, steers (n=10) were fed as weanling calves (CF; n=5) or yearlings (YF; n=5) to a constant live weight of 530 kg. Yearling-fed steers in Exp.

2 gained weight more rapidly (P>.05) than did the CF steers. In both experiments, YF carcasses were leaner, having lower (P < .05) numeric yield grades and percentage dissectable fat and a higher (P<.05) percentage muscle. Higher (P<.05) marbling scores were observed for the CF steers in Exp. 1, but no differences (P>.05) in marbling score were found in Exp. 2. In neither experiment were palatability differences observed between treatments (P>.05). Cutability differences (P<.05) favored YF carcasses in both experiments. Residual standard deviations (r.s.d.) from this study were compared to published studies involving calf- and yearling-feeding. Reductions (P<.05) in r.s.d. were observed in this study for most growth, carcass and palatability traits compared (84% reduction in Warner-Bratzler shear r.s.d.). Thus, nuclear transplantation cloning possesses great potential for reducing animal-to-animal variation observed in research animals, thereby reducing the number of animals necessary to achieve a given level of statistical sensitivity.

Comparison of Thermal Gelation Properties of Pork, Beef, Fish, Chicken and Turkey

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Thermal gelation properties (TGP) of muscle (10% protein at pH 5.5, 6.0, 6.5 or 7.0) and myofibril (MF) fraction (5, 7 or 10% protein at pH 6.0) from pork (P), beef (B), fish (F), chicken breast (CB), chicken thigh (CT), turkey breast (TB) and turkey thigh (TT) were evaluated. TGP of myosin and actin (7% protein) from P and CB were also compared. Gel strength (GS) of all muscles (except CB and TB) was highest (P<.05) at pH 6.0. TB had the lowest (P<.05) GS at pH 6.0, 6.5 and 7.0, while CB had the highest (P>.05) GS at pH 6.5. Cooking losses (CL) of all the muscles decreased as pH increased. CB had the lowest (P>.05) CL at each pH. The GS of the MF increased and CL decreased with increasing protein content. MF of CB and CT had the lowest (P<.05) CL, while MF of F and TT had highest (P<.05) CL. Fish MF had the lowest (P<.05) GS. Pork myosin had higher GS and lower CL than CB myosin (P<.05). Actin had no GS in either species. Myosin and actin mixture (2:1) for P and CB had lower GS and higher CL than myosin alone (P<.05). Overall, CB and CT had the highest protein binding and cooking yield for both muscle and MF, while F had the lowest protein binding and water binding for MF. TGP of myosin gels from P and CB appeared to be different from that of whole muscle and MF.