

Egg and Meat Science and Muscle Biology - Livestock and Poultry II

738 The role of functional ingredients in marinated meat and poultry. B. S. Smith*, *John R. White Company, Inc., Birmingham, AL.*

Traditionally, meat and poultry marinades have been used to convey a mixture of ingredients, through soaking, massaging, tumbling or injecting, in an effort to influence flavor, texture or other sensory attributes. Adding functional ingredients to a marinade can further influence product yield, cook loss, oxidative and microbial stability, and operational efficiency. Functional ingredient classes may include salts, sweeteners, phosphates, starches, gums and other hydrocolloids, and non-meat proteins. Many ingredients perform multiple functions when properly selected and incorporated through marinating. For example, aside from their contribution to flavor, ingredients like sodium chloride, sugars, and sodium or potassium lactate chemically bind water and effectively reduce water activity, which may positively influence shelf life. The combination of sodium chloride with phosphate enhances water holding capacity of the meat system by aiding muscle protein extraction, positively impacting yield and product texture, and minimizing package purge and cooking losses. Phosphates also have chelating properties that effectively reduce oxidation and warmed over flavor. Certain sweeteners participate in maillard browning to enhance product flavor and appearance. Starches, gums and other hydrocolloids effectively manage moisture to improve yield, manipulate texture, and minimize purge. Non-meat proteins also control moisture, but often are formulated to replace meat for economic purposes. Certain non-meat proteins may also contribute to marinade viscosity, which can influence absorption and retention. Freeze-thaw stability can be manipulated by the addition of certain sugars and modified starches. Water, while typically the transport medium for other ingredients in a marinade, can impact the efficacy of certain other functional ingredients. Chilling and softening source water for marinades can provide significant benefits in minimizing oxidation and improving protein extraction. In conclusion, proper ingredient selection, inclusion level, order of addition, and an understanding of functional properties and limitations are critical to success of the finished product.

Key Words: Functional, Ingredients, Marinade

739 Maximizing carcass characteristics of grass- and grain-fed Bonsmara steers using electrical stimulation. K. R. Hawks*¹, R. K. Miller¹, T. D. A. Forbes², F. M. Rouquette, Jr.³, J. W. Holloway², and B. G. Warrington², ¹Texas A&M University, College Station, ²Texas Agricultural Experiment Station Uvalde, Uvalde, ³Texas Agricultural Experiment Station Overton, Overton.

Grass-based beef production systems have increased as market alternatives for beef. The effects of location, forage type, supplementation, limited grain feeding and electrical stimulation (ES) on subsequent carcass characteristics and fatty acid composition have not been fully elucidated. Our objectives were to identify the effects of location, forage type (warm v cool season), supplementation (S), harvesting steers immediately off forage or after 90 d on a high grain feedlot ration, and ES on USDA Quality and Yield grade characteristics, fat and lean color, pH and fatty acid composition in Bonsmara steers. Steers (n=48) were randomly assigned to pasture at Overton or Uvalde, TX. Eight steers were assigned to one of six treatments: Cool-season

forage (CSF) at Uvalde and harvested off grass; CSF at Uvalde and harvested after 90 d on a feedlot ration; CSF at Overton and harvested off grass; CSF at Overton and harvested after 90 d on a feedlot ration; warm season forage (WSF) at Overton and harvested off grass; and WSF at Overton and harvested after 90 d on a feedlot ration. Within a treatment, four steers were given S (corn at 0.8% of BW/d) during forage feeding. After harvest, steers were ES (300 V for 30s, 350 V for 30s, 350V for 30s with 10s rest cycles) and chilled for 48 h. USDA Quality and Yield grade factors, meat and fat color, pH and fatty acid composition were determined. Steers harvested off grass had younger bone maturity, higher lean maturity, less marbling, higher pH, darker colored lean and fat, softer, coarser lean, lighter hot carcass weights and lower yield grades than steers harvested after 90 d on a feedlot ration regardless of location (P>0.01). Treatment by S interactions for lean firmness (P=0.046) and fat thickness (P>0.01) were observed. Lean maturity, heat ring, lean color and marbling were improved by ES (P>0.05). ES carcasses from S steers had lighter subjective lean color than carcasses from non-supplemented non-ES steers (5.0 v 4.5) (P>0.05). Fatty acid composition was influenced by treatment (P>0.05).

Key Words: Forage, Carcass, Cattle

740 A novel technique to assess internal body fat using real-time ultrasound. F. R. B. Ribeiro*¹, L. O. Tedeschi¹, J. Stoffer², and G. E. Carstens¹, ¹Texas A&M University, College Station, ²Cornell University, Ithaca, NY.

The objective of this study was to develop a method to quantify internal fat composition of growing calves using real-time ultrasound (RTU) of KPH fat depth or linear measurement of KPH fat depth at. Data for this study were obtained from 56 animals (24 steers, 16 heifers, and 16 bulls) from two trials. Trial 1 was composed of Angus steers (n = 24) and Trial 2 had Angus bulls (n = 16) and Heifers (n = 16). Ultrasound KPH images were collected between the first lumbar and the 13th rib and KPH depth was measured between the ventral part of the *Psosa major* muscle and the end of the KPH fat 7 days pre-slaughter to measure the depth of KPH (uKPHd). Whole KPH and gastrointestinal tract (GIT) were removed from the hot carcass. Whole GIT was dissected and total internal fat (IF) was physically separated. Bulls were heavier than heifers and steers (479.87, 354.02, and 392.7 kg, respectively). Heifers had more KPH and total IF than bulls and steers (8.7 and 33.27, 7.18 and 28.35, and 7.50 and 28.94 kg, respectively). Carcass KPH depth (cKPHd) was predicted from uKPH with an R² of 0.87. Predictions of KPH weight using uKPHd had an R² of 0.81. Predictions of total IF using uKPHd had an R² of 0.81 whereas using cKPHd had an R² of 0.89. Our results showed that cKPHd can be predicted from uKPHd. Results also indicated that cKPHd can precisely predict total IF and that uKPH is a measurement just as precise as cKPHd to predict IF. The ability to measure total IF with a non-invasive and cheaper technique could greatly increase our ability to measure this trait in live animals at different points of the growing and finishing phase. More research is needed to evaluate the system for different diets, stages of growth, and breeds.

Key Words: Ultrasound, Internal Fat, Non-Invasive

741 Proteomic analysis of whole muscle fingerprints from yellow perch, (*Perca flavescens*), and identification of proteins associated with body weight and length. J. M. Reddish*, K. B. Green-Church, A. D. Nichols, N. S. St-Pierre, and M. Wick, *The Ohio State University, Columbus*.

A challenge of commercial aquaculture is to accelerate growth and increase muscle mass by genetic selection which will lead to higher harvest yields and increased profitability. Increased growth rate of yellow perch can be achieved through genetic selection; however, the concomitant changes in gene expression related to increased muscle growth in fish are not fully understood. Gaining an understanding of the molecular mechanisms of muscle development in fish species will have considerable economic value and may prevent meat quality problems due to selection in fish that have occurred in other animals of agricultural importance such as PSE in swine and poultry. Our hypothesis is that altered gene expression in muscle results in variability in body weight and length in fish and that the differential protein expression associated with the growth of fish muscle can be identified using electrophoretic, statistical and protein sequencing technologies. Our objective is to apply this proteomic technology to identify the gene products unique to enhanced muscle growth in pond-cultured yellow perch. Yellow perch muscle was sampled (n = 70) and body weight and length were recorded. Proteins were resolved by SDS-PAGE on 5 to 20 % gradient gels, stained with SYPRO Ruby[®] and analyzed using TotalLab[™] image analysis software. Individual band percentages were independently analyzed using stepwise linear regression in SAS v.9.1 against body weight and length. Eight bands were associated with body weight ($R^2 = 0.84$) and nine bands were associated with length ($R^2 = 0.85$); four bands were common to body weight and length. Detection by MALDI-TOF-MS of peptides significantly associated with body weight and length identified forty-eight individual proteins or protein isoforms. This information will be used to help identify genes which are uniquely associated with enhanced muscle growth in pond-cultured yellow perch.

Key Words: Yellow Perch, Muscle, Proteomics

742 Production and evaluation of a value-added turkey product using mechanically separated turkey meat. S. Williams*, N. Djeri, M. Balaban, and A. Ruiz, *University of Florida, Gainesville*.

The objectives of this research were to 1) manufacture a turkey product utilizing mechanically separated turkey meat (MSTM) as the chief ingredient, 2) determine the appropriate thermal processing conditions for cooking the canned product and 3) determine sensory and chemical characteristics, and microbial content of the finished product. Frozen 18.2 kg blocks of MSTM were purchased from a Virginia turkey processor and used to manufacture the product. The MSTM (83%) was blended with 17 % nonmeat ingredients (soy protein concentrate, water and seasonings). The meat mixture was stuffed into fibrous casings and cooked to an internal temperature of 71.1°C. The cooked sausage was cut into 681 gram portions, packaged in 0.91 kg capacity metal cans and retorted at 123.0°C for 2 hours or 112.8°C for 3.2 hours. The average protein and fat contents of the finished products were 15.0% and 19.4%, respectively. Sensory evaluation of the product revealed no significant differences ($P > 0.05$) in texture and flavor. However, 20% of the panelists commented that the product processed at 123.0°C for 2 hours had a "slightly softer texture" than the product processed at 112.8°C for 3 hours. The color of the product processed at 123.0°C was rated lower ($P < 0.05$) than the product processed at

112.8°C. The product yield, proximate composition and pH values were similar ($P > 0.05$) for both cooking processes. No microbial growth was detected in the finished canned products. As a result of this study, the canned turkey product is currently being shipped to Jeremie, Haiti for evaluation by the Haitian Health Foundation for utilization in their feeding program for children ages 6 months to 3 years old living in remote villages.

Key Words: Mechanically Separated Turkey Meat, Product Development, Turkey Product

743 Impact of early deboning and portioning on tenderness of vertically portioned broiler breast fillets. C. M. Owens*, S. C. Purcell, A. Saha, and J. F. Meullenet, *University of Arkansas, Fayetteville*.

Uniformity of boneless breast fillets is a highly desired aspect in the food service industry. In order to accommodate the demand for uniform product, poultry producers portion breast fillets to achieve the perfect size and shape. Tenderness is also an important consumer issue and early deboning can often result in decreased tenderness. Portioning fillets early postmortem may also negatively impact meat tenderness. The purpose of this study was to determine the effect of time of portioning and genetic strain on tenderness of vertically portioned breast fillets. One hundred twenty, six-week-old broilers from two commercial high yielding broiler strains were processed via an in-line system and then chilled with a two-stage method in 3 replications. Broiler carcasses were deboned at 2h or 4h postmortem (PM). Boneless breast fillets were vertically portioned at time of deboning (2h or 4h PM) or at 24h PM (i.e., after aging of deboned breast fillet) using a heart-shaped standard template removing cranial and caudal fractions. All fillets were cooked 48h PM to an internal temperature of 76°C and sheared using the MORS method, recording total energy (TE). Whole fillets used in this study were similar in weight (approximately 315 g) and all were portioned to approximately 75% of the original weight. Fillets deboned at 2h PM had significantly higher TE than those deboned at 4 h PM, indicating decreased tenderness as a result of early deboning. Portioning with a vertical cut further impacted meat tenderness as indicated by significantly higher TE in those portioned at time of deboning compared to those portioned at 24h PM ($P < 0.05$). However, this effect was predominantly observed in those fillets deboned at 2h rather than at 4 h. Strain had little impact (Strain, $P = 0.1016$; Strain \times Debone, $P = 0.0570$) on meat tenderness of portioned fillets. The results of this study suggest portioning with vertical cuts early postmortem can decrease meat tenderness to a greater degree than deboning alone. Processing procedures (e.g., deboning and portioning) had a greater impact on tenderness than the effect of commercial strain.

Key Words: Tenderness, Portioning, Broiler

744 Carcass and meat quality traits of Angus-cross steers finished on three different winter annual forages. C. R. Kerth*, K. W. Braden, and B. S. Wilborn, *Auburn University, Auburn, AL*.

Angus-cross steers (n = 18) were randomly assigned to one of three forages during an 84-d finishing phase. Ryegrass (*Lolium perenne*), rye (*Secale cereale*) and oats (*Avena sativa*) were compared with replicate 1.42-ha paddocks (2 paddocks per forage) established and stocked

with three steers (374 kg \pm 6.43 initial BW) per paddock. All steers had access to salt and minerals free-choice. Grazing was initiated on Jan 19, 2006, when average forage mass reached 1000kg ha⁻¹ as the first of two replicate years. When forage quality could no longer sustain growth, cattle were transported 50 km to the Auburn University Lambert-Powell Meat Laboratory and humanely harvested. Carcass data, pH, lean and fat color was measured 48 h postmortem and a boneless ribeye roll was removed from each carcass, vacuum-packaged, and stored (4C) until 21 d postmortem. Steaks were removed from the posterior end of the ribeye roll, overwrapped in PVC film and stored under simulated retail conditions for 7 d. Lean color was measured daily on each steak to monitor L*, a*, and b* values. Average daily gain was not affected ($P > 0.10$) by forage treatment. Type of forage did not affect ($P > 0.50$) HCW, preliminary yield grade, KPH fat%, LM area, maturity, marbling, final yield grade or final quality grade. Carcasses from steers finished on rye tended ($P = 0.08$) to have lighter (higher L* values) subcutaneous fat color compared to carcass from steers finished on either ryegrass or oats. Subcutaneous fat redness and yellowness and lean lightness, redness, and yellowness did not differ ($P > 0.24$) among the three forage treatments. Lean lightness (L*) and redness (a*) decreased ($P < 0.05$) with increasing days of retail display. The type of forage used to finish steers did not ($P > 0.05$) affect color traits of steaks under retail display. Type of forage used to finish Angus-cross steers does not affect carcass or meat color traits.

Key Words: Forage-Fed, Beef, Carcass

745 Impact of litter size and birth weight on growth performance, carcass characteristics, and meat quality in pigs. J. Bérard¹, M. Kreuzer², and G. Bee*¹, ¹*Agroscope Liebefeld-Posieux, Research Station ALP, Posieux, Switzerland*, ²*ETH Zurich, Institute of Animal Science, Zurich, Switzerland*.

There is some evidence that within litter low birth weight (**Btw**) pigs not only grow slower and have fatter carcasses but also meat quality traits are impaired compared to their high Btw siblings. Because the variability of the Btw is greater in large compared to small litters, the aim of this study was to test the hypothesis that effects of Btw on growth performance, carcass characteristics, and meat quality in the LM and the light portion of the semitendinosus muscle (**ST**) are different when pigs originate from small or large litters. The 60 Swiss Large White barrows used originated from 20 litters with either less than 10 (**S**) or more than 14 (**L**) piglets born per litter. Within each litter, the lightest (**L-Btw**), the heaviest (**H-Btw**), and the barrows with a Btw nearest to the average Btw of the litter (**M-Btw**) were selected. At weaning the barrows were individually penned and had free access to the diet until slaughter at 105 kg BW. The Btw of L- as compared to S-litters were lower in L-Btw (1.2 vs. 1.6 kg) and M-Btw barrows (1.6 vs. 1.9 kg) and similar in H-Btw barrows (1.9 vs. 2.0 kg) (litter size \times Btw interaction; $P < 0.01$). The L-Btw barrows grew slower (0.81 vs. 0.90 kg; $P < 0.01$), ingested less feed (2.30 vs. 2.42 kg; $P = 0.03$), and were still less efficient (2.84 vs. 2.71 kg feed/kg gain; $P < 0.01$) than H-Btw- and M-Btw barrows, regardless whether they originated from S- or L-litters. The carcass yield was higher (81 vs. 82%; $P < 0.01$), the liver (1.58 vs. 1.74 kg), and kidney (0.31 vs. 0.34 kg) were lighter ($P \leq 0.01$) in L-Btw barrows in the S- and L-litters. Drip loss and shear force was neither affected by litter size nor by Btw. The LM of L-Btw was less red (6.1 vs. 6.9; $P = 0.02$) than the LM of H-Btw barrows and b*-values of the ST was lower (3.4 vs. 3.8; $P = 0.03$) in barrows originating from L- than from S-litters. The present results confirm the marked effect of Btw on growth performance whereas the hypothesized impact on carcass characteristics and meat quality could not be demonstrated. Although the litter size affected average Btw its impact on growth performance, carcass and meat quality was minor.

Key Words: Birth Weight, Litter Size, Meat Quality

Extension Education - Livestock and Poultry: Extension Dairy Session

746 A Net Present Value Dashboard of the dairy cow in a commercial setting. D. T. Galligan*, J. Ferguson, R. Munson, and D. Remsburg, *University of Pennsylvania, School of Veterinary Medicine, Kennett Square*.

An economic model of the production life of a modern dairy cow was created in a dashboard environment. The user enters information that characterizes the production life of a cow using sliders arranged in a menu driven series of screens: Milk and Feed \$, Reproduction, BST, Heifer, Finance, Other Cost, Labor, Longevity. Over 30 input variables (management factors, production parameters, economic values) are controlled by the user. Based on entered values, an economic model of annual cash flows is created and discounted to reflect the opportunity of value money. Several gauges show: the cow net present value, annuity value per year, internal rate of return estimate, time in the herd and the resulting cull rate. These gauges respond to user changes of inputs instantly demonstrating the magnitude of impact. Lactation yields are shown in a graph format and are changed by altering first lactation yields. For example a cow having 3 lactations and culled at 100 DIM in the last lactation, with a first lactation yield of 22,000 (305 milk) valued at \$13/cwt, with debt/cow at \$2000 financed at 7% over ten years will have a NPV of \$662 and an annuity value of \$160. Use of BST starting at 100 DIM in all lactations, will increase the NPV to \$925 and the annuity value to \$226, assuming a 10 lb daily response

and a start DIM at 100 for each lactation. Other investment strategies can be explored with the model.

Key Words: Net Present Value, Economics, Dashboard

747 Accuracy of prediction of future uniform milk prices in Florida from Class III and IV futures markets. S. Feleke* and A. De Vries, *University of Florida, Gainesville*.

The objective of this study was to evaluate the accuracy of a method to predict the future uniform milk price in Florida from the Class III (cheese) and Class IV (butter) futures markets. Milk futures contracts are traded at the Chicago Mercantile Exchange for delivery 1 to 18 months in the future. Futures market theory holds that futures prices may be unbiased predictors of spot prices. The uniform milk price in Florida is a function of the announced Class III and IV prices, butter price, and the utilization of Class I, II, III, and IV skim milk and butterfat prices. To accurately predict future uniform milk prices, unbiased estimates of these factors are needed. Therefore, future butter prices were predicted from the future Class IV price and the ratio of the most recently announced butter price and the Class IV price. Future