

between replicates or during extended storage. A significant difference ($P < 0.05$) was found in detectable force required to break the vitelline membrane between treatments. This difference was less than 0.05 g. The elasticity of the vitelline membrane decreased during storage ($P < 0.01$) remaining low after 6 wk. Significant differences were detected for L^* , a^* and b^* values. While numerically these differences existed, they were below the degree detectable by the human eye. Therefore, these differences would have no effect on consumer perceptions. Extended cold storage did lead to decreases in egg weight, albumen height and Haugh units. Average Haugh unit values were still within the range of A grade. Shell strength was not affected by the extended storage. Vitelline membrane elasticity also decreased which could lead to yolks more easily rupturing as consumers cracked the eggs.

Key Words: Egg, Storage, Quality

M47 Chemical analyses of commercial shell egg wash water collected from three different operations. J. K. Northcutt*, M. T. Musgrove, and D. R. Jones, *USDA, Agricultural Research Service, Russell Research Center, Athens, GA.*

A study was conducted to evaluate egg wash water from in-line shell egg processing facilities (Plants X, Y and Z). Water samples were collected from the tap, washer 1 (W1) and washer 2 (W2) in each facility. Samples were evaluated for chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), total suspended solids (TSS), total dissolved solids (TDS), pH, temperature, chlorine and soluble iron. Values for COD, TKN, pH, temperature and chlorine varied significantly among the facilities ($P < 0.05$). Sample (tap, W1 or W2) had a significant effect on COD, TKN, TSS, TDS, pH, temperature, chlorine and soluble iron ($P < 0.05$). COD values for both W1 and W2 followed the order of: Plant Z > Plant X > Plant Y. Wash water had COD values that ranged from 7300 mg/L to 1765 mg/L. TKN values for the wash water ranged from 302 mg/L to 81 mg/L. Highest values for TSS and TDS occurred in W1 (601 mg/L and 5287 mg/L, respectively) as compared to W2 (401 mg/L and 3087 mg/L, respectively). Wash water pH varied from pH 11.4 (W1, Plant Z) to pH 10.0 (W2, Plant X). No difference was found in the pH of tap water which averaged from pH 6.1 to 6.7. Wash water temperature ranged from $44.1 \pm 0.1^\circ\text{C}$ to $39.7 \pm 0.3^\circ\text{C}$, and was generally highest in W2 samples from all three plants. Chlorine levels in the wash water for Plant Y (0.89 mg/L, W1; 0.91 mg/L, W2) were significantly lower ($P < 0.05$) than the levels for Plant X (2.72 mg/L, W1; 2.62 mg/L, W2) or Plant Z (4.5 mg/L, W1; 2.35 mg/L, W2). Chlorine levels in the tap water were similar among the facilities and ranged from 0 to 0.15 mg/L ($P < 0.05$). Average values of soluble iron (ferrous) in the egg wash water were 0.29 ± 0.02 mg/L to 1.60 ± 0.29 mg/L; however, iron levels were found to be above the 2.0 mg/L guideline in W1 for Plant X during one of the sample collections. Data provided by the present study may be useful for identifying process deficiencies and minimizing organic and inorganic discharge loads in the waste stream.

Key Words: Shell Eggs, Egg Processing Water, Chemical Analyses

M48 Evaluation of carcasses obtained from broilers fed with ostrich oil and/or soybean oil as energy source. W. Martinez, E. Posadas, E. Avila, and M. P. Castañeda*, *Universidad Nacional Autónoma de México, Salvador Díaz Mirón s/n, Col Zapotitlan, México D.F.*

Ostrich oil is a waste product from the production of leather and meat on Mexican ranches. The objective of this study was to evaluate carcass yield, breast, leg and thigh yields, pigmentation, and fatty acid profiles in meat obtained from broilers fed with ostrich oil and/or soybean oil.

Four hundred twenty broiler chickens (Ross x Ross) were randomly distributed in four treatments with five trials of 21 chickens each. The treatments were as follows: T1 (5% soybean oil in both feeding phases), T2 (5% ostrich oil in both feeding phases), T3 (5% soybean oil in starter feed and 5% ostrich oil in finisher feed) and T4 (5% ostrich oil in starter feed and 5% soybean oil in finisher feed). At 49 days, the birds were processed under commercial conditions and pigmentation, carcass yield, breast, leg and thigh yield, and fatty acid profile (Folch's method) were determined. There were no statistical differences among treatments ($P < 0.05$) for the weight of the carcass, weight of carcass with viscera, carcass yield and breast, leg and thigh yield, and yellowness value. The redness value was not significantly different after picking; however, after chilling T1 (7.79) was only significantly higher than T2 (4.962). The lightness value following chilling indicated T4 (71.79) was significantly higher than T1 (69.16). The results from the fatty acids profile indicated T3 and T4 had the highest content of lipids and saturated fatty acids in breast, leg and thigh. T4 had the highest content of monounsaturated fatty acids in breast and the T3 the highest in leg and thigh compared to the remaining treatments. The content of omega-3, omega-6 indicated that T4 had the highest concentrations in the breast and leg-thigh meat samples compared to the remaining treatments. T4 was significantly higher in omega-9 in the breast meat and T3 was significantly higher in omega-9 in the leg-thigh meat samples compared to the remaining treatments. The results obtained in the present study suggest that ostrich oil and soybean oil increased the polyunsaturated fatty acids levels without affect the yield and pigmentation levels. The ostrich oil is a viable option in the broiler feed as energy source.

Key Words: Ostrich Oil, Soybean Oil, Carcass

M49 Effects of post-defeathering electrical stimulation on moisture retention characteristics of broiler carcasses and phosphate-marinated breast fillets. L. L. Young*¹, D. P. Smith¹, J. A. Cason¹, R. J. Buhr¹, and J. M. Walker², ¹USDA, Athens, GA, ²Stork-Gamco, Inc., Gainesville, GA.

Processing technologies sometimes interact in a way that alters their individual functionalities. The objective of this study was to evaluate effects of simultaneous application of two such technologies, electrical stimulation (ES) of broiler carcasses immediately post-defeathering to improve texture of early harvested breast fillets and marination of breast fillets in sodium tripolyphosphate (STPP) solution to enhance moisture absorption and retention. Mixed-sex broiler chickens were conventionally slaughtered. Half were stimulated by pulsed electrical current (220 VAC, 2 s on, 1 s off) for 90 s immediately after defeathering and prior to evisceration and half remained unstimulated. After chilling, breast fillets were excised. Half the fillets from each stimulation treatment were marinated in STPP and half without STPP. Chiller water absorption by intact carcasses and pH and moisture absorption and retention by marinated fillets were observed. ES slightly depressed chiller water absorption by the carcasses (4.0% v. 4.6%), but its effect on breast fillets was much greater. ES improved marinade absorption by fillets (11.1% v. 9.6%) but did not affect cooking loss. Although the STPP increased fillet pH somewhat (6.28 v. 6.22), it had little effect on marinade absorption (10.1% v. 10.6%); however, fillets marinated without STPP lost more moisture in cooking than those marinated without STPP (17.6% v. 12.4%). No significant statistical interactions between ES- and STPP-treatments were observed in this study. These results suggest that ES affects chiller water absorption by broiler carcasses only slightly and has little effect on the efficacy of STPP in enhancing moisture absorption and retention by marinated breast fillets.

Key Words: Electrical Stimulation, Polyphosphate, Meat

Meat Science and Muscle Biology

M50 DFD-like (dark, firm, dry) meat in a broiler commercial plant. J. Schneider^{2,3}, S. H. I. Oda¹, A. L. Soares¹, E. I. Ida*¹, P. D. Guarnieri², R. Olivo³, and M. Shimokomaki^{1,2}, ¹Department of Food and Drug Technology, Londrina State University, Londrina, PR, Brazil, ²Food Science Graduate Program, Faculty of Pharmaceutical Sciences, São Paulo University, São Paulo, Brazil, ³Globalfood Advanced Food Technology, Alberto Sampaio, São Paulo, S, Brazil.

It has been established there is occurrence of PSE (Pale, Soft, Exudative) chicken meat in commercial plants in Brazil. Attempts to control

its development are currently applied and one of them consists on the use of water shower spray to lower the chicken body temperature. This manouvre has been shown to be successful but it seems to be one cause of the appearance of DFD-like meat. The objective of this work was to evaluate the occurrence of DFD-like poultry meat and its functional properties in a commercial plant. Commercial Ross chickens were divided into two groups: Untreated Group (UG) (n=811) and Treated Group (TG) (n=425), without and with water shower treatments, respectively. Carcasses were refrigerated through water chiller and af-

ter deboning, fillet (*Pectoralis major*) samples were stored for 24h at 4°C and pH, L*, drip loss, cook loss, emulsion capacity were evaluated. Samples were classified as DFD-like, PSE and Normal meat based on the previous established parameters such as L*#880444.0 as DFD-like, L*#880553.0 as PSE and 44.0#8804L*#880453.0 as Normal. The results obtained for UG were 0.37, 21.95 and 77.68% for DFD-like, PSE and Normal meat samples, respectively while for TG the incidence was 0.94, 5.41 and 93.64% for DFD-like, PSE and Normal meat samples, respectively. Birds preslaughter treatment with water shower decreased PSE incidence and increased DFD-like occurrence reflecting the glyco-gen depletion. DFD-like meat showed pH values of 6.15 (± 0.23) similar to the Normal samples 5.93(± 0.26). In addition, DFD-like samples presented the values of L* 43.2 (± 0.53), drip loss 1.11% (± 1.01), cook loss 22.88% (± 2.65), emulsion capacity 0.70% (± 0.12) significantly different (p#88040.05) from the Normal samples of L*49.6 (p#88041.90), drip loss 2.55% (± 2.16), cook loss 25.38% (± 3.96) and emulsion capacity 0.78% (± 0.20). Finally, it is recommended DFD-like meat to be used as raw material to produce emulsified meat products with technological and cost benefits to the industries.

Key Words: Functional Properties, GLycogen Depletion, Abnormal Meat Color

M51 Biochemical and ultrastructural evaluation of PSE (pale, soft, exudative) broiler breast meat in a commercial plant. M. Shimokomaki^{1,2}, A. L. Soares¹, P. D. Guarnieri², R. Olivo³, E. I. Ida¹, R. M. G. Macedo¹, and J. Schneider^{2,3}, ¹Department of Food and Drug Technology, Londrina State University Londrina, PR Brazil, ²Food Science Graduate Program, Faculty of Pharmaceutical Sciences, São Paulo University, São Paulo, SP, Brazil, ³Globalfood Advanced Food Technology, Alberto Sampaio, São Paulo, SP, Brazil, ⁴Maringa State University, Maringa, PR, Brazil.

PSE meat is becoming a problem for the poultry meat industry and it has been demonstrated that it is the consequence of myofibril protein denaturation caused by pre-slaughter handling, particularly physical stress which promotes a rapid muscle pH decline at a relatively high body temperature. It is becoming a routine practice in Brazilian poultry industries to have water spray and air ventilation treatments just before broiler slaughter. The objective of this work was to investigate the influence of these practices on the quality of breast meat (*Pectoralis major*). The characteristics studied were the physicochemical and ultrastructural changes promoted by the biochemical/physiological events during the onset of rigor mortis. Commercial Ross chickens were divided into two groups: Untreated Group (UG) (n=608) and Treated Group (TG) (n=611), without and with water shower treatment, respectively. Drip loss was 3.74% for UG and 2.24% for TG and cook loss was 32.01% for UG and 28.04% for TG (p#88040.01). pH values were 5.85 (± 0.08) and 6.06 (± 0.10) for UG and TG, respectively while colour values were L*53.11 (± 1.50) and 48.78 (± 1.72) for UG and TG respectively, measured after 24h post-mortem both significantly different (p#88040.01). Histological studies of the PSE samples from UG birds 72h post-mortem revealed under light microscopy a shrinking of muscle cell diameter by approximately 10% in relation to TG samples (p#88040.01) and an extra cellular enlargement of endomysium and perimysium sheaths. By electron microscopy of PSE meat, Z-lines appeared fragmented, A-bands including the M-line disappeared and a super-contraction of sarcomeres was observed, indicating that proteins were adversely affected by heat stress. These results showed that water shower spray just before slaughter prevented chicken PSE meat development as determined bio-chemically and ultrastructurally.

Key Words: Breast Meat, Microscopic Evaluation, Myofibril Proteins

M52 Effect of feeding program and sex on productive performance and carcass quality of Iberian crossbred pigs. M. P. Serrano¹, D. G. Valencia¹, R. Lázaro¹, M. Nieto², and G. G. Mateos¹, ¹Universidad Politécnica de Madrid, Ciudad Universitaria sn, ²Copese S.A. Conde de Sepúlveda 24.

A total of 192 crossbred (Duroc sire x Iberian dam) pigs were used to study the influence of the feeding program (energy level in isonutritive diets per kcal of NE during the growing period and source of added fat during the finishing period) on performance and carcass quality of Iberian-cross pigs. From 29 to 110 kg BW there were 6 treatments with 3 levels of energy (2.07, 2.21, and 2.35 Mcal NE/kg) and 2 sexes (castrated males and castrated females). From 110 to 145 kg half of the

pigs received a diet with 6% animal fat and the other half the same diet but with 6% olive soapstocks instead of animal fat. Each treatment was replicated eight times from 29 to 110 kg and four times from 110 to 145 kg and the experimental unit was a pen with 4 pigs. At the end of the trial males tended to grow more than females (846 vs 817 g/d; P#88040.10). Also, an increase in NE concentration of the diet tended to improve feed efficiency (3.99, 3.93, and 3.83 g/d, for low, medium, and high NE diets, respectively; P#88040.10). From 110 to 145 kg BW average daily gain was higher for males than for females (926 vs 875 g/d; P#88040.05) but source of fat did not affect any trait. Males had longer carcasses (86.7 vs 85.1 cm; P#8804 0.001), more proportion of shoulder (14.05% vs 13.82%; P#88040.05), and heavier loins (4.78 kg vs 4.46 kg; P#88040.01) than females; but carcass and ham yield were similar. Backfat and tarsus bone diameter were greater for males than for females (64.4 vs 62.0 cm and 17.5 vs 17.2 cm, respectively; P#88040.05). Experimental treatment did not affect drip losses or pH or temperature of *m. semimembranosus* at 45 min or 24 h *post mortem*. We conclude that an increase in NE of the diet in the growing period improved feed efficiency less than expected and that the type of fat did not influence fattening performance. Both sexes could be used to produce Iberian-cross carcasses with little differences in productivity and carcass quality when slaughtered at same BW.

Key Words: Iberian pigs, Net energy, Carcass quality

M53 Effect of sex and slaughter weight on productive performance and carcass quality of Iberian crossbred pigs. M. P. Serrano¹, D. G. Valencia², R. Lázaro³, J. Viguera⁴, M. Nieto⁵, and G. G. Mateos⁶, ¹Universidad Politécnica de Madrid Ciudad Universitaria sn, ²Copese S.A. Conde de Sepúlveda, 24.

A total of 360 crossbred (Duroc sire x Iberian dam) pigs were used to study the influence of sex (castrated males, CM, castrated females, CF, and entire females, EF) and slaughtered weight (145 and 155 kg BW) on performance and carcass quality. Each of the six treatments were replicated four times and the experimental unit was pen (15 pigs/pen). At the end of the trial pigs slaughtered at 155 kg BW ate more feed (2808 vs 2630 g/d; P#88040.01) and tended to be less efficient (3.65 vs 3.50 g/g; P#88040.10) than pigs slaughtered at 145 kg BW. Also, EF ate less and had better feed efficiency than CF or CM (2598 vs 2733 and 2825 g/d and 3.38 vs 3.67 and 3.68 g/g; P#88040.01, respectively). Pigs slaughtered at 155 kg had more carcass yield and tended to have higher trimmed ham yield than pigs slaughtered at 145 kg. Carcasses of pigs slaughtered at 155 kg BW presented higher pH (P#88040.01) and temperature (P#8804 0.001) at *m. semimembranosus* at 45 min or 24 h *post mortem* than carcasses of pigs slaughtered at 145 kg BW. Entire females had less carcass yield (80.0 vs 80.6 and 80.8%; P#88040.01) and carcass fat (55.6 vs 63.0 and 61.9 mm at P2 and 47.9 vs 55.0 and 54.4 mm at *m. Gluteus medius*; P#88040.001) than CM or CF. Also, EF had more loin yield at 24 h *post mortem* (4.0 vs 3.5 and 3.6% for cm and cf, respectively; P#88040.001) and higher trimmed hams and shoulders yields (18.2 vs 16.8 and 17.2% and 11.6 vs 10.9%; P#88040.001, respectively) than CM and CF. Entire females and CM had higher proportion of shoulders at 6 h *post mortem* than CF (17.1 and 16.9 vs 16.0%; P#88040.05). Castrated males had higher pH of *m. semimembranosus* at 45 min or 24 h *post mortem* (P#88040.001) than EF or CF. We conclude that EF had better productive performance and yield of primal cuts than CF or CM. Nevertheless entire females had less carcass yield than CF or CM. It is recommended to study in detail the possibilities of using EF instead of CF in commercial production of Iberian-cross pigs.

Key Words: Iberian Pigs, Sex, Carcass Quality

M54 Early postmortem pH influences proteolysis of cytoskeletal proteins during aging in porcine longissimus muscle. G. Bee^{*2}, S. M. Lonergan¹, and E. Huff-Lonergan¹, ¹Iowa State University, ²Swiss Federal Research Station for Animal Production and Dairy Products, 1825 Posieux, Switzerland.

The objective of this study was to determine the extent to which early postmortem (PM) pH decline influences proteolysis of the intermediate filament protein desmin and the costameric protein talin in the longissimus muscle (LM) of pigs from two genetic lines (A and B). Based on the 3 h pH (H = pH > 6.0; L = pH < 5.7) PM, 10 pigs per line and pH group were selected from 120 pigs. The average 3 h pH within pH group was 6.19 (H) and 5.41 (L) in line A and 6.27 (H) and 5.47 (L) in line B. LM samples were collected 24, 48, 72 h, and 7 d PM and percent

drip loss was measured after 1, 2, and 7 d PM. These samples were also used to monitor desmin and talin degradation by immunoblotting. The ratio (relative intensity of the 53 kDa band of desmin and 225 kDa band of talin in the samples/intensity of desmin or talin in a reference) was used as a measure of proteolysis. Drip loss at all time points was lower ($P < 0.01$) in the H-pH (d 1: 1.62%; d 2: 1.80%; d 7: 2.99%) than in the L-pH group (d 1: 3.11%; d 2: 3.40%; d 7: 4.72%) regardless of line. Drip loss was lower ($P < 0.01$) in line B (d 2: 2.04%; d 7: 3.14%) than line A (d 2: 3.15%; d 7: 4.56). Independent of the line, proteolysis of desmin was faster ($P < 0.03$) after 1 and 2 d in the LM from the H-compared with those from the L-pH group. At d 7, relative abundance of intact desmin was 45% lower ($P < 0.01$) in the LM from pigs of line B than line A. Compared to the L-pH group, relative abundance of talin determined in the LM 24, 48, 72 h, and 7 d PM decreased ($P < 0.03$) at a faster rate in the H-pH group. Line effects were found at 48 h PM with 46% less intact talin abundance in the LM of pigs from line A compared with those from line B. Disappearance of desmin was positively correlated ($r = 0.51$; $P < 0.01$) with the disappearance of talin. Furthermore, proteolysis of both proteins was positively correlated ($P < 0.01$) with percent drip loss. Degradation of cytoskeletal proteins is related to early postmortem pH and improves water-holding capacity.

Key Words: pH, Proteolysis, Water-holding capacity

M55 Oxidation, ionic strength, and pH affect porcine skeletal muscle calpain and calpastatin activity. K. R. Maddock*, E. Huff-Loneragan, L. J. Rowe, and S. M. Lonergan, *Iowa State University, Ames.*

The objective was to evaluate how oxidation affects activity of μ - and m-calpain and their inhibition by calpastatin at different pH and ionic strengths. Purified porcine skeletal muscle μ - or m-calpain (0.45 units) were incubated in the presence of calpastatin (0, 0.15, or 0.30 units) at pH 7.5, 6.5, or 6.0 with either 165 mM NaCl or 295 mM NaCl. The reactions were initiated with addition of CaCl_2 (100 μM for μ -calpain; 1 mM for m-calpain). Calpain was incubated with the fluorogenic peptide Suc-Leu-Leu-Val-Tyr-AMC (170 μM). Either 0 or 0.160 μM H_2O_2 was added to each assay. Activity was measured at 60 min. In a second experiment, calpain was incubated with highly purified porcine myofibrils (4 mg/ml) under conditions described. Either 0 or 100 μM H_2O_2 was added immediately prior to the addition of calpain. Degradation of desmin was determined with immunoblotting at 2, 15, 60, 120 min. Fluorescence activity was greatest ($P < 0.01$) at pH 6.5 for μ -calpain and 7.5 for m-calpain. No activity of m-calpain was observed at pH 6.0 at either ionic strength or at pH 6.5 at 295 mM NaCl and 0.160 μM H_2O_2 . In general μ - and m-calpain were less active at 295 mM NaCl than at 165 mM NaCl ($P < 0.01$). Oxidation decreased activity of both μ - and m-calpain ($P < 0.01$) at all pH and ionic strength conditions and decreased inhibition of μ - and m-calpain by calpastatin ($P < 0.01$). At pH 6.0, degradation of intact desmin was delayed compared to pH 7.5 or 6.5 and at 295 mM NaCl compared to 165 mM NaCl. Oxidation decreased proteolytic activity of μ -calpain against desmin at pH 6.0 and m-calpain at all pH conditions. Inhibition of μ -calpain by calpastatin was decreased by oxidation at pH 7.5 and 6.5. This is consistent with the observation that oxidation in the presence of calpastatin results in more proteolysis of desmin. Taken together, these results suggest that calpastatin may limit the possibility of oxidation-induced inactivation of μ -calpain.

Key Words: Calpain, Calpastatin, Oxidation

M56 The use of creatine as a means of improving the belly/bacon quality of market barrows fed 4.5 g/ton Paylean®. C. A. Stahl*, M. S. Carlson, T. B. Schmidt, G. Rentfrow, E. K. Burger, and E. P. Berg, *University of Missouri-Columbia, Columbia.*

The objective of this study was to determine if dietary supplementation of creatine monohydrate (in conjunction with high glycemic carbohydrate) influences the belly/bacon quality of market hogs fed 4.5 g/ton Paylean®. Barrows ($n = 128$; 85 kg) were blocked by weight and allotted to one of 16 pens (8 pigs/pen; 4 reps/treatment) using a completely randomized design. A pelleted corn-soybean diet containing 4.5 g/ton Paylean® (PAY) was tested against a positive control (PCON; pelleted corn-soybean diet formulated to meet or exceed the nutrient requirements of the growing pig), and pelleted corn-soybean diets containing

0.92% creatine and 2.75% dextrose (COMBO) and a combination of 4.5 g/ton Paylean®, 0.92% creatine, and 2.75% dextrose (PAYPLUS). Barrows were humanely harvested following 27 d on test. Fresh pork bellies ($n = 64$, 4/replicate pen) were obtained from the fabrication line and weighed. Bellies thickness was recorded as the average depth of eight separate quadrants. Uncooked bellies were then pumped using a commercial brine solution, weighed, hung by a bacon comb, placed on smokehouse trucks, and heat processed according to plant protocol. The following morning, individual bacon slabs were removed from the cooler, weighed, pressed and sliced. Following the removal of comb marks and incomplete slices, individual bacon slabs were weighed to determine slicing yield and divided into five separate sections. Bacon slices (1/section, 5/belly) were weighed and evaluated for subjective fracture analysis (shatter) and cooking loss. Treatment did not influence belly weight, average belly thickness, smokehouse yield, slicing yield, or shatter ($P > 0.05$). However, bacon slice cooking loss was lowest for PAY bellies (PAY: 56.84, PCON: 60.96, COMBO: 60.92, PAYPLUS: 59.75 +/- 0.97%, $P < 0.05$). These findings suggest that feeding creatine in conjunction with a high glycemic carbohydrate has no measurable influence on the belly/bacon quality of market barrows fed 4.5 g/ton Paylean® 27 d pre-harvest.

Key Words: Creatine, Paylean®, Bacon

M57 Physical parameters of lamb meat as affected by aging time. J. Zapata*, *Universidade Federal do Ceara.*

Fresh meat quality is generally associated with the physical aspect of the cuts at the retail market level. Functional properties of the meat, on the other hand, are important parameters to be considered by the further processing industry. The purpose of this study was to determine the effect of aging selected cuts (leg and loin) from tropical lambs on physical characteristics (pH, color and shear force) and functional properties (cooking losses, water holding capacity and emulsifying capacity) of the meat. Meats from the loin (*longissimus dorsi* muscle) and the leg (*semimembranosus* and *biceps femoris* muscles) of tropical lambs with average weight of 35kg were aged for 1, 7, 14 and 21 days at 1C. Meat pH values increased from 5.48 in day one to 5.56 on day 21 and showed a significant ($P < 0.05$) correlation with aging time. The color of the meat was not significantly affected by aging time. Shear force decreased from 8.86kg in day 1 to 6.77kg in day 21 of aging and showed a close correlation with aging time. A significant ($P < 0.05$) correlation of cooking losses with aging time was found in the meat with values increasing from 26.96 to 34.92% throughout the aging period. Meat water holding capacity varied ($P > 0.05$) from 33.85% on day 7 of aging to 29.82% on day 21. Emulsifying capacity of lamb meat decreased ($P > 0.05$) slightly during the aging period from 92.39 to 91.80%. It can be concluded that aging tropical lamb meat for 21 days at 1C does not affect color, water holding capacity or emulsifying capacity. The increase in meat pH, and cooking losses as well as the decrease in shear force are dependent on aging time and regression curves can be drawn for these attributes.

Key Words: Cooking Losses, Water Holding Capacity, Emulsifying Capacity

M58 Extracellular matrix (ECM) properties of lamb skeletal muscle as related to age and muscle. F. Filetti, G. Maiorano*, A. Ciarlariello, M. Gambacorta, and A. Manchisi, *University of Molise Campobasso, Italy.*

Decorin (D), being expected to facilitate the alignment of intramuscular collagen (IMC) fibers, could be followed by a rapid synthesis of hydroxylysylpyridinoline (HLP) crosslinks, which are regarded as main factors contributing to meat tenderness. To study relationships among D, IMC and HLP in skeletal muscle ECM, 24 Italian Merino male lambs were slaughtered in groups of equal number, at 5, 30, 50 and 70 d of age. *Longissimus dorsi* (LD), *semimembranosus* (SM) and *gluteobiceps* (GB) samples were lyophilized and hydrolyzed in 6N HCl for analysis of hydroxyproline (Hyp) and HLP. IMC was calculated assuming that it weighed 7.25 times the measured Hyp weight. HLP was quantified by RP-HPLC. Raw muscles were analyzed for D by immunoblotting with a polyclonal antibody to human D (1:5,000) and an alkaline phosphatase conjugated goat anti-rabbit IgG (1:30,000). D was quantified by densitometry. ANOVA was performed and relationships among variables were analyzed with simple linear regression. Muscle affected IMC ($P < 0.05$) and HLP ($P < 0.001$) amounts, and HLP/IMC ratio ($P < 0.05$). LD compared to SM and GB had lower amounts of IMC (22.0a, 29.1b,

31.9b $\mu\text{g}/\text{mg}$, respectively) and HLP (2.7a, 4.7b, 4.0c $\mu\text{g}/\text{mg}$, respectively). IMC was less mature in LD and GB than in SM, as showed by the HLP/IMC ratio (0.09a, 0.09a, 0.12b mol/mol, respectively). Muscle also affected ($P < 0.001$) D expression, which was higher in LD than in SM and GB (20.1a, 13.0b, 13.6b RDU/mg, respectively). Age clearly ($P < 0.001$) influenced ECM. In the first month of age, a marked reduction was found on IMC (66.0a, 28.5b, 25.4b, 26.1b $\mu\text{g}/\text{mg}$ at d 5, 30, 50, and 70, respectively) and HLP (7.2a, 3.1b, 3.4b, 4.2c $\mu\text{g}/\text{mg}$) amounts. In the same period a sudden rise was detected on D (11.6a, 19.4b, 14.9a, 14.6a RDU/mg), temporally followed by an increase in IMC maturation (0.08a, 0.08a, 0.09a, 0.11b moles HLP per mol IMC). D correlated with HLP muscle amount ($r = -0.61$; $P < 0.001$) and ratio to IMC ($r = -0.37$; $P < 0.01$) confirming that a decorin/crosslink relationship may exist.

Key Words: Lamb, Age, Skeletal Muscle Extracellular Matrix

M59 Carcass and meat quality in three varieties of rainbow trout (*Oncorhynchus mykiss*). A. L. Rentería Monterrubio^{*1}, J. A. García Macías¹, and M. Espinosa^{2, 1} *Universidad Autónoma de Chihuahua, Periferico Francisco R. Almada. Km 1, Chihuahua, Chihuahua, 2Asociación de Productores de Trucha, Región de Madera, A. C..*

240 rainbow trouts of 3 varieties, Danish (80), Mexican (80) and American (80) were evaluated, in four weight groups: 175 - 224 g (1), 225 - 274 g (2), 275 - 324 g (3) and 325 - 375 g (4). The trouts came from farms of the Asociación de Productores de Trucha, Región de Madera, A.C. Measurements of weight and dissections of trouts were made to obtain the carcass quality characteristics. The effect of weight and trout variety were analyzed with a random design in a factorial arrangement of 3 x 4 with PROC GLM procedure of SAS. The greatest carcass yield occurred in the Mexican at 3 (88.35) and 4 group (87.34) and the Danish in group 1 (87.05) and 2 (86.34) ($P < 0.05$). The greatest fillet yield was registered in the Danish group 1 (53.17), in the American group 2 (53) and 4 (54.67) and in the Mexican group 3 with 54.36% ($P \# 88040.05$). Meat quality was evaluated, in luminosity (L^*), the Danish group 2 showed the lowest L^* (43.02) and the American group 3 the highest (47.53) ($P < 0.06$). The Mexican group 1 pH was the highest at 7.25 ($P \# 88040.05$), with the American group 2 at 7.14, 3 at 6.98 and 4 at 6.79 ($P < 0.05$). The four Danish weight groups water holding capacity were the best (51.19, 54.65, 52.16 and 51.42, respectively) ($P \# 88040.05$). The highest electrical conductivity was obtained from the Danish group 3 (13.32) and the lowest with the American group 4 (9.42) ($P \# 88040.05$). The greatest percentages of crude protein were seen with Danish group 1 (20.12), 2 (20.82) 4 (21.58), and the Mexican group 3 (21.50) ($P \# 88040.05$). The Danish weight group 1, 2, 3 and 4 presented the lowest content of fat ($P \# 88040.05$) (2.64, 2.48, 2.66 and 2.98, respectively). It is concluded that the Danish group 1 and the Mexican groups 2, 3 and 4 are the most acceptable rainbow trout carcasses. Fillet commercialization is better in the American group 2 and 4 and the Mexicans weight group 3.

Key Words: Rainbow Trout, Carcass Quality, *Oncorhynchus mykiss*

M60 Effects of sedated-harvest on channel catfish fillet color, pH, and drip-loss. B. G. Bosworth* and D. J. Gregory, *Catfish Genetics Research Unit, USDA-ARS, Stoneville, MS.*

Stress and activity associated with harvest and transport of meat animals elicit physiological responses that negatively impact meat quality. Previous research with channel catfish demonstrated that sedation of fish during harvest with the anesthetic iso Eugenol (Aqui-S#8482) minimized detrimental physiological responses (lower muscle lactate and serum cortisol, higher muscle pH and ATP) compared to control fish. Our objectives were to determine the best method (N_2 gas, CO_2 gas, or electrical stun) for killing sedated fish prior to slaughter and to determine effects of sedated-harvest on fillet quality (color, pH, and drip-loss) during iced-storage. CO_2 was selected as the best method to kill sedated fish based on physiological responses of fish (higher muscle pH and lower blood lactate compared to N_2) and worker safety issues associated with use of electrical stunning during harvest. Two treatments were compared for fillet quality: sedated-harvest (fish sedated with 15 ppm iso Eugenol, then placed in ice slush with CO_2) and control (simulated industry conditions - fish harvested, placed in live-haul tanks at 0.8 kg L^{-1} for 2 h, then electrically stunned). Fish were processed, and fillets were placed in polyethylene bags, immediately chilled in ice slush, and stored on ice for 7 d. Fillets ($n = 10$ treatment/time/replicate) were measured for CIE color (L^* , a^* , b^*), pH, and percent drip-loss

(100*weight loss/initial weight). Two replicate trials were conducted and data were analyzed by ANOVA. Sedated-harvest fillets had lower L^* values than controls at 1 d (49.4 vs. 54.3, $p < 0.001$), 4 d (52.5 vs. 54.1, $p = 0.04$), and 7 d (53.9 vs. 54.9, $p = 0.03$); and lower a^* values at 4 d (0.1 vs. 1.2, $p = 0.02$) and 7 d (-1.0 vs. -0.3, $p < 0.001$). Sedated-harvest fillets had higher pH than controls at processing (7.52 vs. 6.47, $p < 0.001$) and 1 d (6.64 vs. 6.40, $p = 0.002$). Fillet drip-loss was lower in sedated-harvested fish than control fish at 1 d (0.32 vs. 1.36 %, $p < 0.001$), 4 d (0.80 vs. 2.85 %, $p < 0.001$), and 7 d (1.60 vs. 4.14 %, $p < 0.001$). Sedated-harvesting has the potential to improve fillet quality in farm-raised catfish.

Key Words: Catfish, Fillet, Quality

M61 Effect of sexual condition and slaughter weight on carcass traits from buffaloes finished in feedlot. A. M. Jorge^{*1}, C. Andrighetto², D. D. Millen³, and M. G. Calixto², ¹UNESP-FMVZ-DPEA-Botucatu, ²UNESP-FMVZ-PGZOO-Botucatu, ³UNESP-FMVZ-DPEA-Botucatu.

The objective of this work was to evaluate the carcass traits from intact and castrated buffaloes, of the Brazilian type, finished in feedlot and slaughtered at 450 and 500 kg of live weight. There was no significant difference between cold carcass yield of intact animals and castrated (52.4 vs 51.3%). A significant increase was verified in hindquarter and whole shoulder yield from intact males. Castrated animals had a higher forequarter and pistol style cut yield (due to the higher round yield and not a higher yield of spare ribs). There was no difference in the carcass length, longissimus dorsi area and back fat thickness among intact and castrated animals. Carcass back fat thickness from intact males (5.9 mm) was lower than castrates (7.1 mm). The backfat level of intact males was very close of the ideal limits considered by retailers and may contribute to reducing the resistance to slaughtering intact animals. No difference was observed for cold carcass yield (50.5 vs 52.2%), primal cut yield, carcass length, longissimus dorsi area (54.9 vs 58.3 cm²) and back fat thickness (5.3 vs 5.9 mm) from buffaloes slaughtered at 450 kg vs 500 kg of live weight, although heavier animals tended to present the higher values of longissimus dorsi area and back fat thickness.

Key Words: Backfat Thickness, Longissimus dorsi Area, Water Buffalo

M62 Quantitative carcass traits from buffaloes of three genetic groups finished in feedlot and slaughtered at different stages of maturity. A. M. Jorge^{*1}, C. Andrighetto², D. D. Millen³, and M. G. Calixto², ¹UNESP-FMVZ-DPEA-Botucatu, ²UNESP-FMVZ-PGZOO-Botucatu, ³UNESP-FMVZ-DPEA-Botucatu.

This work was conducted to study the quantitative carcass traits from 36 buffaloes, average live weight 330 kg and age 18 months, representing 12 Murrah (MUR), 12 Jafarabadi (JAF) and 12 Mediterranean (MED) finished in a feedlot setting. Four animals inside of each genetic group, were randomly assigned to initial slaughter. The 12 animals of each genetic group, were randomly assigned in three sub-groups of four animals and submitted to the following treatments, respectively: Maturity 1 (Slaughter Weight-1) - 400 kg LW; Maturity 2 (Slaughter Weight -2) - 450 kg LW; Maturity 3 (Slaughter Weight -3) - 500 kg LW. An ad libitum ration was used for all the animals, in that 50% of DMS were supplied by roughage. The empty body weight was determined after each pre-fixed slaughter of the animals through the sum of the total parts of the body. There were no differences ($P > 0.05$) among genetic groups and maturities regarding yield of hind and forequarters, whole shoulder and whole rump. Animals slaughtered at 400 kg LW had higher yield of pistola style cuts than 500 kg LW animals ($P < 0.05$), while 450 kg LW animals did not differ from others. It was observed that whole shoulder yield differed from one side of the carcass to the other. These differences may have been the result of a section of spares ribs left on one side. This may have involuntarily increased ribs proportionally larger in heavier animals.

Key Words: Mediterranean, Murrah, Water Buffalo

M63 Physical carcass composition and tissue relations from buffaloes of three genetic groups finished in feedlot and slaughtered at different stages of maturity. A. M. Jorge^{*1}, C. Andrighetto², D. D. Millen³, and M. G. Calixto², ¹UNESP-FMVZ-DPEA-Botucatu, ²UNESP-FMVZ-PGZOO-Botucatu, ³UNESP-FMVZ-DPEA-Botucatu.

This work was conducted to study the physical carcass composition from 36 buffaloes with 18 months of average age and average initial live weight (LW) of 330 kg, being 12 Murrah (MUR), 12 Jafarabadi (JAF) and 12 Mediterranean (MED) finished in feedlot. Four animals, inside of each genetic group, were randomly assigned to initial slaughter, as reference in the study of the empty body (EBW) and of the initial carcass. The 12 animals of each genetic group, were randomly distributed in three sub-groups of four animals and submitted to the following treatments, respectively: Maturity 1 (Slaughter Weight-1) - 400 kg LW; Maturity 2 (Slaughter Weight -2) - 450 kg LW; Maturity 3 (Slaughter Weight -3) - 500 kg LW. A "ad libitum" ration was used for all the animals, in that 50% of DM were supplied by roughage. The EBW was determined after each pre-fixed slaughter of the animals through the sum of the total parts of the body. There was no difference among genetic groups, regarding to values of carcass length, back fat thickness and loin eye area, expressed in absolute values and in % EBW. There was no difference among genetic groups (MUR, JAF and MED) regarding to the proportions of muscles and adipose tissue (AT). On the other hand, JAF presented larger ($P < .05$) proportion of bones (B) than MUR and MED. MED animals presented larger ($P < .05$) relationship soft tissue/bone (ST/B) and muscle/bone (M/B), while JAF presented smaller ($P < .05$) ST/B and M/B. There was not difference among the maturities regarding the proportion of muscles and of fat tissues. Animals slaughtered at 500 kg LW presented larger ($P < .05$) relationship ST/B, M/B and AT/B than animals slaughtered at 405 kg LW.

Key Words: Fat, Muscle, Water Buffalo

M64 Chemical composition, meat quality and consumer acceptability in Mexican retail beef. E. J. Delgado¹, M. S. Rubio^{*1}, F. A. Iturbe², R. D. Mendez¹, L. Cassis³, and R. Rosiles¹, ¹Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autonoma de Mexico Circuito Exterior, Cuidad Universitaria, Mexico, ²Facultad de Quimica, Universidad Nacional Autonoma de Mexico Circuito Exterior, Mexico, ³Departamento Tecnologia alimentos, Universidad La Salle Benjamin Franklin 47, Col. Condesa, Del. Cuauhtemoc.

Mexican beef cattle producers claim the largest part of imported beef is of poor quality and represents a hindrance for the development of the Mexican beef industry, which has exhibited a poor growth for the last years. Under these circumstances, it is vital for the Mexican beef industry to establish a benchmark for the composition and quality of retail beef. The purpose of this investigation was to study the quality characteristics of Mexican and imported retail beef samples. Mexican and imported (USDA-Choice and commodity US) strip loin beef steaks (NAMP 180) were randomly selected from 80 supermarkets in Monterrey, Mexico City, and Villahermosa. Meat samples were analyzed for chemical composition, Warner Bratzler shear force (WBSF), instrumental color (L^* -, a^* -, and b^* - values), and consumer acceptability. All sources of Mexican beef and commodity US beef had similar composition ($P > 0.05$), averaging $73.0 \pm 0.2\%$ moisture, $3.0 \pm 0.2\%$ fat, $22.1 \pm 0.1\%$ protein, 11.7 ± 0.4 mg/g total collagen, and $16.2 \pm 0.4\%$ soluble collagen. In comparison, USDA-Choice beef had significantly higher ($P < 0.05$) fat content ($6.3 \pm 0.2\%$), lower ($P < 0.05$) moisture ($69.9 \pm 0.2\%$) and total collagen content (9.7 ± 0.4 mg/g). Mexican beef from Monterrey and USDA-Choice beef were tender and paler (WBSF 3.6 ± 0.1 and 3.1 ± 0.1 kg, respectively; a^* -values 14.3 ± 0.3 and 14.1 ± 0.3 , respectively) than Mexican beef from Mexico City, Villahermosa and commodity US beef (WBSF 4.6 ± 0.1 , 4.7 ± 0.1 , and 4.6 ± 0.1 kg, respectively; a^* - values 17.1 ± 0.3 , 17.1 ± 0.3 , and 16.6 ± 0.2 , respectively). Consumer acceptability for Mexican beef from Monterrey was similar to that of USDA-Choice. Commodity US beef had the lowest overall desirability score. Results indicate Mexican beef has some advantages to compete with imports in the current open market. Even so, there is still considerable scope for improvement in its quality characteristics and uniformity.

Key Words: Beef Quality, Chemical Composition, Consumer Acceptability

M65 Effects of sodium lasalocid and electrolytes on carcass characteristics of young bulls from north-central Mexico, finished with a brewery grain-based ration. F. Winston-Bennett, J. J. J. Chavez*, R. Bañuelos, S. Mendez, C. F. Arechiga, and F. Echavarría, Universidad Autonoma de Zacatecas, Zacatecas, Mexico.

The objective was to determine the effect of feeding brewery grain, sodium lasalocid and electrolytes on carcass characterization (post mortem) of young bulls (Angus, Brahman, Charolais crosses with an average weight of 380 kg) from north-central Mexico ($22^{\circ}52'$ northern latitude and 102° western longitude, and 2,153 m above the sea level). Young bulls were exposed to a feeding-adaptation period of 15 d, followed by a 60 d finishing period. Young bulls ($n=20$), were randomly allotted into two treatments groups: 1) RBG, a ration based on Brewery Grain as a control. 2) RBG+LE, a ration based on Brewery Grain containing Lasalocid and Electrolytes. Measurements include: live weight (LW), hot carcass-weight (HCW), cold carcass-weight (CCW), carcass rudiment (CR), empty body-weight (EBW), water-holding capacity (WHC), pH at 45 min, and 24 h post mortem (pH45m & pH24h), electrical conductivity at 45m and 24 h (EC45m and EC24h), cooking losses (CL). Statistical analysis were performed by a complete-randomized design, contrasting means by Tukey test, besides analyses of principal components. Addition of Lasalocid and Electrolytes increased live weight and carcass weight of the bulls (21.2 and 24.3 kg/bull, respectively), as well as mean carcass-rudiment. Whereas, tended to decrease overall pH, EC and CL. In conclusion, Lasalocid and Electrolytes fed in brewery grain-based ration for young bulls improved live weight, carcass weight, carcass rudiments as well as other meat characteristics of quality such as pH, electrical conductivity, water holding capacity and cooking losses.

	CR	pH45m	pH24h	EC45m	EC24h	WHC	CL
RBG	62.17	6.78	5.59	13.4	77.6	35.28	33.27
RBG+LE	64.55	6.76	5.46	0.4	6.6	33.15	30.47

Key Words: Lasalocid, Feedlot Bulls, Brewery Grain

M66 Hanging the beef carcass by the forequarter to improve tenderness of the *Longissimus dorsi*. A. Luchiar-Filho^{*1}, R. P. Macedo², A. S. C. Pereira¹, S. da L. e Silva¹, P. R. Leme¹, and G. F. Feitoza¹, ¹Faculdade de Zootecnia e Engenharia de Alimentos - USP, Pirassununga, SP, Brazil, ²Marfrig Brazilian Beef Via Dr. Shuhei Uetsuka, km 02, Promissão, SP, Brazil.

During four subsequent days 40 Nellore steer carcasses (10/day) were chosen at random in a federally inspected slaughter plant and hanged alternate left and right sides either in the traditional way by the hindquarter (HQ) or by the forequarter (FQ) hung by the carpi radialis muscle. Carcasses had an avg hot carcass wt of 244.1 kg and up to 30 months old. The 24 h pH was not statistically different, 5.69 for HQ and 5.7 for FQ. Carcasses were chilled for 48 h, when samples from the LD at the 12th rib level and the $\langle I \rangle$ Biceps femoris $\langle /I \rangle$ (BF) at the P3 site level were removed, kept under refrigeration ($0-2^{\circ}\text{C}$) for 5 d and then frozen for future analysis. The temperature of the $\langle I \rangle$ Longissimus dorsi $\langle /I \rangle$ (LD) after 48 h, taken adjacent the 12th rib was not statistically different 1.0°C for HQ and 0.9°C for FQ. Fat thickness measured at the 12th rib level was different ($P < 0.05$), 3.8 mm for HQ and 4.3 mm for FQ. All samples were thawed for 48 h to refrigeration temperature to evaluate tenderness. Warner Bratzler Shear force from the LD was lower ($P < 0.001$) for the FQ (3.53 kg) than for HQ (4.78 kg) and the BF was not statistically different, 3.61 kg HQ and 3.52 kg FQ. Total cooking losses were not statistically different, 19.7% HQ and 18.9% FQ. Hanging the beef carcass by the forequarter caused a significant improvement in tenderness of the LD without any detrimental effect on the BF (sirloin level). Although not evaluated in this work, it was noticed an increase in diameter and a decrease in length in the LD muscle, that could partially explain the thicker fat layer for the FQ treatment. Further work has been done to evaluate the effects of hanging by the forequarter in forequarter muscles as well as other major hindquarter muscles.

Key Words: Beef, Meat Quality, Tenderness

M67 Estimation of percentage of lean meat on rib loin by computer image analysis for carcass cross section of Wagyu cattle. M. Hasegawa*¹, K. Kuchida¹, S. Hidaka¹, H. Houkiyama², T. Sakai², Y. Yamamoto², and Y. Sato², ¹*Obihiro University of Agriculture and Veterinary Medicine obihiro-shi Hokkaido 080-8555 Japan*, ²*Hokkaido Animal Research Center Shintoku-cho Hokkaido 081-0038 Japan*.

For the improvement of meat quantity, it is desirable to utilize more detailed data than merely the carcass weight and cutability, which have been measured and recorded at carcass grading. In this study, each muscle area and the ratio of muscle area to total area (MAR) were calculated from the 6-7th cross-section of Wagyu cattle, and the relationship between their image analysis traits and the percentage of lean meat was investigated. Images of 41 cross-sections of Wagyu steers (19-21 mo.) were used for the analysis. Areas calculated by image analysis included 13 muscle areas, such as M.longissimus thoracis (LONG), M.trapezius (TRAP), M.latissimus dorsi (LATIS) etc., total muscle area, subcutaneous and intermuscular fat area, cross-section area and MAR. Weights of lean meat, fat, bone and sinew of the 9-11th rib loin were measured by physical dissection. The relationships among muscle areas, as well as those among the percentage of lean meat, each muscle area and MAR were investigated. The percentage of lean meat was predicted using a multiple regression analysis with 21 covariates associated with 17 image analysis traits and grading records. The ranges for carcass weight, percentage of lean meat and MAR were from 129 to 228 kg (mean; 180.8 kg) from 52.1 to 61.2% (56.3%) and from 49.6 to 67.0% (56.7%), respectively. The correlation coefficient between muscle areas in LONG and TRAP was 0.64 ($p < 0.01$) and 0.73 ($p < 0.01$) in LONG and LATIS. The correlation coefficient between the percentage of lean meat and MAR was 0.53, which was the highest value among the image analysis traits. Selected variables for the prediction equation for estimating the percentage of lean meat were M.iliocostalis area, M.semispinalis capitis area, M.serratus ventralis area, total muscle area and cross-section area. The coefficient of determination (R^2) of the multiple regression equation was 0.69 ($p < 0.01$).

Key Words: Image Analysis, Wagyu, Muscle Area

M68 Development of new photography equipment for carcass cross section of Wagyu beef and its potential use in meat quality evaluation using digital images. K. Kuchida*¹, T. Hori², T. Honma², M. Nami², K. Takahashi¹, M. Hasegawa¹, H. Hokiayama³, T. Sakai³, and Y. Yamamoto³, ¹*Obihiro University of Agriculture and Veterinary Medicine Obihiro-shi Hokkaido 080-8555 Japan*, ²*Hokkaido Industrial Research Institute Sapporo-shi Hokkaido 060-0819 Japan*, ³*Hokkaido Animal Research Center Shintoku-sho Hokkaido 081-0038 Japan*.

In Japan, meat quality grade and yield grade of Wagyu cattle are evaluated by macroscopically observing the cross section of the 6th and 7th rib. Computer image analysis of high resolution for the cross section image may lead to the objective meat quality evaluation. The aims of this study were to develop new photographic equipment for carcass cross section using a digital camera with resolution of 13.5 million pixels, and to investigate the feasibility of this new evaluation method for beef marbling using clear digital images obtained by the equipment. KODAK DSC 14n with a 35mm CMOS device was used as the digital camera with a wide angle lens (Nikkor AF ED 14mm F2.8D). The circumference of light division was shielded so that it would not receive external light. The stainless frame installed on the bottom face of the lighting division was in contact with the carcass surface at photography, so that constant distance and vertical direction could be obtained in the digital image. The height of this equipment was 330 mm, and the photographed image had a range of 300×400mm and included the middle point of *M. latissimus dorsi*. Carcass cross sections of nine Japanese Black steers were photographed. The accuracy of binarization was sufficient for the analysis of meat quality because the source of light was illuminated uniformly on the rib eye area, even when binarization with a single threshold value with the discrimination analysis method was executed. Moreover, a slight fine marbling area of about 0.005cm² (30 pixels) could be clearly and accurately binarized. Means for rib eye area (44.1±6.9 cm²) and marbling percentage (29.5±6.6%) in rib eye obtained from this new equipment were close to those (45.4±7.0 cm², 29.5±5.9%) obtained from the former equipment developed in 1999. No

significant differences were recognized between measurement values from both equipments ($P > 0.05$).

Key Words: Image Analysis, Wagyu, Marbling

M69 Correlations among carcass traits taken by ultrasound and after slaughter in Mediterranean (Bubalus bubalis) bulls fed in feedlot. A. M. Jorge*¹, C. Andrighetto², D. D. Millen³, and M. G. Calixto², ¹*UNESP-FMVZ-DPEA-Botucatu*, ²*UNESP-FMVZ-PGZOO-Botucatu*, ³*UNESP-FMVZ-DPEA-Botucatu*.

The objective of this work was to estimate the correlations among measurements taken in vivo with ultrasound equipment with some carcass traits measured after slaughter. Twenty eight Mediterranean bulls, with average shrunk body weight of 300 kg and 15 months of age, were fed a high concentrate diet for by 120 days. The shrunk body weight, the ribeye area (REAU) and the fat thickness (FTU) over the Longissimus dorsi muscle between 12 and 13th ribs, were measured at 28 days intervals. Real-time ultrasound equipment Piomedical Scanner 200 VET, with 18 cm linear array transducer was utilized. After the slaughter, the hot carcass weight (HCW) and the kidney, pelvic and inguinal fat (KPIF) were weighted and the dressing percentage (DP) calculated. After 24 hours of cooling the ribeye area (REAC) and the fat thickness (FTC) were measured. Both the REAC and the FTC were underestimated by ultrasound measurements. The Pearson correlation coefficients for ribeye area and backfat thickness, measured in the carcass and with ultrasound, were 0.78 and 0.89, respectively. The coefficient between DP and REAU was 0.28; 0.45 between DP and REAC, - 0.28 between DP and FTU and -0.30 between DP and FTC. The KPIF presented a 0.52 correlation coefficient with FTC and FTU. The Spearman correlation was estimated between REAU and REAC and FTU and FTC, and the values were 0.90 and 0.79, respectively.

Key Words: Backfat Thickness, Ultrasound, Water Buffalo

M70 Effect of dietary vitamin E supplementation and storage time on physical characteristics of ten muscles from beef cattle. F. G. Rios*, R. Cortina, G. Contreras, and J. J. Portillo, *FMVZ-Universidad Autonoma de Sinaloa, Mexico Carr. Culiacan-Mazatlan km. 3.5*.

The objective was to determinate the effect of dietary vitamin E supplementation and storage time on the physical characteristics of ten vacuum packaged beef muscles. A complete randomized block design experiment used eighty Brahman-cross bull calves (28 months of age), assigned to receive one of two treatments during experimental period of 30 d prior to slaughter: 1) Regular finishing diet supplemented with 2000 IU of vitamin E for kg/DM and 2) Regular finishing diet. The animals were slaughtered and carcasses refrigerated for 24 h. Ten, 100g samples were obtained from the following muscles: *longissimus thoracis* (LT); *obliquus abdominis externus* (OAE); *longissimus spinalis* (LE); *pectoralis profundis* (PP); *supraespinatus* (SE); *longissimus lumborum* (LL); *biceps femoris* (BF); *semiteminosus* (ST); *semimembranosus* (SM); and *gluteus medius* (GM). Samples were packed with a Ultravac#8482 machine and refrigerated at 4 C. Muscle sample drip loss (DL), pH and colour ($L^*a^*b^*$) were determined on day 0, 7, 14, 21, and 28. Muscles LT and OAE, showed no effect ($P > 0.05$) by treatments for DL. Muscles LE, GM, and BP, DL was 15.35 % less ($P < 0.01$) at d 14, but showed no difference in others periods of storage. Muscle pH diminished ($P = 0.03$) at 7 to 21 storage time for LT, LE, OAE, SM, SE, GM, and PP, with a mean of 5.71 in the muscles from the vitamin E treatment. Brightness (L^*) was modified by vitamin E supplementation in LT (44.35 vs. 40.64) at 21 d, ST (39.19 vs. 37.64) at 7 d, and GM (39.18 vs. 37.60) at 14 d. Redness (a^*) was modified by vitamin E supplementation in SE (20 vs 10.74), PP (15 vs. 11.69), GM (20.9 vs. 10.74) at 28 d storage, and BP (20.9 vs. 10.28) at 7 d storage. It is concluded that 2000 IU/ kg DM vitamin E supplementation improve the physical characteristics of fresh, vacuum packaged bovine meat.

Key Words: Vitamin E, Bovine Meat, Vacuum Packed

M71 Tenderness improvement in fresh and frozen/thawed beef strip loins treated with hydrodynamic pressure processing. M. B. Solomon*, M. Liu, J. Patel, E. Paroczay, and J. Eastridge, *USDA, ARS, FTSL*.

The effect of hydrodynamic pressure processing (HDP) using two different shaped charges (rectangular [REC] vs cylindrical [CYL]) and meat state at 48 h postmortem of beef strip loins (N=16) on meat tenderness was evaluated. HDP was performed by detonating 100 g of explosive placed above vacuum packaged meat samples immersed in water in plastic containers. Meat state was fresh, never frozen compared to frozen at 48 h postmortem followed by thawing at 6-d postmortem. Meat samples were evaluated for tenderness by shear force measurements at both d-1 and d-6 after being treated with HDP. Both shapes of explosives improved ($P < 0.01$) shear force on d-1 (CYL 4.6 vs 5.4 kg; REC 4.4 vs 5.4 kg) compared to controls. The effect of HDP was sustained ($P < 0.01$) throughout d-6 of aging, with the CYL reaching 3.9 kg and the REC reaching 3.6 kg compared to controls (4.5 kg). Freeze/thaw samples were 1 kg lower at d-1 compared to fresh samples (4.3 vs 5.3 kg) and 0.9 kg lower at d-6 (3.6 vs 4.4 kg). There were no significant interactions for meat state and HDP treatments. The percentage of samples with HDP improvements $> 10\%$ was higher for the REC shaped explosive (81%) compared to the CYL shape (56%). Furthermore, the percentage of samples with HDP improvements $> 10\%$ was higher for fresh meat samples (71%) compared to frozen/thawed samples (66%). The percentage of samples that improved greater than the aged control was 100% for REC, 87% for CYL, 94% for fresh samples, and 81% for frozen/thawed samples. These results suggest that both HDP and early postmortem freezing followed by thawing are successful treatments for improving meat tenderness and are better than extended aging for non-treated controls.

Key Words: Tenderness, Pressure Processing, Aging

M72 Recombinant hepatocyte growth factor (rHGF) over-expressed by C2C12 myoblasts is biologically active. C. Zeng*¹, D. E. Gerrard¹, K. H. Hannon², and A. L. Grant¹, ¹*Department of Animal Sciences, Purdue University, West Lafayette, IN*, ²*Department of Basic Medical Sciences, Purdue University, West Lafayette, IN*.

Hepatocyte growth factor (HGF) is a growth factor that activates quiescent satellite cells and alters their growth in culture and in skeletal muscle. In an attempt to increase the amount of local HGF in skeletal muscle, we generated an expression construct to produce an epitope-tagged HGF (rHGF) protein. Reverse transcription-polymerase chain reaction (RT-PCR) was used to clone a cDNA encoding full-length HGF from mouse liver total RNA (forward primer: ATGATGTGGGGGACCAAACCT, reverse primer: TTACAACCTGTATGTCAAAA). The cDNA was subcloned into the pcDNA3.1/V5-His-TOPO expression vector and used to transfect C2C12 myoblasts. Immunoblots containing the concentrated conditioned media from myoblasts stably expressing rHGF showed that the expressed rHGF could be detected using antibodies against HGF or the V5 epitope. Monoclonal anti-HGF antibody detected the N-terminal 70 kDa α -chain of rHGF, whereas the anti-V5 antibody detected the C-terminal 40 kDa β -chain in which the V5 epitope was located. Moreover, subjecting conditioned media to a His-column removed the majority of immunoreactive protein, further suggesting that the product was recombinant HGF-V5-His protein. Furthermore, the conditioned media stimulated C2C12 myoblast replication similar to a commercially available HGF. In experiments in which one-half of DMEM was replaced with FBS-free conditioned medium from stably transfected C2C12 myoblasts, the proliferative effect on normal C2C12 myoblasts was the same ($P > .05$) as that observed when normal C2C12 myoblasts were cultured in DMEM containing a commercial HGF at 5 ng/ml. Finally, immunoneutralization of conditioned media using an anti-HGF antibody at the concentration of 1 $\mu\text{g/ml}$ eliminated ($P < .05$) this proliferative effect in culture, suggesting that rHGF is the major component in conditioned medium to exert the proliferative action. We conclude that our recombinant epitope-tagged HGF is biologically active when expressed in C2C12 myoblasts. This construct provides a valuable reagent for investigating the role of HGF in controlling satellite cell-mediated muscle growth.

Key Words: Hepatocyte Growth Factor (HGF), Muscle, Satellite Cell

M73 Correlations and prediction equations for fatty acids and sensory characteristics of beef longissimus rib steaks from three forage rations and commercial USDA Choice and Select rib steaks. R. T. Baublits*¹, F. W. Pohlman¹, A. H. Brown, Jr.¹, Z. B. Johnson¹, D. C. Rule², C. M. Murrieta², D. O. Onks³, B. A. Sandelin¹, H. D. Loveday³, C. J. Richards³, and R. B. Pugh³, ¹*University of Arkansas, Fayetteville*, ²*University of Wyoming, Laramie*, ³*University of Tennessee, Knoxville*.

Rib steaks (n = 52) from cattle grazing fescue, fescue with soyhull supplementation, orchardgrass with soyhull supplementation, and USDA Choice and Select rib steaks obtained from area purveyors were utilized to determine fatty acid profiles and sensory characteristics. Correlations between fatty acids and sensory characteristics were performed. Also, utilizing fatty acid values, prediction models for sensory characteristics were developed. The beef/brothy and beef fat sensory characteristics were positively correlated ($P < 0.05$) with 16:0, 16:1cis-9, and 18:1, and negatively correlated ($P < 0.05$) with 15:0, α -18:3, 20:4, 20:5, 22:5, and 22:6. The grassy sensory characteristic was positively correlated ($P < 0.05$) with 15:0, 16:1trans-9, 18:0, 18:2cis-9,trans-11 (CLA), α -18:3, 20:5, 22:5, and 22:6. Regression utilizing stepwise selection to develop prediction equations for sensory characteristics was performed, and the beef/brothy sensory characteristic was best predicted ($P < 0.05$) by the single fatty acid 20:5, with this fatty acid explaining 40 % of the variation in beef/brothy flavor. Conjugated linoleic acid (CLA) and α -18:3 were utilized in the model that best predicted ($P < 0.05$) milky/oily flavor, with these two fatty acids explaining 31 % of the variation. These results indicate that CLA and the 20- and 22-carbon polyunsaturates have large roles in influencing flavor, causing increases in grassy and milky/oily flavor or decreasing beef/brothy flavor.

Key Words: Fatty Acid, Sensory, Correlation

M74 Characterization of Romosinuano breeding on palatability traits and retail shelf life of beef steaks. W. J. Horne*¹, J. C. Brooks¹, S. W. Coleman², W. A. Phillips³, D. G. Riley², C. C. Chase Jr.², and M. F. Miller¹, ¹*Department of Animal and Food Sciences, Texas Tech University, Lubbock*, ²*USDA, ARS, SubTropical Agricultural Research Station, Brooksville, FL*, ³*USDA, ARS, Grazinglands Research Laboratory, El Reno, OK*.

This study was conducted to evaluate if Romosinuano (R) cattle, a *Bos taurus* breed native to Columbia, would differ from Brahman (B) and Angus (A) cattle in palatability and retail shelf life properties of beef steaks. Steers (n=142) representing a three-breed diallel crossbreeding program (AA, BB, RR and crossbreds: AB, AR, BA, BR, RA, RB; first letter indicates breed of sire and second letter indicates breed of dam) were fed in El Reno, OK. Carcass data was collected at 48 h post harvest. Loins were recovered, aged for 7 d and fabricated into 2.54 cm-thick steaks for use in Warner-Bratzler shear (WBS), slice shear, and sensory analysis. WBS results indicate that BB cattle exhibited the highest ($P < 0.05$) values (3.98 kg \pm 0.16) while AA and RA had the lowest (3.16 kg \pm 0.20). RA cattle had WBS values similar to the RB cattle, while AR had lower ($P < 0.05$) WBS values than BR. Slice shear results indicate that BB cattle had the highest ($P < 0.05$) values (15.58 kg \pm 0.87) while AB had the lowest (11.93 kg \pm 0.82). RA and AR cattle had similar slice shear values to RB and BR cattle. When R was used on the maternal side of the cross, steers exhibited higher Warner-Bratzler shear values and less desirable sensory panel tenderness scores ($P < 0.05$) than steers sired by R bulls. Breed did not have a significant effect on retail display properties. Results indicate that palatability and shear force values were improved when R was represented on the paternal, rather than maternal, side of the cross. Finally, RA and AR cattle produced panel tenderness scores, shear force values, and retail display properties similar to the BA and AB cattle.

Key Words: Romosinuano, Shelf Life, Palatability

M75 Comparison of beef tallow versus poultry fat in the finishing diets of steers on muscle and subcutaneous fatty acid profiles. S. Hutchison^{*1}, E. B. Kegley¹, J. K. Apple¹, T. J. Wistuba², and D. C. Rule³, ¹University of Arkansas, Fayetteville, ²Morehead State University, Morehead, KY, ³University of Wyoming, Laramie.

Poultry fat has become a more economical source of energy than by-products currently used. Therefore, this study was conducted to determine the effects of dietary fat source (poultry fat or beef tallow) in finishing diets for cattle on the fatty acid composition of beef. Sixty Angus crossbred steers (410.8 kg initial BW) were stratified by source, blocked by weight, and assigned within block to 15 pens (4 steers/pen). Pens were then assigned randomly within blocks to one of three dietary treatments consisting of: 1) a corn-soybean meal control diet devoid of supplemental fat (Ctrl); 2) the control diet formulated with 4% tallow (TAL); or 3) the control diet formulated with 4% poultry fat (PF). Cattle were fed for 112-d and harvested at a commercial beef packing plant. Wholesale ribs were collected during carcass fabrication (357.7, 357.3, and 369.5 kg for carcasses of Ctrl, TAL, and PF-fed cattle, respectively), and samples of subcutaneous fat and LM were analyzed for fatty acid composition (reported as mg/g wet tissue). In the LM, total saturated fats (14:0, 15:0, 16:0, and 18:0) were similar ($P > 0.10$) among diets. Furthermore, total monounsaturated fatty acids (MUFA) were not ($P > 0.10$) affected by finishing diets. The LM from the steers fed PF had increased ($P < 0.05$) 18:2 and total PUFA than the LM of the steers fed Ctrl or TAL-diets. Conversely, the LM of TAL-steers had lower ($P < 0.05$) concentrations of 20:3 than Ctrl or PF-fed steers. The only changes detected in subcutaneous fat were steers that consumed the Ctrl-diet had the highest ($P < 0.05$), and PF-fed steers had the lowest ($P < 0.05$), 17:0 concentrations. Furthermore, subcutaneous fat from TAL-fed steers had lower ($P < 0.05$) conjugated linoleic acid concentrations than fat from controls and PF steers; however, diet did not ($P > 0.10$) affect total saturated, MUFA, PUFA, omega-6, or trans fatty acids. Feeding finishing steers diets formulated with poultry fat did not negatively impact the fatty acid composition of subcutaneous fat or the LM, and may serve as an alternative to beef tallow as a source of energy for cattle finishing diets.

Key Words: Beef Tallow, Poultry Fat, Fatty Acids

M76 Comparison of beef tallow versus poultry fat in the finishing diets of steers on beef quality during retail display. S. Hutchison^{*1}, J. K. Apple¹, E. B. Kegley¹, and T. J. Wistuba², ¹University of Arkansas, Fayetteville, ²Morehead State University, Morehead, KY.

The current study was conducted to determine the effects of dietary fat source (poultry fat or beef tallow) in finishing diets of cattle on beef quality traits during 7 d of simulated retail display. Sixty Angus crossbred steers (410.8 kg initial BW) were stratified by fat source, blocked by weight, and assigned to 15 pens (4 steers/pen). Pens were then assigned randomly within blocks to one of three dietary treatments consisting of: 1) a corn-soybean meal control diet devoid of supplemental fat (Ctrl); 2) the control diet formulated with 4% tallow (TAL); or 3) the control diet formulated with 4% poultry fat (PF). Cattle were fed for 112-d and harvested at a commercial beef packing plant. Wholesale, bone-in ribs were collected during carcass fabrication, and 2.54-cm thick, boneless LM steaks were cut, weighed, placed on foam trays with an absorbent pad, and overwrapped with PVC film for display (deluxe warm white

Nonruminant Nutrition: Weanling Pig - Vitamin & Mineral

M78 Is vitamin B6 a modulator of the effect of supplementary tryptophan on tryptophan metabolism and growth responses in weanling pigs? J. J. Matte^{*1}, N. LeFloc'h², C. Relandeu³, L. Le Bellego³, A. Giguère¹, and M. Lessard¹, ¹Agriculture and Agri-Food Canada, Lennoxville, Qc, Canada, ²Institut National de la Recherche Agronomique, St-Gilles, France, ³Ajinomoto Eurolysine S.A.S., Paris, France.

The present experiment aimed to determine if tryptophan (Trp) metabolism and the eventual growth response to dietary supplement of Trp is modulated by the dietary supply of pyridoxine (B6). Early-weaned piglets ($n = 544$) (BW: 5.96 ± 0.14 kg) were grouped in 32 pens ($n = 32$) of 17 animals and distributed by initial weight ranges in four

light; 1600 lx) in chest-type display cases (3°C). On d 0, 1, 3, 5, and 7 of display, a three-person panel scored steak discoloration (1 = total discoloration to 7 = no discoloration), and instrumental color (L^* , a^* , and b^* values) was measured and used to calculate hue angle, chroma, and delta E (measure of total color change from d-0) values. Thiobarbituric acid reactive substances (TBARS) of steaks were measured on d 0 and 7 of display. Beef became lighter (higher L^* value; $P < 0.01$), and less red (lower a^* value; $P < 0.001$) and yellow (lower b^* value; $P < 0.001$) during the 7 d of retail display. The LM from Ctrl-steers tended to be lighter (higher L^* value; $P < 0.10$); however, there were no ($P > 0.10$) diet effects on a^* , b^* , hue angle, chroma, delta E, or discoloration scores. Even though TBARS concentrations were numerically higher in the LM of steers consuming diets formulated with fat (0.54, 0.53, and 0.34 mg/kg for PF, TAL, and Ctrl, respectively), diet had no ($P > 0.10$) appreciable effect on the development of oxidative rancidity. Results indicated that replacing beef tallow with a more economical energy source, poultry fat, in cattle finishing diets had no detrimental effects on beef quality during retail display.

Key Words: Dietary Fat, Beef Quality, Retail Display

M77 Glycolytic intermediates in muscle and adipose tissue of cattle fed different sources and amount of energy. R. D. Rhoades^{*}, J. T. Vasconcelos, D. K. Lunt, J. E. Sawyer, K. Y. Chung, and S. B. Smith, Department of Animal Science, Texas A&M University, College Station.

Seven Angus and eight Wagyu steers (BW = 208 and 172 kg) were used to evaluate energy source effects on glycolytic intermediates within muscle and adipose tissue. Steers were blocked by breed and fed a corn-based diet for 244 d (total energy: 3207 Mcal/kg) or a hay diet for 362 d (total energy: 6293 Mcal/kg). Corn-based diet was fed for 1.3 kg/d gain. Hay-fed steers were fed to the same carcass endpoint. Carcass adjusted fat thickness (AFT), marbling score, postmortem plasma, muscle, subcutaneous, and intramuscular adipose tissues were collected. Data were analyzed as a complete block design. Plasma glucose ($\mu\text{mol/ml}$) was numerically greater ($P=0.06$) in corn-fed (3.77 ± 0.06) vs. hay-fed (2.88 ± 0.05) steers. Glucose ($\mu\text{mol/g}$) in muscle was greater ($P=0.04$) in hay-fed steers (4.68 ± 0.07 vs. 3.07 ± 0.08). Muscle glucose-6-phosphate (G6P), and fructose-6-phosphate (F6P; $\mu\text{mol/g}$) were similar ($P=0.10$) among treatments. Glucose ($P=0.13$), G6P ($P=0.34$), and F6P ($P=0.22$) concentrations in subcutaneous adipose were also similar. Glucose and F6P concentrations in intramuscular adipose were 2-fold and 10-fold higher, respectively, than observed in subcutaneous depots, but were similar ($P>0.6$) for corn-fed and hay-fed steers. G6P was numerically greater in hay-fed (0.186 ± 0.008) vs. corn-fed steers (0.084 ± 0.009 ; $P=0.08$). Steers were fed to a common AFT (0.47 cm). Mean marbling score in corn-fed steers (710 ± 78) was numerically greater than in hay-fed steers (564 ± 72) although statistical separation was not achieved ($P=0.4$). Plasma glucose indicates greater glucose pool size in corn-fed steers; greater concentrations of glucose and intermediaries in muscle of hay-fed steers may reflect decreased pathway flux. Correlations between marbling score and intramuscular adipose glucose concentration were -0.6 ($P=0.18$) for corn-fed steers and 0.7 ($P=0.04$) for hay-fed steers, supporting the concept that corn-based diets promoted provision and utilization of glucose for accretion of intramuscular fat relative to hay-based diets. Manipulation of glucose disposal rate in finishing steers may improve carcass quality grade.

Key Words: Glucose, Marbling, Energy

factorial treatments ($n = 8$ pens in each): two dietary additions of B6 [0 (B6-) vs. 5 ppm (B6+)] and two dietary additions of synthetic Trp [0 (Trp-) vs. 0.05 % (Trp+) for a Trp/Lys ratio of 0.174 vs. 0.204, respectively]. Growth performance was recorded every week from 2 to 9 wk of age. Blood samples were taken from 64 piglets, two from each pen, before initiation of treatments and at 4, 6 and 8 wk of age. No treatment effect ($P > 0.19$) was observed on overall ADFI (679 ± 7 g), ADG (454 ± 4 g), or feed conversion (1.50 ± 0.01), although the B6+Trp+ piglets had the highest ADG and feed conversion during the last week of experiment (B6 x Trp x Age linear, $P < 0.02$). Pyridoxal in red blood cells was 19% lower in B6- ($2.8 \pm 0.1 \mu\text{M}$) than in B6+ piglets ($3.3 \pm 0.1 \mu\text{M}$; B6 x Age quadratic, $P < 0.01$). Initial values