method and from the supernatant using a Qiagen DNeasy Plant Mini Kit. A TaqMan® PCR assay was used to quantify the *cp4 epsps* transgene in 245 ng of extracted DNA from whole and supernatant samples of RF and DF. Fiber content did not affect the persistence of the *cp4 epsps* transgene in RF or DF (P > 0.05). In whole RF, the *cp4 epsps* copy number was greatest for the HF and LF diets (2635 and 2432 copies, respectively) 1 h after being fed and eventually decreased to below the limit of quantification (less than 20 copies) by 21 h after feeding. In contrast, the *cp4 epsps* copy number in whole DF peaked at 7 h after feeding for both HF and LF treatments (245 and 278 copies, respectively) and decreased to below the limit of quantification by 21 h. The transgene was not detected in any of the supernatant samples devoid of plant cells. This study suggests that the transgenic DNA detected in RF and DF was mainly associated with solid undigested plant material.

Key Words: Genetically modified, Transgene, Real-time PCR

Meat Science and Muscle Biology: Meat Quality Prediction and Enhancement

T101 Prediction of monounsaturated fatty acid in the rib eye marbling of Japanese Black by image analysis using high resolution digital image. K. Kuchida*[1], Y. Hirayama[1], A. Oka[2], E. Iwamoto[2], and M. Fukushima[3], [1]*Obihiro University of Agriculture and Veterinary Medicine, Obihiro-shi, Hokkaido, Japan*, [2]*Hyogo Prefectural Agricultural Institute, Kasai-shi, Hyogo, Japan*, [3]*Hyogo Prefectural Hokubu Agricultural Institute, Wadayama-cho, Hyogo, Japan*.

Evaluation of beef meat quality based on objective metrology and eating quality will be needed in the future, although the evaluation now depends more on the judgment by the naked eye. The purpose of this research was to predict the ratio of monounsaturated fatty acid (MUFA) of marbling fat in the rib eye muscle by detailed image analysis using high resolution carcass images. Japanese Black (29 steers and 17 females) cattle, which were slaughtered at 24-30 months (average: 27.7 months), were used in this study. The ratio of marbling area to rib eye area (FATPER), overall coarseness of marbling (O_COARSE), coarseness of the largest marbling particle in rib eye (M_COARSE), coarseness of single marbling particle (S_COARSE), ratio of minor and major axis of rib eye (MM_RATIO), and complexity of rib eye shape (COMP) were calculated by image analysis. The original images of rib eye were converted into binary images, which were then thinned by 5 and 10 rounds while maintaining the connection of pixels. The hairline (width of line being 1 pixel) of the thinned image was retained (hairline image). The pixels of each hairline, second moment, maximum length, pattern width, pattern direction, equivalent circular diameter, degree of circularity, ruggedness degree, circumference length, number of hairlines and total area were calculated for the hairline image by image analysis. MUFA was obtained by an official method. The range of MUFA was 51.0-62.5% (average: 56.7%), and the correlation coefficient of MUFA with marbling score and the O_COARSE were 0.15 (NS) and 0.47 (p<0.01), respectively. As the result of stepwise regression analysis, the M_COARSE, average of circumference length of hairline image, green color component of marbling, MM_RATIO and COMP were selected for the multiple regression equation for the prediction of MUFA (R^2=0.82). For the confirmation of the equation, an additional 10 steers were analyzed. The MUFA could be predicted using different data set (R^2=0.73).

Key Words: Image Analyisis, Monounsaturated Fatty Acid, Japanese Black

T102 Development of photography equipment for the cross section of beef and its use in the evaluation of beef marbling and color of rib eye. K. Takahashi*[1], K. Kuchida[1], T. Hori[2], M. Nami[2], T. Honma[2], H. Kotaka[3], and H. Tsukuda[4], [1]*Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, Japan*, [2]*Hokkaido Industrial Research Institute, Sapporo, Hokkaido, Japan*, [3]*Hayasaka Science and Engneering Corporation, Sapporo, Hokkaido, Japan*, [4]*Livestock Improvement Association of Japan, Makubetsu, Hokkaido, Japan*.

In Japan, the area, marbling and color of rib eye of Wagyu are economically important traits at the purchasing by buyer. Although marbling and meat color are subjectively evaluated currently, an objective method is more desirable from the viewpoint of equitable evaluation. The aim of this study was to develop a photography equipment (to) that could obtain clear images of beef carcass cross-section and to evaluate marbling and meat color using the equipment. The view angle of the equipment was 384mm×318mm and the resolution of the digital camera (Kodak DCS Pro 14n) combined with the equipment was 13.5 million pixels. A super wide lens (Nikkor Ai AF ED 14mm F2.8D) was attached to this digital camera. Two line lightings of white LED (CCS Co. Ltd. LND-300H - SW-DF) were used. The rib eye images of the cross-section between the 6th and 7th ribs of 240 Japanese Black steers were analyzed by computer image technique. Nine variables (marbling percentage, marbling coarseness, etc.) were calculated for the estimation of the Beef Marbling Standard (BMS) number, and 108 variables (R, G and B components of color of marbling or lean, etc) calculated for the estimation of Beef Color Standard (BCS) number were computed as image analysis traits from these images. The BMS and BCS numbers assigned by the grader were predicted using these image analysis traits by multiple linear regression analysis. Four variables were selected in the multiple regression equation of the BMS number (R^2 = 0.84). Percentages of 71.7% and 96.7% for the differences between the BMS numbers predicted by image analysis and assigned by the grader were within ±0 and within ±1, respectively. The multiple regression equation of the BCS number was composed of 5 image analysis traits (R^2=0.74). Ratios of the difference between BCS number predicted by image analysis and BCS number assigned by grader being ±0 and within ±1 were 81.6% and 100%.

Key Words: Beef Carcass, Marbling, Meat Color

T103 Prediction of BMS number by image analysis and comparison of estimated BMS numbers in different cross sections of Holstein steers. Y. Hamasaki*, K. Kuchida, S. Hidaka, K. Shimada, and M. Sekikawa, *Obihiro University of Agriculture & Veterinary Medicine, Obihiro-shi, Hokkaido, Japan*.

In Japan, the 6-7th rib of carcass cross section has been used in meat quality evaluation of beef. Marbling scores in *M. longissimus thoracis* are classified into 12 levels and have a large economic impact. Marbling scores evaluated by different graders have some discrepancy in the same carcass and even in the same muscle when the section is different. The aims of this study were to develop a prediction method of the BMS (Beef Marbling Standard) number by image analysis and to investigate the difference between BMS numbers in the 6-7th ribs and those in other areas. Digital images of the 6-7th cross section from 61 Holstein steers were used to predict BMS number with a multiple regression equation. The ratio of marbling to rib eye area (FATPER), the coarseness of marbling and the shape of rib eye were considered as independent variables, and the BMS number evaluated by a grader was a dependent variable for the multiple regression analysis. The multiple regression equation was applied to 4 cross sections, which were cut in 2.5 cm intervals from the 6-7th cross section toward the direction of the lumbar of 18 other Holstein steers. Selected variables of the multiple regression equation for estimating the BMS number were FATPER, the area of the largest marbling particle, coarseness of a single marbling particle and rib eye area (R^2 = 0.71). The differences of the image analyzed BMS numbers between the 6-7th cross section and the other 3 cross sections were not large, ranging from -0.99 to 0.72. Samples with large differences of the BMS numbers among the cross sections contained a huge marbling particle in the rib eye. After removing the huge marbling particle by image processing, the BMS number was predicted again using the multiple regression equation, and the differences of the BMS numbers between the 6-7th cross

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section and the other 3 cross sections were smaller. This result indicated that the huge marbling particle should not be treated as the marbling in meat quality evaluation.

Key Words: Image Analysis, Marbling Scores, Beef

T104   Prediction of total and regional carcass lean content by DXA cross-sectional analysis of pork carcasses. A. Mitchell*[1], A. Scholz[2], and V. Pursel[1], [1]*USDA, Agricultural Research Service*, *Beltsville, MD*, [2]*Ludwig Maximillians University-Munich*, *Oberschleissheim, Germany*.

The primary means of establishing the value of pork carcasses is based on lean yield. Dual energy X-ray absorptiometry (DXA) can be used to measure pork carcass composition by performing a total scan of the half-carcass. The scan can be analyzed for total or regional fat, lean, and bone mineral content, but is too slow for on-line slaughter application. The purpose of this study was to determine the feasibility of predicting carcass lean yield based on a single-pass cross-sectional measurement. A total of 327 right half-carcasses (43.2 ± 4.8 kg) were scanned by DXA. The DXA scans were analyzed for percentage lean in the entire half-carcass as well as the shoulder, ham, loin, and side regions. A total of 14 cross-sections (57.6 mm wide) were analyzed: 6 in the shoulder/thoracic region, 3 in the loin region, and 5 in the ham region. Regression analysis was used to compare the DXA lean measurements (kg) in the total carcass with those of the various regions. Carcass lean (kg) was predicted using carcass weight and the DXA value of percentage lean in a single slice from the ham region (R^2=0.94, SEE=0.66 kg), loin region (R^2=0.96, SEE=0.53 kg), or shoulder region (R^2=0.96, SEE=0.53 kg). The prediction was improved only slightly by using carcass weight in combination with a slice from each region (R^2=0.97, SEE=0.46 kg). The combination of carcass weight and DXA percentage lean in a single slice was less accurate for predicting the primal cut lean yield (kg) in the shoulder region (R^2=0.75, SEE=0.54 kg) or ham region (R^2=0.84, SEE=0.43 kg). These results indicate that carcass lean yield can be measured by performing a single-pass cross-sectional scan that would be compatible with on-line processing; however additional refinements are needed for accurate prediction of lean yield of primal cuts.

Key Words: Carcass Composition, DXA, Swine

T105   Potential of an electronic nose based on mass spectrometry to sort out boar tainted carcasses. S. Ampuero, P.-A. Dufey, and G. Bee*, *Agroscope Liebefeld-Posieux, Swiss Federal Research Station for Animal Production and Dairy Products (ALP), Posieux, Fribourg, Switzerland*.

Based on a parliamentary decision, in the year 2009 castration of male piglets without anesthesia will be banned in Switzerland. Thus, pork producers are forced to search for alternatives to the common practice. Rearing intact male pigs to market weight could constitute one possible alternative solution. However, producers, retailers, and consumers are concerned about the incidence of taint in pork. Therefore, a reliable, fast, and objective method to detect carcasses with the undesirable odor is a prerequisite for boar production. The aim of this study was to evaluate the potential of the electronic nose (SMart Nose 151, LDZ, Switzerland) with a mass spectrometer (quadripole) as a detector to classify boar tainted carcasses. In back fat (**BF**) samples of 35 boars and three castrates obtained from the loin region the concentrations of androstenone, skatole, and indole were determined by HPLC technique. The androstenone, skatole, and indole concentration in the BF of boars ranged between 0.2 - 4.4, 0.02 - 0.68, and 0 - 0.14 mg/kg, respectively. As expected, the androstenone, skatole, and indole levels in the BF of castrates were lower and ranged between 0 - 0.32, 0 - 0.04, and 0 - 0.01 mg/kg, respectively. These results revealed that the highest androstenone and skatole concentrations in the BF samples of the castrates were higher than the lowest concentrations determined in the BF of the boars. Subsequent analyses of the BF samples with the SMart Nose were carried out using two different sampling modes: solid phase micro extraction (**SPME**) fiber (divinylbenzen / carboxen / polydimethylsiloxane) and pyrolyser. The obtained spectra were subjected to Principle Component Analysis and revealed that with SPME 99% of the BF samples and with the pyrolyser, directly coupled to the injector, 100% of the BF samples of boars were correctly discriminated against the BF samples of the castrates. These preliminary results demonstrated the potential of the electronic nose to detect low levels of boar taint, independently of the kind of substance, and therefore to sort-out boar tainted carcasses.

Key Words: Electronic Nose, Boar Taint

T106   Relationship of pork longissimus muscle fatty acid profile with pork loin texture and sensory traits. S. Lonergan*[1], K. Stalder[1], T. Knight[1], R. Goodwin[2], K. Prusa[1], and D. Beitz[1], [1]*Iowa State University, Ames*, [2]*Goodwin Family Farms, Ames, IA*.

The objective this project was to determine the contribution of lipid composition and lipid profile to textural and sensory properties of fresh pork. Pigs (n=2009; from 306 sires and 1030 dams) from the 1991, 1992, 1994, and 2001 National Barrow Show Sire Progeny Test were used in this study. The test included purebred Berkshire (269), Chester White (175), Duroc (360), Hampshire (228), Landrace (196), Poland China (130), Spotted (195), and Yorkshire (456) barrows (1178) and gilts (831). Diets were uniform within test and across breeds. The halothane (Hal 1843™) genotype was determined. Pigs were slaughtered at 105 kg body weight, and samples of the longissimus muscle were obtained from each carcass at the 10th rib. Star probe, sensory traits, lipid content, and fatty acid profile were determined on the longissimus muscle from each pig. Data were analyzed using a mixed linear model including test, gender, halothane genotype, breed, and breed-by-gender interaction as fixed effects, with sire and dam within breed included as random effects. Total lipid content was correlated with saturated fatty acids and negatively correlated with unsaturated fatty acids. Myristic acid was positively correlated with tenderness and negatively correlated with star probe. Negative correlations between stearic acid and the traits of tenderness and juiciness were detected. No other fatty acid component was determined to have a strong correlation with pork texture or sensory traits. The results suggest that,when pigs are fed a similar diet, normal variations in pork loin fatty acid profile have little contribution to pork texture and sensory traits.

Pearson correlation coefficients for lipid composition and pork quality traits.

	C14:0	C16:0	C16:1	C18:0	C18:1	C18:2	C20:3,C20:4
Lipid %	-.395	.443	.297	.187	.444	-.688	-.633
Star Probe	-.219	-.172	-.037	.025	-.031	.148	.191
Juiciness	.234	-.003	-.155	-.336	-.118	.109	-.017
Tenderness	.271	.031	-.122	-.330	-.095	.061	.064
Flavor	-.027	.028	.175	.172	.112	-.137	-.076

Key Words: Fatty Acids, Pork, Sensory Quality

T107   Effect of dietary conjugated linoleic acids (CLA) and sex on intramuscular collagen and bone characteristics in heavy pig. G. Maiorano*[1], A. Manchisi[1], K. Paolone[1], L. Costanza[1], M. Musella[2], and C. Corino[2], [1]*University of Molise, Campobasso, Italy*, [2]*University of Milano, Milano, Italy*.

Twenty-two heavy crossbred pigs (Goland x Hypor), 12 barrows and 10 gilts, were used to study the effects of dietary CLA supplementation (0.75% of the total diet) and sex (S) on intramuscular collagen (IMC) properties (collagen and crosslink concentrations) and skeletal development. *Longissimus dorsi* muscles and 3rd and 4th metacarpal and metatarsal bones were collected from chilled carcasses. Muscles were trimmed of fat and epimysium, lyophilized, and hydrolysed in 6N HCl for determination of hydroxyproline (Hyp) and hydroxylysylpiridinoline (HLP) crosslinks, which are regarded as main factors

contributing to meat tenderness. On bones were determined: length, diaphyseal diameter, fresh weight, and moisture. Moreover, on 3th metacarpal bone was measured growth plate width, site of the longitudinal bone growth. Collagen amount was calculated assuming that it weighted 7.25 times the Hyp weight. HLP was quantified by RP-HPLC. Data were analyzed by ANOVA. CLA reduced HLP concentration (6.29 vs 7.58 µg/mg; P=0.032), index of collagen crosslinking (which has been related to change in meat tenderness), whereas had very little effect on both IMC content and collagen maturity (HLP/IMC ratio). Gilts compared to castrate had higher amount of IMC (10.85 vs 8.83 µg/mg; P=0.014) tending to be less mature (-13.7% HLP/IMC), this confirms that castration reduces collagen synthesis and turnover. Metacarpal bones were affected by CLA supplementation, resulting more long (P=0.079) and less large (P=0.018) in treated animals. In addition, CLA reduced (P=0.08) growth plate width. S did not significantly influence bone characteristics, except for metatarsal diameter that was higher (P=0.047) in barrows than gilts. These results suggest that CLA supplementation has a positive effect on texture and tenderness of pork meat and skeletal development, who may condition muscle growth and fat deposition. Whereas S has limited influence on IMC properties and bone characteristics.

Key Words: Pork Quality, CLA, Sex

T108   Histochemical properties and meat quality traits of porcine muscles during growth: Effect of feed restriction in pigs slaughtered at the same weight and different age. G. Bee*, M. Calderini, C. Biolley, G. Guex, and W. Herzog, *Agroscope Liebefeld-Posieux, Swiss Federal Research Station for Animal Production and Dairy Products (ALP), Posieux, Fribourg, Switzerland.*

Results of a previous study revealed that when the slaughter weight of pigs is lower at the same age the light portion of the semitendinosus (**STL**) was more oxidative, the LM and STL exhibited smaller myofibers, and these differences negatively affected meat tenderness. The aim of the study was to compare the histochemical properties of myofibers and meat quality traits of the LM and STL in pigs slaughtered either at the end of the growing or finishing period at the same BW but different age. Swiss Large White barrows (n = 24) from six litters were given ad libitum (**A**) or restrictive (**R**) access to a grower and finisher diet from 19.8 to 60 kg and 60 to 100 kg BW, respectively. Two littermates from each feeding regimen were slaughtered at 61 (**A60** and **R60**) or 101 kg (**A100** and **R100**). Muscle fibers were stained and classified based on the stain reaction as slow-oxidative (**SO**), fast oxidative-glycolytic (**FOG**), and fast glycolytic (**FG**), and fiber area and distribution were determined. In addition, percentages of cooking loss and shear force were assessed. Regardless of the BW at slaughter, while myofibers size was unaffected, the relative amount of SO was lower (8 vs. 12%; $P = 0.06$) and that of FG fibers was higher (71 vs. 64%; $P < 0.01$) in the LM of R60- and R100-pigs compared with the LM of A60 and A100-pigs. The SO fibres were more abundant in the STL of R60- (15%) than R100-pigs (5%), which were similar to the relative amount, found in the A60- (4%) and A100-pigs (6%) (feed restriction x weight interaction; $P = 0.02$). Compared to pigs of the ad libitum group, the STL of the restricted pigs was less tender (shear force of 4.3 vs. 3.3 kg; $P < 0.01$) and percentages of cooking loss were higher (23 vs. 19%; $P = 0.02$). Size of SO (r = -0.44), FOG (r = -0.41), and FG (r = -0.33) fibers were negatively ($P ≤ 0.03$) correlated with shear force. In conclusion, at the same slaughter weight, myofiber size was unaffected by the age of the animal but the LM of restricted pigs was more glycolytic and a clear negative relationship existed between fiber size and meat tenderness.

Key Words: Slaughter Weight, Muscle Fibers, Meat Quality

T109   Effect of sire line and sex on productive performance and carcass quality of Iberian pigs. M. P. Serrano[1], D.G. Valencia[1], R. Lázaro[1], A. Fuentetaja[2], and G.G. Mateos*[1], [1]*Universidad Politécnica de Madrid, Madrid, Spain*, [2]*Copese, Segovia, Spain.*

The production of Iberian pigs, the ancestral dark hairy pig original from Spain, has increased dramatically for the last 10 years, and current number of sows is close to 300.000. Cured products from Iberian pigs are characterized for its high quality but the productivity of sows and fattening pigs is low. A total of 180 pigs was used to study the influence of terminal sire line (DD, Danish Duroc; SD, Spanish Duroc; IB, Iberian) and gender (barrows, gilts) on performance and carcass quality of pigs sacrificed at 146 kg body weight. The female line used was pure Iberian in all cases. Treatments were arranged factorially (3 × 2) with five replicates (six pigs) per treatment. Crossbreds from DD and SD grew faster (682 and 672 vs 534 g/d; P ≤ 0.001) and were more efficient (3.88 and 3.96 vs 4.56 g/g; P ≤ 0.001) than pure IB. Barrows ate more feed (2673 vs 2488 g/d; P ≤ 0.01) and were less efficient (4.26 vs 4.00 g/g; P ≤ 0.01) than gilts. SD sired pigs had less carcass yield (80.2 vs 81.0 and 81.2%; P ≤ 0.05) than DD and IB sired pigs. Iberian pigs were fatter (79.8 vs 50.0 and 50.9 mm at P_2 and 64.8 vs 42.7 and 44.4 mm at m. *Gluteus medius*; P ≤ 0.001) and had higher pH at 2 and 24 h *post mortem* (P ≤ 0.001) than DD or SD pigs. Primal trimmed cuts yield was higher for DD and SD than for IB sire line pigs (32.21 and 31.66 vs 24.81%; P ≤ 0.001). Gilts had less carcass yield (80.3 vs 81.3%; P ≤ 0.01) and carcass fat (58.9 vs 60.8 mm at P_2 and 48.8 vs 51.9 mm at m. *Gluteus medius*; P ≤ 0.01) and had lower pH at 2 and 24 h *post mortem* (P ≤ 0.10) than castrates. Also, gilts had more loin (4.32 vs 3.93%; P ≤ 0.001), trimmed hams (18.28 vs 18.00%) and trimmed shoulders (11.62 vs 11.42%) yield than barrows (P ≤ 0.05). We conclude that gilts had better productivity and yield of primal cuts but less carcass yield than barrows and that DD boars are a good alternative to pure IB boars for production of heavy pigs destined to the dry-cured industry.

Key Words: Iberian Pigs, Productive Performance, Carcass Quality

T110   Comparison of mineral content in beef, lamb and pig meat. G. Maiorano*[1], C. Cavone[1], C. Tarasco[2], L. De Tullio[2], and E. Gambacorta[3], [1]*University of Molise, Campobasso, Italy*, [2]*ARPA Molise, Campobasso, Italy*, [3]*University of Basilicata, Potenza, Italy.*

Minerals are essential trace nutrients in man diet, and deficiency causes abnormalities of growth and metabolism. The need to constantly update nutrient composition of different meats is well beyond discussion, because of their potential usefulness for food composition databases, research studies, nutritional education and patient counselling. Therefore, this study was designed to compare mineral composition (mg/100g of edible portion) in raw meat of beef, pig and lamb. *Longissimus dorsi* muscles were collected from chilled carcasses of 17 Podolian beefs, 16 Comisana lambs and 18 Large White pigs, slaughtered at 399.3, 18.6 and 179.3 kg LW, respectively, for Na, K, Mg, Ca, Fe and Zn determination. Samples were analysed in duplicate using flame atomic absorption spectrophotometry (wave-length: Na, 589.0 nm; K, 766.5 nm; Mg, 285.2 nm; Ca, 422.7 nm; Fe, 248.3 nm; Zn, 213.9 nm), after digestion in hydrochloric acid. Data were analysed by ANOVA. By comparison with data extracted from the Italian Food Composition Tables, was observed a similar mineral composition, except for Zn and Ca of beef meat, that were highest and lowest, respectively. However, the analysis of variance showed that lamb meat has significantly (P<0.01) highest level of Zn (3.4±1.1), Fe (2.1±0.3) and Na (94.2±15.4). Whereas, pig meat was richer (P<0.01) in K (430.0±53.2) than that of beef (347.1±41.1) and lamb (364.9±22.4), but poorest (P<0.01) in Fe (1.2±0.3). When compared to values of pig, beef meat was similar for Zn (P>0.05; 1.6±1.1 vs 2.2±0.5, for beef and pig, respectively) and higher for Fe (P<0.01; 1.7±0.3 vs 1.2±0.3 for beef and pig, respectively) and Na (P<0.05; 53.2±10.5 vs 41.2±5.7 for beef and pig, respectively) amount. No significant differences were found for Ca (7.7÷10.5) and Mg (24.8÷26.5) level. By meat mineral content comparison of different meat types, lamb meat results more valuable source of Zn and Fe than that of beef and pig, but too much rich of Na; while pork meat is better for both K and Na content.

Key Words: Beef, Meat, Minerals

T111   Effect of sex and castration ages on fatty acids composition of longissimus muscle in Hanwoo. N. H. Park*[1], J. Jeong[1], S. S. Lee[1], K. C. Lee[2], and C. B. Choi[2], [1]*Livestock Research Institute, National Agricultural Cooperative Federation, Ansung, Korea*, [2]*Yeungnam University, Kyungsan, Korea.*

To determine effects of sex and castration at different ages on fatty acids composition of longissimus muscle in Hanwoo, 75 Hanwoo were randomly assigned to one of five treatments(intact, castration at 5, 8, 12 and 16Mo of age). All animals were slaughtered at 26Mo of age. Regardless of sex and ages of castration, unsaturated fatty acids(UFA) were higher than saturated fatty acids(SFA). UFA from the castration groups, animals castrated at 8Mo of age had the highest of $59.24\pm.84\%$, followed by animals castrated at $16(58.09\pm.79\%)$, $12(57.22\pm.85\%)$, and $5Mo(53.55\pm1.26\%)$ of age. Monounsaturated fatty acid(MUFA) was the highest in animals castrated at 8Mo of age and the lowest in intact animals($50.36\pm.84$ vs $47.36\pm.98\%$, $p\leq0.05$). Also UFA/SFA, MUFA/SFA and PUFA/SFA were $1.58\pm.05$, $1.35\pm.04$, and $.23\pm.02\%$, respectively, in animals castrated at 8Mo of gae showed that fatty acids composition was the best out of all. Regardless of sex and ages of castration, C16:0 and C18:1 were the highest among SFA and UFA, respectively. Animals castrated at 8Mo of age had the highest of C18:1($42.57\pm.77\%$) followed by animals castrated at $12(40.19\pm.76\%)$, $16(39.84\pm.80\%)$, $5Mo(39.48\pm.74\%)$ of age and intact animals($38.03\pm.90\%$). Except animals castrated at 16Mo of age, C14:0, C16:0, and C18:1 were higher in castration groups than in intact. The remnants of C14:1, C15:0, C16:1, C17:0, C18:0, C18:2, and C18:3 were higher in intact than castration groups. Varying the ages of castration may be used as a tool to manipulate fatty acids composition of carcass to meet market specification.

Key Words: Castration, Fatty Acids, Hanwoo

T112   Eating quality of forage-finished beef produced in Hawaii as compared to the imported mainland beef. M. DuPonte*, J. Dobbs, H. M. Zaleski, and Y. S. Kim, *University of Hawaii, Honolulu.*

Forage-finished beef contains a much lower amount of intramuscular fat, higher amount of omega-3 and unsaturated fatty acids than grain-finished beef. Forage-finished beef, however, is generally known to be less tender and less palatable than grain-finished beef. The objective of the study was to evaluate the sensory characteristics of locally-produced forage-finished beef in comparison to that of imported mainland beef. Rib steaks from 15 local forage-finished cattle, as well as 8 imported select and 8 imported choice steaks were used for sensory panel evaluation and shear force measurement. Average quality grade of the local forage-finished beef was low select. Local forage-finished beef had the lowest lipid content (3.12%) of ribeye muscle among the three beef types. Local forage-finished steaks had higher (p<0.05) shear force values than choice grade steaks. No difference in shear force was observed between the local forage-based steaks and select grade steaks. Sensory panel did not find a difference in flavor intensity and juiciness between the local forage-finished steaks and that of imported mainland beef. However, local forage-finished steaks scored lower (p<0.05) ratings in overall tenderness and overall palatability as compared to choice grade steaks. Increasing aging period of the local forage-finished steaks from 2 weeks to 3 weeks did not significantly affect the shear force and panel scoring of any of the sensory traits evaluated. Local forage-finished steaks showed wide variation in sensory traits, particularly tenderness, as compared to choice grade steaks, indicating an inconsistency in eating quality of the local forage-finished steaks. The results of this study suggest that identifying factors causing the inconsistency in tenderness of forage-finished beef is critical for a successful marketing of forage-finished beef.

Key Words: Forage-Finished Beef, Sensory Characteristics

T113   Effect of dietary lipid supplement on the performance and muscle fatty acid composition of beef bulls. D. A. Kenny*[1], R. P. Malone[1], E. Jordan[1], M. G. Diskin[2], B. Murray[4], and A. P. Moloney[3], [1]*University College Dublin, Belfield, Dublin, Ireland.*, [2]*Teagasc Research Centre, Athenry Co. Galway, Ireland.*, [3]*National Food Centre, Ashtown, Co. Dublin, Ireland*, [4]*Grange Research Centre, Dunsany, Co. Meath, Ireland.*

This study was designed to examine the effect of two different soyaoil supplementation strategies as well as the combination of soyaoil with fishoil, on tissue concentrations of conjugated linoleic acid (CLA) in cattle. Forty-eight continental cross bulls with a mean ± s.e. age and liveweight of 244 ± 2.29 days and 347 ± 3.63 kg respectively, were blocked on age, bodyweight, and breed and within block, randomly assigned to one of four dietary treatments over a 100-day finishing period. Animals were individually offered straw (10% of DMI) and barley based concentrate rations (90% of DMI) ad libitum. The concentrates contained one of the following: (i) no added lipid (CON); (ii) whole untreated soyabeans (WSB); (iii) 6% soyabean oil (SO), or (iv) 4% soyabean oil and 2% fish oil (FSO). Treatments (ii) to (iv) included 6% added oil in the dry matter and were isonitrogenous (18% CP). Feed intake was monitored on a daily basis. Following slaughter steaks were recovered from the M. longissimus dorsi and were analysed for fatty acid profile by GC. Daily DMI was lower for animals on WSB and FSO (P < 0.05) than CON and SO. Average daily gain, slaughter weight and carcass weight did not differ (P>0.05) between animals on CON, SO and FSO but tended (P=0.07) to be lower for animals on WSB when compared to FSO. The weight of kidney and channel fat (KCF) was highest for animals on SO. Intramuscular fat content was not different (P>0.05) between treatments. Concentrations of TVA were higher (P<0.001) in FSO and SBO than CON or WSB. The concentration of CLA cis-9, trans-11, was higher in animals on the supplemented treatments than on CON (P<0.001) and there was a tendency for this fatty acid to be higher in animals on SO (P=0.09). The omega-6:omega-3 ratio was lowest for FSO (P<0.001). Inclusion of soyaoil or a blend of fish and soya oil can increase tissue CLA concentration and feed conversion efficiency while maintaining satisfactory animal performance relative to a cereal based diet. Steaks from animals fed a combination of fish and soyaoil also had a low -6:-3 fatty acid ratio, which would be of additional benefit to human health.

Key Words: CLA, Fatty Acids, Beef

T114   Meat quality on female calves feeding high oil corn. G. J. Depetris*[1], F. J. Santini[1,2], E. L. Villarreal[1], E. E. Pavan[1], and D. H. Rearte[1], [1]*INTA EEA Balcarce, Balcarce, Argentina*, [2]*Fac. Cs. Agrarias, UNMdP, Argentina.*

Forty-two Angus female calves (FC; 160 ± 12 kg BW) were fed for 70-d on high concentrate diet consisting of either high oil corn (T1; 75% of ration) or conventional corn (T2; 75 % of ration). Twelve FC (248.8 ± 2.5 kg BW; P=0.17) per treatment were slaughtered in a commercial abattoir to carry out the carcass measurements. After 24 h postmortem, *Longissimus dorsi m.* (LM, 11th to 13th rib) was removed and cut into 15 cm steaks and frozen (-20ºC) for latter analysis of Warner-Bratzler shear force (WBSF), meat color (L* a* and b*), muscle ultimate pH, cooking loss and i.m. fatty acid (FA) composition. Carcass weight was affected by diet (T1:137.8 vs. T2: 133.5 kg; P = 0.07), but no differences was observed in dressing percentage (T1: 54.82 and T2: 54.24 %; P = 0.29). Kidney fat and total LM lipid content was greater (P = 0.03) in T1 (2.63 kg, 2.96 %) than in T2 (2.03 kg, 2.34%). Female calves fed T1 have a higher proportion (mg/100 mg fatty acid) of saturated FA (T1: 40.0 vs. T2: 38.4; P = 0.02) and conjugated linoleic acid *cis-9 trans-11* (CLA; T1: 0.36 vs. T2: 0.30; P = 0.09) than those fed T2 and lower proportion of unsaturated FA (T1: 47.84 and T2: 50.03; P = 0.01). No diet effect for n-3, n-6 FA, momounsaturated FA and polyunsaturated FA was observed (0.69, 7.97, 39.82, 9.11 mg/100 mg FA, respectivamente). FC fed T1 had lower WBSF (T1:4.05 vs. T2: 5.10 kg P < 0.05) and muscle pH values (T1: 5.56 vs. T2: 5.97; P < 0.01) but higher b* value (T1: 15.93 vs T2: 13.37). No differences were observed for a* and L* value or for cooking losses (%) between treatments (14.82, 36.21, 30.0%; P > 0.05). These data suggest that substituting high oil corn for conventional corn in diets for finishing FC improved meat quality by decreasing the ultimate pH and by increasing tenderness and i.m. fat content, however, although high oil corn tend to increase the desired CLA in the i.m. fat also increased the proportion of the less desired saturated FA.

Key Words: High Oil Corn, Female Calves, Meat Quality

T115 Predicting beef tenderness: the relationship between myosin light chain 1 and fast myosin heavy chain fragments. R. Johnson*, J. Sawdy, M. Updike, N. St-Pierrre, and M. Wick, *The Ohio State University*, *Columbus*.

A correlation study was conducted to determine the relationship between the electrophoretic fingerprint quantity of myosin light chain I (MLC1) and the electrophoretic fingerprint quantity of fast myosin heavy chain (fMyHC) fragments from longissimus dorsi taken at 36 h post-harvest from cattle with differing Warner-Bratzler shear force values at 7 d. Data were analyzed using SAS; Proc Corr. Although the electrophoretic fingerprint intensities of MLC1 and both fMyHC fragments were predictive of tenderness at 7 d, neither of the two fMyHC fragments band intensities were correlated with each other. However, MLC1 band intensity was found to have a correlation of 0.5 with the individual band intensities of each fMyHC fragment (p ≤ 0.05). Analyses of these results support the hypothesis that an increased association of MLC1 with fMyHC results in an improvement in meat quality. This implies that fMyHCs that are associated with higher MLC1/MLC3 ratio are more susceptible to proteolytic digestion than are fMyHCs with lower MLC1/MLC3 ratios.

Key Words: Tenderness, Myosin, Fingerprinting

T116 Enhancement with varying phosphate types, concentrations, and pump rates, without sodium chloride on beef biceps femoris quality and sensory characteristics. R. T. Baublits*, F. W. Pohlman, A. H. Brown, and Z. B. Johnson, *University of Arkansas*, *Fayetteville*.

Beef biceps femoris muscles (n = 45) were used to evaluate the effect of enhancement with solutions containing either sodium hexametaphosphate (SHMP), sodium tripolyphosphate (STPP), or tetrasodium pyrophosphate (TSPP) at either 0.2% or 0.4% of product weight, without sodium chloride. All solutions were injected into muscle samples at either 112% (12% pump) or 118% (18% pump) of raw product weight. Muscles enhanced with STPP or TSPP had a higher (P < 0.05) pH than SHMP or untreated muscles (CNT), whereas there was no difference (P > 0.05) in pH between SHMP and CNT. Muscles enhanced with STPP had less (P < 0.05) free water than CNT, whereas SHMP and TSPP did not differ from CNT. However, direct comparison of phosphate types revealed no difference (P > 0.05) in free water. Steaks enhanced with SHMP had greater (P < 0.05) cooking losses than CNT, whereas steaks treated with STPP or TSPP did not differ (P > 0.05) from CNT. Additionally, phosphate inclusion at 0.2% allowed for greater (P < 0.05) cooking losses than CNT, whereas 0.4% phosphate inclusion exhibited similar (P > 0.05) cooking losses as CNT. Although there were no differences (P > 0.05) in cooking loss between pump rates, steaks enhanced at an 18% pump rate had greater (P < 0.05) cooking losses than CNT, whereas those enhanced at 12% had similar (P > 0.05) cooking losses as CNT. Enhancement with either of the three phosphate types or either concentration did not improve (P > 0.05) sensory tenderness or juiciness characteristics compared to CNT, but enhancement at an 18% pump rate al-

lowed for increased (P < 0.05) tenderness, compared to a 12% pump rate. These results suggest that, while phosphate enhancement independent of sodium chloride generally produced similar yields and palatability as untreated samples, utilizing higher phosphate concentrations, or utilizing STPP or TSPP effectively retained the additional water associated with solution enhancement, allowing for similar free water and cook yields as untreated samples.

Key Words: Beef, Phosphate, Sodium Chloride

T117 Enhancement effects of phosphate type, concentration, and pump rate, without sodium chloride on beef biceps femoris instrumental color characteristics. R. T. Baublits*, F. W. Pohlman, A. H. Brown, and Z. B. Johnson, *University of Arkansas*, *Fayetteville*.

Enhancement of beef biceps femoris muscles (n = 45) with solutions comprising sodium hexametaphosphate (SHMP), sodium tripolyphosphate (STPP), or tetrasodium pyrophosphate (TSPP) at either 0.2% or 0.4% of product weight, with the exclusion of sodium chloride, was performed to observe the independent phosphate effects on whole-muscle instrumental color during simulated retail display. All solutions were injected into muscle samples at either 112% (12% pump) or 118% (18% pump) of raw product weight. All three phosphate types maintained higher (P < 0.05) L* values than untreated steaks (CNT) through 5 days of display, and SHMP had higher (P < 0.05) L* values than STPP and TSPP through 7 days of display. Additionally, steaks with 0.2% phosphate inclusion were lighter (L*; P < 0.05) than CNT throughout display, and were lighter (P < 0.05) than steaks enhanced with 0.4% phosphates through 7 days of display. Steaks enhanced with TSPP had higher (P < 0.05) a* values than CNT on days 5 and 7 of display, whereas SHMP- or STPP-enhanced steaks had similar (P > 0.05) a* values as CNT. Direct comparison of phosphate concentrations revealed no differences (P > 0.05) in a* values. Steaks enhanced with TSPP had higher (P < 0.05) proportions of oxymyoglobin (630/580 nm) than CNT on days 5 and 7 of display. However, direct comparison of phosphate types indicated that TSPP- and STPP-enhanced steaks had similar (P > 0.05) oxymyoglobin proportions during display. Phosphate inclusion at 0.4% maintained higher (P < 0.05) oxymyoglobin proportions than 0.2% phosphate inclusion through 5 days of display. These results indicate that while 0.2 % phosphate concentrations maintain lighter color (L*), 0.4% concentrations can more effectively retain oxymyoglobin during display. Additionally, steaks enhanced with TSPP were redder (a*) and had higher oxymyoglobin proportions than untreated steaks during the latter stages of display.

Key Words: Beef, Phosphate, Instrumental Color

T118 Withdrawn.

Nonruminant Nutrition: Amino Acids and Dietary Restrictions

T119 Development of the enzymes of homocysteine metabolism from birth through weaning in the pig. D. M. Ballance* and J. D. House, *Department of Animal Science*, *University of Manitoba, Winnipeg, MB, Canada*.

In humans, non-human primates and rats, cysteine (CYS) is considered to be a conditionally indispensable amino acid. Developmental delays in the activity levels of a key enzyme from the transulphuration pathway, cystathionine-β-synthase (CBS) and cystathionine-γ-lyase (CGL) may contribute to the limitation in endogenous CYS availability. As CYS is an important precursor for protein and glutathione synthesis, information on the developmental patterns of these enzymes for the pig is important for the optimization of diets for cysteine delivery, especially when pigs are weaned at an early age. To this end, a study was designed to measure the activities of CBS and CGL, and associated metabolite profiles, from birth through to post-weaning in the pig. Piglets were

collected from eight litters at six time points: Days 0 (pre-suckle), 1, 9, 18 (pre-wean), 19 (post-wean) and 26. Blood was collected and plasma retained for total CYS and homocysteine (HCY) measurements. Piglets were killed by overdose of barbiturates, and livers and kidneys were weighed and retained for CBS and CGL activity measurements and CYS levels. Hepatic activities for both CBS and CGL were low at birth and increased (P < 0.001) immediately thereafter. Plasma CYS and HCY levels were lowest at birth and increased 2.5- and 5-fold, respectively, up to weaning, with levels declining post-weaning (P < 0.001). Despite changes in enzyme activities and plasma concentrations, hepatic CYS levels were constant from birth through weaning, but increased by 50% at d 26. The current data provide evidence that hepatic CBS and CGL activities increase from birth, providing a partial explanation for changes in plasma CYS and HCY levels. However, hepatic CYS levels appear to be insensitive to changes