

## Meat Science and Muscle Biology

**W151 Traceability of animal byproducts in quail (*Coturnix coturnix japonica*) tissues using carbon-13 and nitrogen-15 stable isotopes.** C. Mori\*<sup>2</sup>, E. A. Garcia<sup>1</sup>, C. Ducatti<sup>1</sup>, J. C. Denadai<sup>1</sup>, and K. Pelicia<sup>1</sup>, <sup>1</sup>São Paulo State University, Botucatu, São Paulo, Brazil, <sup>2</sup>São Paulo State University, Registro, São Paulo, Brazil.

Consistent information on meat products consumed by the public is essential. The technique of stable isotopes is a powerful tool to recover consumer confidence, as it allows the detection of animal byproduct residues, particularly in quail meat. This study aimed at checking the presence of poultry byproduct mixtures in quail diets by applying the technique of carbon (<sup>13</sup>C/<sup>12</sup>C) and nitrogen (<sup>15</sup>N/<sup>14</sup>N) stable isotopes in quail breast muscle, keel, and tibia. Sixty 4 one-day-old male quails were obtained from commercial farm. Birds were randomly distributed into 8 experimental treatments, and fed diets containing poultry offal meal (POM), bovine meat and bone meal (MBM) or poultry feather meal (PFM), or their mixtures. Four birds per treatment were slaughtered at 42 d of age, and breast (Pectoralis major), keel, and tibia were collected for analyses. Isotopic analyses of feed ingredients, feeds, and tissues were carried out at the Center of Stable Environmental Isotopes of the Biosciences Institute (CIE/IB), UNESP, Botucatu campus. Isotopic carbon (<sup>13</sup>C/<sup>12</sup>C) and nitrogen (<sup>15</sup>N/<sup>14</sup>N) ratios were determined in a isotopic ratio mass spectrometer (IRMS) type DELTA S (Finnigan Mat) coupled to an Elementary Analyzer (EA 1108 CHN). The obtained isotopic results were submitted to multivariate analysis of variance (MANOVA) using GLM (General Linear Model) procedures of SAS statistical software. Data were generated by error matrices for each tissue, which were later graphically distributed in regions (ellipses) with 95% confidence of observing possible differences between experimental treatment means and control treatment means. The inclusion of animal byproducts in quail diets was detected by <sup>13</sup>C/<sup>15</sup>N analyses in the tissues of the birds; however, it was not possible to specify which byproducts were used. It was concluded that quail meat can be certified by the technique of stable isotopes.

**Key words:** animal byproducts, meat quails, stable isotopes

**W152 Meat quality of Pelibuey sheep finished with different levels of alfalfa.** V. Resendiz-Cruz<sup>1</sup>, O. Hernandez-Mendo<sup>1</sup>, J. Gallegos-Sanchez<sup>1</sup>, I. Guerrero-Legarreta<sup>2</sup>, P. A. Martinez-Hernandez<sup>3</sup>, and G. Aranda-Osorio\*<sup>3</sup>, <sup>1</sup>Colegio de Postgraduados, Montecillos, Estado de Mexico, Mexico, <sup>2</sup>Universidad Autonoma Metropolitana-Iztapalapa, Mexico D.F., Mexico, <sup>3</sup>Universidad Autonoma Chapingo, Chapingo, Estado de Mexico, Mexico.

The objective of this study was to evaluate the effect of feeding different levels of alfalfa to sheep on meat quality and fatty acid profile. For this purpose, 36 Pelibuey male sheep with initial live weight mean of 22.3 ± 0.3 kg were finished for 11 weeks. They were distributed homogeneously into 4 groups of 3 each, with 3 replicates per group, and then randomly assigned to each of the following treatments: 0, 20, 30 and 40% alfalfa (dry basis). Meat chemical composition, color, shear force in raw and cooked meat, water activity (Aw), water holding capacity (WHC) and fatty acid profile (FAP), were evaluated. A completely random design under Proc GLM of SAS was used, and a mean comparison with Tukey test was done. Results about ether extract are stated later and includes discussions of fatty acid content. The red index (a) of meat was more intense ( $P \leq 0.05$ ) for the control animals diet than for the alfalfa treatments. The resistance to the cut of raw and cooked meat, and the WHC, did not show differences ( $P$

$\geq 0.05$ ) between treatments, averaging 1.4 and 2.5 kg/cm<sup>2</sup>, and 18.5 mL/100 g of meat, respectively. The Aw was higher when animals were fed with no alfalfa in the diet ( $P \leq 0.05$ ). Within the fatty acid profile, only myristic, palmitic, palmitoleic, stearic and oleic acids, were higher ( $P \leq 0.05$ ), 49.6, 553.8, 47.9, 326.6, and 1075.4 mg/100g, respectively, when sheep received no alfalfa, followed by those with 20, 30 and 40% alfalfa. CLAc9 was higher (18.8 mg/100g) ( $P \leq 0.05$ ) when included 20% alfalfa in the diet, followed by those with 40, 30 and 0% alfalfa, with values of 15.0, 14.7, and 12.0 mg/100g, respectively. Meat from animals fed with alfalfa in the diet, had lower ( $P \leq 0.05$ ) amounts of fatty acids, with higher proportion of unsaturated fatty acids, compared with those with the control diet. These results suggest that including alfalfa in the diet of finishing sheep, improves fatty acid profile and, it is proposed as a viable alternative to meet current demand of healthier food.

**Key words:** lambs, alfalfa, meat characteristics

**W153 Meat quality of lambs fed fresh or dehydrated spineless cactus (*Opuntia ficus-indica*).** M. I. Aguilar-Yañez<sup>1</sup>, O. Hernandez-Mendo<sup>1</sup>, G. Aranda-Osorio\*<sup>2</sup>, J. E. Ramirez-Briebesca<sup>1</sup>, I. Guerrero-Legarreta<sup>3</sup>, and M. M. Crosby-Galvan<sup>1</sup>, <sup>1</sup>Colegio de Postgraduados, Montecillos, Estado de Mexico, Mexico, <sup>2</sup>Universidad Autonoma Chapingo, Chapingo, Estado de Mexico, Mexico, <sup>3</sup>Universidad Autonoma Metropolitana-Iztapalapa, Mexico D.F., Mexico.

The objective of this study was to evaluate meat quality and fatty acid profile of lambs supplemented with fresh or dehydrated spineless cactus (*Opuntia ficus-indica*). Twenty-seven crossbred male lambs with initial live weight mean of 21.4 ± 2.18 kg were finished for 11 weeks of different treatment diets. They were distributed homogeneously into 3 groups of 9 each, and then randomly assigned to each of the following treatments: (T1) control diet, (T2) diet with 17% (dry basis) of dehydrated cactus, and (T3) diet with 17% (dry basis) of fresh cactus. Color, texture of raw and cooked meat, water activity (Aw), water holding capacity (WHC) and fatty acid profile were evaluated. A completely random design under Proc GLM of SAS was used, and when statistical differences were observed, a mean comparison was done using the Tukey test. Meat chemical analysis, color and texture, were not different ( $P \geq 0.05$ ) between treatments, neither were the percentage of total fatty acids, saturated, monounsaturated or polyunsaturated. The only difference was found on WHC ( $P \leq 0.001$ ), which was greater when feeding fresh and dehydrated cactus, than that with no cactus, with values of 32.13, 30.50, and 25.58 mL/100g of meat, respectively. These results suggest that the inclusion of cactus into the finishing lamb diets, had similar benefits on meat quality than that of the commercial one, which makes cactus a viable feeding strategy.

**Key words:** cactus, sheep, meat characteristics

**W154 Qualitative characteristics of meat from lambs fed with sunflower seeds and vitamin E.** F. A. Almeida\*, A. G. Silva Sobrinho, G. M. Manzi, N. L. L. Lima, N. M. B. L. Zeola, V. Endo, and J. C. Barbosa, Universidade Estadual Paulista - Unesp/ Campus de Jaboticabal, Jaboticabal, São Paulo, Brasil.

Health professionals recommend diets low in saturated fatty acids. It is possible to obtain leaner carcasses or to increase levels polyunsaturated acids in meat from cattle and sheep by feed them with sun-

flower seeds. Supplementation of diets with vitamin E increases the  $\hat{I} \pm$  -tocopherol concentration of muscle and improves color stability of beef and lamb meat. The objective of this study was to evaluate the qualitative characteristics pH, color, water holding capacity, cooking loss and tenderness of the Longissimus dorsi muscle from Ile de France lambs fed with diets that contain sunflower seeds and vitamin E. Thirty 2 lambs were used with an average body weight of 15 kg, which were housed in individual stalls. The work consisted of 4 treatments as it follows: D1 - sugarcane + concentrate without sunflower seeds; D2 - sugarcane + concentrate with sunflower seeds; D3 - sugarcane + concentrate without sunflower seeds and 1000 mg vitamin E/kg of dry matter (DM) from the diet; D4 - sugarcane + concentrate with sunflower seeds and 1000 mg vitamin E/kg of DM from the diet. The experimental design was completely randomized, with a factorial scheme 2x2 (2 diets (with or without the inclusion of sunflower seeds) x 2 levels of vitamin E (0 and 1000mg/kg DM diet)). The qualitative characteristics were not influenced by the sunflower seeds and vitamin E with the exception of the variable b\* (yellowness) was higher in meat of the lambs fed with diets that contain sunflower seeds and vitamin E (3.74), sunflower seeds without vitamin E (2.47) and vitamin E without sunflower seeds (2.20), than in meat of the lambs fed with diets without sunflower seeds and vitamin E (-0.12). The meat pH ranged from 5.47 to 5.57, L\* (lightness) from 39.42 to 40.85, a\* (redness) from 12.70 to 13.79, water holding capacity from 60.96 to 64.87, cooking loss from 36.16 to 38.01 and tenderness from 2.35 to 2.64. Finally, it could be concluded that the values found for the qualitative characteristics studied are consistent with the guidelines for lamb meat. Sunflower seeds and vitamin E may be used to feed lambs without harming the quality of meat.

**Key words:** qualitative characteristics, lamb meat, nutrition

**W155 Effects of nutritional plane and selenium supply during gestation in primiparous ewes on offspring skeletal muscle development.** C. A. Schwartz\*, W. L. Keller, T. L. Neville, L. P. Reynolds, D. A. Redmer, A. M. Meyer, C. J. Hammer, K. A. Vonnahme, J. S. Caton, and K. R. Maddock-Carlin, *Department of Animal Sciences, North Dakota State University, Fargo.*

To investigate the effects of nutritional plane and selenium (Se) supply during gestation, serviced ewes were stratified by BW and randomized to receive diets formulated to contain either adequate Se (ASe; 3.5  $\mu\text{g Se}\cdot\text{kg BW}^{-1}\cdot\text{d}^{-1}$ ) or high Se (HSe; 65  $\mu\text{g Se}\cdot\text{kg BW}^{-1}\cdot\text{d}^{-1}$ ). On d 40 of gestation 42 ewes from each Se treatments were assigned randomly to 1 of 3 nutritional planes supplying 60% (RES), 100% (CON), or 140% (HI) of NRC requirements. At birth, lambs were given artificial colostrum for the first 20 h and then ad libitum access to feed and milk replacer. On d 21, lambs were stunned and exsanguinated. LM, semi-membranosus (SM), and psoas major (PM) muscles were harvested and snap frozen for later analyses of  $\mu$ -calpain autolysis by Western blotting, cellularity, myosin heavy chain types 1 and 2 by SDS-PAGE, and  $\mu$ -calpain and calpastatin mRNA expression by RT-PCR. Autolysis of  $\mu$ -calpain in the PM was greater ( $P = 0.01$ ) in lambs from HSe supplemented ewes as compared with ASe ewes. The LM DM percentage in lambs from HI ewes was greater ( $P = 0.02$ ) than that in lambs from RES ewes. Protein in the SM from HI lambs was greater ( $P = 0.03$ ) than that from RES lambs. The RNA and RNA:DNA in the LM were greater ( $P < 0.02$ ,  $P < 0.04$ , respectively) in the ASe RES lambs than in the ASe HI lambs. HSe RES lambs had lower LM protein than that from ASe HI. The RNA:DNA in the LM HSe HI was greater ( $P < 0.03$ ) than that in the HSe RES. Overall, the protein:DNA was greater in the PM than in LM and SM while the RNA:DNA was greater in SM

than in PM and LM.  $\mu$ -Calpain autolysis was less ( $P < 0.01$ ) in the PM of HSe RES lambs than in the PM of HSe HI lambs while autolysis in the LM of the ASe CON tended ( $P < 0.07$ ) to be greater than all other treatment groups. Of all muscles, the LM had less ( $P < 0.04$ )  $\mu$ -calpain autolysis than both the SM and PM muscles. Maternal Se supply and nutritional plane appeared to have an influence on offspring skeletal muscle protein expression and cellularity. We can conclude that the interaction of maternal Se and nutritional supplementation may affect fetal skeletal muscle growth and development.

**Key words:** skeletal muscle, selenium, calpain

**W156 Maternal dietary protein affects transcriptional regulation of myostatin gene distinctively at weaning and finishing stages in skeletal muscle of Meishan pigs.** X. Liu, J. Wang, R. Li, X. Yang, Q. Sun, and R. Zhao\*, *Nanjing Agricultural University, Nanjing, P. R. China.*

Skeletal muscle is susceptible to nutritional programming and myostatin is identified as a potential mediator of offspring phenotype. In this study, we determined the effects of maternal dietary protein on transcriptional regulation of myostatin in skeletal muscle of pig offspring. Sixteen Meishan sows were fed either low-protein (LP) or standard-protein (SP) diets throughout gestation and lactation, and myostatin expression in the longissimus dorsi muscle were determined both at weaning and finishing stages. Myostatin mRNA abundance was downregulated at weaning, but upregulated at finishing in LP pigs, indicating stage-specific transcriptional regulation of myostatin. At weaning, CCAAT enhancer binding protein (C/EBP $\beta$ ) expression in nuclear lysate was decreased in LP piglets, associated with diminished binding of C/EBP $\beta$  to all the 3 putative binding sites at myostatin promoter. None of the histone modification marks showed differences between SP and LP piglets. Among 12 microRNAs predicted to target myostatin, none was differently expressed between 2 groups. At finishing stage, C/EBP $\beta$  expression remained unchanged, but the binding of C/EBP $\beta$  to 1 of the 3 putative binding sites increased in LP pigs. H3Ac and H3K27Me3 modifications on myostatin promoter were increased, while H3K9Me1 decreased in LP pigs. Moreover, ssc-miR-136 and ssc-miR-500 expression reduced significantly. These results indicate that maternal dietary protein affects myostatin expression through distinct transcriptional regulation mechanisms at different stages. The immediate effect at weaning is mediated by C/EBP $\beta$  binding without epigenetic modifications, whereas the long-term effect at finishing stage involves both C/EBP $\beta$  binding and epigenetic regulations including histone modification and microRNA expression.

**Key words:** Meishan pig, maternal dietary protein, skeletal muscle

**W157 Linear mixed models built with the stepAIC function in the R environment for evaluation of TPA and WBSF.** A. Dufek\*<sup>1,2</sup>, J. Subrt<sup>3</sup>, and J. Simeonovova<sup>3</sup>, <sup>1</sup>Research Institute for Cattle Breeding, Ltd., Vיקyrovice, Czech Republic, <sup>2</sup>Agriresearch Rapotin Ltd., Vיקyrovice, Czech Republic, <sup>3</sup>Mendel University in Brno, Brno, Czech Republic.

The first aim of this work was to test the significance of selected fixed and random effects on Warner-Bratzler Shear Force (WBSF [N]) and Texture Profile Analysis (TPA [N.cm<sup>-2</sup>]). The second aim was to determine the efficiency of the R software for quick fitting linear mixed models using a new combination of 2 functions: the lme function in the package nlme to test significance of random effects and the stepAIC function in the MASS package to test the significance of fixed effects.

Random effects were put into the models at nested levels – animals within a sire. Further, the stepAIC selected automatically from the fixed effects: aging time, sex and age of animal, carcass mass, length of quarters, weight and proportion of longissimus muscle (LM), and others. Log-transformed and centered data were used in the case of aging time in relation to the WBSF decline. The LM (n = 70) was divided into 4 samples, vacuum packed, stored at 2–4°C and analyzed 48 h, 16, 30 and 44 d post-mortem. In both cases (WBSF and TPA) the random effects analyses showed that only the subject affected dependent variables. In the case of model for WBSF, the stepAIC selected 5 significant fixed effects (AIC declined from 2786.8, model with no fixed effect, to 2347.8 for the final model): the estimates of parameters of the final model revealed that higher values for aging time, weight of fat and weight of LM resulted in lower values of WBSF (reg. coef. -24.2,-2.7,-3.7, resp.). Higher values for age of animals resulted in higher WBSF (reg. coef. 0.1). Steers had lower WBSF (74 N) than heifers (81 N) or bulls (84 N). In the case of model for TPA the stepAIC selected 5 significant fixed effects (AIC declined from 3313.7 to 3303.8): the parameters of the final model revealed that higher values for proportion of separable fat and length of quarters resulted in lower values of TPA (reg. coef. -9.9,-2.1, resp.). Higher values for aging time, weight of bones and age of animals resulted in higher values of TPA (reg. coef. 1.2,4.0,0.2, resp.). Data indicate that the lme and stepAIC functions are useful for fitting of mixed models when hypotheses on more fixed effects are tested.

**Key words:** AIC, mixed, meat

**W158 Effect of kidney matrix on the detection of  $\beta$ -lactam and tetracycline residues by UPLC-MS/MS.** M. P. Almeida<sup>1,2</sup>, M. O. Leite<sup>\*2</sup>, S. V. Cançado<sup>2</sup>, M. R. Souza<sup>2</sup>, and M. M. O. P. Cerqueira<sup>2</sup>, <sup>1</sup>Lanagro-MG/Ministério da Agricultura, Pecuária e Abastecimento, <sup>2</sup>Escola de Veterinária - Universidade Federal de Minas Gerais.

Antimicrobials are widely used in veterinary medicine, mostly in livestock as therapeutic, prophylactic, and growth promoters. The indiscriminate use of them may lead to the presence of their residues in foods. Most methods recommended for  $\beta$ -lactam and tetracycline detection use ultra performance liquid chromatograph (UPLC) connected to a mass spectrometer, commonly referred to as UPLC/MS/MS system. Biological matrices are very complex and interfere on the analytes compromising their quantification. The aim of this work was to study the influence of the kidney matrix on the detection and quantification of  $\beta$ -lactam and tetracycline residues by UPLC-MS/MS. The following drugs were studied:  $\beta$ -lactam - ampicillin, cefazolin, penicillin G, nafcillin, cloxacillin, dicloxacillin, oxacillin, penicillin V, and penicillin G deuterated (N-ethylpiperidin) as internal standard, and tetracyclines – chlortetracycline, oxytetracycline, and tetracycline. Pure standard calibration curves and matrix curves were prepared at the concentrations of 0.50, 0.75, 1.00, 1.25, and 1.50xLMR7 in 3 different days. The matrix curve was prepared from the extraction of swine kidney blank samples (2g) with water/acetonitrile (8:2), followed by purification in hexane, and Bond Elut C18 dispersive phase. The curves were simultaneously injected and compared by F test and Student's t- test, point to point, at 95% significance level. The slopes and intercepts were also compared by t-test using the same aforementioned significance level. Significant effect of matrix on the studied analytes was observed even with the use of  $\beta$ -lactam internal standard. Tests of slope and intercept at 95% significance level indicated a significant effect of the matrix in search of the tetracyclines. Penicillin G was the only substance that had no effect on all tests. As significant

influence of the kidney matrix on the detection and quantification of  $\beta$ -lactam and tetracycline residues by UPLC-MS/MS was observed, kidney samples should be carried out using the matrix curve.

**Key words:** antimicrobial residues, matrix effect, mass spectrometry

**W159 Extent of  $\mu$ -calpain autolysis differs depending on the extent of destructured tissue in the ham.** M. Müller<sup>2</sup>, C. Biolley<sup>1</sup>, P. Silacci<sup>1</sup>, and G. Bee<sup>\*1</sup>, <sup>1</sup>Agroscope Liebefeld Posieux Research Station (ALP), Posieux, Switzerland, <sup>2</sup>Swiss College of Agriculture, SHL, Zollikofen, Switzerland.

Destructured zones in cooked hams cause great economic losses to the Swiss meat industry. In previous studies it has been reported that these zones can be observed already at 24 h postmortem (pm) in the outer portion of the semimembranosus muscle (SM). These observations suggested that pm processes might be causally linked to these problems. Thus the objective of the study was to determine the relationship between the extent of tissue destruction, muscle pH decline,  $\mu$ -calpain autolysis and desmin degradation in the SM. To achieve these objectives, 12 pigs were selected the day after slaughter and their SM were classified into 1 of 3 classes: 1 = none; 2 = mild and 3 = strong tissue destruction in the outer portion of the SM. Using a cylindrical cutting device, muscle samples from the outer (O), middle (M) and deeper (D) portion of each muscle were obtained. The samples were prepared for immunoblotting with antibodies against  $\mu$ -calpain 80-kDa subunit and desmin. The class 1 SM originated from lighter (7.7 vs. 8.2 and 8.2 kg;  $P < 0.10$ ) hams than those from class 2 and 3. Compared with class 3, the SM in class 1 tended (5.7 vs. 5.4;  $P < 0.10$ ) to have higher 3 h pm pH with intermediate values for those in class 2 (5.5). No ( $P > 0.10$ ) pH differences among classes were observed at 45 min and 24 h pm. In the M- and I-portion but not the O-portion, marked class effects were observed for the relative abundance of the unautolyzed (80 kDa)  $\mu$ -calpain subunit and its autolysis products (78 and 76 kDa) at 24 h pm. Compared with the classes 2 and 3, the 80-kDa band was less ( $P < 0.10$ ) abundant and the 76-kDa band was more ( $P < 0.10$ ) abundant in the M- and I-portion of class 1 samples. In the I-portion the abundance of intact desmin was lower ( $P = 0.05$ ) in class 1 than class 2 with intermediate values for class 3. In accordance, the abundance of a degradation product was numerically higher ( $P = 0.14$ ) in class 1 samples. These data indicate that extent of visible tissue destruction may affect autolysis of  $\mu$ -calpain also in the deeper portion of the muscle.

**Key words:**  $\mu$ -calpain autolysis, proteolysis, ham

**W160 Early adaptation of sarcoplasmic reticulum  $Ca^{2+}$  pump in bovine myofiber under chronic low-frequency electrical stimulation.** T. Sakurada<sup>\*1</sup>, E. Kitagawa<sup>1</sup>, M. Miyake<sup>1,2</sup>, S. Ohwada<sup>1</sup>, H. Aso<sup>1</sup>, and K. Watanabe<sup>1</sup>, <sup>1</sup>Tohoku University, Sendai, Japan, <sup>2</sup>The University of Tokushima, Tokushima, Japan.

SERCA (Sarcoplasmic reticulum  $Ca^{2+}$  pump,  $Ca^{2+}$ -ATPase) is one of crucial regulators of muscular contraction, which is involved in transferring of cytosolic  $Ca^{2+}$  into sarcoplasmic reticulum (SR). SERCA is classified into 2 isoforms: fast-type SERCA1a in fast myofiber and slow-type SERCA2a in slow myofiber. Chronic low-frequency electrical stimulation (CLFS) changes myofiber type from fast to slow. The fast-to-slow transformation of myofiber by CLFS exhibits drastic turnover of myofilaments and finally remodeling of whole myofiber, however, in bovine, no information of CLFS effect on muscle has been reported. In this study, we investigated mechanism of adaptation for CLFS in the bovine longissimus lumborum (LL) muscle, especially

focused on expression of SERCA. Six Holstein male calves were used: 3 calves were CLFS group (5 Hz, 24 h/day) and 3 calves were control group. After 30 d of CLFS, calves were slaughtered and the LL muscles were removed. Muscle samples were quickly frozen by a mixture of dry ice and acetone. Serial frozen sections (10 µm thick) were cut on a cryostat. Then the serial sections were stained immunohistochemically with anti-myosin heavy chain (MyHC: fast and slow) and anti-SERCA (1a and 2a) antibodies. Myofiber types were classified into fast, slow, and hybrid (fast and slow co-expressed) myofibers by MyHC staining pattern. Expressions of MyHC and SERCA in myofiber types were measured by a microscopic densitometry using image analyzing software (Scion Image). Thirty days of CLFS increased percentages of slow and hybrid myofibers in the bovine LL muscle ( $P = 0.051$ ). This change of myofiber types indicated functional adaptation for endurance muscle contraction by CLFS. Expression of SERCA2a in CLFS myofibers were higher in order of slow, hybrid and fast myofibers ( $P < 0.01$ ). In CLFS hybrid myofibers, expression of slow MyHC increased in advance, and expression of SERCA2a rose subsequently. This fast-to-slow transition pattern suggests that the CLFS induced transformation of SERCA may need preceding upregulation of slow MyHC in the early phase of bovine myofiber type adaptation.

**Key words:** myofiber types, SERCA, CLFS

**W161 Effects of temperament classification on carcass characteristics, tenderness and value in Angus-based composite steers.** J. W. Behrens<sup>\*1</sup>, R. K. Miller<sup>1</sup>, D. S. Hale<sup>1</sup>, J. T. Walter<sup>1</sup>, J. C. Bailey<sup>1</sup>, A. N. Hafsa<sup>1</sup>, T. Machado<sup>2</sup>, L. O. Tedeschi<sup>1</sup>, and G. E. Carstens<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Texas A&M University at Kingsville, Kingsville.

Angus-based composite steers ( $n = 508$ ; initial BW =  $310 \pm 56$  kg) obtained over 3 years from Rex Ranch were used in this study. Steers were fed a high-grain diet (ME = 3.08 Mcal/kg DM) and feed intakes measured using a GrowSafe system for 70 d. Thereafter, steers were fed in group pens and harvested at an average backfat thickness of 1.2 cm in 2 groups. Exit velocity (EV), measured as the rate of distance traveled (m/s) while exiting from a squeeze chute, was used as an objective measure of temperament. Within year, steers were classified into calm, moderate and excitable temperament groups based on  $\pm 0.50$  SD from the mean EV. Steers were commercially harvested and USDA Yield and Quality grade characteristics determined. Carcass weights tended ( $P = 0.13$ ) to be lighter in excitable than calm steers ( $312.7$  vs  $306.7 \pm 3.37$  kg). Warner-Bratzler (WBSF) and Slice shear force (SSF) values were measured on top loin steaks after 1, 7, and 14 d of vacuum-packaged storage at 2°C. Carcasses from calm and moderate steers had lower ( $P = 0.005$ ) d 7 SSF values ( $9.29$  and  $9.09$  vs  $9.99 \pm 2.58$  kg) and tended to have lower ( $P = 0.06$ ) d 7 WBSF values ( $2.08$  and  $2.02$  vs  $2.14 \pm 0.053$  kg) than excitable steers, respectively. One and 14 d WBSF and SSF values and carcass Yield and Quality grades were not affected ( $P > 0.10$ ) by temperament classification. Carcass value (\$/kg) was determined using a grid formula based on premiums for Quality grade (Prime = +0.11), and discounts for carcass weight (<250 kg = -0.37; > 454 kg = -0.44), Quality grade (Select = -0.18; Standard = -0.44), Yield grade (>5 = -0.40; > 4 and <5 = -0.24) and tenderness assessment (WBSF >3.9 kg = -0.44). Carcass value tended ( $P = 0.09$ ) to be lower for steers with excitable temperaments compared with steers with calm temperaments ( $1038.11$  vs  $1013.93 \pm 11.89$  \$/carcass, respectively). Temperament classification did not affect carcass characteristics, but tended to affect carcass value of Angus-based steers. Steers with excitable temperaments had higher

7 d SSF values, suggesting that temperament classification of steers may influence carcass tenderness.

**Key words:** temperament, tenderness

**W162 Rump measurements as related to others carcass traits.** M. N. Bonin<sup>\*1</sup>, S. L. Silva<sup>1</sup>, J. B. S. Ferraz<sup>1</sup>, D. P. D. Lanna<sup>2</sup>, F. Manicardi<sup>1</sup>, R. C. Gomes<sup>1</sup>, M. H. A. Santana<sup>1</sup>, V. N. Barbosa<sup>1</sup>, F. Novais<sup>1</sup>, J. H. A. Campo<sup>1</sup>, and F. Syuffi<sup>1</sup>, <sup>1</sup>University of Sao Paulo, College of Animal Science and Food Engineering, Pirassununga, Sao Paulo, Brazil, <sup>2</sup>University of Sao Paulo, College of Agricultural Sciences, Piracicaba, Sao Paulo, Brazil.

Ultrasound carcass traits, such as ribeye area (UREA), backfat thickness (UBFT) and rump fat thickness (RFT) are used to estimate carcass composition in beef cattle. Additionally, others traits obtained on the rump may also be correlated to traditional carcass traits and contribute to predict retail product yield in beef cattle. Therefore, the aim of this study was to evaluate the correlations between rump measurements and carcass traits evaluated by ultrasound. A total of 410 Nelore bulls, with 18 mo of age, grass fed and reared in the Paraná State, Brazil, were evaluated by ultrasound scanning. A first image was collected of Longissimus dorsi muscle at 12th and 13th ribs for measures of UREA and BFT. A second image was obtained from Gluteus medius muscle to measure RFT and Gluteus medius depth (GDT). Images were collected utilizing an Aloka 500V equipment with a 3.5–Mhz, 17.2–cm linear array transducer. Other traits obtained were the rump width (RWD) and length (RLG), defined as the distance between the tuber coxae extremities and between the hip and the pin bone, respectively. The traits were correlated by simple Pearson correlations analyses using the statistical procedure PROC CORR of SAS. Positive correlations were found between UREA and GDT ( $r = 0.50$ ;  $P < 0.0001$ ), RWD ( $r = 0.39$ ;  $P < 0.0001$ ), RLG ( $r = 0.38$ ;  $P = 0.0001$ ), UBFT ( $r = 0.09$ ;  $P = 0.08$ ) and RFT ( $r = 0.16$ ;  $P = 0.002$ ). The high correlation between UREA and GDT indicates that these measures could be adequate indicators of rump primal cuts yield. High correlations were found between UBFT and RFT ( $r = 0.53$ ;  $P < 0.0001$ ) and a low correlation between BFT and GDT ( $r = 0.08$ ;  $P = 0.12$ ) and between RFT and GDT ( $r = 0.10$ ;  $P = 0.04$ ), indicating that GDT measurements could not explain large variations in the rump fat depth. The GDT presented medium correlation with RWD ( $r = 0.28$ ;  $P < 0.0001$ ) and RLG ( $r = 0.26$ ;  $P < 0.0001$ ). Results suggest that measurements obtained on the rump can be used as auxiliary in vivo measures to predict carcass composition and rump primal cuts yield in beef cattle.

**Key words:** *Bos indicus*, gluteus medius, ultrasound

**W163 Effect of finishing heifers on tall fescue, tall fescue with grain, or alfalfa on: I. carcass and LM quality.** S. K. Duckett<sup>\*1</sup>, M. C. Miller<sup>1</sup>, T. A. Burns<sup>1</sup>, and M. L. Wahlberg<sup>2</sup>, <sup>1</sup>Clemson University, Clemson, SC, <sup>2</sup>Virginia Tech University, Blacksburg.

Angus heifers ( $n = 40$ ) were used to evaluate the effect of finishing on endophyte-free tall fescue (TF), TF with grain (TF+G), or alfalfa (AL) on carcass and LM quality. Heifers were finished on TF or AL to 2 time endpoints, which corresponded to 161 or 189 d of grazing. The TF+G heifers also grazed TF for 161 or 189 d and after adaptation were offered corn grain ad libitum for a total of 56 or 84 d before slaughter. Carcasses were graded at 24 h postmortem and one rib obtained. Two steaks were removed from the posterior end of the rib for Warner-Bratzler shear force (WBS) and proximate composition. Hot carcass weight was greater ( $P < 0.05$ ) for AL than TF and TF+G.

Fat thickness, KPH, marbling score and quality grade were higher ( $P < 0.05$ ) for AL than TF and TF+G. There was a 10% incidence of dark cutters; however, no effect of dietary treatment or slaughter time was observed. Longissimus muscle pH and objective color scores ( $L^*$ ,  $a^*$ ,  $b^*$ ) did not differ ( $P > 0.05$ ) by dietary treatments or slaughter time. Supplementation of corn grain during the grazing period did not alter ( $P > 0.05$ ) WBS in ribeye steaks aged 14 d. Warner-Bratzler shear force averaged 2.89 kg across all treatments. Total lipid content of the ribeye steaks was higher ( $P < 0.05$ ) for AL than TF or TF+G. Total saturated fatty acid concentration was higher ( $P < 0.05$ ) for AL and TF compared with TF+G. Monounsaturated fatty acid concentration was higher ( $P < 0.05$ ) for TF+G than TF. Omega-6 polyunsaturated fatty acid (PUFA) concentration was highest ( $P < 0.05$ ) for TF+G-84d and lowest ( $P < 0.05$ ) for TF-189d. The ratio of omega-6 to omega-3 PUFA was higher ( $P < 0.05$ ) for TF+G-84d than for TF+G-56d, which were both higher ( $P < 0.05$ ) than AL or TF. Concentration of conjugated linoleic acid (CLA), cis-9 trans-11 isomer, was highest ( $P < 0.05$ ) for TF+G-56d and TF-189d. Extending time of grain supplementation on TF lowered ( $P < 0.05$ ) CLA levels compared with TF+G-56d and TF-189d. Finishing heifers on alfalfa increased carcass weight, fat thickness and marbling score. Corn grain feeding on TF increased linoleic acid and the ratio of omega-6 to omega-3 PUFA.

**Key words:** beef, forages, fatty acids

**W164 Effect of finishing heifers on tall fescue, tall fescue with grain, or alfalfa on: II. fatty acid composition and lipid oxidation in ground beef.** S. K. Duckett<sup>\*1</sup>, M. C. Miller<sup>1</sup>, T. A. Burns<sup>1</sup>, and M. L. Wahlberg<sup>2</sup>, <sup>1</sup>Clemson University, Clemson, SC, <sup>2</sup>Virginia Tech University, Blacksburg.

Angus heifers ( $n = 40$ ) were used to evaluate the effect of finishing on endophyte-free tall fescue (TF), endophyte-free tall fescue with grain (TF+G), or alfalfa (AL) on fatty acids and lipid oxidation in ground beef. Heifers were finished on TF or AL to 2 time endpoints, which corresponded to 161 or 189 d of grazing. The TF+G heifers also grazed TF for 161 or 189 d and after adaptation were offered corn grain ad libitum for a total of 56 or 84 d before slaughter. Carcasses were graded at 24 h postmortem and one rib obtained from each. The rib (6–11th rib) was trimmed to a similar fat thickness and ground. Ground beef patties were held at 2°C under lights for 0, 2, 5, 7, 9, and 11 d for lipid oxidation (TBARS) and objective color ( $L^*$ ,  $a^*$ ,  $b^*$ ) measurements. Ground beef samples were also packaged in vacuum packages or chubs for frozen storage and measurement of lipid oxidation over time (0, 30, 60, 90, 180, and 360 d). Hydrophilic and lipophilic ORAC values did not differ ( $P > 0.05$ ) by finishing treatment or slaughter time. Total lipid content was higher ( $P < 0.05$ ) for AL than TF and TF+G. Total saturated fatty acid percentage was greater ( $P < 0.05$ ) for TF and AL than TF+G. Total MUFA concentration was highest ( $P < 0.05$ ) for TF+G and lowest ( $P < 0.05$ ) for TF. Omega-3 polyunsaturated fatty acid concentration (PUFA) was highest ( $P < 0.05$ ) for AL and lowest ( $P < 0.05$ ) for TF+G. Trans-11 vaccenic acid (TVA) concentration was higher ( $P < 0.05$ ) for TF and TF+G than AL in the first slaughter time but TVA decreased in TF+G with increased time of grain feeding. Length of grain feeding increased ( $P < 0.05$ ) linoleic acid and omega-6 PUFA concentration in TF+G. Lipid oxidation on a total lipid basis (mg TBARS/kg lipid) in fresh ground beef was higher ( $P < 0.05$ ) for TF+G than TF or AL at 9 and 11 d of retail display. In frozen ground beef samples, AL had higher ( $P < 0.05$ ) TBARS values than TF and TF+G in chub packages but TBARS did not differ ( $P > 0.05$ ) among treatments in vacuum packages. Finishing heifers on TF

with grain increased omega-6 PUFA levels and lipid oxidation rates in fresh ground beef.

**Key words:** beef, forages, lipid oxidation

**W165 Gene expression profile of *M. longissimus* in Japanese Black, Holstein, and Charolais steers fed a high-energy diet.** E. Albrecht<sup>\*1</sup>, S. Ponsuksili<sup>1</sup>, K. Wimmers<sup>1</sup>, T. Gotoh<sup>2</sup>, and S. Maak<sup>1</sup>, <sup>1</sup>Leibniz Institute for Farm Animal Biology, Dummerstorf, Germany, <sup>2</sup>Kyushu University, Kuju Agricultural Research Center, Kujicho, Oita, Japan.

Cattle breeds differ largely in their capability for intramuscular fat (IMF) deposition. In an experiment comprising each 3 Japanese Black (JB), Holstein (HS), and Charolais (CH) steers, the animals received a high-energy diet typical for the production of highly marbled beef in Japan. The animals were slaughtered at 26 mo of age. The breeds differed significantly in marbling, measured via image analysis as fat area percentage (JB > HS > CH;  $P = 0.001$ ) and in the average diameter of the adipocytes (JB > HS > CH;  $P = 0.04$ ) in *M. longissimus* (LM). Total RNA was isolated from LM and RT-qPCR was conducted for selected candidate genes for marbling. There were neither significant differences in the expression of adipogenic transcription factors (CEBPB, CEBPA, PPARG) nor in downstream targets (PLIN1, ADIPOQ). A subsequent genome wide expression analysis confirmed these results (Affymetrix GeneChip Bovine Genome Array). However, pathway analyses revealed, among others, differential regulation of genes involved in calcium signaling. Beside muscle specific genes significantly upregulated in CH compared with JB and HS (RYR1, ATP2A1), we found significant differences in mRNA abundance for members of the S100 calcium binding protein family (S100A1, S100A16, S100B). Genes of this family have been linked only recently to adipogenesis and obesity in cell cultures and human, respectively. Separate analyses of their expression in dissected IMF from JB and HS revealed a more than 2.3-fold upregulation of S100B in JB ( $P = 0.005$ ). In contrast, no differences were found in IMF between both breeds for S100A1 and S100A16, indicating that the observed differential expression in LM is linked to muscle cells rather than to adipocytes. Our results demonstrate that the mRNA abundance of S100 calcium binding protein B is related to IMF content in LM of intensively fed cattle. These results underline the necessity of separate expression analyses of LM (usually containing IMF) and dissected IMF to identify markers for differences in IMF deposition between breeds.

**Key words:** cattle, gene expression, intramuscular fat

**W166 Effect of genotype on fatty acid composition of bovine muscles fattened with maize silage and flaxseed supplemented concentrate.** G. Hollo<sup>\*1</sup>, T. Somogyi<sup>1</sup>, K. Lóki<sup>1</sup>, I. Anton<sup>2</sup>, and I. Hollo<sup>1</sup>, <sup>1</sup>Kaposvár University, <sup>2</sup>Research Institute for Animal Breeding and Nutrition.

The aim of this study was to determine the intramuscular fat level (IM) and fatty acid composition in longissimus dorsi, (LD) semitendinosus (ST) and psoas major (PM) muscles of young bulls kept under the same condition and fed with flaxseed supplemented concentrate in the finishing period. Sixty-two growing bulls from Angus (A), Charolais (CH), Holstein (H), Hungarian Grey (HG), Hungarian Simmental (HS), Charolais x Hungarian Grey (CHxHG) were used. The diet consisted of maize silage ad lib., grass hay 2 kg/day, and 2-4 kg concentrate. After 450 kg live weight the concentrate contained 25% linseed supplementation. The average slaughter weight was 598.89±25.11 kg.

Muscle samples were taken after 24 hours chilling from the right half carcass. The effect of genotype and muscle was evaluated with multivariate analysis of variance GLM III (SPSS 10.0). The differences were evaluated with Tukey's test ( $P < 0.05$ ). A bulls had the highest IM level (3.76), particularly in PM (4.74), followed by HG (3.40), CHxHG (3.05), CH (2.33), HS (2.21), with the lowest level for H (2.11). IM for LD (2.87) and ST (1.77) were significantly lower than PM (3.60). SFA was significantly higher for the PM, due to the high level of IM. ST contained the highest PUFA (12.99), followed by LD (10.30) and PM (10.19). The n-6 fatty acids were affected either by breed, or by muscle type. The linoleic acid was the highest in H bulls except for PM, whilst the lowest was in all cases in A bulls. The same tendency can be seen for long chain n-6 fatty acids. The n-3 fatty acids differed among genotypes from 1.36 to 1.80%. Significant differences were shown only for PM. The n-3 long chain fatty acids were the highest level in ST of H, in LD of CH and in PM of HS bulls. The n-6/n-3 ratio was ranged from 4.48 to 6.22 and significantly higher in H than in A bulls. The highest CLA level was detected in all cases in HG bulls. The results demonstrate the clear effect of genotype on intramuscular fat content and fatty acid composition of beef despite the same housing and feeding conditions.

**Key words:** cattle, beef, fatty acid composition

**W167 Quality characteristics of dried meat laver made from different beef muscle types.** G. D. Kim<sup>\*1</sup>, E. Y. Jung<sup>1</sup>, H. U. Seo<sup>1</sup>, J. Y. Jeong<sup>2</sup>, S. J. Hur<sup>3,1</sup>, H. S. Yang<sup>1</sup>, and S. T. Joo<sup>1</sup>, <sup>1</sup>*Division of Applied Life Science (BK21 Program), Gyeongsang National University, Jinju, Republic of Korea*, <sup>2</sup>*Swine Scientific and Technology Center, Gyeongnam National University of Science and Technology, Jinju, Republic of Korea*, <sup>3</sup>*College of Biomedical and Health Science, Department of Applied Biochemistry, Konkuk University, Chungju, Republic of Korea*.

The aim of this study is to find adequate muscle type for making dried meat laver which can be used for making rice rolls. In general, a dried laver from seaweed is used for making steamed rice roll (Kimbab). However, a meat laver was made from beef meat instead of seaweed and investigated the quality characteristics of meat laver. Four types of meat lavers were made from different beef muscles: Semimembranosus m. (SM), Semitendinosus m. (ST), Gracilis m. (GR) and Extensor carpi radialis m. (EC). A homogenate made of 20 g of meat and 180 g of water was spread on the fabric (0.2x0.2 mm). The homogenate was dried for 7 h in the oven (DS-80-1, Dasol Sci. Co., Ltd., Korea) of 60°C. The quality traits of meat laver such as yield (%), proximate composition (%), surface color (CIE L\*a\*b\*) and textural properties (folding test, cutting strength) were investigated. Fat content was significantly higher in meat lavers made from SM (26.62%) and EC (26.75%) muscle than in those of ST (24.28%) or GR (24.99%) muscle ( $P < 0.05$ ). However, moisture, crude protein and crude ash content were not significantly different among the meat lavers ( $P > 0.05$ ). Yield of meat laver range from 40.57% to 41.85%, but there were no significant differences between meat lavers ( $P > 0.05$ ). The meat laver made from EC muscle had the highest CIE a\* value (45.76) of surface color among meat lavers ( $P < 0.05$ ), however, CIE L\* or CIE b\* value were not significantly different among meat lavers ( $P > 0.05$ ). The meat laver made from SM muscle had the lowest value of folding test (2.30 cm) and cutting strength (1780.00 g/cm<sup>2</sup>), however, there were no significant differences in cutting strength and folding test of meat lavers between ST muscle (2605.00 g/cm<sup>2</sup> and 3.07 cm, respectively) and EC muscle (2835.00 g/cm<sup>2</sup>, 3.33 cm, respectively) ( $P > 0.05$ ). Therefore, the results of folding test (2.30 cm) and cutting strength

(1780.00 g/cm<sup>2</sup>), which are the lowest values among the meat lavers, indicate that meat laver made from SM muscle is neither flexible nor useful for making rice rolls. In conclusion, EC muscle or ST muscle could be used for making a more flexible and red meat laver.

**Key words:** laver, beef, muscle type

**W168 Carcass characteristics of bullocks of different genotype finished under feedlot conditions.** O. V. Vazquez-Mendoza, G. Aranda-Osorio\*, M. Huerta-Bravo, E. J. Maldonado-Siman, and J. C. Garcia-Ortiz, *Universidad Autonoma Chapingo, Chapingo, Estado de Mexico, Mexico*.

The objective of this study was to evaluate the effect of breed type on carcass characteristics of young bulls finished in feedlot. There were 90 tropical bullocks fattened in a temperate region of Mexico with the following distribution: Zebu (Z) n = 5 (initial liveweight 385.6 ± 24.7 kg); European Brown Swiss (EBS) n = 8 (365.1 ± 112.4 kg); Holstein (H) n = 9 (401.6 ± 63.4 kg); Z × European Brown Swiss (Z × EBS) n = 28 (423.4 ± 46.4 kg); Z × American Brown Swiss (Z × ABS) n = 19 (399.6 ± 49.9 kg); and Z × H (Z × H) n = 21 (428.7 ± 32.6 kg). The cattle were fed with a diet based on: ground corn (43%), bakery waste (24%), corn stalks (20%), soybean meal (8%), mineral premix (1.5%), bypass fat (Enervit®, Zuavit; 1%), buffer (18.2% Na and 8.4% Mg; 0.5%) and zilpaterol hydrochloride (Zilmax®, Intervet; 6.7 mg kg<sup>-1</sup>) to fulfill the requirements for this type of livestock. Variables evaluated for feedlot performance were: average daily gain (ADG) and final liveweight (FLW). Variables evaluated for carcass attributes were: hot carcass weight (HCW), hot carcass yield (HCY), backfat depth (BFD), ribeye area (REA), physiological age (PA), fat percentage on kidney, pelvis and heart (KPH), marbling score (M), carcass conformation (CONF), and carcass fatness (CF). Data were analyzed using the GLM procedure of SAS, taking days of finishing, type of breed × days of finishing and initial and final liveweight as covariates. The Z × ABS presented the highest ( $P = 0.001$ ) ADG. The greatest ( $P = 0.017$ ) FLW was for Z × ABS ≥ EBS ≥ H. The genotype did not affect ( $P = 0.161, 0.143, 0.218$ ) HCW, HCY or BFD, but the REA was larger ( $P = 0.012$ ) for the EBS. The H and EBS bullocks exhibited the lowest ( $P = 0.001$ ) PA; although the H cattle had greater ( $P = 0.006$ ) KPH. The best ( $P = 0.014$ ) CONF was obtained by the Z × ABS and Z × EBS genotypes. The greatest amount of M ( $P = 0.001$ ) was found for the H breed. There were not differences ( $P ≥ 0.05$ ) on CF among genotypes. The crossbred genotypes showed better feedlot performance and carcass characteristics, and it seems that Holstein breed could have a potential from the marbling score point of view.

**Key words:** beef cattle, finishing, carcass attributes

**W169 Relationship between meat quality and the expression of related genes in the muscle of two different genetic groups of cattle.** J. Giusti<sup>1</sup>, E. P. Castan<sup>1</sup>, S. R. Balain<sup>2</sup>, M. D. B. Arrigoni<sup>2</sup>, M. Dal Pai-Silva<sup>2</sup>, and H. N. Oliveira<sup>\*1</sup>, <sup>1</sup>*State University of Sao Paulo, Jaboticabal, Sao Paulo, Brazil*, <sup>2</sup>*State University of Sao Paulo, Botucatu, Sao Paulo, Brazil*.

All body functions and traits of living beings are controlled by specific genes, and for meat quality is not different. In this paper we correlate  $\mu$ -calpain, m-calpain, Thyroglobulin (TG), diacylglycerol acyltransferase 1 (DGTA1) and leptin (LEP) gene expression to meat quality of longissimus dorsi in 2 beef cattle genetic groups: Nellore and Canchim. We analyzed 15 young bulls of each breed. The animals were kept at the experimental feedlot facilities of the College of Veterinary

Medicine and Animal Science of UNESP, Botucatu. They were fed with the same diet and kept under the same management conditions. Animals were slaughtered at minimum weight of 470 kg and 4 mm of fat thickness accessed by ultra-sound. Samples of longissimus dorsi were collected for meat traits analysis (marbling), total lipids contents (TL), shear force (SF) and myofibrillar fragmentation index (MFI) at zero and 7 d postmortem and gene expression analysis, using qRT-PCR technique. Among the meat quality traits, MFI and TL contents were different between groups ( $P < 0.01$  and  $P < 0.03$ , respectively). The calpains did not show differential gene expression or correlations with meat traits between groups. Among genes involved in metabolism of fat, DGTA1 did not show difference between groups ( $P < 0.87$ ). However, a positive correlation was observed between DGTA1 and SF ( $r = 0.51$ ,  $P < 0.05$ ) and negative correlation between DGTA1 and MFI ( $r = -0.52$ ,  $P < 0.05$ ) at 7 d postmortem. In Nellore breed, in contrast, the correlation was negative to SF at the d 7 ( $r = -0.75$ ,  $P < 0.01$ ). The TG gene expression did not differ between groups ( $P < 0.15$ ), however it has been negatively correlated in both breeds to the MFI on day zero ( $r = -0.52$ ,  $P < 0.05$ ). With the results, we conclude that the tender meat phenotype is not obtained only by the action of genes related to it, but by the handling of carcasses in the postmortem. Therefore, more studies should be conducted joining these parameters to understand the processes between gene expression and phenotype, enabling the development of breeds adapted to produce quality beef.

**W170 Measurement of loin muscle in the carcass of Nellore breed on *Brachiaria brizantha* ‘Marandu’ with two levels of concentrate supplementation.** S. L. S. Cabral Filho<sup>\*1</sup>, R. V. Oliveira<sup>1</sup>, J. M. S. Diogo<sup>1,2</sup>, R. A. Mandarino<sup>1</sup>, C. F. Lobo<sup>1</sup>, F. A. Oliveira<sup>1</sup>, and G. S. Firmino<sup>1</sup>, <sup>1</sup>Universidade de Brasília, Brasília, Distrito Federal, Brasil, <sup>2</sup>Fazenda Experimental Agua Limpá, Brasília, Distrito Federal, Brasil.

The objective of this study was to measure loin muscle area in the carcass of Nellore cattle grazing in *Brachiaria brizantha* ‘Marandu’, with 2 levels of concentrate supplementation. A total of 30 Nellore bulls at 22 mo of age with average weight of 330.42 kg and final slaughter weight of 477.94 kg were used. The supplement consisted of corn, sunflower meal, soybean hulls, urea and minerals, and the treatments were SCONF1 - average daily intake of supplement of 0.91% of body weight in dry matter (DM) and SCONF2 - average intake of daily supplement of 1.42% of live weight, DM basis. The statistical design was randomized blocks with 2 treatments and 3 replications. Data were subjected to ANOVA the averages were compared by Duncan test at 5% of significance level. After the slaughter the carcass was proceeded to skinning, gutting, separation of the 2 symmetrical halves of the body (right and left), weighed and cooled for 24 h at 3°C. Longissimus dorsi area (AOL) and subcutaneous fat (SF) were measured between the 12th and 13th rib. There was no statistical difference ( $P > 0.05$ ) among treatments for AOL, which showed average values of 74.50 and 70.33 cm<sup>2</sup> for SCONF1 and SCONF2, respectively. However, levels of supplementation affected ( $P < 0.05$ ) SF, and the treatment SCONF2 showed higher values (2.70 mm) compared with SCONF1 (2.00 mm). Supplementation did not impact AOL but increased subcutaneous fat with a higher supplementation level.

**Key words:** *Bos indicus*, supplement, meat quality

**W171 Frame size and sex effects on meat quality characteristics of Nellore cattle.** S. L. Silva\*, R. C. Gomes, A. F. Rosa, M. D. Poleti, M. N. Bonin, T. M. C. Leme, J. L. F. Souza, L. M. Zoppa, and

P. R. Leme, *Universidade de São Paulo (FZEA/USP), Pirassununga, SP, Brazil.*

Large frame cattle and intact males produce leaner carcasses which can affect meat tenderness due to cold shortening during the chilling process. Because the beef meat production in Brazil is based on Nellore (*Bos indicus*) intact males, it is necessary to investigate the effects of sex and frame size (FS) on carcass quality in this breed. The aim was to evaluate carcass and meat quality traits of Nellore young bulls and steers from different FS, finished under feedlot conditions. Throughout 2009 and 2010, Nellore bulls ( $n = 75$ ,  $500 \pm 4.5$  BW, 23-mo old) and steers ( $n = 80$ ,  $474 \pm 6.1$  BW, 23-mo old) from small ( $n = 51$ ), medium ( $n = 53$ ) and large ( $n = 50$ ) frame size, according to BIF, were finished in feedlots receiving high-grain diets for 50d to 140d. Following slaughter, carcasses were weighed (HCW), chilled for 24h (0–2°C) and then ribbed between 12th/13th ribs for determination of Longissimus muscle (LM) area (LMA) and backfat thickness (BFT). LM samples were removed, vacuum packaged and aged 1d, 7d or 14d postmortem for Warner-Bratzler shear force (WBSF) and cooking loss (CL) determinations. Data analysis included the fixed effects of sex, FS, year and sex x FS interaction. There were no sex x FS interactions for any trait ( $P > 0.05$ ). Intact males had heavier carcasses (154 vs. 142 kg;  $P < 0.0001$ ), greater LMA (73.7 vs. 67.3 cm<sup>2</sup>;  $P < 0.0001$ ) and lower BFT (4.8 vs. 5.5 mm;  $P = 0.0012$ ) than castrated males. Sex did not affect WBSF on 1d (9.7 kg) and 14d postmortem (6.7 kg) but WBSF was lower for castrated cattle than for intact males (7.7 vs 8.5 kg;  $P < 0.0001$ ). Large FS cattle showed heavier HCW than small FS animals (151 vs. 145 kg,  $P = 0.0028$ ). There was no effect of FS in LMA (70 cm<sup>2</sup>), BFT (5.1 mm) and WBSF (9.3, 7.7 and 6.8 kg for 0, 7 and 14 d of aging, respectively). Meat CL were not affected by sex or frame size. Despite the high WBSF values observed in this work (greater than 4.5 kg), the results indicate that meat quality attributes are not greatly affected by sex or FS in Nellore cattle. It is likely that the fat thickness of carcasses from both intact and castrated males was enough to avoid problems of cold shortening during chilling process.

**Key words:** beef cattle, carcass, tenderness

**W172 Carcass traits obtained at the fifth rib level to predict retail cuts in Nellore (*B. indicus*) cattle.** J. L. F. Souza\*, S. L. Silva, R. C. Gomes, M. N. Bonim, P. Z. Silva Neto, and P. R. Leme, *Universidade de São Paulo/ Faculdade de Zootecnia e Engenharia de Alimentos, Pirassununga, São Paulo, Brazil.*

Measurements conducted on Longissimus muscle (LM) at the 12th rib level are traditionally associated to lean meat yield. However, in the Brazilian industry, carcasses are sectioned into hindquarter and forequarter at the 5th to 6th ribs, making unfeasible the exposure of LM at the 12th rib in packing plants. Therefore, the objective was to estimate predicting equations of retail product weight (RPW) and percentage (RPP) in relation to cold carcass weight (CW) using traits measured on LM at the 11th/12th (LM12) and 5th/6th (LM5) by video image analysis (VIA) of Nellore bulls carcasses. Seventy-six bulls were feedlot finished and slaughtered ( $523 \pm 34$  kg BW, 22-mo old) following humanitarian procedures. The left carcass side was broken into wholesale cuts and digital images were taken of the LM5 and LM12 surfaces. Wholesale cuts were weighed and broken into retail product, bones and trimmings. Retail product was defined as the sum of all cuts trimmed to a fat thickness of 5 mm. The Lince software (M&S Consultoria Ltda. Pirassununga, SP, Brazil) was used to analyze LM images. For the LM5 images, the evaluated traits were rib eye area (REA5), rib thickness (RIBT), intermuscular fat thickness (INTERFAT5) and

subcutaneous fat thickness (SFT5). In LM12 images, the rib eye area (REA12) and subcutaneous fat thickness (SFT12) were obtained. Multiple regression analyses were carried out to estimate predicting equations for RPW and RPP using measurements obtained by VIA as independent variables. Traits that best explained RPW and RPP were selected using stepwise regression and entered into the prediction equation. Using LM12 traits, the best equations for RPW and RPP were RPW (kg) = 10.63502 + 0.06402\*REA12 + 0.76071\*CW ( $R^2 = 0.94$ ; SEP = 2.38); and RPP (%) = 67.47563 + 0.06252\*REA12;  $R^2 = 0.09$ ; SEP = 1.56). Using LM5 traits, the best equations were RPW (kg) = 14.78075 + 0.23758\*REA5 + 0.28579\*BFT5 + 0.79065\*CW; ( $R^2 = 0.94$ ; SEP = 2.38) and RPP (%) = 62.87192 + 0.16159\*REA5 - 0.17820\*BFT5 + 0.04108\*CCW;  $R^2 = 0.21$ ; SEP = 1.46). Results indicated that LM measurements obtained at the 5th rib level can be used to predict retail product yield in Nellore cattle.

**Key words:** edible portion, Longissimus muscle, video image

**W173 The influence of two levels of supplementation on the yield of hindquarter cuts of Nellore in *Brachiaria brizantha* 'Marandu'.** R. V. Oliveira<sup>\*1</sup>, F. A. Barbosa<sup>2</sup>, J. M. S. Diogo<sup>1</sup>, G. S. Firmino<sup>1</sup>, J. F. A. Oliveira<sup>1</sup>, J. F. B. Guedes<sup>1</sup>, I. S. Silva<sup>1</sup>, and G. A. Carneiro<sup>1</sup>, <sup>1</sup>Faculty of Agronomy and Veterinary Medicine, University of Brasilia - UnB, Brasilia, DF, Brazil, <sup>2</sup>School of Veterinary Medicine, Federal University of Minas Gerais - UFMG, Belo Horizonte, MG, Brazil.

This study was conducted to evaluate the yields of cuts from the carcasses from the young cattle raised under semi-confinement system, grazing *Brachiaria brizantha* cv Marandu with 2 levels of dietary supplementation (0.91 or 1.42% of BW, dry matter basis). Thirty Nellore bulls were used, with medium age of 22 mo, average of 330.42 kg live weight and 477.94 kg slaughter weight. The dietary supplementation was based on corn, sunflower meal, soybean hull, urea and minerals. The statistical design was randomized blocks design with 2 treatments and 3 replications, and the Duncan test was applied at 5% significance level. After slaughter, the carcasses were cooled during 24 h at 3°C. The right half-carcasses (hindquarter) were separated in the following cuts: eye of rump, cap of rump, flatround, inside, loin, tenderloin, eye of round and knuckle. There was no influence ( $P > 0.05$ ) of the supplementation levels on the weights of the cuts, which had average values of 4.28 kg of eye of rump, 1.60 kg of cap of rump; 6.40 kg of flatround, 10.30 kg of inside; 8.16 kg of loin; 2.47 kg of tenderloin, 2.86 kg of eye of round and 5.58 kg of knuckle. The yields of the cuts were not affected by treatments ( $P > 0.05$ ), obtaining average values of 6.57% of eye of rump, 2.46% of cap of rump, 9.81% of flatround, 15.79% of inside, 12.52% of loin, 3.79% of tenderloin, 4.38% of eye of round and 5.58% of knuckle. The different levels of supplementation resulted in similar weight and yields for all cuts, suggesting the use of the intake level of 0.90% to Nellore without negatively affecting in the carcass quality.

**Key words:** *Bos indicus*, commercial cuts, concentrated

**W174 Influence of two levels of supplements on the characteristics of cuts yields of carcass in Nellore cattle grazing *Brachiaria brizantha* 'Marandu'.** R. V. Oliveira<sup>\*1</sup>, J. F. A. Oliveira<sup>1</sup>, F. A. Barbosa<sup>2</sup>, F. F. Gouveia<sup>1</sup>, G. A. Carneiro<sup>1</sup>, J. M. S. Diogo<sup>1</sup>, J. F. B. Guedes<sup>1</sup>, and R. A. Mandarino<sup>1</sup>, <sup>1</sup>Faculty of Agronomy and Veterinary Medicine, University of Brasilia - UnB, Brasilia, DF, Brazil, <sup>2</sup>School

of Veterinary Medicine, Federal University of Minas Gerais - UFMG, Belo Horizonte, MG, Brazil.

The objective of this study was to evaluate the yields of carcass cuts of cattle submitted to the semi-confinement system, with 2 different levels of supplement intake during 6 mo, grazing *Brachiaria brizantha* cv Marandu. Thirty Nellore bulls 22 mo old were used, with an average body weight (BW) of 330.42 kg and final slaughter weight of 477.94 kg. The supplement consisted of corn, sunflower meal, soybean hulls, urea and minerals. There were 2 treatments: SCONF1 - average daily intake of 0.91% of BW of supplement in the dry matter (DM); and SCONF2 - average daily intake of 1.42% of BW of supplement, in the DM. The statistical design was randomized blocks design with 2 treatments and 3 replications, and the Duncan test was applied at 5% significance level. After the slaughter, the carcass was divided in 2 symmetrical halves, weighed and cooled for 24 h at 3°C. The right half-carcasses were separated in the following cuts: hindquarter (HIND) which covers the posterior region of the carcass separated in the fifth and sixth ribs at a distance of approximately 20 cm from the spine; forequarter (FORE), which includes neck, shoulder, arm and 5 ribs; and spare ribs (SR) which includes the region of the sixth rib over the abdominal muscles. The cuts were weighed individually and their proportion to the cold half-carcass determined. There was no influence of the supplementation level on the cuts weights, which presented values of 60.85 and 66.53 kg for FORE, 64.45 and 65.20 kg for HIND and 15.50 and 15.47 for SR, in treatments SCONF1 and SCONF2, respectively. The yields of FORE, HIND and SR were 44.21, 45.05 and 10.74%, respectively, and did not show statistical difference between treatments ( $P > 0.05$ ). The different supplementation levels provided similar weights and yields of cuts, suggesting that ingestion of 0.91% of BW of animals can be adopted in semi-confinement systems, without losing carcass quality.

**Key words:** *Bos indicus*, beef cattle, special hindquarter

**W175 Effect of different levels of whole raw soybean grain on performance and meat characteristics of feedlot finished Nellore steers.** N. R. B. Consolo<sup>\*</sup>, A. S. C. Pereira, J. R. Gandra, R. Gardinal, C. S. Takiya, P. Barros J. Carvalho, F. P. Renno, J. E. Freitas Junior, G. D. Calomeni, and R. D. Mingoti, Universidade de Sao Paulo, Pirassununga, Sao Paulo, Brasil.

The aim of this study was to evaluate the performance and carcass quality of steers fed whole raw soybeans at increasing inclusion levels. Fifty-four Nellore with mean weight and age of 350 kg and 24 mo were fed for 84 d with 4 isoproteic diets of 15% crude protein: T0, with 0% of whole raw soybean grain, T8, with 8% whole raw soybean grain, T16, with 16% whole raw soybean grain and T24, with 24% whole raw soybean grain, on dry matter basis. Steers were allotted to 4 pens and assigned to a completely randomized design. Animals were weighed at 28 d intervals after 18 h fasting to evaluate the performance. Animals were slaughtered in the commercial plant, according to proper welfare guidelines, and hot carcass weight, carcass yield, liver weight were evaluated. Twenty-four hours later, *Longissimus* muscle area and backfat thickness was measured at the interface of the 12th and 13th ribs. *Longissimus* muscle samples were aged 14 d with temperature varied between 0°C and 4°C for Shear force (SF) analysis. SF was obtained with Warner Bratzler equipment. Effects of treatments were evaluated using SAS software. No difference ( $P > 0.05$ ) was observed for the measured variables: performance ( $1.82 \pm 0.09$  kg/d), hot carcass weight ( $284.07 \pm 4.65$ kg), carcass yield ( $53.45 \pm 0.52\%$ ), liver weight ( $5.69 \pm 0.19$ kg), muscle area and backfat thickness ( $74.61 \pm$

2.46mm<sup>2</sup> and 2.08 ± 0.26mm). However, shear force characteristics had a quadratic effect ( $P > 0.05$ ) with the highest scores for the treatment with 8% of soybean grain (7.17 kgf), which differed from the T0 (5.61 kgf) treatment but not the other treatments. The inclusion of whole raw soybean grain in beef cattle diets at the trial levels did not affect performance and carcass traits except for a slight increase in shear force at 8% grain inclusion levels.

**Key words:** protein source, tenderness, ruminants

**W176 Genetic group and slaughter weight influence on meat color of feedlot cattle.** R. Mello<sup>\*1</sup>, A. C. de Queiroz<sup>2</sup>, F. D. de Resende<sup>3</sup>, L. A. de Miranda Gomide<sup>2</sup>, P. B. Costa<sup>2</sup>, and W. da Silva Cotrim<sup>2</sup>, <sup>1</sup>Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil, <sup>2</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, <sup>3</sup>Agência Paulista de Tecnologia dos Agronegócios, Colina, São Paulo, Brazil.

The purpose of this study was to investigate the genetic group and slaughter weight influence on meat color of the cattle. Thirty-six young (20 mo) bulls, 18 crossbred F1 Red Angus × Nelore (1/2 RA 1/2 N) and 18 F1 Blonde D'Aquitaine × Nelore (1/2 BA 1/2 N) were used. The young bulls were feedlot finished and slaughtered at 480, 520 and 560 kg of shrunk body weight (SBW). A completely randomized experimental design of a 2 × 3 (2 genetic groups × 3 slaughter weights) factorial arrangement with 6 replicates was used. The animals were slaughtered in a commercial slaughter-house. The meat color evaluation was carried out in the Longissimus dorsi muscle at 13th rib. Data were analyzed with SAS<sup>®</sup> software using initial SBW as a covariate. The table below shows the least squares means of L\* (luminosity), a\* (redness), b\* (yellowness), c\* (saturation) and h\* (hue). There was no effect ( $P > 0.05$ ) of genetic group on color indexes. The interaction between genetic group and slaughter weight was not significant ( $P > 0.05$ ) for all color traits. As the slaughter weight increased, the hue (h\*) increased ( $P < 0.05$ ) and a\*/b\* ratio decreased ( $P < 0.05$ ). Accordingly, lighter weight animals at slaughter produced meat with better visual appearance of color than animals slaughtered at heavier weights, regardless of breed.

**Table 1.** Least squares means

	Genetic Group (GG)		Slaughter Weight (SW)			CV	SEM
	½ RA ½ N	½ BA ½ N	480	520	560		
L*	39.73	40.24	39.29	40.46	40.21	4.6	0.30
a*	4.87	5.07	4.89	5.39	4.64	14.9	0.12
b*	6.60	7.32	6.44	7.14	7.30	16.2	0.20
c*	8.24	8.93	8.12	8.97	8.66	13.4	0.20
h*	53.12	55.22	52.02 <sup>b</sup>	52.95 <sup>ab</sup>	57.53 <sup>a</sup>	8.9	0.89
a*/b*	0.77	0.70	0.80 <sup>a</sup>	0.76 <sup>ab</sup>	0.64 <sup>b</sup>	19.6	0.03

Within a row, means followed by different capital and small letters differ ( $P < 0.05$ ), respectively, among GG and SW by Tukey test.

**Key words:** beef cattle, *Longissimus dorsi*, young bulls

**W177 C18:1,2,3 fatty acid isomers from intramuscular fat influenced by genetic group and slaughter weight.** R. Mello<sup>\*1</sup>, A. C. de Queiroz<sup>2</sup>, F. D. de Resende<sup>3</sup>, D. P. D. Lanna<sup>4</sup>, M. H. de Faria<sup>3</sup>, and E. da Costa Eifert<sup>4</sup>, <sup>1</sup>Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil, <sup>2</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, <sup>3</sup>Agência Paulista de Tecnologia dos

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The work was carried out to evaluate the effect of genetic group (GG) and slaughter weight (SW) on C18:1, C18:2 and C18:3 fatty acid isomers of intramuscular fat from Longissimus dorsi muscle at 13th rib. Thirty 6 young (20 mo) bulls, 18 crossbred F1 Red Angus × Nelore (1/2 RA 1/2 N) at 447.7 ± 5.8 kg of shrunk body weight (SBW) and 18 F1 Blonde D'Aquitaine × Nelore (1/2 BA 1/2 N) at 444.3 ± 6.5 kg of SBW were used. The animals were in compensatory growth because previously to the beginning of the experiment they remained for 2 mo at Brachiaria brizantha pasture under continuous grazing system. The young bulls were feedlot finished and slaughtered at 480, 520 and 560 kg of SBW. A completely randomized experimental design in a 2 × 3 (2 genetic groups × 3 slaughter weights) factorial arrangement with 6 replicates was used. Data were analyzed with SAS software using initial SBW as a covariate. The table below shows the least squares means of dependent variables. The backfat thickness increased ( $P < 0.05$ ) as slaughter weight rised, being 2.1, 2.7 and 4.4 mm, respectively, for animals slaughtered at 480, 520 and 560 kg. The 1/2 BA 1/2 N young bulls had higher ( $P < 0.05$ ) cis-13 C18:1 and cis-9 trans-11 C18:2 (CLA) levels than 1/2 RA 1/2 N young bulls. As the slaughter weight rised the trans, trans-9, trans-11 and trans-16 C18:1; cis-9 trans-11 and trans-10 cis-12 C18:2 (CLA); and cis-9,12,15 and cis-6,9,12 C18:3 levels decreased ( $P < 0.05$ ); while cis, cis-9 and cis-12 C18:1 levels increased. The interaction between GG and SW was not significant ( $P > 0.05$ ) for all levels of C18:1,2,3 fatty acid isomers. Therefore, crossbred F1 Blonde D'Aquitaine × Nelore young bulls and lighter animals had better profile of C18:1,2,3 fatty acid isomers in the intramuscular fat than F1 Red Angus × Nelore young bulls and heavier animals.

**Table 1.** Least squares means

	Genetic Group		Slaughter Weight		
	½ RA ½ N	½ BA ½ N	480	520	560
C18:1					
cis-9	32.42	33.49	32.01 <sup>b</sup>	32.3 <sup>ab</sup>	34.53 <sup>a</sup>
cis-13	0.26 <sup>B</sup>	0.31 <sup>A</sup>	0.27	0.27	0.32
trans-9	0.16	0.17	0.19 <sup>a</sup>	0.18 <sup>a</sup>	0.13 <sup>b</sup>
trans-11	0.85	1.03	1.15 <sup>a</sup>	1.00 <sup>ab</sup>	0.66 <sup>b</sup>
C18:2					
cis-9 trans-11 (CLA)	0.24 <sup>B</sup>	0.30 <sup>A</sup>	0.34 <sup>a</sup>	0.27 <sup>b</sup>	0.21 <sup>c</sup>
trans-10 cis-12 (CLA)	0.02	0.01	0.02 <sup>ab</sup>	0.03 <sup>a</sup>	0.005 <sup>b</sup>
C18:3					
cis-9,12,15	1.16	1.05	1.35 <sup>a</sup>	1.13 <sup>ab</sup>	0.84 <sup>b</sup>
cis-6,9,12	0.10	0.09	0.10 <sup>a</sup>	0.09 <sup>ab</sup>	0.08 <sup>c</sup>

Within a row, means followed by different capital and small letters differ ( $P < 0.05$ ), respectively, among GG and SW by Tukey test.

**Key words:** conjugated linoleic acids, *trans* stereoisomer, young bulls

**W178 Fatty acids profile of intramuscular fat from crossbred young bulls slaughtered at different body weights.** R. Mello<sup>\*1</sup>, A. C. de Queiroz<sup>2</sup>, F. Dutra de Resende<sup>3</sup>, D. P. D. Lanna<sup>4</sup>, M. H. de Faria<sup>3</sup>, and E. da Costa Eifert<sup>4</sup>, <sup>1</sup>Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil, <sup>2</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, <sup>3</sup>Agência Paulista de Tecnologia dos

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The aim was to investigate fatty acids profile of intramuscular fat from Longissimus dorsi muscle at 13th rib of crossbred bulls at different body weights. Thirty 6 young (20 mo) bulls, 18 crossbred F1 Red Angus × Nellore (1/2 RA 1/2 N) at 447.7 ± 5.8 kg of shrunk body weight (SBW) and 18 F1 Blonde D’Aquitaine × Nellore (1/2 BA 1/2 N) at 444.3 ± 6.5 kg of SBW were used. The animals were in compensatory growth. The young bulls were feedlot finished and slaughtered at 480, 520 and 560 kg of SBW. A completely randomized experimental design in a 2 × 3 (2 genetic groups × 3 slaughter weights) factorial arrangement with 6 replicates was used. Data were analyzed with SAS<sup>®</sup> software using initial SBW as a covariate. The table below shows the least squares means of dependent variables. The backfat thickness increased ( $P < 0.05$ ) as slaughter weight rised, being 2.1, 2.7 and 4.4 mm, respectively, for animals slaughtered at 480, 520 and 560 kg. The 1/2 BA 1/2 N young bulls had higher ( $P < 0.05$ ) monounsaturated fatty acids levels than 1/2 RA 1/2 N young bulls. As the slaughter weight rised the n-3 fatty acids levels decreased ( $P < 0.05$ ). Thus, crossbred F1 Blonde D’Aquitaine × Nellore young bulls and lighter animals had better fatty acids profile in the intramuscular fat than F1 Red Angus × Nellore young bulls and heavier animals.

**Table 1.** Least squares means

FA	Genetic Group		Slaughter Weight			SEM
	½ RA ½ N	½ BA ½ N	480	520	560	
Short-chain	0.2	0.2	0.2	0.2	0.1	0.01
Medium-chain	33.2	33.2	32.6	33.2	33.8	0.5
Long-chain	60.3	60.2	60.2	60.4	60.3	0.3
Very long-chain	4.0	4.0	4.6	3.9	3.4	0.3
Odd-chain	2.3	2.4	2.4	2.3	2.3	0.1
Saturated	46.7	46.0	45.9	46.9	46.4	0.5
MUFA	42.8 <sup>B</sup>	44.3 <sup>A</sup>	43.4	42.9	44.4	0.4
PUFA	10.4	9.6	10.7	10.2	9.2	0.5
n-3	3.0	3.0	3.6 <sup>a</sup>	3.0 <sup>ab</sup>	2.5 <sup>b</sup>	0.2
n-6	7.7	6.8	7.3	7.5	7.0	0.3

Within a row, means followed by different capital and small letters differ ( $P < 0.05$ ), respectively, among GG and SW by Tukey test.

**Key words:** breed, feedlot, *Longissimus dorsi*

**W179 Effects of modified wet corn distillers grains containing 6.7% fat on beef quality and rib fat composition.** J. L. Veracini<sup>\*1</sup>, P. M. Walker<sup>1</sup>, B. R. Wiegand<sup>2</sup>, H. L. Evans<sup>2</sup>, R. L. Atkinson<sup>3</sup>, M. J. Faulkner<sup>1</sup>, and L. A. Forster<sup>4</sup>, <sup>1</sup>Illinois State University, Normal, <sup>2</sup>University of Missouri, Columbia, <sup>3</sup>Southern Illinois University, Carbondale, <sup>4</sup>Archer Daniels Midland Co., Decatur, IL.

As the demand for ethanol increases, the availability of modified wet corn distillers grains (DGS) for inclusion in cattle diets increases. Several studies evaluating the effects of dietary DGS on performance characteristics have been reported. Fewer studies have evaluated high inclusion levels (over 50% diet DM) of DGS in finishing cattle diets on the effects on beef quality and adipose profile. The objective of this study was to compare beef quality characteristics and rib fat profile of steers fed 0, 25, 40 and 70% DGS (DM basis). Following a 48 h chill, rib sections (ribs 10 to 12) were removed, individually tagged, bagged and refrigerated. Rib sections were allowed to age for 7 d at

4°C before they were deboned, sliced into 2.54 cm steaks, and evaluated for Minolta color, cooking loss, shear force, % fat, % moisture and intramuscular fat (IMF) fatty acid composition. There were no differences ( $P > 0.05$ ) in % moisture, % fat, shear force, or cooking loss between treatments. Steers fed 70% DGS diets produced ribeye steaks with significantly lower a\* values ( $P < 0.05$ ), and a trend for lower b\* ( $P < 0.10$ ) values compared with ribeye steaks from steers fed 0, 25, or 40% DGS. Lower redness scores (a\*) can be associated with oxidation of unsaturated fatty acids that can trigger oxidation of myoglobin. Fatty acid analysis showed a linear increase ( $P < 0.05$ ) in SFA (44% vs. 48% for 0% and 70% DGS, respectively) at the expense of MUFA (50% vs. 43% for 0% and 70% DGS, respectively). Linear increases were observed in PUFA/SFA, CLA, and ω6 fats, with increasing DGS level. Citing a decrease in C18:2n6c from 3.51 to 4.50 to 5.23 to 6.69 for 0%, 25%, 40% and 70% DGS, respectively. Since DGS can have 3 to 12% (depending on extraction and blending methods) corn oil and corn oil has a high percentage of linoleic acid, it appears that increasing dietary DGS resulted in increased rumen bypass or incomplete rumen biohydrogenation of corn oil, thus shifting fatty acid profiles of IMF.

**Key words:** DGS, beef color, fat profile

**W180 Diet and genotype effects on the quality index of beef Nellore and F1 Nellore × Brahman produced in feedlot.** R. A. Mandarino<sup>\*1</sup>, F. A. Barbosa<sup>2,1</sup>, I. S. Silva<sup>1</sup>, S. L. S. Cabral Filho<sup>1</sup>, J. L. Vilela<sup>1</sup>, and C. F. Lobo<sup>1</sup>, <sup>1</sup>University of Brasilia, Brasilia, DF, Brazil, <sup>2</sup>Federal University of Minas Gerais, Belo Horizonte, MG, Brazil.

This experiment evaluated the effect of diet and genetic group on meat tenderness and the initial (pHi) and final pH (pHf) of the carcass after slaughter. The experiment lasted 96 d. The herd was composed of 42 bulls with a average age of 23 mo composed of 21 breed Nellore (NEL) and 21 crossbreed Nellore x Brahman (NBR). Each genetic group was divided into 3 diets, with 7 animals each: SIL - corn silage and concentrate (corn grain, soybean meal, soybean hulls, urea and mineral supplement) at a ratio of 25:75 (in dry matter), PEL - exclusive diet of pellets; GRN - diet with whole grain corn and pellets. The experiment was conducted in a randomized scheme in a 2 × 3 factorial, divided as follows: NELSIL, NELPEL, NELGRN, NBR SIL, NBRPEL and NBRGRN. The average initial body weights were 352.36 kg for genetic group NEL and 377 kg for the NBR animals. The final body weight averages were 481.37 kg for NEL and 461.4 kg for the NBR animals. The results of the pH measured 2 h (pHi) after slaughter were higher for NEL compared with NBR, 6.11 and 5.85, respectively ( $P < 0.05$ ). There was a influence by the diet on the pHi with higher value to GRN when compared with PEL and SIL, 6.08, 5.99, 5.86, respectively ( $P < 0.05$ ). The results of pH measured 24 h (pHf) after slaughter were higher for NEL compared with NBR, 5.92 and 5.28, respectively ( $P < 0.05$ ) but were not influenced by the diets ( $P > 0.05$ ). The meat tenderness, measured by shear force, was only numerically higher for NEL with a value of 4.97 and 4.62 kgf for NBR but were not influenced by genetic or by diet ( $P > 0.05$ ). For both genetic groups the meat can be considered as a moderately soft meat and resilient to consumption. The pH can be influenced by genetics or the diet. The results also showed a normal value for pH what is expected to be 2 h and 24 h after slaughter.

**Key words:** shear force, tenderness, pH

**W181 Beef quality parameters of Nellore bulls finished with cottonseed cake as fat source.** A. P. Neto<sup>\*1,2</sup>, R. H. Branco<sup>3</sup>, S. F. M. Bonilha<sup>3</sup>, T. L. S. Corvino<sup>3</sup>, E. N. Andrade<sup>2</sup>, and R. de Oliveira

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Cottonseed cake (CSC) is a residue obtained by mechanical extraction of oil seed upon biodiesel manufacturing. This study aimed to evaluate effects on beef quality of CSC inclusion as fat source in finished diets of Nellore bulls. Forty bulls were slaughtered with averages of 21 mo for age and 451 kg for BW, after 102 d under feedlot conditions. CSC inclusion was based on diet ether extract (EE): 3%, 4% and 5%. Other treatments, with 3% and 5% of EE, having soybean (SB) products as fat source were also tested. Beef quality parameters evaluated were: pH 24 h, shear force, beef color objectively by Minolta CR-410 [ $L^*$  = brightness;  $a^*$  = red;  $b^*$  = yellow] and subjectively using score of 1 = extremely light red to 7 = extremely dark red. Means were tested using 4 non-orthogonal contrasts: C1 = 3%SB vs. 3%CSC; C2 = 5%SB vs. 5%CSC; C3 = 3%CSC vs. 5%CSC; and C4 = 3%CSC and 5%CSC vs. 4%CSC. Contrasts were analyzed by Scheffé test. Beef quality parameters evaluated were not influenced by fat source and EE level. Means of 5.71 for pH 24 h, 5.70 kg for shear force, 38.8 for brightness, 16.7 for red color, 4.6 for yellow color and 3.75 for subjective color score were observed. The meat traits evaluated indicated high quality beef. Therefore, CSC did not influence beef traits and can be used as fat source on finishing diets of Nellore bulls.

**Table 1.** Beef quality parameters of Nellore bulls feed with cottonseed cake (CSC) and soybean (SB)

	SB		CSC			$P^1$			
	3%	5%	3%	4%	5%	C1	C2	C3	C4
pH 24 h	5.70	5.65	5.59	5.66	5.97	NS	NS	NS	NS
Shear force, kg	6.02	5.93	5.62	6.03	4.91	NS	NS	NS	NS
$L^*$	39.1	39.2	39.6	38.2	37.9	NS	NS	NS	NS
$a^*$	16.5	16.4	17.8	16.3	16.7	NS	NS	NS	NS
$b^*$	4.64	5.13	5.37	4.10	3.82	NS	NS	NS	NS
Color score	3.87	3.37	3.00	3.87	4.62	NS	NS	NS	NS

<sup>1</sup>C1 = 3%SB vs 3%CSC; C2 = 5%SB vs 5%CSC; C3 = 3%CSC vs 5%CSC; and C4 = 3%CSC and 5%CSC vs 4%CSC. NS = no significance ( $P \geq 0.05$ ).

**Key words:** biodiesel, byproducts, feedlot

**W182 Meat tenderness of Nellore cattle classified for residual feed intake.** T. L. Sobrinho<sup>1</sup>, K. Zorzi<sup>2</sup>, R. H. Branco<sup>3</sup>, S. F. M. Bonilha<sup>3</sup>, L. T. Egawa<sup>3</sup>, E. Magnani<sup>3</sup>, and M. E. Z. Mercadante<sup>\*3</sup>, <sup>1</sup>Faculdade de Ciências Agrárias e Veterinárias, Jaboticabal, São Paulo, Brasil, <sup>2</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brasil, <sup>3</sup>Instituto de Zootecnia, Sertãozinho, São Paulo, Brasil.

Residual feed intake (RFI), expressed as the difference between DM intakes observed and estimated by regression equation as function of metabolic BW and ADG, is an alternative measure of feed efficiency and can be used as tool to reduce costs of beef production. This study aimed to evaluate Warner-Bratzler shear force (SF) and myofibrillar fragmentation index (MFI) of meat from low (more efficient) and high (less efficient) RFI animals. The experiment was conducted at Instituto de Zootecnia, Sertãozinho/São Paulo/Brazil, with 59 Nellore bulls slaughtered with 447 kg of average BW and 20 mo of age. Carcasses were chilled at 2°C for 24 h and then steak samples of Longissimus dorsi muscle, with 2.5 cm of thickness, were removed from 11th rib for SF and MFI determination. Steaks were aged for 7 and 21 d at 0–2°C and then were frozen, totaling 3 samples for animal, with 1, 8 and 22 d post mortem. Data were analyzed using GLM procedure of SAS, and means were compared using *t*-test. RFI variation was 0.740 kg of DM per d, with averages of –0.330 and 0.410 kg, respectively, for animals more and less efficient. No difference was detected for MFI between RFI levels, being MFI averages 35.8 and 40.6 (d 1;  $P = 0.0877$ ), 49.3 and 50.5 (d 8;  $P = 0.800$ ) and 70.9 and 78.8 (d 22;  $P = 0.249$ ), respectively for low and high RFI levels. Low RFI animals had higher SF than the high RFI ones. SF averages were 4.30 and 3.83 kg (d 1;  $P = 0.0424$ ); 4.00 and 3.47 kg (d 8;  $P = 0.0339$ ); and 3.12 and 2.58 kg (d 22;  $P = 0.005$ ), respectively for low and high RFI levels. MFI increases with aging result from proteolytic enzymes, among them calpains, that act on muscle fibers and promote meat tenderness. However, despite not showing up significant difference for MFI, low RFI animals had higher SF values, indicating less tender meat. According to literature, more efficient animals have stronger action of calpastatin, responsible for inhibiting calpain action, resulting in less tender beef.

**Key words:** beef quality, efficiency, shear force