

# Meat Science and Muscle Biology: Beef Quality

**M150 Beef quality of bovines supplemented with vitamin E.** G. Aranda-Osorio<sup>\*1</sup>, H. Barragan-Gonzalez<sup>1</sup>, M. Huerta-Bravo<sup>1</sup>, O. Hernandez-Mendo<sup>2</sup>, E. Maldonado-Siman<sup>1</sup>, and J. C. Garcia-Ortiz<sup>1</sup>, <sup>1</sup>Universidad Autonoma Chapingo, Chapingo, Mexico, <sup>2</sup>Colegio de Posgraduados, Montecillos, Mexico.

The aim of this study was to establish the feeding duration and dietary level of vitamin E offered to young bulls which does not affect performance but positively improve shelf-life of beef. Three experiments were carried out: E1) 1,000 IU vitamin E/animal per d fed during 37, 49, and 63 d; E2) 2,000 IU vitamin E/animal per d fed for 77 d and E3) 3,000 IU vitamin E/animal per d fed for 55 d. In E1, E2 and E3 a total of 36 (12, 549 ± 22.44; 12, 510.42 ± 27.48; and 12, 480.25 ± 19.99 kg), 24 (396.21 ± 24.39), and 24 (432.50 ± 23.81 kg) crossbred (*Bos taurus* × *Bos indicus*) young bulls were used, respectively. Average daily weight gain (ADG), dressing percentage (DP) as well as pH, water retention capacity (WRC), L\* and chroma values and hue angle (hue°) of the rib eye (obtained between the 12th and 13th rib) were determined. Data were analyzed as a randomized block (E1) and completely randomized (E2 and E3) design using PROC GLM of SAS. Neither ADG nor DP were negatively affected ( $P \leq 0.05$ ) by the feeding duration or the dietary vitamin E level (E1, E2 or E3). Differences ( $P \leq 0.05$ ) in pH, L\*, chroma and hue° in beef until d 63 (E1) of supplementation were observed in animals offered vitamin E. There were no ( $P \geq 0.05$ ) differences in beef quality traits on d 1 post-mortem, but differences ( $P \leq 0.05$ ) were found on d 8 and 16 post-mortem (E2), when the beef color was more stable. In E3 the beef quality traits were similar to those found in E2, suggesting that supplementing 3,000 IU of vitamin E/animal per day during 55 d had a similar effect than supplementing 2,000 IU vitamin E/animal per d during 77 d. In conclusion, it is feasible to supplement 1,000, 2,000, or 3,000 IU of vitamin E/animal per d without compromising the finishing performance. However, the vitamin E supplement has to be offered for at least 45 d before the slaughter to improve beef quality.

**Key Words:** beef cattle, vitamin E, meat traits

**M151 Effect of vitamin E supplementation on the finishing of beef cattle.** G. Aranda-Osorio<sup>\*1</sup>, P. De la Cruz-Honorato<sup>1</sup>, R. Hernandez-Arrieta<sup>1</sup>, O. Hernandez-Mendo<sup>2</sup>, and J. C. Garcia-Ortiz<sup>1</sup>, <sup>1</sup>Universidad Autonoma Chapingo, Chapingo, Mexico, <sup>2</sup>Colegio de Posgraduados, Montecillos, Mexico.

The objective of this study was to evaluate the effect of vitamin E supplementation on performance (dry matter intake (DMI), average daily gain (ADG), feed conversion (FC), feed efficiency (FE), backfat depth (BFD), trimming fat (TF), hot carcass yield (HCY), and profitability of finishing young bulls. Two experiments were carried out. In experiment 1 (E1), 36 young bulls (*Bos taurus* × *Bos indicus*) were assigned to 3 BW blocks (549.50 ± 22.44, 510.42 ± 27.48 and 480.25 ± 19.99 kg) and offered 1000 IU vitamin E /head per d for 37, 49 or 63 d during the finishing period. To each BW block 12 animals were assigned (6 with and 6 without vitamin E supplementation). Each bull was the experimental unit, with 6 replicates per treatment. In experiment 2 (E2) 24 young bulls (*Bos taurus* × *Bos indicus*) with an ILW of 396.21 ± 24.39 were used. Half of them were offered 2000 IU vitamin E/head per d during

77 d. They were vaccinated against *Clostridium*, dewormed, vitaminized, implanted and individually penned (2 × 2 m). The diet was based on corn (42.2%), bakery waste (24.6%), barley straw (22.9%), soybean meal (7.93%), minerals (2%), and CaCO<sub>3</sub> (0.4%), with 13.1% crude protein, 1.79 Mcal ENm, 1.16 Mcal ENg and 11.6% crude fiber. The animals were slaughtered the d after they finished their fattening period. Data were analyzed as a randomized block (E1) and completely randomized (E2) design using PROC GLM of SAS. In E1, vitamin E supplementation for 37 d enhanced ( $P \leq 0.05$ ) DMI, ADG, FC, FE, BFD, and TF but decreased ( $P \leq 0.05$ ) HCY. However, vitamin E supplementation for 49 or 63 d enhanced ( $P \leq 0.05$ ) DMI but affected ( $P \leq 0.05$ ) ADG, FC, FE, BFD, and HCY. In E2, 2000 IU vitamin E supplementation improved ( $P \leq 0.05$ ) feedlot performance but decreased ( $P \leq 0.05$ ) FC. However, due to the high costs of dietary vitamin E profitability was reduced. It is concluded that vitamin E supplementation in the finishing period of young bulls did not negatively affect animal performance and therefore can be used to improve beef quality.

**Key Words:** young bulls, vitamin E, performance

**M152 Influence of different forms of lipid supplements on physical characteristics of heifers' meat fed on feedlot system.** M. C. A. Santana<sup>\*1</sup>, T. T. Berchielli<sup>1</sup>, R. A. Reis<sup>1</sup>, G. T. Pereira<sup>1</sup>, and R. C. Canesin<sup>1</sup>, <sup>1</sup>São Paulo State University, Jaboticabal, São Paulo, Brazil, <sup>2</sup>Bellman Animal Nutrition Mineral Supplements, Jaboticabal, São Paulo, Brazil.

Physical quality of meat products can be influenced by the feed offered to the animal. The evaluation of beef quality indicators is important because it is able of determining the product which will be offered to the consumer. The focus areas in this experiment are colors (a, b, L), shear force (WBSF), water-holding capacity (WHC), pH and cooking loss percentage (CLoss) in meat from heifers fed under different lipid supplements in feedlot system. The experiment design was completely random, using 3 supplements. The supplements came from soya lipid-based supplements, offered in different forms (soybean grain, soybean oil and protected fat - Megalac-E), 60:40 concentrate:corn silage. The treatments were compared by analyzing variables using the GLM procedure (SAS 9.1, SAS Institute, Inc., Cary, NC). Mean values were compared using the Tukey test at a significance level of 0.05. Using a colorimeter, the color of the longissimus muscle (LM) at the 12th and 13th rib interface in the L\*a\*b\* color space (CIE system) was determined. A time span of 30 min was awaited before color analysis. The WBSF was obtained from steaks previously thawed and roasted using an insert thermometer until 70°C was obtained. Later, the samples were cut into cubes; the data collected was achieved using a Warner-Bratzler shear machine. The muscle pH measurements were taken from the interior of the LM at 24 h and 48h postmortem using a portable pH meter. The water holding capacity was obtained by determining the difference of the sample weights under 10 kg of pressure for 5 min. The cooking loss value was determined according to the reduced percentage rate before and after the meat was cooked. The results of this research suggest that the physical indicators of meat quality were not influenced by the supplements, offered in different forms (soybean grain, soybean oil and protected fat - Megalac-E).

**Table 1.** Means for the colors a, b and L, meat pH, water-holding capacity (WHC), and percentage cooking loss (Closs) and shear force (WBSF) of heifer's meat from feedlot.

	Soybean grain	Soybean oil	Protected fat	Mean	CV (%)
WBSF (kgf/cm <sup>3</sup> )	6.5	8.2	7.9	7.6	21.7 <sup>NS</sup>
WHC (%)	73.8	71.8	71.2	72.2	6.6 <sup>NS</sup>
Closs (%)	34.7	33.7	32.7	33.6	5.1 <sup>NS</sup>
Color L (%)	35.0	34.0	34.7	34.5	7.4 <sup>NS</sup>
Color A (%)	16.6	16.7	16.4	16.5	13.5 <sup>NS</sup>
Color B (%)	3.5	3.5	3.6	3.6	33.6 <sup>NS</sup>
pH (48 h)	6.1	6.1	6.2	6.1	3.2 <sup>NS</sup>
pH (24 h)	5.6	5.6	5.7	5.6	2.2 <sup>NS</sup>

NS = nonsignificant.

**Key Words:** soybean grain, soybean oil, protected fat

**M153 Effect of maternal nutritional status on muscle development and carcass characteristics in heifer progeny.** L. V. Nicodemus\*, K. R. Underwood, J. F. Tong, P. L. Price, B. W. Hess, S. I. Paisley, W. J. Means, R. J. McCormick, and M. Du, *Department of Animal Science, University of Wyoming, Laramie.*

In the Western United States, cow herds commonly experience nutrient deficiency due to frequent drought conditions. Mid to late gestation is an important time for skeletal muscle and adipose tissue development. The objective of this study was to evaluate the effects of maternal nutrient deficiency during mid gestation on the growth performance and carcass traits of heifer progeny. Thirty-two heifers, born to crossbred cows from 2 years were evaluated for the effects of dietary treatments from d 45 through d 180 of gestation on muscle development, meat quality, and carcass characteristics. At d 45 of gestation cows were randomly allotted to 1 of 3 dietary treatments consisting of individually fed native grass hay plus a soybean meal-based supplement: control (C, 100% NRC requirements), nutrient restricted (NR, 70% NRC requirements), and nutrient restricted plus ruminally undegradable protein supplementation (NRP, 70% NRC requirements with essential amino acids supplemented to the control level), and that 11 C, 7 NR and 14 NRP offspring heifers were produced from the herd. Following weaning, heifers from all treatments were back-grounded, and then placed in the feedlot where they received a high concentrate diet until slaughter. Carcass characteristics were measured at 48 h postmortem. Steaks were removed 14 d postmortem for Warner-Bratzler Shear Force and proximate analysis. The 12th rib fat thickness of C heifers was less ( $P \leq 0.05$ ) than that of NR. The Semitendinosus muscle weight was reduced in NR compared with C carcasses ( $P \leq 0.05$ ). There was no difference in LM area, percent KPH fat, or marbling scores between treatments. Data show that a low plane maternal nutrition during early to mid-gestation increased fatness and reduced muscling of heifer progeny, and protein supplementation had no major impact on carcass composition of offspring heifers.

**Key Words:** maternal nutrition, beef, fetal development

**M154 Nutrient restriction during early prenatal growth and carcass characteristics of beef steers.** T. A. Pye\*, B. H. Boehmer, R. P. Wettemann, and G. W. Horn, *Oklahoma Agricultural Experiment Station, Stillwater.*

To evaluate the effect of prenatal nutritional restriction on carcass characteristics, Angus heifers (15 mo of age) were AI, and after  $32 \pm 1$  d, pregnancy was determined. Heifers were stratified by BW and BCS and allotted to low (L, 55% of NRC requirements) or moderate nutritional (M, > 100% NRC requirements) treatment groups. After 86 d of treatment (128 d of gestation), heifers were managed in a single pasture and received a common diet (>100% of NRC requirements). Bulls were castrated at birth, weaned at 230 d, and maintained as a group before and after weaning. At 14 (rep 1) or 18 mo (rep 2) of age, L (n = 13) and M (n = 10) steers were fed a high-energy finishing diet and gained  $2.1 \pm 0.2$  kg/d to a BW of  $592 \pm 7$  (rep 1) or  $631 \pm 6$  kg (rep 2). Steers were harvested at  $1.3 \pm 0.2$  cm backfat. Data were analyzed using PROC GLM procedures of SAS. There was no treatment  $\times$  rep effects ( $P > 0.32$ ). At onset of treatment, BW ( $P = 0.37$ ) and BCS ( $P = 0.30$ ) were similar for L and M heifers. During early gestation M heifers gained  $68 \pm 7$  kg and L heifers lost  $54 \pm 8$  kg ( $P < 0.001$ ). After treatment, M heifers had greater BCS ( $5.5 \pm 0.1$ ) compared with L heifers ( $4.3 \pm 1$ ;  $P < 0.001$ ). Hot carcass weight ( $P < 0.001$ ), dressing percentage ( $P < 0.001$ ), REA ( $P < 0.02$ ), marbling ( $P < 0.001$ ) and KPH fat ( $P < 0.001$ ) were influenced by replication but not by prenatal nutritional treatment ( $P > 0.15$ ). Neither treatment nor replication influenced yield grade or fat thickness at the 12th rib. Major nutritional restriction of young bovine dams during 32 to 118 d of gestation, that resulted in 1.2 BCS units difference, did not influence carcass characteristics of steer progeny at normal harvest weights.

**Key Words:** beef cattle, carcass characteristics, prenatal programming

**M155 Residual feed intake in three-cross beef heifers: color and chemical composition of *Longissimus dorsi* muscle.** S. F. Reis<sup>1</sup>, P. V. R. Paulino<sup>\*1</sup>, S. R. Medeiros<sup>2</sup>, S. C. Valadares Filho<sup>1</sup>, G. L. D. Feijó<sup>2</sup>, R. A. A. Torres Júnior<sup>2</sup>, R. O. Cristaldo<sup>2</sup>, R. A. Silva<sup>2</sup>, D. A. Fausto<sup>3</sup>, and J. Cavali<sup>1</sup>, <sup>1</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil, <sup>2</sup>EMBRAPA Gado de Corte, Campo Grande, MS, Brazil, <sup>3</sup>Universidade de São Paulo, Piracicaba, SP, Brazil.

Residual feed intake (RFI), as an index for feed efficiency selection, is promising because it is independent of growth traits of the animal. However, studies have shown that efficient animals (low RFI) tend to produce beef with less intramuscular fat (IMF). This trial aimed to evaluate the color and chemical composition of *Longissimus dorsi* (LD) muscle of 31 3-cross beef heifers. The same diet (ME = 2.73 Mcal/kg DM, CP = 11.90% DM) was fed during 84 d. The experiment was conducted according to a completely randomized design. The animals were classified in 3 groups according to their RFI value (high, medium or low). The RFI was calculated as the difference between an animal's actual and predicted feed intake - Predicted DMI =  $-3.82593 + 0.15438 \times \text{MBW} + 1.09531 \times \text{ADG}$ . At the end of the trial all animals were slaughtered. After 18 h of chilling, color (L\*, a\*, b\*) of the LD was evaluated, according to CIELAB system. A sample of the LD was collected to assess the chemical composition. Data were analyzed using the PROC GLM of SAS and the effects of treatments were considered significant at  $P < 0.05$ . Chemical composition and color of the LD was similar ( $P > 0.05$ ) among RFI groups. The mean chemical composition of the LD obtained was 4.28% fat; 18.3% CP and 77.42% moisture. The mean L\*, a\* and b\* values were 40.47, 24.74 and 16.13, respectively. The L\* and a\* values were greater than those commonly reported for

beef (35.00 – 38.00 and 18 – 22, respectively). The b\* value found in this study (16.13) was greater than the values reported for cattle under feedlot conditions (3.00 to 5.00). The yellow intensity is related to the amount and color of IMF in the meat. Thus, one can hypothesize that it might have been influenced by the high proportion of IMF (4.28%) found in this study as well as to a greater carotene incorporation, once the animals were raised on pasture for approximately 2 years before being placed in a feedlot. We conclude that efficient animals (low RFI) produce beef with color attributes and chemical composition similar to that produced by less efficient animals (high RFI).

**Key Words:** feedlot, feed efficiency, meat color

**M156 Residual feed intake in three-cross beef heifers: Sensorial traits of *Longissimus dorsi* muscle.** S. F. Reis<sup>1</sup>, P. V. R. Paulino<sup>\*1</sup>, R. A. Silva<sup>3</sup>, S. R. Medeiros<sup>2</sup>, S. C. Valadares Filho<sup>1</sup>, G. L. D. Feijó<sup>2</sup>, R. A. A. Torres Júnior<sup>2</sup>, F. A. Curci<sup>2</sup>, and M. A. Rezende<sup>2</sup>, <sup>1</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil, <sup>2</sup>EMBRAPA Gado de Corte, Campo Grande, MS, Brazil, <sup>3</sup>Universidade Federal do Mato Grosso do Sul, Campo Grande, MS, Brazil.

Studies have indicated that animals selected for residual feed intake (RFI) may produce lean carcasses which can result in changes in sensory traits of meat. This trial aimed to evaluate sensorial traits (flavor, texture and juiciness) of *Longissimus dorsi* (LD) muscle of 31 3 cross beef heifers. A same diet (ME = 2.73 Mcal/kg DM, CP = 11.90% DM) with roughage:concentrate ratio of 40:60 was fed during 84 d. The experiment was conducted under a completely randomized design. The animals were classified in 3 groups according to its RFI value (high, medium or low). RFI was calculated as the difference between an animal's actual and predicted feed intake – Predicted DMI =  $-3.82593 + 0.15438 \times \text{MBW} + 1.09531 \times \text{ADG}$ . At the end of the trial all animals were slaughtered and the carcasses chilled for about 18 h. After chilling, a sample was removed from LD muscle to evaluate sensorial traits and shear force (SF). The sensorial panel was composed by trained individuals (regular consumers of beef, up to 3 times / week). The sensory panel scores were attributed for each sample, following a scale ranging from 1 (low meat quality) to 9 (high meat quality). Data were analyzed using the GLM procedure of SAS. No differences ( $P > 0.05$ ) between classes of efficiency for the sensorial traits and SF of LD muscle were detected. Sensory panel score means for flavor, texture and juiciness were 5.6; 6.1 and 5.4. As all traits were analyzed by a subjective method (sensory panel), only very contrasting results would be detected as different. In this study, animals with low RFI produced meat tenderness similar to those from other classes of efficiency. The mean value of SF was 5.3 kg, which was above those usually reported to crossbred animals (about 4.0 kg) and it may be accounted to the fact that the heifers had 25% of zebu breeds in their composition. The hypothesis that animals with better RFI produce tougher and less desirable meat was not proven in this study, thus RFI is as an interesting tool to select animals in breeding programs.

**Key Words:** feed efficiency, feedlot, tenderness

**M157 Ageing process influence on fatty acids relations in yearling bulls fed different sources of omega-3 and omega-6.** A. A. M. Sampaio<sup>1</sup>, T. M. Pivaro<sup>1</sup>, E. A. Oliveira<sup>\*1</sup>, W. Henrique<sup>2</sup>, B. L. Rosa<sup>1</sup>, and A. R. M. Fernandes<sup>3</sup>, <sup>1</sup>FCAV/Unesp, Jaboticabal, SP, Brazil, <sup>2</sup>APTA, São José do Rio Preto, SP, Brazil, <sup>3</sup>UFMG, Dourados, MS, Brazil.

The aim of this study was to investigate the effects of oil supplemented diets on the fatty acids levels of bovine *Longissimus thoracis* muscle aged for different days. Thirty-five yearling Nelore bulls were kept in

feedlot during 96 d during which 5 dietary fat sources were tested: control (without oil), soybean oil, soybean oil rumen-protected, linseed oil and linseed oil rumen-protected. Sugarcane was the exclusive roughage source for all diets. Sections of loin meat (2.5 cm of thickness) were removed from each left half-carcass, vacuum packed and submitted to aging for 7, 14 and 21 d, followed by lyophilization, lipid extraction and methylation. Fatty acid methyl esters were analyzed using gas chromatography. All data were subjected to ANOVA and Student's *t*-test. The interaction treatment  $\times$  aging period was not significant in this experiment. There were no ( $P > 0.05$ ) differences for variables related to total amount of saturated and unsaturated fatty acids, neither for the saturated/unsaturated fatty acids ratio when comparing aging periods and *in natura* meat. Aged meat monounsaturated fatty acids values (46.66, 46.76 and 47.23%), monounsaturated:saturated ratio (1.04; 1.03; 1.04) and omega-6:omega-3 ratio (3.85; 3.76 and 3.99) for 7, 14, and 21 d, respectively, were lower ( $P < 0.05$ ) when compared with non-aged meat (48.29%, 1.08, 4.12). However, the amount of polyunsaturated fatty acids was higher ( $P < 0.05$ ) in aged (8.62, 7.89 and 7.44%, respectively) than in non-aged meat (6.18%). Aged meat values for omega-3 (1.24, 1.70 and 1.57%), omega-6 (6.14, 5.56 and 5.23%) and polyunsaturated:saturated ratio (0.19; 0.17 and 0.16) were also higher ( $P < 0.05$ ) than in non-aged meat (1.44%, 4.88% and 0.13, respectively). Independently of the oil source, oil supplementation improves the fatty acid composition of meat aged for 7 and 14 d.

**Key Words:** fatty acids ratio, saturated fatty acids, unsaturated fatty acids

**M158 Feeding flaxseed to beef cows increases concentrations of omega-3 fatty acids and linolenic acid biohydrogenation intermediates in subcutaneous fat.** M. L. He<sup>1,3</sup>, T. A. McAllister<sup>\*1</sup>, J. P. Kastelic<sup>1</sup>, Y.-H. Chung<sup>1</sup>, K. A. Beauchemin<sup>1</sup>, P. S. Mir<sup>1</sup>, J. L. Aalhus<sup>2</sup>, M. E. R. Dugan<sup>2</sup>, and N. Aldai<sup>2</sup>, <sup>1</sup>Lethbridge Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada, <sup>2</sup>Lacombe Research Centre, Agriculture and Agri-Food Canada, Lacombe, AB, Canada, <sup>3</sup>University of Saskatchewan, Saskatoon, Saskatchewan, SK, Canada.

This study was conducted to investigate changes in fat deposition and fatty acid profiles in beef cows fed hay or silage based diets, with or without flaxseed supplementation. Crossbred cull beef cows (64, > 30 mo of age, 620  $\pm$  5 kg) were removed from grassland pastures, randomly assigned to 16 pens and given ad libitum access to 50:50 (wt:wt, DM basis) forage:concentrate diets containing 0 or 15% ground flaxseed (DM basis, 5.2% added fat). The diets were: hay control, HC; hay+flaxseed, HF; silage control, SC; silage+flaxseed, SF. Flaxseed improved ( $P < 0.01$ ) feed conversion ratio and tended to increase body weight gain ( $P = 0.10$ ) and back fat thickness ( $P = 0.07$ ), as assessed by ultrasonography. Compared with hay, silage increased ( $P < 0.01$ ) feed intake, body weight gain, fat thickness ( $P = 0.07$ ) and improved ( $P < 0.01$ ) feed conversion. Subcutaneous fat contained 0.65% omega-3 fatty acids (wt:wt) at arrival, which reached concentrations of 0.69, 0.81, and 0.93% in HF cows, and 0.65, 0.77, and 0.90% in SF cows, after 6 wk, 12 wk, and at slaughter, respectively. In contrast, at these same sampling points, omega-3 fatty acids had decreased in HC and SC cows, to 0.50, 0.47, and 0.43%, and to 0.39, 0.36, and 0.33%, respectively. Flaxseed also improved ( $P < 0.01$ ) wt:wt of conjugated linoleic acids in plasma and fat and resulted in an accumulation of non-conjugated, non-methylene interrupted dienes in fat. This was more pronounced ( $P < 0.01$ ) in cows fed with hay- than with silage-based diet. In summary, a 15% flax supplement in hay- or silage-based diets fed to cows coming off fall pastures increased omega-3 fatty acid concentrations,

which was accompanied by increased concentrations of linolenic acid biohydrogenation intermediates.

**Key Words:** cull beef cow, flaxseed, omega-3 fatty acids

**M159 Effect of finishing system on subcutaneous fat melting point and fatty acid composition.** S. K. Duckett<sup>\*1</sup>, J. P. S. Neel<sup>2</sup>, W. S. Swecker<sup>3</sup>, J. P. Fontenot<sup>3</sup>, and W. Clapham<sup>2</sup>, <sup>1</sup>Clemson University, Clemson, SC, <sup>2</sup>USDA-ARS, Beaver, WV, <sup>3</sup>Virginia Tech University, Blacksburg.

Angus-cross steers (n = 69) were used to determine the effect of finishing system on subcutaneous fat melting point and fatty acid composition. Three finishing systems were evaluated: 1) mixed pasture for 134 d [MP], 2) mixed pasture for 93 d and alfalfa for 41 d [AL], or 3) concentrate finishing for 134 d [CONC], in a 2-yr study. Subcutaneous fat samples at the 12th rib were obtained at 24 h postmortem. Melting point was determined using the OptiMelt Automated Melting Point System. Total saturated fatty acid (SFA) and omega-3 fatty acid contents were greater ( $P < 0.05$ ) for AL and MP than CONC. Monounsaturated fatty acid and omega-6 polyunsaturated fatty acid contents were greater ( $P < 0.05$ ) for CONC than AL and MP. The ratio of omega-6 to omega-3 fatty acids was higher for CONC (8.81) than forages (1.64), regardless of forage species grazed. Average temperature for onset point, start of melting point where liquid first appears, was higher ( $P < 0.05$ ) for MP and AL than CONC. Average temperature for clear point, melting point where fat is completely liquid, was higher ( $P < 0.05$ ) for MP and AL than CONC. Melting point was highly, positively correlated with SFA ( $r = 0.73$ ) and highly, negatively correlated with MUFA ( $r = -0.78$ ) and omega-6 ( $r = -0.60$ ). Prediction equations for s.c. fat melting point included MUFA and SFA contents, and explained 83% or 93% of the variation for AL and MP, respectively. Prediction equations for s.c. fat melting point included omega-3, omega-6 and SFA, and explained 57% of the variation for CONC. Finishing system altered subcutaneous fat composition and melting point. Finishing on forages (MP and AL) increased SFA by 17% and decreased MUFA by 24%, which translated to a higher subcutaneous fat melting point (42.35 vs. 38.64 C).

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

**M160 Effects of supplemental dietary lipid sources on fatty acids compositions of *Longissimus* muscle in yearling bulls.** E. A. Oliveira<sup>\*1</sup>, A. A. M. Sampaio<sup>1</sup>, W. Henrique<sup>2</sup>, B. L. Rosa<sup>1</sup>, T. M. Pivaró<sup>1</sup>, and A. R. M. Fernandes<sup>3</sup>, <sup>1</sup>FCAV/Unesp, Jaboticabal, SP, Brazil, <sup>2</sup>APTA, São José do Rio Preto, SP, Brazil, <sup>3</sup>UFGD, Dourados, MS, Brazil.

The aim of this study was to improve fatty acids composition of bovine *Longissimus* muscle by adding different sources of fat in the diet of Nellore yearling bulls. Thirty-five animals, averaging 18 mo of age ( $402.69 \pm 14.90$  Kg), were housed during 96 d in individual pens at Jaboticabal Campus of São Paulo State University. Five different diets were tested: control (without oil), soybean oil (3.8% of diet), rumen-protected soybean oil (4.5% of diet), linseed oil (3.8% of diet) and rumen-protected linseed oil (4.5% of diet). All diets included sugarcane as exclusive roughage source. The experiment was a randomized block design with 7 blocks and 5 replications and means were compared by orthogonal contrasts. After 24 h of carcass cooling process, *Longissimus thoracis* (<b < LT) muscle sections were removed at the 12–13th rib level and submitted to lyophilization, lipid extraction and methylation. Samples were analyzed by gas chromatography. The LT of animals fed the oil-supplemented diets had higher ( $P < 0.05$ ) levels of conjugated linoleic (CLA) (0.72% vs 0.35%) and linolenic acid (LLA) (0.66% vs. 0.32%) and lower levels ( $P < 0.05$ ) of saturated fatty acid. Among oil-

supplemented diets, there was no ( $P > 0.05$ ) difference for CLA when comparing soybean and linseed oil (0.77% and 0.67%, respectively). However, the LT of animals fed linseed oil had higher ( $P < 0.05$ ) levels of LLA (1.21% vs. 0.44%). There was no ( $P > 0.05$ ) difference between control and other diets concerning saturated and unsaturated fatty acids concentrations. Omega6:omega3 ratio was lower ( $P < 0.05$ ) and closer to ideal for linseed oil when compared with the other diets (2.36 vs. 3.77, respectively). Soybean or linseed oils supplementation to feedlot cattle provides better fatty acids composition and improve their relationship, leading to a healthier and more balanced meat, independently of being protected or not.

**Key Words:** beef, fatty acids, health

**M161 Fatty acid profile of intramuscular fat of young bulls grazing tropical pasture and supplemented with different strategies.** J. Cavali<sup>1</sup>, P. V. R. Paulino<sup>\*1</sup>, I. M. Oliveira<sup>1</sup>, M. M. C. Silva<sup>1</sup>, H. J. Fernandes<sup>2</sup>, R. Mezzomo<sup>1</sup>, J. F. H. Rodrigues<sup>1</sup>, É. E. L. Valente<sup>1</sup>, S. F. Reis<sup>1</sup>, and L. A. M. Gomide<sup>1</sup>, <sup>1</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil, <sup>2</sup>Universidade Estadual do Mato Grosso do Sul, Aquidauana, MS, Brazil.

Grass fed beef gathers desirable nutritional characteristics that are valuable to the final consumer. The objective of this study was to evaluate the fatty acid profile of intramuscular fat (IMF) of young bulls grazing *Brachiaria decumbens* pastures and supplemented with different strategies. Fifty 2 Nellore young bulls were used, being distributed, in a completely randomized design, into 4 treatments (13 replicates): control, when the animals had free access only to mineral mixture throughout the experiment; and 3 protein supplementation strategies, when the animals were creep-fed with supplements containing 10, 20 and 30% CP, respectively. After weaning the creep-fed animals received isonitrogenous supplements designed to supply 0.50 and 0.66 g of CP/day during growing and finishing, respectively. After 580 d, the animals were slaughtered and a sample of the *Longissimus dorsi* was taken at the level of the last rib and the fatty acid profile of the IMF was determined by gas chromatography. IMF of bulls of the control group (pasture + mineral mixture) had greater ( $P < 0.10$ ) contents of palmitic (C16:0), oleic (C18:1), linoleic (C18:3) and eicosapentaenoic acid (EPA), more monounsaturated fatty acids (MUFA) and lower stearic acid (C18:0) when compared with the other groups, but did not differ ( $P > 0.10$ ) from the supplemented counterparts regarding total saturated fatty acids (SFA) content. Protein supplementation improved ( $P < 0.10$ ) the amount of polyunsaturated fatty acids (PUFA) and n-6/n-3 ratio of the IMF of the animals, when compared with the control group. However, the MUFA and EPA content of the IMF of the supplemented animals were lower ( $P < 0.10$ ) than the values observed in the animals that received only mineral mixture. Different strategies of protein supplementation of young bulls grazing tropical pastures can modify the fatty acid profile of intramuscular fat and thus be used as a tool to produce beef that meets specific niche markets.

**Key Words:** beef cattle, pasture, protein supplementation

**M162 How do n-3 fatty acids affect human perception of ground beef?** T. Jiang<sup>\*</sup>, J. R. Busboom, M. L. Nelson, and R. Mengarelli, Washington State University, Pullman.

Our objective was to determine the impact of increasing levels of Eicosapentaenoic acid (EPA; C20:5n-3) and Docosahexaenoic acid (DHA; C22:6n-3) on beef palatability. Two commercial supplements of EPA and DHA (GNC DHA 250 with DHA: EPA = 2.5:1 and GNC Triple Strength Fish Oil with EPA: DHA = 2.6:1) were added to patties

(176.2 ± 3.76 g) made from 85% lean ground beef with different levels (0, 0.3, 0.4, 0.5, 0.6, 0.7, and 1% as-is). Olive oil was added so that a total of 1% lipids were added to all treatments. A control treatment was prepared with no fatty acid supplement or olive oil. Patties were aged for 72 h at 3°C, frozen at -20°C and vacuum packaged. A 9-member trained sensory panel was conducted to evaluate beef aroma, off-aroma, beef flavor, off-flavor, tenderness, juiciness, and overall acceptability of ground beef on a 10-cm unstructured line scale labeled at each end. Six tasting sessions were conducted with 6 patties served in each session. Patties were assigned across the sessions in a randomized complete block design, with the first 3 sessions as block 1 and the next 3 as block 2. Control and 0% supplement (1% olive oil) patties were served in each session. Results indicated that increasing levels of DHA did not impact ground beef palatability. Similarly, increasing levels of EPA had no impacts on most sensory attributes. However, off-aroma and off-flavor scores vs. EPA levels fit a non-linear plateau model ( $P < 0.0001$ ). The slopes ( $\beta_1$ ) of the models for off-aroma and off-flavor were  $4.4 \pm 0.62$  and  $9.0 \pm 0.95$ , respectively. The maximum scores (D) were  $1.9 \pm 0.35$  and  $4.2 \pm 0.53$  for off-aroma and off-flavor, respectively. In conclusion, n-3 long chain polyunsaturated fatty acid EPA had a greater negative impact on ground beef palatability than DHA. Furthermore, the panelists seemed to be more sensitive to EPA in off-flavor perception than off-aroma.

**Key Words:** EPA, DHA, ground beef palatability

**M163 Geometrical isomers of octadecenoic, octadecadienoic and octadecatrienoic acids from subcutaneous fat of British or Continental versus Nellore crossbred cattle slaughtered at different end points.** 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, RS, Brazil, <sup>2</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil, <sup>3</sup>Agência Paulista de Tecnologia dos Agronegócios, Colina, SP, Brazil, <sup>4</sup>Universidade de São Paulo – Escola Superior de Agricultura ‘Luiz de Queiroz’, Piracicaba, SP, Brazil.

The study was carried out to evaluate the effect of genetic group (GG) and slaughter weight on C18:1, C18:2 and C18:3 fatty acids isomers in subcutaneous fat sampled at the 13th rib. 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 software using initial SBW as a covariate. 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 RA 1/2 N young bulls had a higher ( $P < 0.05$ ) *cis*-12 C18:1, *cis*-9,12 C18:2, and *cis*-9,12,15 C18:3 levels than 1/2 BA 1/2 N young bulls. As the slaughter weight rised the *cis*-15, *trans*-9, *trans*-11, and *trans*-12 C18:1 levels decreased ( $P < 0.05$ ); while *cis*-11 C18:1 level increased. The *trans*-11 *cis*-15 C18:2, *cis*-9 *trans*-11 C18:2 (CLA), and *cis*-6,9,12 C18:3 levels also decreased ( $P < 0.05$ ) as the slaughter weight increased. The interaction between GG and SW was significant ( $P > 0.05$ ) for *cis*-9, *cis*-13 and *trans*-16 C18:1 levels. The 1/2 RA 1/2 N young bulls slaughtered at 520 kg had lower *cis*-9 and *cis*-13 C18:1 levels and the 1/2 RA 1/2 N slaughtered at 560 kg had lower *trans*-16 C18:1 level than others. Thus, crossbred F1 Red Angus × Nellore young bulls had higher *cis*-9,12,15 C18:3 ( $\alpha = n-3$ ) level in the subcutaneous fat (0.41) than F1 Blonde D’Aquitaine × Nellore young bulls (0.37).

Animals slaughtered at lighter weights had higher *cis*-9 *trans*-11 C18:2 (CLA, 0.50) and *cis*-6,9,12 C18:3 ( $\gamma = n-6$ , 0.13) levels in the subcutaneous fat than animals slaughtered at heavier weights (0.32 and 0.10 respectively).

**Key Words:** conjugated linoleic acid, fatty acids, *trans* stereoisomer

**M164 Fatty acid profiles of subcutaneous adipose tissue from cross young bulls produced by different genetic groups sires and slaughtered with distinct 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, RS, Brazil, <sup>2</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil, <sup>3</sup>Agência Paulista de Tecnologia dos Agronegócios, Colina, SP, Brazil, <sup>4</sup>Universidade de São Paulo – Escola Superior de Agricultura ‘Luiz de Queiroz’, Piracicaba, SP, Brazil.

In the present study the aim was to investigate fatty acid profiles of subcutaneous adipose tissue from *Longissimus dorsi* muscle at 13th rib of crossbred bulls at different body masses. 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 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 raised, being 2.1, 2.7 and 4.4 mm, respectively, for animals slaughtered at 480, 520 and 560 kg. The 1/2 RA 1/2 N young bulls had a higher ( $P < 0.05$ ) content of long-chain fatty acids, polyunsaturated fatty acids and *n*-6 than 1/2 BA 1/2 N young bulls. On the other hand, the 1/2 BA 1/2 N young bulls had a higher ( $P < 0.05$ ) content of medium-chain fatty acids than 1/2 RA 1/2 N young bulls. As the slaughter weight raised the content of odd-chain fatty acids decreased ( $P < 0.05$ ); whereas the animals slaughtered at 520 kg had a smaller ( $P < 0.05$ ) content of *n*-3. The interaction between genetic group (GG) and slaughter weight (SW) was significant ( $P > 0.05$ ) for saturated fatty acids and monounsaturated fatty acids (data not shown). The 1/2 BA 1/2 N young bulls slaughtered at 520 kg had smaller content of saturated fatty acids, while 1/2 RA 1/2 N young bulls slaughtered at 520 kg had smaller content of monounsaturated fatty acids than others. Thereby, crossbred F1 Red Angus × Nellore young bulls and lighter animals had better fatty acid profiles in the subcutaneous fat than F1 Blonde D’Aquitaine × Nellore young bulls and heavier animals.

**Table 1.** Least squares means

Fatty acids	Genetic Group		Slaughter Weight		
	½ RA ½ N	½ BA ½ N	480	520	560
Short-chain	0.1	0.1	0.1	0.1	0.1
Medium-chain	41.0 <sup>B</sup>	43.4 <sup>A</sup>	42.7	42.9	41.0
Long-chain	56.4 <sup>A</sup>	54.0 <sup>B</sup>	54.4	54.6	56.6
Very long-chain	0.1	0.1	0.1	0.1	0.1
Odd-chain	2.3	2.4	2.7 <sup>a</sup>	2.2 <sup>b</sup>	2.2 <sup>b</sup>
Saturated	49.2	49.3	50.0	49.1	48.6
Monounsaturated	47.3	47.7	46.9	47.6	48.1
Polyunsaturated	3.4 <sup>A</sup>	3.0 <sup>B</sup>	3.1	3.3	3.3
<i>n</i> -3	0.8	0.7	0.8 <sup>a</sup>	0.7 <sup>b</sup>	0.8 <sup>a</sup>
<i>n</i> -6	3.0 <sup>A</sup>	2.5 <sup>B</sup>	2.5	2.8	2.8

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, feedlot, *Longissimus dorsi*

**M165 Meat quality of Nellore heifers finished at pasture, in tropical conditions, supplemented with crushed sunflower.** S. L. N. Cerilo\*, R. H. de Tonissi e Buschinelli de Goes, H. L. Lima, A. R. M. Fernandes, K. A. de Souza, D. de Faria Pereira, K. C. da Silva Brabes, and A. F. Marquez, *Universidade Federal da Grande Dourados, Dourados, MS, Brasil.*

Meat quality traits of Nellore Heifers finished on pasture of *Brachiaria humidicola* and fed crushed sunflower, in partial substitution of soybean meal, were evaluated. Twenty animals, slaughtered at a 378.5 kg BW were used. The supplements contained 20% CP and was composed of corn, soybean meal and minerals. The soybean meal was replaced by crushed sunflower in the proportions of 0, 20, 40 and 60% and its lipid content was 2.5, 4.7, 7.0 and 9.2%, respectively. The supplement was offered at 0.8% BW/animal per d, which corresponded to 3.31, 3.35, 3.28 and 3.25 kg of supplement/d. The experimental design was completely randomized and mean values were compared using the Tukey's test at  $P < 0.05$ . After slaughter the carcasses were cooled for 20 h. Subsequently, from the left carcass at the 12nd to 13rd rib level, a 2.5 cm thick LM sample was removed and pH,  $L^*a^*b^*$ -values, water holding capacity, cooking loss, and shear force were determined. There was no ( $P > 0.05$ ) effect of replacing soybean meal by crushed sunflower for pH,  $L^*$ ,  $a^*$  and  $b^*$  values, water holding capacity, cooking loss and shear force. The mean values were for pH = 5.59,  $L^* = 37.48$ ,  $a^* = 18.42$ ,  $b^* = 10.01$ , water holding capacity = 65.86%, cooking loss = 31.94% and shear force = 7.70 kg/cm<sup>2</sup>. Partial substitution of soybean meal by crushed sunflower does not alter the qualitative characteristics of meat from Nellore heifers finished on pasture under tropical conditions.

**Key Words:** shear force, luminosity, pH

**M166 Longissimus dorsi muscle fiber profile in young bulls grazing tropical pasture and supplemented with different strategies.** J. Cavali\*<sup>1</sup>, P. V. R. Paulino<sup>1</sup>, I. Lage<sup>2</sup>, C. A. Neves<sup>1</sup>, M. V. Santos<sup>1</sup>, M. F. Paulino<sup>1</sup>, R. Justino<sup>3</sup>, J. F. H. Rodrigues<sup>4</sup>, and D. Melo<sup>1</sup>, <sup>1</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil, <sup>2</sup>Universidade Federal dos Vales do Jequitinhonha e Mucuri, Diamantina, MG, Brazil, <sup>3</sup>JBS Friboi, Barretos, SP, Brazil, <sup>4</sup>Universidade Estadual Paulista, Jaboticabal, SP, Brazil.

The objective of this study was to evaluate the muscle fiber profile of young bulls grazing *Brachiaria decumbens* pastures and supplemented with different strategies. Fifty 2 Nellore young bulls were used, being distributed, in a completely randomized design, into 4 treatments (13 replicates): control, when the animals had free access only to mineral mixture throughout the experiment; and 3 protein supplementation strategies (T1, T2 and T3), when the animals were creep-fed with supplements containing 10, 20 and 30% crude protein (CP), respectively. After weaning the creep-fed animals received isonitrogenous supplements designed to supply 0.50 and 0.66 g of CP/day during the growing and finishing phases, respectively. The supplements used during growing and finishing contained different urea levels: 0; 4.0; 8.0 and 0; 3.0; 6.0% for T1, T2 and T3 respectively. After 580 d, the animals were slaughtered and a sample of LD muscle was taken at the last rib, frozen at  $-80^{\circ}\text{C}$ . Later on histological cuts were obtained to assess the muscle fiber profile. T2 and T3 supplementation strategy elicited an increase ( $P < 0.10$ ) in the frequency of IIB muscle fiber (61.00 and 59.80%) when compared with control and T1 treatments (54.00 and 56.15%). Probably,

a modulation of intermediate muscle fibers (type IIA) into glycolytic fibers (IIB) occurred, as the increase in the proportion of IIB muscle fiber observed in T1 and T2 treatments was accompanied by a decrease ( $P < 0.10$ ) in the frequency of IIA muscle fibers (31.17a; 31.03a; 27.57b and 25.32% for control, T1, T2 and T3 treatments, respectively). The frequency of type I muscle fiber was equal ( $P > 0.10$ ) among treatments (19.50%). Probably, the protein supplementation strategies T2 and T3 might have provided a higher energy intake by the animals, leading to muscle modulation into more glycolytic fibers. The change observed in muscle fiber metabolism due to the different protein supplementation strategies can alter important beef quality attributes. However, it still has to be investigated in beef cattle grazing tropical pastures.

**Key Words:** muscle fiber, protein supplementation, tropical grass

**M167 Effect of concentrate- vs. forage-based finishing diet on carcass traits, beef palatability, and color stability of longissimus muscle from Angus heifers.** A. J. Garmyn\*, D. L. VanOverbeke, R. G. Mateescu, and G. G. Hilton, *Oklahoma State University, Stillwater.*

The objective of the study was to determine the effect of finishing diet on carcass traits, beef palatability, and color stability of longissimus from Angus heifers. Half-siblings were obtained from a herd involved in selection for increased intramuscular fat, ribeye area, and retail product, and decreased back fat and alternatively assigned to a forage- or concentrate-based finishing diet. Longissimus muscle samples ( $n = 155$ ) were obtained and fabricated into steaks for trained sensory panel, Warner-Bratzler Shear force (WBS), thiobarbituric acid reactive substances (TBARS), and simulated retail display. ANOVA was conducted through the MIXED procedure of SAS using harvest age as a covariate. Carcasses from heifers finished on concentrate had greater adjusted fat thickness (1.86 vs. 0.87 cm), higher percentage KPH (2.14 vs. 1.35%), higher numerical yield grades (3.38 vs. 2.25), and higher marbling scores (modest 90 vs. traces 70;  $P < 0.05$ ) than forage-finished heifers. There was no difference in longissimus muscle area between diets ( $P > 0.05$ ). Steaks from concentrate-fed heifers had lower WBS values (3.67 vs. 5.05 kg), higher tenderness ratings, higher beef flavor intensity, lower grassy/cowdy flavor intensity, and higher painty/fishy flavor intensity than steaks from forage-fed heifers ( $P < 0.05$ ). There was no difference ( $P > 0.05$ ) between diets for initial or sustained juiciness and livery/metallic flavor intensity. Initial TBARS were higher ( $P < 0.05$ ) in steaks from concentrate-fed heifers when compared with grass-fed heifers, but TBARS were not different ( $P > 0.05$ ) between diets following 7 d in retail display. Diet did not have an effect on instrumental or subjective color, except  $L^*$  values (0 = black and 100 = white) were higher (38.36 vs. 32.25;  $P < 0.05$ ) for steaks from concentrate-fed heifers than from forage-fed heifers. This study points to several disadvantages of forage-based finishing diets in relation to beef palatability, especially tenderness and beef flavor.

**Key Words:** beef palatability, color stability, diet

**M168 Does creep feed and backgrounding energy source affect lifetime growth performance and carcass characteristics of nursing calves pastured on annual ryegrass?** M. S. Gadberrry\*<sup>1</sup>, P. A. Beck<sup>2</sup>, B. Barham<sup>1</sup>, W. Whitworth<sup>3</sup>, and J. Apple<sup>4</sup>, <sup>1</sup>University of Arkansas, Little Rock, <sup>2</sup>University of Arkansas, Hope, <sup>3</sup>University of Arkansas, Monticello, <sup>4</sup>University of Arkansas, Fayetteville.

Angus sired, fall born steer ( $n = 36$ ) and heifer ( $n = 24$ ) calves (BW = 153 kg) with their dams were randomly assigned to 1 of 3 creep feeding treatment pastures (2 pastures/treatment) 93 d before weaning. Annual ryegrass (*Lolium multiflorum*) pastures were stocked at 2.47

cow/calf pair per ha. Treatments included no creep (NC), soybean hull (SC) based creep, or corn (CC) based creep offered at 1% BW (as-fed). After weaning, calves were allocated to 1 of 12 backgrounding pens receiving either a soybean hull or corn based diet for 63 d. Following the backgrounding phase, calves were fed a common finishing diet for 133 d. Pasture and pen were considered the experimental units. Post-weaning data were analyzed as a split-plot with pre-weaning treatments as the whole plot and backgrounding treatments and pre-weaning by backgrounding interaction as the subplot. Creep feed did not affect ADG pre-weaning ( $P = 0.41$ ). Pre-weaning ADG averaged 1.3, 1.4, and 1.4 kg/d for NC, SC, and CC, respectively. Backgrounding BW gain was not affected by pre-weaning diet ( $P = 0.14$ ), backgrounding diet ( $P = 0.38$ ), or their interaction ( $P = 0.54$ ). Backgrounding ADG averaged 1.2 kg/d among treatments. Over the 133 d finishing period, calves averaged 1.8 kg/d BW gain which was not affected by pre-weaning diet ( $P = 0.88$ ), backgrounding diet ( $P = 0.52$ ), or their interaction ( $P = 0.86$ ). Calves were harvested with an average back fat thickness of 1.6 cm. Hot carcass weight (339 kg), back fat thickness, calculated yield grade (3.6), and percentage USDA Choice (56.4%) were not significantly affected by pre-weaning diet, backgrounding diet, or their interaction. These results suggest that neither creep feed nor source of energy in creep or backgrounding diets affect lifetime performance when calves are developed on a high plain of nutrition beginning pre-weaning.

**Key Words:** creep feed, backgrounding, carcass characteristics

**M169 Does creep feed and backgrounding energy source affect lifetime growth performance and carcass characteristics of nursing calves pastured on improved warm-season grasses?** B. Barham<sup>1</sup>, P. A. Beck<sup>2</sup>, M. S. Gadberry<sup>1</sup>, W. Whitworth<sup>3</sup>, and J. Apple<sup>4</sup>, <sup>1</sup>University of Arkansas, Little Rock, <sup>2</sup>University of Arkansas, Hope, <sup>3</sup>University of Arkansas, Monticello, <sup>4</sup>University of Arkansas, Fayetteville.

Angus sired, spring born steer ( $n = 78$ ) and heifer ( $n = 42$ ) calves (BW = 141 kg) with their dams were randomly assigned to 1 of 3 creep feeding treatment pastures (2 pastures/treatment) 90 d before weaning. Mixed warm-season, grass pastures were stocked at 2.47 cow/calf pair per ha. Treatments included no creep (NC), soybean hull (SC) based creep, or corn (CC) based creep offered at 1% BW, as-fed basis. After weaning, calves were allocated to 1 of 12 backgrounding pens receiving either a soybean hull or corn based diet for 45 d. Following the backgrounding phase, calves were fed a common finishing diet for either 147 or 183 d. Pasture and pen were considered the experimental units. Post-weaning data were analyzed as a split-plot with pre-weaning treatments as the whole plot and backgrounding treatment and pre-weaning by backgrounding interaction as the subplot. Creep fed calves gained 0.3 kg/d more than NC calves ( $P = 0.002$ ); however, there was no difference between SC and CC ( $P = 0.28$ ). Creep feed conversion averaged 5.2 kg feed per kg additional BW gain. Average daily gain during the backgrounding phase was not affected by creep diet ( $P = 0.45$ ), backgrounding diet ( $P = 0.93$ ), or their interaction ( $P = 0.46$ ). At feedlot entry, creep fed calves continued to weigh more than NC calves ( $P = 0.03$ ); however, by the conclusion of the finishing phase, there were no significant treatment effects on finished BW. Calves were finished at an average back fat thickness of 1.4 cm after an average 173 d finishing period. Hot carcass weight (319 kg), days on feed, back fat thickness, calculated yield grade (3.7), and percentage USDA Choice (73.6%) were not significantly affected by pre-weaning diet, backgrounding diet, or their interaction. These results suggest that improvements in BW gain may occur with calves offered creep feed during summer months; however, the benefit of additional BW may diminish by the

end of feedlot finishing. In addition, creep feeding showed no beneficial effect on carcass characteristics.

**Key Words:** creep feed, backgrounding, carcass characteristics

**M170 Genetic group and slaughter weight influence on meat quality of feedlot cattle.** R. Mello<sup>1</sup>, F. D. de Resende<sup>2</sup>, A. C. de Queiroz<sup>3</sup>, M. H. de Faria<sup>2</sup>, R. A. Possenti<sup>2</sup>, and G. F. Alleoni<sup>2</sup>, <sup>1</sup>Universidade Federal de Santa Maria, Santa Maria, RS, Brazil, <sup>2</sup>Agência Paulista de Tecnologia dos Agronegócios, Colina, SP, Brazil, <sup>3</sup>Universidade Federal de Viçosa, Viçosa, MG, Brazil.

The purpose of this study was to investigate the genetic group and slaughter weight influence on meat quality of the cattle. Thirty 6 young (20 mo) bulls, 18 crossbred F1 Red Angus × Nellore (1/2 RA 1/2 N) and 18 F1 Blonde D'Aquitaine × Nellore (1/2 BA 1/2 N) were used. The young bulls were finished in a feedlot 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. Data were analyzed with SAS software using initial SBW as a covariate. The table below shows the least squares means of pH at 24 h after slaughter in the *Longissimus dorsi* muscle (LM), tenderness (WBSF) and cooking loss in the LM at 12th rib, and chemical composition (humidity, ash, crude protein, crude fat) in the LM at 13th rib. There was no effect ( $P > 0.05$ ) of genetic group (GG) and the interaction between GG and slaughter weight (SW) was not significant ( $P > 0.05$ ) for all measured traits. The tenderness, cooking loss, and chemical composition (humidity, ash, crude protein, crude fat) of meat were similar for all treatments. On the other hand, as the slaughter weight raised the pH 24 h increased ( $P < 0.05$ ). Therefore, finishing of crossbred F1 Blonde D'Aquitaine or Red Angus versus Nellore young bulls on feedlot and slaughtered at 480, 520 and 560 kg produced meat with similar and suitable quality.

**Table 1.** Least squares means

	Genetic Group (GG)		Slaughter Weight (SW)		
	½ RA	½ N	480	520	560
pH 24 hours	5.8	5.8	5.7 <sup>c</sup>	5.8 <sup>b</sup>	5.9 <sup>a</sup>
Shear (WBSF), kgf/cm <sup>2</sup>	4.41	4.72	4.88	4.47	4.35
Cooking loss, %	26.0	24.3	23.3	25.0	27.2
Humidity, %	75.3	74.5	75.4	75.1	74.1
Ashes, %	1.0	1.0	0.9	1.0	1.0
Crude protein, %	19.5	20.0	19.2	20.0	20.1
Crude fat, %	4.3	4.5	4.4	3.9	4.8

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:** chemical composition, *Longissimus dorsi*, young bulls

**M171 Animal health effects on carcass quality.** T. M. Jeske\*, R. J. Maddock, and K. R. Carlin, North Dakota State University, Fargo.

The objective of this study was to investigate the effects of medical treatment and lung condemnations on carcass quality of feedlot cattle. Steers and heifers ( $n = 1974$ ) were individually identified in one of 3 cooperating feedlots, and all health issues and treatments were noted. When cattle reached market weight, they were slaughtered at one location and USDA yield and quality grade was obtained for all carcasses. In addition, complete carcass traits were recorded from 276 head. Data were

analyzed using ANOVA to compare between carcasses with or without condemned lungs, and to compare between treated and untreated. Difference in grading percentages were evaluated using chi-squared. Lung condemnations were noted for 1297 carcasses at slaughter, of which 109 lungs (8.4%) were condemned for some defect related to the heart, lung or trachea. USDA Quality grades of cattle with condemned lungs were 0% Prime, 69.7% Choice, 27.5% Select and 2.7% as No Rolls. Complete carcass data on 38 of the carcasses with condemned lungs found an average ribeye area of 80 cm<sup>2</sup> (SD = 3.4) marbling score of 459 (Sm59) (SD = 28), fat thickness of 1.26 cm (SD = 0.12). Cattle with lungs not condemned (n = 1185) had a USDA Quality grade breakdown with 1% Prime, 68% Choice, 28% Select and 2.1% as No Rolls. Average carcass data for carcasses without lung condemnations was a ribeye area of 83 cm<sup>2</sup> (SD = 4.1) marbling score of 437 (Sm37) (SD = 41) and a fat thickness of 1.17 cm (SD = 0.16). No significant differences in carcass traits were noted between carcasses with or without condemned lungs. Cattle treated at the feedyard consisted of 84 out of 1974 head or 4.25%. USDA Quality grades for treated cattle were 0% Prime, 56% Choice, 37% Select and 7% as No Roll, and an average USDA Yield grade of 2.54. Comparatively, overall carcass data was 1.1% Prime, 67.3% Choice, 29.5% Select, 2% as No Rolls, and average USDA Yield grade was 2.51. A strong trend ( $P = 0.08$ ) was found for treated cattle to have inferior USDA quality grading percentages. These data indicate that health status may be related to USDA Quality grade of steer and heifers.

**Key Words:** beef, health, carcass quality

**M172** Effect of garlic and onion on the thiobarbituric acid reactive substances (TBARS), volatile compounds and sensory evaluations of irradiated cooked ground beef. H. S. Yang\*, G. D. Kim, K. Y. Seo, E. Y. Jung, and S. T. Joo, *Division of Applied Life Science (BK21 Program), Graduate School of Gyeongsang National University, Jinju, Gyeongnam 660-701, Republic of Korea.*

The effects of adding garlic and onion on the lipid oxidation, volatile compounds, and sensory evaluations of irradiated ground beef patties

were investigated during storage. Beef rounds were ground, added with none (control), 0.1% garlic or 0.5% onion, packaged in oxygen permeable bags, irradiated at 0 or 2.5 kGy, and cooked to an internal temperature of 75Å°C. Data was analyzed by the procedures of generalized linear model (GLM) of SAS (2000). SNK (Student-Newman-Keuls) multiple-range test was used to compare the mean values of treatments. Differences in sensory values were compared using the Tukey's honestly significant differences. Irradiated ground beef had significantly higher TBARS values than nonirradiated ones regardless control and garlic treatment at 3 d. However, at d 5, the TBARS values of irradiated ground beef with 0.5% onion (0.78) sample was lower than nonirradiated control (1.04 mg malonaldehyde/kg meat) ( $P < 0.05$ ). Addition of garlic greatly increased the amounts of all sulfur compounds. In control beef, carbon disulfide was not detected, but methanethiol, dimethyl disulfide, and dimethyl trisulfide were newly produced after irradiation. During storage, the amounts of all S-compounds in ground beef decreased rapidly, and carbon disulfide, 2-propen-1-thiol, 3,3-thiobis-1-propene, methyl 2-propenyl disulfide, dimethyl trisulfide and di-2-propenyl disulfide were not detected from the irradiated ground beef with 0.5% onion treatment after 3 d storage and no S-compounds were found in both onion alone and control ground beef after 5 d storage. Although, addition of garlic produced large amounts of S-compounds, the intensity of irradiation aroma and flavor in irradiated cooked ground beef with garlic or onion was similar to that of the nonirradiated control ( $P > 0.05$ ). Therefore, addition of 0.5% onion or 0.1% garlic is recommended to mask or prevent off-odor in irradiated ground beef.

**Key Words:** irradiated, ground beef, garlic and onion