

methane emissions. Methane was measured using an internal tracer (sulfur hexafluoride, SF₆) method. The buffalo were fitted with collection canisters and measurements were taken for five consecutive days. The gases were analyzed using a gas-liquid chromatograph equipped with a flame-ionization detector and an electron capture device. Results were analyzed using analysis of variance procedures. Buffalo consuming the BR-MU produced more 4% Fat Corrected Milk as compared to the BR group ($P < 0.05$) (63.7 liters vs. 51.8 liters). When analyzed monthly, buffalo consuming the BR-MU produced more milk per month ($P < 0.05$) as compared to buffalo consuming BR. Likewise, buffalo consuming the BR-MU has a greater butterfat concentration as compared to the BR group ($P < 0.05$) (6.6% vs. 6.0%). Furthermore, the average weight gain of buffalo consuming the BR-MU was greater ($P < 0.05$) than the BR group (28 kg vs. 15 kg). Daily methane production for the buffalo consuming the BR-MU was 190 grams per day as compared to 239 grams per day for the BR group ($P < 0.05$). Supplementing typical high-fiber buffalo diets with a combination of molasses-urea resulted in greater daily production of butterfat, milk and weight gain. Furthermore, the addition of molasses-urea resulted in a 20% reduction in the amount of methane produced per animal and the amount of methane per unit of 4% FCM was 34% less. The data suggests that the supplementation of high fiber diets with a molasses-urea combination will reduce methane emissions.

Key Words: methane production, global warming, molasses-urea supplementation

654 SUPEROVULATORY response and embryo recovery in buffalo heifers and cows treated with Super-Ov and LH gonadotropins. A.M. Osman*, S.H. Shehata, and G.A. Megahid, *Dept Theriogenology, Fac. Vet. Medicine, Assiut University, Assiut.*

Superovulation and nonsurgical embryo collection were tried on 5 heifers and 10 buffalo cows. These animals were healthy, cycling, non lactating

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655 Pork quality of pigs finished indoors or outdoors under a commercial setting. J.G. Gentry, J.R. Blanton, J.J. McGlone, and M.F. Miller*, *Texas Tech University, Lubbock.*

The objective of this study was to determine the effects of outdoor and indoor housing on pork quality of pigs. Barrows and gilts were randomly selected from a group of indoor raised pigs and placed into one of two housing systems. The outdoor housed pigs were finished on a dirt lot while the indoor housed pigs were finished on concrete slats. The average initial weight of the pigs was 30 kg. Carcass data were collected and boneless loins were aged for 14 days. Pork loins were cut into 2.54 cm thick chops and frozen for further analysis. Retail shelf life was evaluated on chops aged 14 days in a simulated retail case. Chops were scored daily for color, uniformity, discoloration and browning. Hunter L*, a*, b* measurements were taken at the 10th rib. Other measurements included subjective color, firmness, and marbling, Warner-Bratzler shear force (WBS) and sensory panel scores for tenderness, juiciness and flavor. No differences were detected for average daily gain ($P > .05$). Outdoor finished pigs had a larger loin eye area ($P = .0003$), whereas indoor finished pigs had a higher NPPC marbling score ($P = .001$). There were no significant differences in 6, 12 or 24 hr pH measurements of the *Longissimus dorsi* muscle. No differences were detected for sensory evaluation except, indoor pigs had a higher initial juiciness score ($P = .003$), which may be attributed to the higher marbling score. Retail display scores were similar among the groups, but the outdoor finished pigs had lower visual color scores on day 1 and day 4 ($P < .05$). These results indicate little differences in pork quality of pigs finished in outdoor and indoor environments.

Key Words: Pigs, meat quality, environment

656 The effect of magnesium supplementation on pork quality. R. vanLaack*¹, ¹*Department of Food Science and Technology, University of Tennessee, Knoxville.*

The objective of the study was to determine the feasibility of improving pork quality by magnesium supplementation, as magnesium-sulfate. In a pilot study, we determined that the level and duration of magnesium

and 2-5 years old. They were selected from those raised in a local buffalo farm. Through rectal examinations, these animals were assigned to be at mid luteal phase before superovulation treatment. Super-Ov (purified porcine FSH: Mfd. in Canada by W.A. Montreal Inc.) was administered intramuscular, morning and evening for 3 consecutive days (Total 75 NIH. unit divided into 6 equal doses). Lutalyse 25 mg was injected with the fifth Super-Ov injection according to manufactures instructions. In addition, 2000 USP unit chorionic gonadotropine (Steris, Lab. Inc. Phoenix, Arizona) was injected at the 5th day of the treatment to improve rate of ovulation. All buffaloes were closely observed by experts to detect the onset and duration of oestrus. Buffalo bulls were allowed to mount female at oestrus several times. Rectal examinations was performed to count numbers of corpora lutea (CL) and unovulated follicles at day 7 from breeding and just before the nonsurgical embryo collection. The onset of oestrus began earlier in heifers than cows (16.0 + 1.4 and 24.7 + 9.9 hours respectively) and the difference was significant ($P < 0.05$). The duration of oestrus was significantly shorter ($P < 0.05$) in cows than heifers (30.2 + 3.7 and 39.2 + 8.1 hours respectively). The number of CL was significantly higher ($P < 0.01$) in cows than heifers (4.2 + 1.03 and 2.4 + 0.5 respectively). The number of unovulated follicles was significantly higher ($P < 0.05$) in heifers than cow (4.4 + 1.6 and 2.3 + 0.67 respectively). The ovulation rate is higher in cows (83%) than heifers (35%). Uterine flushing failed in 3 cases due to narrow cervix (2 heifers) and subclinical endometritis (1 cow). The other flushing revealed a total of 12 embryos with a recovery rate of 27.9% (range from 0-66%) from the cows only. The used protocol appeared satisfactory in buffalo cows rather than heifers.

Key Words: Superovulation, Buffalo, Embryo

supplementation required to increase blood levels of magnesium (Mg) by 10% was 2 g elemental Mg/kg feed for 5 days before slaughter. The final concentration of Mg in the control and supplemented feed were 1.3 and 3.7 g Mg/kg feed, respectively. Subsequently, 100 halothane-negative pigs were supplemented at this level of magnesium for 5 days before slaughter. One-hundred non-supplemented pigs of the same genetic line were used as control group. Pigs were slaughtered on day 6, after 12 h fasting and transport to the packing plant. Blood, collected immediately after slaughter, was analyzed to determine Mg concentration. Blood Mg concentration in supplemented animals was 10% higher than in the control group ($P < 0.05$). At 30 min, and at 3, 5 and 20 h postmortem, the pH in the loin was 6.43, 6.39, 6.20 and 5.71 respectively. Mg supplementation did not influence the pH decline. Meat quality characteristics at 24 h postmortem (color and water holding capacity) of the loin and ham (semimembranosus muscle) were not influenced by Mg supplementation. Mg supplementation did not influence purge % and shear force of 3 weeks stored loins. We conclude that in normal halothane-negative pigs, short term Mg supplementation does not significantly improve pork quality or reduce purge losses.

Key Words: Magnesium supplementation, Water-holding capacity, Color

657 Effect of chromium-methionine supplementation on the apparent muscle fiber number in newly hatched Japanese quail (*Coturnix coturnix japonica*) under heat stress condition. G. Contreras*, F. Rios, and R. Barajas, *Universidad Autonoma de Sinaloa, Sinaloa, Mexico.*

The fact that chromium stabilize nucleic acids is known, in concordance with that, the hypothesis that organic chromium supplementation increase myofiber number was tested in this study. Our objective was to determine the effect of chromium-methionine supplementation on apparent muscle fiber number in newly hatched Japanese quail under heat stress condition. A complete randomized design experiment was conducted. 320 breeders Japanese quail (240 females and 80 males) were divided in 10 groups of 32 avian (24 females and 8 males), and allocated in metal wire cages. The quails were randomly assigned to one of two experimental diets: 1) Diet containing 21% CP and 2.9 Mcal of

ME/kg (control); and 2) Diet similar to control, but supplemented with 200 ppb of Cr from chromium-methionine. Twenty-four (12 by treatment) newly hatched quail (1 day old) were randomly selected to be slaughtered. The iliobtibialis cranialis muscle was dissected and stained. From each of 24 muscle-samples one microphotography (400 X) was taken, and the apparent muscle fiber number was counted in paper photo. The mean and maximum mean temperature were 29C and 34.7C respectively. Chromium-methionine supplementation diminished ($P < 0.01$) daily feed intake by 9.7% (5.4 vs 4.9 g/d). The percentage of eggs hatching (77.25 vs 78.92%), and hatchability (51% vs 50%) were not affected ($P > 0.10$) by treatments. The chromium-methionine supplementation reduced ($P < 0.05$) apparent muscle fiber number by 22.5% (6,428 vs 4,964 cells/mm²) in the iliobtibialis cranialis muscle. It is concluded, that chromium-methionine supplementation under heat stress condition reduced feed intake and apparent muscle fiber number of Japanese quail.

Key Words: Chromium, Japanes quail, Heat stress

658 Enhancement of conjugated linoleic acids in beef steers fed different levels of full-fat extruded soybeans. M. Madron*¹, D. Peterson¹, D. Dwyer¹, D. Beermann², and D. Bauman¹, ¹Cornell University, Ithaca, NY, ²University of Nebraska, Lincoln.

Conjugated linoleic acids (CLA) have been shown to have anti-cancer properties and other beneficial health effects in biomedical studies with animal models. Rumen biohydrogenation of polyunsaturated fatty acids is involved in CLA production and dietary supplement with extruded full-fat soybeans results in a marked increase in milk fat content of CLA in dairy cows. Crossbred Angus steers (n=30) were used to determine if the conjugated linoleic acid content of adipose tissue could be increased by feeding varying levels of extruded full-fat soybeans during the finishing phase of growth. Diets were 1) control 2) 12.5% extruded full-fat soybeans (LESB) and 3) 25% extruded full-fat soybeans (HESB). Steers were individually housed and total days on feed was 111. The starting weight averaged 417 kg and the average daily gains were 1.64 kg for control, 1.68 kg for LESB and 1.72 kg for HESB. The average final slaughter weights for the groups was 592 kg for control, 599 kg for LESB, and 618 kg for HESB. Time of slaughter was determined by visual evaluation of finish and average dressing percentage across the entire group was 62%. All steers were A maturity and quality grades ranged from prime- to choice-. At slaughter the chuck, round, and loin were removed and processed for analysis. From each meat cut three adipose tissue depots (subcutaneous, intermuscular, and intramuscular) were sampled for CLA analysis. The CLA content was measured using gas chromatography and to date analysis for 5 steers per diet has been completed for the loin muscle. All three adipose sites for the loin muscle had similar CLA content so values were averaged. The CLA content in adipose tissue from the loin muscle did not differ among treatments and averaged 4.8, 4.7 and 5.5 mg/g of fatty acids for the control, LESB and HESB diets respectively. Thus, altering the supply of fatty acids for rumen biohydrogenation by use of extruded full-fat soybeans had no effect on CLA content in the fat from the loin muscle.

Key Words: CLA, Extruded, Beef

659 Effect of pre-harvest oral calcium gel administration on tenderness. S. K. Duckett*¹, J. G. Andrae¹, G. T. Pritchard¹, S. L. Cuvala¹, and J. Church¹, ¹University of Idaho, Moscow.

Twenty-four Charolais-cross spayed heifers and steers (540 kg) were used to determine the effect of administering an oral calcium gel at 3 to 4 h before harvest on tenderness in three muscles. Animals were randomly assigned within sex to one of the following treatments: controls, 1.5 L of water dosed orally (N) and calcium gel, 1.5 L of Dr. Larson's Up and Over 1000, (150 g of calcium) dosed orally (CA). Serum calcium levels were measured before dosing and at harvest. Longissimus pH and temperature levels were monitored at 1, 3, 6, 12, and 24 h postmortem. Samples were taken at 1 h postmortem for determination of calpain/calpastatin activity. At 24 h postmortem, carcass data were collected and four steaks (2.54 cm thick; aged 1, 3, 7, and 14 d) were removed from longissimus (LM), supraspinatus (SS) and semitendinosus (ST) for Warner-Bratzler shear force (WBS) determination. Data were analyzed with sex, treatment, time (if appropriate) and all interactions tested. For serum and muscle traits, sex and sex by treatment interaction were not significant ($P > .05$). Serum normalized calcium levels

were similar ($P > .05$) between treatments before dosing and 32% higher ($P < .05$) for CA than N at harvest. Longissimus pH levels declined ($P < .05$) over time but were lower ($P < .05$) for CA than N. Free calcium levels in the longissimus were elevated ($P < .05$) by 41% and 84% for CA than N at 1 and 24 h, respectively. Activity of u- and m-calpain per g of muscle was 12% and 20% higher ($P < .05$) for CA than N. Total calcium content of LM was 32% higher ($P < .05$) for CA than N; however, total calcium values were similar ($P > .05$) between treatments for SS and ST. WBS values and variation were lower ($P < .05$) for CA than N in LM. In the SS and ST, WBS values were similar ($P > .05$) between treatments; however WBS variation within the muscle was lower ($P < .05$) for CA than N. Pre-harvest calcium gel administration elevated serum and longissimus calcium levels and activated the calpains to improve tenderness. However, other muscles (ST and SS) were less responsive.

Key Words: Beef, Calcium, Tenderness

660 Impact of high oil corn on beef steak quality. S.K. Duckett¹, B.A. Gardner*², M.A. Hinds³, and F.N. Owens³, ¹University of Georgia, Athens, ²Oklahoma State University, Stillwater, ³Optimum Quality Grains, L.L.C., Des Moines, IA.

Ribeye (longissimus) steaks were obtained from 200 steers fed either high oil or typical corn grain for Warner-Bratzler shear force measurements and evaluation by 8-member trained taste panels. Steaks were gathered at commercial packing plants from steers fed in trials at a commercial feedyard in western Kansas (92 steaks), the University of Idaho (28 steaks), and the Pioneer Livestock Nutrition Center in Johnston, IA (80 steaks). Of these steers, 66% of those fed high oil corn and 64% of those fed typical corn graded U.S. Choice or greater. Mean carcass weight, yield grade, marbling score, skeletal maturity, and fat thickness (355 kg, 3.25, 534, 117, and 1.1 cm.) were not significantly altered by corn source. Compared with steaks from steers fed typical corn, steaks from steers fed high oil corn had greater juiciness (4.97 vs 4.71; $P < .02$) and tenderness (5.42 vs 5.20; $P < .02$) when tested using the trial by corn type interaction. When marbling score was included as a covariate, shear force tended to be lower for those steers fed high oil corn (3.66 vs 3.77 kg; $P < .06$). Steers that graded U.S. Choice tended to have lower ADG (1.57 vs 1.69 kg; $P < .06$) but higher yield grades (3.28 vs 3.05; $P < .01$) than steers that failed to grade U.S. Choice. Steaks from carcasses that graded U.S. Choice were juicier (4.97 vs 4.69; $P < .01$) and tended to be more tender (5.49 vs 5.08; $P < .15$) and flavorful (5.18 vs 5.06; $P < .07$) and have lower shear force (3.64 vs 3.81; $P < .21$) than steaks from steers graded below U.S. Choice. Interactions between quality grade and corn source suggested that high oil corn had adverse effects on steak flavor of steaks not grading U.S. Choice but improved juiciness most for steaks from carcasses that graded U.S. Choice or above. Correlations between marbling score and shear force, steak juiciness, tenderness, and flavor were low ($r = -.19; .18; .28$; and $.09$).

Key Words: High Oil Corn, Meat Quality, Tenderness

661 Impact of high oil corn on meat quality. B.J. Johnson*¹, D.M. Wulf¹, M.S. Eibs¹, B.J. Reuter¹, J.M. Bok¹, B.D. Rops¹, and F.N. Owens², ¹South Dakota State University, Brookings, ²Optimum Quality Grains, Des Moines, IA.

Angus-sired steer calves (N = 153) were fed on a high concentrate diet consisting of either typical corn (C:79.5% of ration), high oil corn (HOC: 79.5% of ration), or high oil corn fed at level isocaloric to typical corn (ISO: 74.5% of ration) for 156 days. Rib sections were removed 72-h postmortem. Steaks (2.54 cm thick) were cut from rib sections and used for retail display panel (RDP), Warner-Bratzler shear force (WBS), and trained sensory panel (TSP) measurements. Samples of grain and meat were collected for tocopherol analysis. Three storage treatments were used prior to RDP: 1) domestic chilled (DC), chilled storage for 13 d postmortem; 2) export chilled (EC), chilled storage for 34 d postmortem; 3) export frozen (EF), chilled 3 d postmortem then frozen 56 d. Samples for TSP and WBS were aged for 14-d postmortem. RDP was monitored for 9 d (d 0-8) under simulated retail meat display conditions with samples appraised visually by a 5-member panel. On d 8, thiobarbituric reactive substances (TBARS) of RDP samples were quantified. Preplanned contrasts were used to assess treatment differences. HOC contained greater ($P < .05$) alpha and gamma-tocopherol levels than C (3.72 and 11.43 vs 1.95 and 5.38 mg/kg). Ribeye samples from steers fed HOC also contained greater ($P < .05$) levels of both alpha-tocopherol

(2.49 vs 1.66 ppm) and gamma-tocopherol (.34 vs .18 ppm) than samples from steers fed C. Rate of discoloration, as appraised by RDP, was slower ($P < .05$) in steaks from steers fed HOC than steers fed C for EC storage treatment, with case life extended by approximately 2 d. TBARS were lower ($P < .05$) in samples from steers fed HOC and ISO than steers fed C for the EC steaks (.548, .455 vs 1.059 mg of malonaldehyde/kg tissue). No treatment differences ($P > .10$) were detected for TSP or WBS measurements. These data suggest that substituting high oil for typical corn in diets for finishing beef steers will elevate tocopherol levels in beef and extend case life of beef for export.

Key Words: High oil corn, Beef, Case life

662 Effect of dietary lycopene supplementation for eight weeks before slaughter on lycopene accumulation in tissue, fat color, and meat quality during display in Japanese Black steers. M. Mitsumoto*¹, K. Sasaki¹, T. Ito², K. Hodate¹, H. Abe¹, Y. Kawakita¹, S. Oshima³, and T. Inakuma³, ¹National Institute of Animal Industry, Tsukuba, Japan, ²Nagano Animal Industry Experiment Station, Shiojiri, Japan, ³Kagome Research Institute, Nishinasuno, Japan.

Effects of dietary lycopene supplementation to steers for eight weeks on lycopene accumulation in tissue and fat color, and meat quality during display were studied. Three Japanese Black steers were fed no supplemental lycopene and three were supplemented with 3,000 mg of lycopene mixed in 8 kg concentrate per animal daily for eight weeks before slaughter. Blood samples were drawn before and after dietary lycopene supplementation. Samples of liver, subcutaneous and intermuscular adipose tissue, semitendinosus (ST) and longissimus thoracis (LT) muscles were obtained after slaughter. Fat color (L^* , a^* and b^* values) was measured before freezing. These tissues were vacuum-packaged and stored at -20°C until required. The lycopene concentrations of plasma and tissue samples were determined by the HPLC method. Steak samples from thawed ST and LT muscles were over-wrapped with PVC film and displayed under fluorescent lights at 4°C for 10 days. Drip loss percentages, meat color, metmyoglobin percentages, and 2-thiobarbituric acid reactive substances values were determined at day 1, 4, 7 and 10. Dietary lycopene supplementation accumulated ($P < .01$) lycopene in the plasma, liver and subcutaneous adipose tissue, but did not in the intermuscular adipose tissue and muscles. Dietary lycopene increased ($P < .01$) a^* and b^* values of fat color compared to the control. Dietary lycopene did not improve ($P > .05$) drip, meat color and lipid stability during display compared to the control. The data indicated that dietary lycopene was absorbed in small intestine and incorporated into plasma lipoproteins, and transferred to liver and subcutaneous adipose tissue, but not to muscles. Therefore, dietary lycopene could not work for retaining meat quality during display.

Key Words: Lycopene, Fat color, Meat quality

663 Carcass, sensory, and adipose tissue traits of Brangus steers fed casein-formaldehyde-protected starch and(or) canola lipid. C. D. Gilbert*, D. K. Lunt, R. K. Miller, and S. B. Smith, Texas A&M University, College Station.

Eighteen Brangus steers of similar live weight were assigned randomly to one of three dietary treatment groups: cracked corn (Corn), casein-formaldehyde-protected Canola Lipid (CL), or casein-formaldehyde-protected Marble Plus (MP). The purpose of the study was to determine if feeding protected starch and lipid increased marbling scores without increasing carcass fat. All diets were equally balanced for ME (291 Mcal/kg), crude protein (12.5%), and dry matter (89%). Ether extract was 3.7, 6.9, and 6.9% for the Corn, CL, and MP diets, respectively. The CL and MP diets provided equal amounts of protected lipid (3.3%). The MP also contained 3.7% protected starch. Steers were fed their respective diets for 126 to 130 d before slaughter. Beef carcasses from steers fed Corn, CL, or MP did not differ in adjusted fat, ribeye area, hot carcass weight, or yield grade ($P \geq 0.23$). Percentage KPH fat was higher ($P < 0.05$) for CL and MP carcasses than for Corn carcasses. Marbling score and quality grade did not differ among treatment groups; nor did Warner-Bratzler shear force, meat palatability, or sensory flavor attributes of steaks ($P \geq 0.13$). Subcutaneous and i.m. adipose tissue explants were incubated with 5 mM [^{14}C]glucose \pm 0.1 mU/mL insulin. Glucose incorporation into total lipids (TL), glyceride-glycerol (GG), and fatty acid (FA) fractions were highest ($P < 0.05$) in s.c. adipose tissue from steers fed MP, but was unaffected by diet in i.m.

adipose tissue. Insulin did not affect ($P > 0.05$) glucose incorporation into TL, GG, or FA for s.c. adipose tissue, but tended ($P < 0.06$) to increase incorporation into TL in i.m. adipose tissue. Percentages of 16:1 and 17:1 were lower ($P < 0.05$), and 18:2 and 18:3 were higher ($P < 0.05$), in CL and MP tissues. This indicates that the protected diets decreased ruminal biohydrogenation of fatty acids. These data indicate that the increased availability of glucose and unsaturated fatty acids to the small intestine modified s.c., but not i.m., adipocyte metabolism.

Key Words: Steers, Adipose Tissue, Protected Fat

664 Fatty acid composition of muscle from beef cattle fed pre-slaughter rations based on grass silage or maize silage. A.P. Moloney*¹, P. French¹, P. O'Kiely¹, and C. Stanton², ¹Teagasc, Grange Research Centre, Dunsany, Co. Meath, Ireland, ²Teagasc, Dairy Products Research Centre, Moorepark, Co. Cork, Ireland.

Human health benefits are associated with increased polyunsaturated (PU) : saturated (S) fatty acid (FA) ratio, decreased n-6 to n-3 PUFA ratio and increased concentration of conjugated linoleic acid (CLA) in the diet. The objective of this study was to determine the concentration and ratios of FA in muscle from heifers fed combinations of grass silage and maize silage prior to slaughter. Forty-five crossbred heifers were offered *ad libitum*, grass silage, a mixture of 500 g grass silage and 500 g maize silage/kg dry matter or maize silage in a randomised block design. Animals received 3 kg concentrates daily and were slaughtered after 167 days when samples of the *m. longissimus dorsi* were collected. The FA profile (g/kg FA) of grass silage and maize silage, respectively, was oleic acid 44 and 158, linoleic acid 198 and 563 and linolenic acid 473 and 55. For grass silage, mixed silages and maize silage, respectively, the concentration of lipid in *longissimus* muscle averaged 38, 45 and 49 (s.e.d. 0.7) g/kg, SFA averaged 443, 449 and 455 (s.e.d. 9.0) g/kg FA, monounsaturated FA averaged 452, 452 and 461 (s.e.d. 9.3) g/kg FA, PUFA averaged 47, 47 and 44 (s.e.d. 5.6) g/kg FA and CLA averaged 3.5, 3.6 and 3.6 (s.e.d. 0.37) g/kg FA, none of which was affected by diet. Increasing maize silage in the ration linearly decreased ($P < 0.05$) the proportion of linolenic acid (7.3, 6.1 and 4.5 g/kg FA) and unidentified unsaturated FA (59.5, 54.5 and 40.4 g/kg FA) and linearly increased ($P < 0.05$) the n-6 : n-3 PUFA ratio (5.1, 6.7 and 8.5). It is concluded that the source of conserved forage in the ration influences the FA profile of beef and that grass silage inclusion results in a more beneficial FA profile from a consumer health perspective than maize silage.

Key Words: Fatty Acids, Conjugated Linoleic Acid, Beef

665 Carcass and meat quality of calf-fed, short- and long-yearling steers. R. D. Sainz, M.C. Coelho, and R.F. Ver-nazza*, University of California, Davis.

Sixty Angus-hereford steers were allocated at weaning (May 1997) to three groups. Calf-fed (CF) steers were sent to the UCD feedlot immediately, short-yearlings (SY) remained on irrigated pasture until Sept. 1997, then sent to the feedlot, and long yearlings (LY) remained on irrigated pasture until Sept. 1997, then on native range until May 1998, then sent to the feedlot. All steers were fed on a high-energy corn-based ration until average ultrasound backfat for the group reached 12.7 mm. Backfat had significant effects on most carcass variables studied, except for ribeye area. At equal slaughter weight, CF had more backfat (12.2 mm) than both SY and LY (9.9 and 9.7 mm, respectively; $P < 0.05$). At equal backfat depths (mean 10.6 mm), LY steers had heavier live and carcass weights (526 and 318 kg) than CF (448 and 285 kg) and SY (452 and 280 kg) steers, respectively. CF steers had the most ($P < 0.05$) KPH (2.24%), SY had the least (1.86%), and LY were intermediate (2.21%). CF steers had higher ($P < 0.05$) fat contents in the longissimus muscle (3.05%) than both SY (2.25%) and LY (2.61%). Carcass fat content tended ($P < 0.10$) to follow the same pattern (28.1, 26.8 and 25.3% for CF, SY and LY, respectively). Ribeye area ($71.2 \pm 6.6 \text{ cm}^2$) and marbling score (9.12 ± 1.95 , where 9 is Slight+ and 10 is Small-) were not affected by nutritional background. There were no differences ($P > 0.05$) among groups in Warner-Bratzler shear force ($3.44 \pm 0.70 \text{ kg}$), or panel tenderness, juiciness, flavor intensity or flavor quality (5.12 ± 1.01 , 4.62 ± 0.98 , 4.93 ± 0.55 , and 5.32 ± 0.48 , respectively, on a 1 to 8 scale). These results confirm that backgrounding increases the weight at which cattle reach slaughter finish. Moreover, neither objective nor subjective measures of meat quality were affected by varying feeding periods from

83 to 192 days. Prolonged grazing can be used to reduce the length of feeding without adverse effects on carcass or meat quality.

Key Words: Carcass, Meat quality, Beef cattle

666 Effects of pre-feedlot growth rate on carcass composition and meat tenderness. I.T. Brigman^{*1}, R.K. Miller¹, G.E. Carstens¹, and F.M. Rouquette^{2, 1} *Texas A&M University, College Station, ²Texas A&M University, Overton.*

To examine pasture growth rate effects on carcass composition and tenderness, weaned calves (106 steers; 43 heifers) of two breed types (Angus x Brahman; Simmental-sired calves from F1 Bos indicus x Bos taurus dams) were grazed on ryegrass pasture at one of three stocking rates (SR). Calves were randomly assigned within breed type and sex to low (1.5 hd/Ac), medium (2.1 hd/Ac) or high (2.75 hd/Ac) SR pastures. After grazing for 130 d, calves were fed a high-grain diet in a commercial feedlot. To target a similar carcass-weight slaughter endpoint, low- and medium-SR calves were slaughtered after 131 d on feed, whereas, high SR calves were slaughtered after 175 d. Carcass characteristics were measured 36 h postmortem. Soft tissue from 9-10-11 rib sections was analyzed for fat, protein and moisture content. Longissimus muscle sections were aged for 35 d and 2.54 cm steaks removed to measure Warner-Bratzler (WB) shear force. Grazing ADG was affected by SR (1.15, .76 & .36±.04 kg/d for low, medium & high SR, respectively) and Angus steers had higher ADG ($P < .001$) than Simmental steers and heifers (.85, .75 & .67 kg/d, respectively). Final carcass weights were not affected by SR (365, 358, 361±9 kg) or breed type and sex. Carcass weight was used as a covariate to analyze carcass data. Backfat thickness tended to be lower ($P < .04$) in low- and medium-SR calves than high-SR calves (.91, .85, 1.03±.08 cm). Rib fat content was lower ($P < .006$) in medium-SR calves compared to high-SR calves (26.0, 28.0±1.2%). Quality grades was ($P = .006$) lower for medium-SR calves than high-SR calves (620, 651±04). Shear forces after 14 and 35 days of aging were not affected by SR. Simmental-sired steers had lower backfat (.7 vs 1.0 and 9.9±.04), less rib fat (24.13 vs 28.99 and 28.60±.6%) than Angus x Brahman steers and Simmental-sired heifers. Quality grades and shear force values were not affected by breed type and sex class. In conclusion, decreasing pre-finishing growth rates of calves grazing ryegrass pasture by increasing SR, increased subsequent carcass fatness but did not affect meat tenderness.

Key Words: Beef, Background, Tenderness

667 Pork quality attributes associated with carcass side to side variation. C.A. Stahl^{*1}, M.L. Linville¹, M.A. Swaney-Stueve², K.R. Maddock¹, G.L. Allee¹, and E.P. Berg^{1, 1} *University of Missouri Department of Animal Science, Columbia, ²University of Missouri Department of Food Science & Human Nutrition, Columbia.*

The objective of this study was to evaluate side to side variation in pork carcass quality. Barrows (n=56; 45 Kg) were fed a high-energy corn/soybean based diet ad libitum to a market weight of 118 Kg. Animals were slaughtered at the University abattoir. Immediately following electrical stunning, animals were shackled and hoisted by the right hind leg just prior to exsanguination. At 45 min. postmortem, intramuscular pH was taken (10th -11th rib) in both left and right side loins (L: 6.10 vs. R: 6.26 +/- .05, $P < .05$). 24-h postmortem pH measurements showed no significant loin variation (L: 5.48 vs. R: 5.51 +/- .02, $P > .05$). Whole loins were halved at the 10th rib and light reflectance measurements (Hunter L* a* b*) were taken on the cut lean surface of the sirloin, center, and blade sections at 24-36 hours postmortem. Differences in light reflectance were noted in the sirloin L* (L: 53.08 vs. R: 57.61 +/- .65, $P < .05$), center b* (L: 13.81 vs. R: 13.01 +/- .18, $P < .05$), and blade L* (L: 54.61 vs. R: 57.09 +/- .44, $P < .05$), a* (L: 7.37 vs. R: 6.26 +/- .15, $P < .05$), b* (L: 14.72 vs. R: 13.68 +/- .21, $P < .05$) values. Loins were then vacuum packaged and stored at 1 degree C for a duration of either 21 or 41 days to represent storage time required for delivery in domestic and export markets, respectively. Immediately following their allotment to storage, left/right loin sensory characteristics were evaluated by a descriptive attribute sensory panel (n=9) using a line scale of 1-10 (10 being the highest) for toughness and juiciness. Domestic loins (21d.) had a significant difference in toughness (L: 3.95 vs. R: 2.74, $P < .05$) and juiciness (L: 3.19 vs. R: 4.24, $P < .05$) while export loins (41d.) had a significant difference in toughness (L: 3.06 vs. R: 2.82, $P < .05$) yet no significance in juiciness. From this trial it can be concluded that significant differences in left/right variation exist within

a given pork carcass. This variation may be attributed to single leg shackling prior to exsanguination.

Key Words: Sensory Panel, Light Reflectance, Pork Quality

668 Conjugated linoleic acids (CLA) markedly modify fatty acid profile of fat tissues in growing pigs. G. Bee^{*}, *Swiss Federal Research Station for Animal Production, Posieux, Switzerland.*

CLA is the acronym for a class of positional and geometric conjugated dienoic isomers of linoleic acid. They were reported to profoundly affect lipid metabolism and to act as a repartitioning agent in a number of animal species. Up to date, little is known about their effect on the fatty acid profile of body fat in pigs. In the present study we determined the lipid composition of the back fat inner and outer layer and omental fat in 16 Large White pigs fed on diets supplemented either with 2% CLA or linoleic acid enriched oil (LA). The LA oil (66% linoleic acid) was prepared from sunflower oil and served as source material for the CLA oil. The isomers of the commercial preparation of CLA, containing 59% CLA isomers, were cis(c),trans(t)-9,11 (35%), t,c-10,12 (37%), t,t-9,11/10,12 (17%), c,c-9,11 (9%), and c,c-10,12 (2%). Animals were moved into individual pens at 70 kg live weight and fed 2.8 kg/d of a grower ration up to slaughter at 105 kg. Growth performance and carcass measurements were not affected by the dietary fat supplementation. Total lean and fat deposition was similar for both treatment groups. Unlike lipid content, fatty acid profile of the fat pad was markedly influenced by CLA. Independent of the tissue, pigs fed the CLA diet exhibited higher levels of palmitic (16:0) and stearic acid (18:0) ($P < .05$) and lower levels of palmitoleic (16:1), oleic (18:1), linoleic and arachidonic acid ($P < .05$). The levels of CLA isomers in back fat and omental fat were similar and do not indicate a preferential incorporation in either one of the tissues. The in vitro activity level of malic enzyme and fatty acid synthase was not altered by the dietary fat and the data suggest that lipogenesis was not affected by CLA. The distinct shift toward higher palmitic and stearic acid and lower palmitoleic and oleic acid concentrations, which resulted in significantly lower 16:1/16:0 and 18:1/18:0 ratios, could indicate a down-regulation of $\Delta 9$ -desaturase activity by dietary CLA. Furthermore, the lower tissue levels of arachidonic acid in the CLA group imply that $\Delta 5$ -desaturase activity might also be affected.

Key Words: Pigs, Conjugated Linoleic Acids, Fatty Acid Profile

669 Influence of dietary conjugated linoleic acid on meat quality and sensory traits of stress-genotype pigs. B.R. Wiegand^{*}, J.E. Swan, F.C. Parrish, Jr., and T.J. Baas, *Iowa State University, Ames.*

Growing-finishing pigs (n = 64) weighing 40 kg were fed a control diet or a diet containing 0.75% conjugated linoleic acid (CLA). Pigs were assigned to diets by stress-genotype (normal, carrier or positive). Pigs were harvested at 106 kg of body weight. Indicators of meat quality including postmortem pH decline, color, marbling, firmness, and sensory evaluation were analyzed for diet and genotype effects. A lower pH in the loin was detected at 3 h postmortem for stress-genotype pigs compared with normal and stress-carrier pigs. All pigs fed CLA exhibited a lower pH at 3 h postmortem compared with all control diet pigs. No differences were observed in subjective color scores for diet or genotype effects. Loins from all pigs fed CLA showed higher marbling scores compared with all control diet pigs. Marbling scores were higher in normal pigs compared with positive pigs, while carrier pigs were intermediate. Firmness scores followed the same results as marbling scores with respect to diet and genotype classes. Hunter L* values were higher for loins from CLA-fed pigs compared with control diet pigs, regardless of genotype class. No differences were observed for a* value due to CLA, but stress-positive, control diet pigs exhibited higher a* values compared with stress-carrier and normal genotype pigs fed the control diet. Loin chops from normal genotype pigs fed CLA had higher b* values compared with normal genotype, control diet pigs. No differences were observed for sensory attributes of juiciness, tenderness, or flavor intensity due to CLA supplementation. This study shows that pH is lower early postmortem with CLA supplementation. However, this aspect did not negatively influence characteristics of marbling or firmness. CLA supplementation significantly improved these meat quality attributes.

Key Words: Conjugated Linoleic Acid, Stress Genotype, Meat Quality

670 Compositional differences in bellies of CLA-fed stress genotype pigs as determined by TOBEC. J.E. Swan*, B.R. Wiegand, S.T. Larsen, F.C. Parrish, Jr., and T.J. Baas, *Iowa State University, Ames.*

Sixty-four crossbred growing-finishing pigs were placed on a control (soybean oil) or CLA (0.75%) diet until harvest. Pigs were penned in pairs according to diet and stress-genotype (negative, carrier or positive). Right and left side bellies were fabricated from carcasses at 24 h post-mortem with right side bellies being subjected to a belly bar firmness test, with higher lean up and lean down values constituting a firmer belly. All skin off bellies were scanned by TOBEC producing a Peak Mean Average (PMA) value. Predictions for protein, moisture, protein+moisture, and fat-free soft tissue (FFST) composition of bellies were performed and reported at R² of .67, .68, .71, .78, respectively. Belly bar firmness values were not affected by CLA, but negative pigs showed significantly higher firmness values than positive and carrier pigs (P<.05). Additionally, within the control diet, carrier pigs exhibited significantly lower lean down values than negative pigs (P<.05). Regardless of diet, positive and carrier pigs had higher moisture, and lower fat values compared with negative pigs (P<.05). Bellies from CLA supplemented pigs exhibited increased moisture and protein and decreased fat values compared with control fed pigs (P<.05). However, with genotype effect, only carrier pigs fed CLA had significantly higher protein values than control fed (P<.05). Within the control diet, bellies from positive pigs had significantly less fat and higher moisture values than negative genotype pigs (P<.05). Independent of diet, bellies from positive and carrier pigs had a higher TOBEC derived PMA value (P<.05) and FFST value (P<.05), than the negative genotype pigs. Changes in lean composition with dietary CLA could not be discerned with TOBEC analysis.

Key Words: TOBEC, Conjugated linoleic acid, Pork

671 Does creatine monohydrate supplemented to swine finishing rations affect pork quality? E.P. Berg¹, M.L. Linville*¹, C.A. Stahl¹, K.R. Maddock¹, and G.L. Allee¹, ¹*University of Missouri, Columbia.*

The objectives were to examine supplementing creatine monohydrate (CMH) in a complete swine-finishing ration and determine the effects on meat quality. Sixty pigs were allotted 3 pigs per pen and five pens per treatment. Treatment diets included 20g of CMH/ pig/ day fed for 5, 10 and 15 days prior to slaughter were compared to controls receiving no CMH. The basal diet was a traditional corn/soy finishing diet. Pigs (123 kg) were delivered to a commercial packing plant (31 km) and slaughtered according to industry practices. Carcasses were blast chilled and placed in the cooler for 24h. Right loins and hams were collected from the fabrication line, vacuum packaged, and boxed for delivery to the University Meat Lab. Ham pH and light reflectance (L*, a*, and b*) was obtained on the gluteus medius muscle. Hams were scanned for lean content by a primal cut electromagnetic scanner. Loin pH and light reflectance was obtained at the juncture of the 10/11th rib. The posterior section of the boneless loin was weighed, vacuum packaged, and stored for 7d at 3-degrees C. After 7-days aging, loins were unpackaged, weighed to calculate purge, and remeasured for light reflectance. Warner/Bratzler shear force was determined on 7d aged loin chops. Least squares means were calculated for each parameter and evaluated for linear, quadratic, and cubic contrast. A cubic trend (P=.08) was found for percent ham lean favoring longer duration supplementation of CMH. A linear trend (P=.07) was observed for ham L* (CON, 39.28; 5d, 41.82; 10d, 41.39; and 15d, 41.84). A cubic trend was observed for ultimate loin pH (P=.102) with controls and 5d higher than 10d and 15d. Hunter L*-values had a negative linear contrast (P<.01) after 7d aging (CON, 49.67; 5d, 48.71; 10d, 51.46; and 15d, 52.96). A cubic effect (P=.05) was shown for %moisture lost as purge (CON, 2.28; 5d, 1.50; 10d, 2.08; and 15d, 1.90%). Warner/Bratzler shear were different (P=.025) in a linear fashion (CON, 2.97; 5d, 2.95; 10d, 3.50; and 15d, 3.33 kg). It appears that supplementing creatine in swine diets longer than 5d reduces the quality of fresh pork.

Key Words: Pork Quality, Creatine Monohydrate, Supplement

672 The effect of Improvac on pork quality. D.N. D'Souza¹, D. Hennessy², M. Danby², I. McCauley³, and B.P. Mullan*¹, ¹*Agriculture Western Australia, South Perth, Australia,* ²*CSL Limited, Melbourne, Australia,* ³*Victorian Institute of Animal Science, Attwood, Australia.*

Improvac[®] (CSL Limited, Australia) is an immuno-castration vaccine directed against the pig's own gonadotropin releasing factor (GnRF) which eliminates boar taint. The aim of this study was to determine the effect of Improvac on boar taint (skatole and androstenone) and objective pork quality parameters (pH, colour, surface exudate and intramuscular fat). Forty loin muscle and backfat samples each from crossbred (Large White x Landrace x Duroc) entire male, female and Improvac vaccinated entire male pigs were collected 48h post-slaughter and assessed for boar taint, muscle pH, colour (Minolta L*a* and b*), surface exudate and intramuscular fat. Improvac vaccinated male pigs had lower backfat skatole and androstenone concentration compared to entire male pigs (skatole, 0.087 vs 0.193 ug/g, P=0.042; androstenone, 0.30 vs 1.12 ug/g, P=0.001). Pork from entire males and females had lower ultimate muscle pH compared to Improvac vaccinated male pigs (5.42 and 5.44 vs. 5.53, P=0.001). Entire male and female pigs had paler (L*) pork compared to Improvac vaccinated male pigs (51.9 and 54.8 vs. 49.8, P=0.001). Pork from Improvac vaccinated male and entire male pigs was redder (a*) compared to female pigs (7.47 and 7.74 vs. 6.80, P=0.044). Surface exudate measured using the filter paper method was lower for pork from Improvac vaccinated male pigs and entire male compared to pork from female pigs (39.5mg and 46.1mg vs. 54.8mg, P=0.001). Improvac vaccinated male pigs and female pigs had higher intramuscular fat in the loin muscle compared to entire male pigs (2.55 and 2.46 vs 1.66(%), P=0.010). The results from this study indicate that the Improvac vaccine, in addition to eliminating boar taint was also effective in improving the pork quality of male pigs.

Key Words: Immuno-castration, Boar taint, Pork quality

673 Pork quality and muscle characteristics of pigs finished indoors or outdoors during the winter months. J.G. Gentry*¹, J.R. Blanton¹, J.J. McGlone¹, J.L. Morrow-Tesch², and M.F. Miller¹, ¹*Texas Tech University, Lubbock, TX,* ²*USDA-ARS, Lubbock, TX.*

The objectives of this study were to determine the effects of diverse housing systems and exercise levels on pork quality and muscle characteristics. Forty-eight barrows were randomly selected from a group of indoor-raised pigs and placed on alfalfa pasture or indoors on a total slatted concrete flooring system during the winter months. The average starting weight of each group of pigs was 52 kg. Average daily gain was similar (P=.79) for the indoor and outdoor finished groups. Two groups of pigs (n=32) were randomly selected from the group of 48 for slaughter at the Texas Tech University Meat laboratory. After 24 hours of chilling, carcasses were ribbed between the 10th and 11th rib and allowed to bloom for 30 minutes. At this time, Hunter L*, a*, b*, NPPC color, firmness, and marbling scores were recorded on the *Longissimus dorsi* muscle. The pH decline of carcasses were also recorded. There were no differences in loin L*, a*, b*, color or marbling scores (P>.05). NPPC scores for firmness for the indoor and outdoor raised pigs were 3.37 and 2.62, respectively (P=.03). Measurements for 24 hr pH were 5.63 for the indoor group and 5.70 for the outdoor group (P=.05). Loin chops were cut after 7 and 14 days of aging. Pork loins were cut into 2.54 cm chops and frozen for further analysis. Warner-Bratzler shear force values for the indoor and outdoor raised pigs were not different (3.05 and 3.42 kg, respectively). There were no significant differences in sensory panel scores for tenderness, juiciness and flavor (P>.05) between the environments. Results from this study indicated that pigs finished in an outside pasture environment had similar growth and meat quality characteristics compared to pigs finished in a conventional slatted floor housing system. Further studies need to be conducted to determine if this trend remains over different seasons and for outdoor-born pigs.

Key Words: Pigs, housing system, meat quality

674 Modeling the probability of purchasing pork with specific quality traits. P. Chen, K. Koehler, T. J. Baas, and J.C.M. Dekkers, *Iowa State University, Ames.*

The objective of this study was to investigate the effects of meat quality traits, including ultimate pH, percentage of lipid (lipid%), and Instron

score on consumer preferences for pork. Data included preferences of 650 consumers toward purchasing pork versus chicken at a given price from a consumer preference study in 4 cities of pork loin from 12 breeds that was conducted by the National Pork Producers Council. Each consumer evaluated 4 pork samples. Regression analysis found significant effects of city, ultimate pH, lipid%, Instron score, and breed factors on evaluations of juiciness, tenderness, and flavor. This analysis used random consumer effects to account for correlations among multiple responses from individual consumers. A logistic regression model with city, ultimate pH, lipid%, Instron score, breed, the interaction between ultimate pH and breed (pH*breed), and the price ratio between pork and chicken (pratio) as fixed and consumer as a random effect was fitted to preference (0/1) data. Ultimate pH, lipid%, Instron score, breed, pH*breed, and pratio were found to be significant ($P < 0.05$). The odds ratio of purchasing pork instead of chicken increased 50% for each unit increase in lipid% and decreased 11% for each unit increase in the Instron score. A significant positive quadratic effect of ultimate pH was found, with greater odds ratios for pork with low and high pH, which was opposite from what was expected. Ultimate pH also exhibited the significant interaction with breed effects ($P < 0.05$). Pratio had a large effect on the odds ratio of buying pork over chicken. Results indicate that efforts to increase lipid% and to decrease Instron score can increase consumer preference for pork over chicken.

Key Words: Probability, Consumer preference, Meat quality trait

675 Supplemental vitamin D₃ improves beef tenderness. J. L. Montgomery^{*1}, J. G. Gentry¹, L. L. Behrends², E. R. Behrends², G. G. Hilton¹, M. Galyean¹, J. R. Blanton¹, A. Barham¹, B. Barham¹, and M. F. Miller¹, ¹Texas Tech University, Lubbock, ²Colorado State University, Fort Collins.

Feedlot steers (n=142) were supplemented one of four vitamin D₃ treatments for eight consecutive days prior to slaughter to characterize treatment effects on carcass traits and beef tenderness. A total of 48 pens of three steers each were utilized in a 4 X 3 factorial arrangement to study vitamin D₃ effects. The four vitamin D₃ treatments consisted (36 head/treatment) of no supplemental vitamin D₃, 1/2 million, 1 million, or 5 million IU/steer/d. The steers were classified as either a Bos taurus-British, Bos taurus-continental, or Bos indicus breed type. Average daily gain (ADG) and feed intake were reduced ($P < .05$) at the end of the feeding trial by supplementing 5 million IU/steer/d. Vitamin D₃ supplementation did not negatively affect lean color, yield or quality grade factors ($P > .05$). Thus, improvements in beef tenderness due to vitamin D₃ supplementation can be made without negatively affecting beef carcass quality and yield factors. Supplementing cattle with 5 million IU/steer/d of vitamin D₃ increased 24 h muscle pH and drip loss ($P < .05$). Supplementing steers with 1/2, 1, or 5 million IU/steer/d of vitamin D₃ resulted in elevated carcass temperatures at 3 h postmortem ($P < .05$). Vitamin D₃ treatments significantly reduced Warner-Bratzler shear force (WBS) of strip loin and inside round steaks at 7, 10, 14, and 21 d postmortem ($P < .05$). Reductions in WBS ranged from .7 to 1.0 kg for strip loin steaks and .4 to 1.1 kg for the inside round steaks. All vitamin D₃ treatments reduced WBS in strip loin steaks by 7 d postmortem when compared to controls ($P < .05$). For inside round steaks the largest reduction in WBS due to vitamin D₃ treatment was found at 3 d postmortem. While breed type affected ($P < .05$) many quality and yield factors, breed type and vitamin D₃ treatment did not interact ($P > .05$) for WBS values. Therefore, vitamin D₃ appears to affect beef tenderness of cattle from different breed types equally. Thus, vitamin D₃ treatments can reduce WBS up to 21 d postmortem when compared to non-supplemented samples. Supplementing steers with 1/2 and 1 million IU for 8 consecutive days can improve beef tenderness without negatively affecting ADG, feed intake, or carcass traits.

Key Words: Beef, Tenderness, Vitamin D

676 Characterization of muscle degradation from vitamin D₃ supplementation of feedlot steers using a muscle cell culture system. J. L. Montgomery^{*1}, K. J. Morrow¹, and M. F. Miller¹, ¹Texas Tech University, Lubbock.

Primary bovine muscle cell culture studies were conducted to determine whether supplemental vitamin D₃ has a direct effect on in vitro cellular protein synthesis and degradation. Feedlot steers (n=142) were supplemented one of four vitamin D₃ treatments for eight consecutive days prior to slaughter to characterize treatment effects on amino acid uptake

and protein degradation. The four vitamin D₃ treatments consisted (36 head/treatment) of no supplemental vitamin D₃, 1/2 million, 1 million, or 5 million IU/steer/d. The steers were classified as either a Bos taurus-British, Bos taurus-continental, or Bos indicus breed type. At slaughter serum was collected on each of the individual steers. Muscle samples were collected from the longissimus lumborum at 1-h postmortem for extraction and incubation with primary bovine muscle cells. Each muscle sample was a 10-g sample of muscle, free of fat and connective tissue extracted in 50 mM Tris and 10 mM EDTA with leupeptin, ovomucoid, and PMSF to inhibit proteolysis. Myoblast cultures were pretreated with serum and muscle extracts for 24 h before a 4-h synthesis or 6-h degradation measuring period. Serum samples did not differ in amino acid uptake or protein degradation. Amino acid uptake of muscle extracts was also not affected by vitamin D₃ treatment or breed type. There was a vitamin D₃ X breed type interaction for protein degradation of muscle extracts ($P < .05$). Protein degradation from the muscle extracts was increased ($P < .05$) if steers had been treated with 5 million IU/d compared to the non-supplemented feeding regime. All of the vitamin D₃ treated steers of the Bos taurus-British breed type had increased ($P < .05$) muscle degradation when compared to control steers of the same breed type. Treating steers from the Bos-taurus-continental and Bos indicus breed types with 1/2 or 1 million IU/steer/d of vitamin D₃ resulted in a minimal effect on cellular protein degradation from muscle extracts ($P > .05$). These results indicate that in some breeds a high concentration of supplemental vitamin D₃ may function through a secondary mechanism in muscle to increase muscle protein degradation.

Key Words: Muscle cells, Vitamin D, Protein degradation

677 Carcass and palatability traits of steer progeny of Hereford, Angus, Norwegian Red-Swedish Red and White, Friesian, and Wagyu sires. T. L. Wheeler^{*}, L. V. Cundiff, S. D. Shackelford, and M. Koohmaraie, USDA-ARS, U.S. Meat Animal Research Center, Clay Center, NE.

For carcass traits, data were obtained for 576 steers resulting from artificial insemination matings of Hereford (H, 32), Angus (A, 30), Norwegian Red-Swedish Red and White (NS, 14 and 16, respectively), considered the same breed because of open herd books), Friesian (F, 24 non-Holstein influenced), and Wagyu (W, 19) sires to Hereford, Angus, and composite MARC III dams. For Warner-Bratzler shear force and trained sensory panel traits, data were obtained for 337 and 261 longissimus steaks, respectively. Carcasses from H- and A-sired steers (377 and 374 kg, respectively) were the heaviest ($P < 0.05$) and carcasses from W-sired steers (334 kg) were the lightest ($P < 0.05$). A greater ($P < 0.05$) percentage of carcasses from A- and W-sired steers graded USDA Choice (88 and 85%, respectively) than carcasses from other sire breeds (52 to 71%). Adjusted fat thickness for carcasses from A-sired steers (1.3 cm) was highest ($P < 0.05$), followed by H-sired steers (1.1 cm), then W- and F-sired steers (0.9 cm), and NS-sired steers (0.8 cm). Longissimus area was not different ($P > 0.05$) among sire breeds (mean = 80.6 cm²). Carcass yield of boneless, totally trimmed retail product was lowest ($P < 0.05$) for A-sired steers (60.1%), intermediate for H-sired steers (61.5%), and similar ($P > 0.05$) for all other sire breeds (62.5 to 62.8%). Longissimus from carcasses of A- and W-sired steers had lower ($P < 0.05$) shear force values (3.7 kg) than longissimus from other sire breeds (4.1 to 4.2 kg). Trained sensory panel tenderness, juiciness, or beef flavor intensity ratings for longissimus were not different ($P > 0.05$) among the sire breeds. Relative to the other sire breeds, W-sired steers had the highest percentage of USDA Choice yield grade 1 and 2 carcasses with similar longissimus tenderness.

Key Words: Beef, Breed, Quality

678 The effect of Wagyu and Limousin genetics on factors associated with tenderness. P. S. Kuber^{*1}, J. R. Busboom¹, J. G. Nordyke¹, S. K. Duckett², P. S. Mir³, Z. Mir³, J. D. Cronrath¹, K. A. Johnson¹, J. J. Reeves¹, and C. T. Gaskins¹, ¹Washington State University, Pullman, ²University of Idaho, Moscow, ³Agriculture and Agrifood Canada, Lethbridge, AB.

The objective of this study was to evaluate longissimus muscle (LD) samples from 12 Wagyu (W), 12 Wagyu X Limousin (WXL) and 12 Limousin (L) cattle for attributes affecting tenderness. A 2x3 factorial arrangement of treatments, with the main effects breed and diet, were analyzed using GLM procedures. Cattle were fed barley-based back-grounding and finishing diets with either 6% supplemental sunflower oil

or no added oil, for an average of 259 d. Cattle were humanely slaughtered and samples were collected at 24 h postmortem (PM), vacuum packed and aged at 2°C (1, 3, 7, 14, 28 and 56 d). Samples were then frozen at -40°C, after aging for later analysis. Day 0 calpastatin activity (CA) did not differ ($P > .05$) between breeds. Repeated measure analysis showed that the effect of PM aging on Warner-Bratzler shear force (WBS) was significant ($P < .05$); a 2 kg difference was detected from 1 d (5.12 kg) to 56 d (3.14 kg) of aging. The overall effect of breed for WBS indicated that W were more tender than L ($P < .05$). Although not significant ($P > .05$), W had higher WBS values at 1 d PM than did WXL or L, but by d 14, WBS values for W were .767 kg less ($P < .05$) than for L. The WXL did not differ in WBS from the other breeds. Breed did not affect ($P > .05$) free calcium levels (FCL), measured at 0, 1, 3, 7 and 14 d PM. In all breeds, FCL concentrations were approaching levels ($>300 \mu\text{Mol}$) necessary to activate m-Calpain by 7 d PM. An overall breed effect was detected for the rate of temperature and pH decline ($P < .05$). Wagyu were slower in pH and more rapid in temperature decline than WXL or L, yet no difference existed at 24 h PM. Steaks from W had lower WBS values than L at d 14, however CA (0 d) and FCL do not explain this result.

Key Words: Tenderness, Calpastatin Activity, Free Calcium

679 Anabolic implants and meat tenderness. C.W. Wiltbank^{*1}, E.W. Hawkins¹, D.K. Lunt², and T.E. McCullum², ¹Brigham Young University, Provo, ²Texas A&M University, College Station.

A total of 438 Angus crossbred steer and heifer calves of similar genetic makeup were randomly assigned to five treatments to determine the effect of anabolic implants on meat tenderness. Treatments consisted of: (1) no implant, (2) no implant at branding (6 weeks of age) + Synovex S or H at weaning (8 mo of age) + Synovex S or H 90 d later, (3) no implant at branding + Synovex S or H at weaning + Synovex Plus 90 d later, (4) Synovex C at branding + Synovex S or H at weaning + Synovex S or H 90 d later, (5) Synovex C at branding + Synovex S or H at weaning + Synovex Plus 90 d later. Calves were produced on three different ranches and were transported to a growing yard at weaning (206 kg \pm 29.38). When calves reached 341 kg live wt. they were transported to a feed lot where they were put on a finishing ration for approximately 90 d and slaughtered. USDA quality and yield grade factors were obtained and samples of strip loins were taken from each carcass. Each sample was aged for two weeks at 2°C prior to being frozen until they could be shear tested. The meat was prepared and sheared following research guidelines published by the American Meat Science Association. Six cores were taken from each sample and were analyzed via Warner-Bratzler Shear methodology. Statistical analysis was performed using analysis of variance. The effects of treatment, ranch, sex and slaughter group were evaluated. There was no difference in shear force between the five treatment groups ($P > .05$). However differences in shear force due to ranch, sex, and slaughter group were detected ($P < .05$). It was noted that over 98% of the strip steaks, regardless of implant treatment, sex or ranch of origin, required < 4.55 kg of shear force.

Key Words: Tenderness, Implants

680 Correlations among selected pork quality traits in a Berkshire by Yorkshire F2 population. E. Huff-Lonergan^{*}, T. J. Baas, M. Malek, J. Dekkers, K. Prusa, and M. F. Rothschild, Iowa State University, Ames.

Mechanisms underlying the development of pork quality traits are elusive. Establishing relationships among specific quality traits is important if significant progress toward genetic selection for meat quality is to be realized. As part of a study to examine the individual effects of genes on meat quality traits in pigs, a three-generation resource family was developed. Two Berkshire sires and ten Yorkshire dams were used to produce ten F1 litters. Sixty-five matings were made from the F1 litters to produce four sets of F2 offspring for a total of 525 F2 animals that were used in the study. These F2 animals were slaughtered at a commercial facility at approximately 110 kg. Loin samples ($n = 525$) were collected at 48 hours postmortem and meat quality traits were evaluated. These quality traits included (but were not limited to): Hunter L values (HL), pH, drip loss (DL), glycolytic potential (GP), Star probe measurement of instrumental tenderness (InTen), and total lipid content (TLP). Mean values and standard deviations (SD) for these traits are as follows: HL (46.87, SD 3.39), pH (5.83, SD 0.19), DL (5.84%, SD 1.99), InTen (4.36

kg, SD 0.86), and TLP (3.23%, SD 1.32). Ratio of TypeIIa/IIb muscle fibers (IIa/IIb) was also evaluated. InTen was significantly correlated ($P < .01$) to DL (0.29), GP (0.30), pH (-0.29), TLP (-0.14) and HL (0.28). DL was significantly correlated ($P < .01$) to GP (0.36), pH (-0.28), IIa/IIb (-0.10, $P < .05$), and HL values (0.33). HL values were also significantly correlated to TLP (0.33, $P < .01$) and IIa/IIb (-0.11, $P < .05$). These data suggest that improvements in some meat quality traits may have an effect on other meat quality attributes. This work was supported by an industry consortium of the National Pork Producers Council, the Iowa Pork Producers Association, the Iowa Purebred Swine Council, Babcock Swine, Danbred USA, DEKALB Swine Breeders, PIC, Seghersgenetics USA, and Shamrock Breeders.

Key Words: Pork, Meat quality

681 Quality characteristics of PSE hams. C. Perez-Linares¹, A. Alarcon-Rojo^{*1}, and J. Jimenez-Castro¹, Universidad Autonoma de Chihuahua, Chihuahua, Chih. Mexico.

Two experiments were conducted to evaluate the use of pale, soft and exudative (PSE) pork in restructured hams. The objective of experiment 1 was to evaluate the physicochemical, microbiological and sensory quality of hams containing 0, 10 and 20% PSE pork and stored for 1, 7 and 14 d at chilling temperatures. The objective of experiment 2 was to evaluate the quality of 20% PSE hams with the addition of a carrageenan-containing water binder. There was no effect ($p \geq .05$) of PSE-meat level and storage time on color (L*, a*, b*), pH, shear force, water-holding capacity, and total protein of hams. Vacuum packaged restructured hams stored at 4°C had similar ($p \geq .05$) aerobic and anaerobic mesophiles and psychrophiles counts regardless of PSE level or storage time, averaging 3.44, 3.30 and 2.71 log₁₀ CFU/g, respectively. Sensory quality of PSE hams (appearance, color, texture and flavor) did not differ ($p \geq .05$) from the control hams, but 20% PSE hams showed the highest ($p \leq .05$) cooking (1.05%) and storage losses (1.90% at d 14). The addition of PSE meat decreased ($p \leq .05$) ham pH at day 1 of storage (5.90) but it remained constant through the storage time ($p \geq .05$). The addition of carrageenan did not change ($p \geq .05$) water-holding capacity, shear force, color and sensory quality of both normal and PSE hams, though it decreased ($p \leq .05$) cooking (-.87%) and storage losses (- 2.50%) of hams. The results of this study suggest that the addition of up to 20% PSE meat and carrageenan to restructured hams had no detrimental effect on product quality.

Key Words: PSE pork, Ham, Quality

682 Relationship of beef carcass traits to chemical and tissue composition of rib samples by X-ray computer tomography. G. Hollo¹, F. Szabo^{*2}, E. Szuecs¹, J. Tözsér¹, J. Csapo³, B. Huth³, and I. Hollo³, ¹Szent Istvan University, Godollo, ²University of Veszprem, Georgicon Faculty, Keszthely, ³University of Kaposvar, Faculty of Animal Science, Hungary.

Due to its measures, in vivo estimation of beef carcass composition by X-ray computer tomography does not seem to be feasible. The aim of this study was if there is an opportunity for indirect estimation of tissue composition and/or carcass value from samples taken from beef carcass by means of CT. Animals ($N=136$) of various breeds (Holstein-Friesian (HF), Hungarian Red Spotted (HRS) and HRS x HF crossbreds) and sexes (heifers, bulls and culled cows) were slaughtered at different weights (range 270-790 kg). In addition to data recorded at slaughter samples were taken after 24 hrs. chilling from 11-13th ribs of right half carcasses and examined by Siemens Somatom Plus S40 spiral CT in two measuring steps for tissue composition. Just the same samples were used for chemical analysis. Moisture, protein, intramuscular fat and crude ash content were determined by standard procedure. Statistical analysis was made by SPSS 8.0 for Windows (1997), where coefficients of correlation were estimated among parameters registered. Close association among tissue composition traits of carcasses and that of rib samples were established. Highest coefficients of correlation were found for amount of percentage of kidney fat, carcass fat and intermuscular fat of rib samples ($r = 0.91$; 0.83 and 0.92 , resp., $P < 0.001$). Coefficients of correlation for amount of bone and muscle in carcass and in rib samples were $r = 0.76$ and 0.87 , resp. ($P < 0.001$), and a negative relationship of protein to fat content in rib samples was established ($r = -0.95$, $P < 0.001$). Similar tendencies were present for the amount of fat recorded at slaughter and protein content of rib samples ($r = -0.84$ - $r = -0.85$, $P < 0.001$). The amount of fat in carcasses and/or kidney fat

showed obvious and positive association to fat content of rib samples. Relationships of tissues (muscle, bone and fat) in rib samples determined by CT seemed to be higher than that of estimated by tissue separation of carcasses. Coefficients of correlation were $r = 0.80$; 0.66 and 0.94 in the former and $r = 0.64$; 0.52 and 0.91 in the latter case ($P < 0.001$). In conclusion, using X-ray tomography for tissue composition of rib samples can effectively be used for estimation of tissue composition of beef carcasses.

Key Words: Composition of beef carcass, X-ray computer tomography, Chemical composition of rib samples

683 Comparison of two different containers for performing hydrodynamic pressure process. M.B. Solomon* and B.W. Berry, USDA, ARS, MSRL.

Hydrodynamic pressure processing (HDP) has been shown to instantaneously improve tenderness of meat cuts. This process has typically been performed in either 208 L, 115 L, 98 L disposable plastic containers (PEC) or in a 1060 L stationary steel chamber (HU). A small scale (54 L) model (mini-HU) of the HU was constructed for laboratory tests. Tenderness improvement in USDA Select grade boneless strip loins was assessed by application of HDP in either 115 L PECs or the 54 L mini-HU ($n=24$). Quantity of explosive was adjusted according to the distance to the bottom of each container in an attempt to generate similar pressure fronts entering the meat samples. Treated and control samples were cut into 2.5 cm thick steaks after being HDP treated and cooked to 71 C on open-hearth electric broilers. HDP generated in the PEC resulted in 40% improvement in shear force compared to controls (6.76 vs 4.08 kg). Samples treated in the mini-HU improved 28% compared to controls (6.76 vs 4.88 kg). Results suggest that although HDP does improve tenderness, the magnitude of improvement is conditional on the configuration and composition of the container and may be dependent on other parameters yet to be determined.

Key Words: Beef, Tenderness, Hydrodynamic Pressure Process

684 Tenderizing meat from Brahman cattle: Hydrodynamic pressure process and within-muscle effects for bottom round. J. S. Eastridge*¹, M. B. Solomon¹, R. L. West², and C. C. Chase, Jr.³, ¹USDA, ARS, Beltsville, MD, ²Univ. of Florida, Gainesville, ³USDA, ARS, STARS, Brooksville, FL.

Hydrodynamic pressure (HDP) has been used successfully to tenderize meat. A HDP shock wave is generated from an underwater detonation of a small amount of explosive. The wave passes through vacuum packaged meat that is also underwater until it encounters a reflective surface or 'boundary' of different acoustic properties than water. At the boundary, the shock wave essentially turns back to pass a second time through meat, thus impacting tenderness. In the single-use plastic explosive container (PEC) a steel plate is used in the bottom to provide a reflective boundary; however, there is an air boundary outside the PEC which has not been explored for its impact on HDP process. This 2 x 2 factorial study was designed to evaluate the depth of the air boundary outside the PEC on the tenderization response within the bottom round (BR) from Brahman cattle. Six whole BR (shipped fresh from Gainesville, FL to the USDA lab in Beltsville, MD then frozen at 7 d postmortem) were thawed 40 hr at 4° C and a 3-cm thick steak for control (CON) was cut from the middle of each BR. The remaining heel and caudal halves were randomly assigned to HDP treatment (100 g explosive placed 30 cm from the meat) in a PEC suspended in air to create boundary depth of 23 or 37 cm. After HDP, three to four 3-cm steaks were cut from each half for 39 paired comparisons (CON vs HDP). All steaks were cooked to internal temperature of 71° C on an electric grill. An interaction ($P < .03$) between BR half and air boundary depth was noted for shear force after HDP treatment. Shear force of heel portion HDP treated at 23 cm air (5.7 kg) was not different from CON (6.1 kg) whereas all other paired comparisons resulted in lower ($P < .05$) shear force after HDP. Shear force values for CON vs HDP were: 8.0 vs 6.3 kg for heel at 37 cm; 7.8 vs 6.2 kg for caudal at 23 cm; 8.1 vs 5.0 kg for caudal at 37 cm. The 28.6% improvement in shear force in the BR caudal half was more than double that in the heel portion (13.8%). A deeper air boundary (37 cm) resulted in a greater ($P < .01$) reduction in shear force (29.3%) when compared to 23 cm boundary depth (13.2%). Understanding factors that affect the performance of HDP will aid in

equipment design and allow for the optimization of HDP for meat tenderness enhancement.

Key Words: Tenderness, Hydrodynamic pressure, Brahman

685 Application of hydrodynamic pressure processing for further processed meat products. B. W. Berry*¹, M. B. Solomon¹, and A. G. Senecal², ¹ARS-USDA, Beltsville, MD, ²US Army Natick R, D & E Center, Natick, MA.

Hydrodynamic pressure processing (HDP) has produced considerable tenderness improvements in fresh meat cuts. The high moisture content of fresh muscle has been thought to be instrumental in achieving this tenderness improvement with HDP. The objective of this study was to ascertain whether HDP could affect tenderness/texture properties of further processed, lower moisture meat products. Shelf-stable beef and chicken sticks (50%fat) were subjected to HDP in either 115 L disposable plastic containers (PEC), a 1060 L stationary steel chamber (HU) or a smaller 54 L stationary unit (SHU). Meat sticks ($n=37$ to 60 depending on test) were subdivided, repackaged, subjected to HDP and evaluated for shear force. HDP reduced ($P \leq .05$) shear force with HU producing a greater reduction than PEC and SHU. In a second study, U.S. Select and Choice beef loin and round muscles were subjected to HDP using PEC and HU systems prior to cutting into steaks, freeze-drying, rehydrating, cooking and measuring tenderness with various instrumental measures. HDP resulted in lower ($P \leq .05$) peak shear force and time to attain peak shear (Choice knuckles only) both before and after freeze-drying. With U.S. Select strip loins, HDP generated in PEC produced tenderness improvements (peak load, punch and die) $\geq 40\%$ both before and after freeze-drying. HDP resulted in a decrease in protein solubility in these samples. These studies illustrate that HDP has the potential of altering tenderness/texture properties in further processed meat products.

Key Words: Processed meats, Hydrodynamic pressure, Shear force

686 Intramuscular collagen properties of longissimus muscle of *Bison bison*. G. Maiorano*¹, F. Filetti¹, R. J. McCormick², D. C. Rule², and A. Manchisi¹, ¹Universiti degli Studi del Molise, Campobasso, Italy, ²University of Wyoming, Laramie.

The objective of this study was to determine intramuscular collagen properties in *longissimus* muscle of 31 mo-old bison bulls (*Bison bison*) raised on grass and 18-mo old bison bulls fed a high-concentrate diet for 6 mo. *Longissimus* samples were taken from the 12th rib 14 d post mortem of 10 bulls of each feeding regimen. *Longissimus* samples also were taken from carcasses of 10 crossbred beef steers finished on a high-concentrate diet. Carcasses were held at 2 to 4° C. Muscle samples were lyophilized and then hydrolyzed in 6N HCl for analysis of hydroxyproline and hydroxylysylpyridinoline (HLP) crosslink. Collagen concentration was calculated assuming that collagen weighed 7.25 times the measured hydroxyproline weight. HLP crosslink concentration of intramuscular collagen was determined by reverse phase HPLC. Grain- and grass-fed bison *longissimus* had similar ($P > .05$) amounts of collagen (15.4 and $15.9 \pm .6$ $\mu\text{g}/\text{mg}$ of muscle, respectively) and similar ($P > .05$) HLP concentrations (.31 and $.34 \pm .01$ mol/mol of collagen, respectively). Total collagen of beef steer *longissimus* ($15.6 \pm .6$ $\mu\text{g}/\text{mg}$ of muscle) was similar ($P > .05$) to that of grain-fed bison. However, HLP was 25% greater ($P < .05$) in beef cattle *longissimus* ($.39 \pm .02$ mol/mol of collagen) than in grain-fed bison. Results suggest that grain-fed and grass-fed bison *longissimus* intramuscular collagen could have a similar stabilization degree due to similar HLP crosslink concentrations; however, bison *longissimus* intramuscular collagen may be more immature than that from beef cattle due to lower HLP crosslink concentrations in the bison muscle.

Key Words: Bison, Intramuscular Collagen, Beef Cattle

687 Influence of diet on amino acid profiles of two muscles in chianina beef. F Nicastro*¹, R Gallo¹, A Caputi Jambrenghi¹, and L Zezza¹, ¹Department of Animal production, University of Bari, Bari, Italy.

The amino acid composition of beef is an important factor in the human diet. This study relates to differences observed in amino acid profile and chemical composition content in two muscles of beef. Twenty cattle Chianina males, six months old, were divided equally into two treatment

groups for energy level (High=10.5 and Low=8.3 ME/kg DM). The animals from each group were slaughtered at 8 months of age. Samples of longissimus thoracis (Lt) and semimembranosus (Sm) muscles were removed from the carcasses 4h after slaughter and stored at -80°C until they were analyzed. The aminoacids (Aspartic acid, Glutamic acid, Serine, Threonine, Alanine, Arginine, Proline, Phenylalanine, Leucine and Isoleucine, Valine, Methionine, Histidine, Lysine, Tryptophan and Glycine) were quantified by means of chromatographic technique and the protein was determined by Kjeldahl nitrogen analysis. Data were tested following the SAS programme using the General Linear Models procedure. In general, data presented similar profiles in both muscles, in the two treatment groups, with only a few significant differences. Lt muscle of animals fed in group H had higher values for glutamic acid ($P < 0.01$) and aspartic acid ($P < 0.05$). Lt contained a higher amount of ether extract and protein when compared to Sm. The results of this study indicate that the levels of energy of the diet as used in this trial did not influence the profile of the amino acids in the two muscles at this age.

Key Words: Beef, Chemical composition, Diet

688 Fiber type (Myosin Heavy Chain I) and biochemical traits of *Longissimus thoracis* from three European beef breed types. M. Gil¹, X. Serra¹, M.A. Oliver¹, C. Sa'udo², J.L. Olleta², M.D. Garcia-Cachn³, M.C. Olivn³, M.M. Lopez-Parra⁴, R. Quintanilla⁵, and J. Piedrafita⁵, ¹IRTA- CTC, Monells, Spain, ²Univ. Zaragoza, Zaragoza, Spain, ³ETC, Guijuelo y CIATA, Villaviciosa, Spain, ⁴SIAEX, Badajoz, Spain, ⁵UAB, Barcelona, Spain.

The effect of the breed type on some chemical and biochemical traits (intramuscular fat (IMF), haem pigment, myosin heavy chain I (MHC-

I), lactate dehydrogenase and isocitrate dehydrogenase (ICDH) activities) of muscle *longissimus thoracis* (LT) from seven European beef breeds was studied. The animals (478) were fattened with concentrate *ad libitum* and straw from 7 to 12-18 months depending upon breed-production system. Breed-production systems were grouped into three types: 1) Fast growth rate (FG) (n=199, carcass weight, CW, 312.9 ±36.7 kg), 2) double muscle condition (DM) (n=70, CW, 324±21.8 kg) and 3) rustic characteristics (RC) (n=208, CW, 265.1±26.7 kg). MHC-I was determined by enzyme-linked immunosorbent assay using a specific MHC-I monoclonal antibody. A least squares analysis including the effect of breed type was performed using the GLM procedure of the SAS. The breed type influenced all the muscle characteristics studied. The three groups showed different average daily gains (ADG) (LSM±SE, 1.64±0.02 (FG), 1.41±0.04 (DM) and 1.30±0.02 (RC) kg/day). The animals from the DM group had the highest lean percentage (76±0.6%) and the lowest IMF percentage (0.99±0.14%) whereas the RC breeds showed the opposite (65.5±0.35% and 2.64±0.08% for lean and IMF, respectively). The most oxidative traits were found in the RC group (MHC-I, 35.3±0.9%). ADG was negatively correlated with pigment content and ICDH in the FG group of animals, but this was not observed in the other groups. MHC-I presented a positive and significant correlation with respect to pigment content in the three groups studied, indicating that muscles with a higher MHC-I content had a higher myoglobin content and, consequently, were more oxidative. The differences in muscle characteristics found in the three breed types suggest differences in the technological and sensorial characteristics of their meat quality.

Key Words: Breed type, Myosin I, Intramuscular fat

MILK SYNTHESIS

689 Estrogen treatments to initiate dryoff in dairy cows. M.L. Schairer*, K.C. Bachman, M.J. Hayen, and H.H. Head, University of Florida Gainesville.

Mammary involution in dairy cows is accelerated by exogenous estrogen. Estradiol-17β (E₂) and estradiol-17β cypionate (ECP[®]) were evaluated to determine their effectiveness in promoting mammary involution as monitored by the decline in daily milk yield. Response of pregnant, lactating dairy cows (n=5) to 4 consecutive once-daily injections of E₂ (E4x15; 15mg/d, s.c.) served as the positive control for intramuscular ECP treatments of 20 and 30 mg administered via single injection (ECP1x30, n=4; ECP1x20, n=5) or two once-daily injections (ECP2x15, n=6; ECP2x10, n=5). Cows were milked thrice daily before and after the injections which were begun at the onset of projected 60d dry periods. Milk production (kg/d) for E4x15 and ECP treatments (1x30, 2x15, 1x20, 2x10) before injection and on day 7 post-first injection were: 19.9, 21.0, 20.0, 21.6, 17.8 and 7.8, 8.4, 8.0, 10.6, 12.7. Thus, daily milk yields declined 60.9, 60.0, 60.1, 51.0, and 29.0 percent despite the thrice daily milkings. Average daily high ambient temperature and minimum relative humidity were 32.8°C and 57%. This heat stress plus the physical stress and oxytocin stimulation associated with the milk removal activity, as well as, stage of gestation at estrogen treatment, were considered possible contributors to the abortion events that occurred. Days post-injection at which 6 cows aborted were: E4x15, n=2 (7,8); ECP1x30, n=1 (15); ECP1x20, n=1 (12); and ECP2x10, n=2 (9,11). During a second experiment, at final milk removal, thirty pregnant, lactating cows projected to have 30d dry periods received one i.m. injection of ECP: (cottonseed expient, n=10; 30 mg, n=10; or 20 mg, n=10). Abortion did not occur. In contrast to the previous cows, these cows received ECP later in gestation (250vs220 d pregnant) and were not milked post-injection. Also, they experienced less heat stress, in that, both temperature (26.2°C) and humidity (56%) were lower. Results suggest that ECP[®] administered at dryoff might allow the length of the non-income producing dry period to be shortened profitably.

Key Words: Estrogen, Dry period, Involution

690 Exogenous *trans*10,*cis*12-18:2 reduces *de novo* synthesis and desaturation of milk fatty acids in cows fed diets supplemented with high-oleic or high-linoleic oil. J. J. Loor* and J. H. Herbein, Virginia Polytechnic Institute & State University, Blacksburg.

To determine the effects of an elevated supply of *c9,t11-18:2* (CLA9/11) or *t10,c12-18:2* (CLA10/12) on milk fat concentration and fatty acid profiles, four Holstein cows fed oil (2.5% of DM) were infused (0.625 g/h) with CLA9/11 (90% pure) or CLA10/12 (95% pure) for 48 h via the abomasum. High-oleic safflower (HO; 70% *c9-18:1*) or high-linoleic safflower oil (HL; 65% *c9,c12-18:2*) were used as oil supplements. Treatments were assigned in a 2 × 2 factorial design. Cows were fed the assigned diets for 11 d prior to each 48-h infusion period. During the 7-d transitions between periods, all cows were fed a diet supplemented (2.5% of DM) with equal proportions of HO and HL. Milk samples were obtained at -12 and 0 h before infusion, at 12, 24, 36, and 48 h during infusion, and at 60, 72, 84, and 96 h after infusion. Milk yield and DMI were not affected by treatment. Percentages and yields of protein, lactose, and SNF in milk also were not affected by treatment. Milk fat percentages from 24 to 96 h were lower in response to CLA10/12 (2.7, 2.4, 2.3, 2.2, 2.1, 2.5, and 2.7%) compared with CLA9/11 (3.3, 3.2, 3.4, 3.5, 3.4, 3.5, and 3.4%) regardless of diet. Fat yield also was lower in response to CLA10/12. Concentration of *c9,t11-18:2* in milk fat before infusion was higher when HL (9 mg/g total fatty acids) was fed compared with HO (6 mg/g), and it increased to 15 or 11 mg/g by 48 h of CLA9/11 infusion in cows fed HL or HO. Although *t10,c12-18:2* was not detectable in milk fat before infusion, it accounted for 6 mg/g by 48 h of CLA10/12 infusion. Regardless of diet, concentration of saturated fatty acids with 4 to 16 carbons decreased from 410 mg/g at 0 h to 350 mg/g at 48 h of CLA10/12 infusion, whereas concentration of 18:0 increased from 144 mg/g at 0 h to 210 mg/g at 48 h. Concentration of *t11-18:1* in milk fat (9 or 16 mg/g for HO or HL) before an infusion was greater when HL was fed, and infusion of CLA10/12 caused a further increase in concentration by 48 h (15 or 18 mg/g for HO or HL). Ratios of 18:0 to *c9-18:1*, *t11-18:1* to *c9,t11-18:2*, and *c9,c12-18:2* to 20:4 in milk fat increased from 0.5, 1.7, and 18 at 0 h to 0.8, 2.7, and 25 at 48 h of CLA10/12 infusion regardless of diet. Increased *t10,c12-18:2* availability and uptake by the mammary gland reduced *de novo* fatty acid synthesis and desaturation of 18-carbon fatty acids.

Key Words: CLA, Trans fatty acids, Milk fat