

**89 Comparison of beef cattle ultrasound and carcass measures to predict percent retail product yield from the four primals.** R. G. Tait, Jr\*, D. E. Wilson, and G. H. Rouse, *Iowa State University, Ames IA.*

Retail product yield from the four primals is a very economically important trait for the beef industry. The most widely used system to predict this trait is USDA yield grade. The purpose of this study was to determine if routine ultrasound measures and additional rump measures could be used to more accurately predict the percent lean from the four primals than the carcass measures going into the USDA yield grade equation. This study utilized market cattle (n=471) consisting of Angus bulls, Angus steers, and crossbred steers. The right side of each carcass was fabricated into retail cuts, lean trim, fat, and bone; weights of each component were then recorded. Retail product from the four primals was then expressed as a percentage of side weight. Traditional carcass measures collected were: 1) hot carcass weight (HCW), 2) 12-13<sup>th</sup> rib fat thickness (CFAT), 3) 12-13<sup>th</sup> rib ribeye area (CREA), and 4) percent kidney, pelvic, and heart fat (KPH). Live animal ultrasound measures collected within seven days prior to harvest were: 1) scan weight (SCANWT), 2) 12-13<sup>th</sup> rib fat thickness (UFAT), 3) 12-13<sup>th</sup> rib ribeye area (UREA), 4) subcutaneous fat thickness over the termination of the *biceps femoris* in the rump (reference point) (URFAT), 5) depth of *gluteus medius* under the reference point (URDEPTH), 6) area of *gluteus medius* anterior to the reference point (URAREA). A stepwise regression was performed to develop models to predict percent retail product from the four primals based on carcass measures or ultrasound measures, and comparisons were made between the models. Significant measures (p<.001) for the carcass data were CFAT, KPH, and CREA with a model R<sup>2</sup> = .297. Significant measures (p<.001) for the ultrasound data were UFAT, UREA, SCANWT and URDEPTH with a model R<sup>2</sup> = .448.

**Key Words:** Beef, Ultrasound, Retail Product Yield

**90 Body composition changes in Angus Bulls from weaning to yearling measured serially with real-time ultrasound.** G. H. Rouse\*, D. E. Wilson, J. R. Tait, A. Hassen, and A. G. Rouse, *Iowa State University, Ames, Iowa.*

The objective of this study was to evaluate body compositional changes in bulls from weaning to yearling. Bull calves born in the spring of 1999, 2000 and 2001 were fed a 61 Mcal diet from December to May, scanned, weighed and hip height measured approximately every 28 days. Compositional changes were determined by measuring subcutaneous fat cover (SFC) longissimus dorsi area (LDA) and percent intramuscular fat (PFAT) with a Classic Scanner 200 and an attached 18 cm, 3.5 MHz linear array transducer six times on each of 315 Angus bull calves. Models were developed using weight and age to predict rate of change for muscle and fat deposition from 273 kg to 545 kg or 220 to 400 days of age. Initially data were adjusted for year effect. Ultrasound data pooled within sex were analyzed using mixed model procedures that included fixed linear and quadratic effects of age and weight at measurement and random effects of animal.

Within a week of harvest mean live weight and age were 559.8±44 Kg and 400.0±21.1 days respectively. A comparison of final ultrasound scan (ULT) and carcass (CM) measurements are shown below.

SFC increased with increasing weight (P<.01) and age was nonsignificant while PFAT increased with age (P<.01) and weight was nonsignificant. LDA increased from weaning to yearling, both age and weight were significant (P<.01). During the 180 day scanning period rate of SFC deposition declined while rate of LDA increased and PFAT rate of deposition was static.

	ULT	CM	BIAS	SEP	r
SFC, cm	0.882±.287	0.967±.307	-0.033	0.086	0.73
LDA, cm <sup>2</sup>	85.72±8.28	83.89±7.95	0.28	1.13	0.60
PFAT, %	4.20±1.01	3.88±1.35	0.31	0.96	0.70

**Key Words:** Beef, Ultrasound, Body Composition

**91 Effects of cooking method, reheating, holding time, and holding temperature on beef longissimus lumborum and biceps femoris tenderness.** E. Obuz\*, M.E. Dikeman, and T.M. Loughin, *Kansas State University.*

Effects of cooking method, holding temperature, holding time, and reheating on Warner-Bratzler peak shear force (WBPSF); Warner-Bratzler myofibrillar force (WBM-F), Warner-Bratzler connective tissue force (WBC-F) and cooking loss were investigated. Two muscles (longissimus lumborum and biceps femoris) from USDA Choice beef carcasses were used. Water-bath cooking resulted in higher WBPSF, WBM-F, and WBC-F than belt-grill cooking for longissimus lumborum. The biceps femoris muscle tenderness improved more with holding time after cooking on a belt than the longissimus lumborum due to its higher collagen content. Cooking biceps femoris steaks to 54°C by a belt grill and holding them at 54°C in a water bath for 15 min and subsequent reheating to 70°C (best treatment combination) produced a 25% reduction in WBPSF, a 37% reduction in WBC-F, and a 12% reduction in WBM-F as compared to the control (cooking steaks directly to 70°C without holding). Water-bath cooking resulted in lower WBPSF than belt-grill cooking for biceps femoris without any holding time, but further tenderization did not occur with holding. Water-bath cooking resulted in higher cooking losses than belt-grill cooking for both muscles.

**Key Words:** Cooking, Tenderness, Holding

**92 Influence of treadmill exercise (TME) on meat quality of Holstein calves.** C. B. Boger, J. K. Apple, E. B. Kegley, W. J. Roberts, T. J. Wistuba, D. L. Galloway, and L. K. Rakes, *University of Arkansas, Fayetteville, AR.*

Holstein steers (n = 25) were used to evaluate the influence of varying durations and speeds of TME on meat quality and formation of dark-cutting beef. Calves were blocked by weight and assigned within blocks to 1 of 5 treatments of a 2 x 2 factorial design with an unexercised control (NS). Calves were exercised at either 4 or 8 km/h for either 10 or 15 min, then immediately harvested. Blood samples were collected via indwelling jugular catheters at 10 and 2 min pre-exercise, at initiation of exercise (0-min), and at 2-min intervals during exercise and at harvest for quantification of serum cortisol, lactate, and glucose, and plasma NEFA. Upon completion of TME, calves were harvested, and longissimus muscle (LM) samples were removed from the right sides at 0, 1.5, 3, 6, 12, 24, and 48 h post-exsanguination for pH determinations. After a 48-h chill at 1C, subjective and objective color measurements of the LM were obtained, and samples of LM were used to measure bound (BNDMST) and expressible moistures (EXPMST) using the Carver press methodology. There was no effect (P > 0.10) of TME on serum cortisol levels until 6 min after the initiation of exercise. At harvest calves that were exercised at 8 km/h had increased (P < 0.05) serum cortisol levels when compared to the control and calves that exercised at 4 km/h. Calves that were exercised at 8 km/h had elevated (P < 0.05) serum lactate concentrations at every time point after the initiation of exercise, when compared to the control and calves that exercised at 4 km/h. However, TME did not affect (P > 0.30) postmortem pH decline, and had no (P ≥ 0.29) effect on LM color or moisture content. Even though TME elicited a noticeable stress response, this physical stressor failed to produce dark-cutting beef.

Item	10 min		15 min		P <	
	NS	4.0 km/h	8.0 km/h	4.0 km/h		8.0 km/h
Color score (a)	4.9	4.8	5.0	4.6	4.5	0.39
CIE L*	40.0	40.4	39.7	41.5	41.9	0.28
CIE a*	11.8	11.8	11.5	11.9	10.9	0.66
CIE b*	13.5	13.7	13.3	14.1	13.7	0.53
Moisture, %	76.6	76.4	76.6	77.1	76.7	0.50
BNDMST, %	56.7	57.0	58.5	55.3	56.6	0.80
EXPMST, %	43.3	43.0	41.5	44.7	43.4	0.80

(a)1 = pale, grayish pink to 6 = dark purple

**Key Words:** Calves, Exercise, Meat Quality

**93 Effects of restraint and isolation stress on stress physiology and the incidence of dark-cutting longissimus muscle in Holstein steers.** C. B. Boger, J. K. Apple\*, E. B. Kegley, W. J. Roberts, T. J. Wistuba, D. L. Galloway, and L. K. Rakes, *University of Arkansas, Fayetteville, AR.*

Thirty-two Holstein steers, weighing approximately 136 kg, were used to test the effects of varying durations of restraint and isolation stress (RIS) on endocrine and blood metabolite status, and the incidence of dark-cutting longissimus muscle (LM). Calves were blocked by weight, and assigned randomly within blocks to one of four treatments: unstressed controls, or 2, 4, or 6 h of RIS. Blood samples were collected via indwelling jugular catheters, 40, 20, and 0 min pre-stressor application and at 20-min intervals during RIS, and unstressed calves remained in their home stanchions and were subjected to minimal handling and stress. Serum cortisol, as well as plasma glucose and lactate, concentrations were elevated ( $P < 0.01$ ) in RIS-calves, regardless of stressor duration, compared with their unstressed counterparts. Insulin concentrations were similar among treatment groups during the first 80 min after stressor application, but, from 100 to 340 min, calves subjected to RIS had greater ( $P < 0.01$ ) insulin concentrations than unstressed calves. In the LM, 24- and 48-h pH values were in excess of 6.0, and higher ( $P < 0.01$ ) in calves subjected to 6 h RIS than unstressed controls and calves subjected to 2 or 4 h RIS. Total moisture in the LM was similar among treatment groups. However, calves subjected to 6 h RIS had greater ( $P < 0.01$ ) bound moisture and lower expressible moisture than unstressed controls and calves subjected to 2 or 4 h RIS. In the LM, CIE L\* values were reduced ( $P < 0.01$ ) in RIS-calves, regardless of stressor duration, compared with their unstressed counterparts. Seventy-five percent of carcasses from calves exposed to 6 h of RIS were deemed to be dark-cutters; whereas, only 25% of carcasses of calves subjected to 2 or 4 h RIS, and no controls, were classified as dark-cutters. Therefore, subjecting young, lightweight Holstein steers to 6 h of RIS may be an effective, reliable, animal-model to study the dark-cutting condition.

**Key Words:** Calves, Stress, Meat Quality

**94 Effect of pig age at market weight and magnesium supplementation through drinking water on pork quality.** B. R. Frederick\*, E. van Heugten, and M. T. See, *North Carolina State University, Raleigh, NC.*

Thirty-two halothane negative pigs ( $108 \pm 0.6$  kg BW) were used to determine the effect of age of pig and magnesium supplementation through drinking water on pork quality. Two initial groups of 50 pigs that differed by 30 d of age were fed diets to meet or exceed nutrient requirements from 28 kg BW. Sixteen pigs were selected from each group, individually penned, provided 2.7 kg of feed (0.12% Mg) daily, and allowed free access to a nipple waterer for the duration of the study. After 7 d of adjustment, pigs were randomly allotted by sex and weight to 0 or 900 mg/L of supplemental Mg as  $MgSO_4$  in drinking water 2 d prior to harvest. All 32 pigs were then transported (110 km) to a commercial abattoir on the same day and harvested 2.5 h after arrival. *Longissimus dorsi* (LD) and *Semimembranosus* (SM) chops were packaged and stored to simulate display storage for fluid loss and Minolta color determination at 0, 4, and 8 d. Two remaining sections of the LD were vacuum-packed and stored at 4°C for 25 or 50 d. Fast (younger) and slow (older) growing pigs differed by 27 days of age, 153 and  $180 \pm 0.4$  d ( $P < 0.001$ ) at 108 and  $109 \pm 0.4$  kg BW ( $P > 0.20$ ), respectively. Purge loss, color, or oxidation of vacuum-packed LD or SM nor oxidation or fluid loss of displayed LD and SM were affected by age of pig or Mg supplementation ( $P > 0.10$ ). Surface exudate, measured by filter paper, of the SM from older pigs was less than younger pigs, 61 vs  $74 \pm 6$  mg ( $P < 0.05$ ). Surface exudate of the LD was not affected by age of pig, 58 vs  $73 \pm 7$  mg ( $P > 0.10$ ), respectively. The LD from older pigs displayed for 4 and 8 d had lower L\* than younger pigs, 51.9 vs  $53.7 \pm 0.7$  ( $P < 0.05$ ) and 54.4 vs  $55.6 \pm 0.6$  ( $P < 0.06$ ). The SM from older pigs had lower L\* after 8 d, 54.4 vs  $56.0 \pm 0.4$  ( $P < 0.05$ ), and tended to have higher a\* after 4 and 8 d of display storage, 9.7 vs  $9.2 \pm 0.4$  and 9.4 vs  $8.8 \pm 0.4$  ( $P < 0.10$ ), respectively. Magnesium had no effect on pork quality. However, the SM from older pigs had less exudate, tended to be redder, and the LD and SM from older pigs were darker than younger pigs.

**Key Words:** Pork Quality, Magnesium, Water

**95 The effects of Paylean on growth, carcass and meat quality traits of Berkshire and Yorkshire progeny.** M.J. Ritter\*, C.P. Allison, N.L. Berry, R.O. Bates, G.M. Hill, and M.E. Doumit, *Michigan State University.*

An experiment consisting of two replicates was conducted to determine the effects of Paylean on growth, carcass and meat quality traits of Berkshire- (B) and Yorkshire- (Y) sired progeny. At approximately 82 kg live weight, barrows ( $n = 56$ ) were blocked by litter, live weight, ultrasound tenth rib backfat and loin muscle area and were assigned to one of four treatments: Berkshire-sired control (BC), Berkshire-sired fed Paylean (BP), Yorkshire-sired control (YC) and Yorkshire-sired fed Paylean (YP). Paylean was fed at 10 ppm in a 16% crude protein and 0.9% lysine corn-soybean meal diet for the last four weeks of the finishing phase. Paylean did not affect average daily feed intake, average daily gain or live weight at harvest, but YP had higher feed efficiencies than YC ( $P < 0.03$ ). Paylean did not affect hot carcass weight or carcass backfat thickness of BP or YP in comparison with their respective controls. Carcasses from BP had larger loin muscle areas ( $P < 0.02$ ) and more kg of fat-free lean ( $P < 0.05$ ) than BC. Additionally, Paylean increased trimmed loin weights in B and Y carcasses ( $P < 0.03$ ) and YP carcasses had heavier picnic shoulder weights than YC ( $P < 0.05$ ). Significant treatment by breed by replicate interactions ( $P < 0.05$ ) existed for loin muscle 1 h and 24 pH and d 1 CIE L\* values. Also, loin muscle from BP had higher 30 min temperatures than BC ( $P < 0.04$ ). However, these interactions and differences in carcass temperature appear to be of little practical importance as Paylean did not affect water-holding capacity or subjective color, firmness and marbling of fresh loin chops from B and Y. In conclusion, 10 ppm of Paylean for the last four weeks of the finishing phase improved lean yield of B and increased trimmed loin weights of B and Y, yet had no effect on fresh pork quality traits.

**Key Words:** Paylean, Carcass Traits, Pork Quality

**96 Local variation in glycolytic potential, pH, and pork quality traits in the longissimus dorsi of pigs.** T.M. Bertol\*<sup>1,2,3</sup>, M. Ellis<sup>1</sup>, M.J. Ritter<sup>1</sup>, and D.N. Hamilton<sup>1</sup>, <sup>1</sup>*University of Illinois at Urbana-Champaign*, <sup>2</sup>*Empresa Brasileira de Pesquisa Agropecuária - Brasil*, <sup>3</sup>*Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil.*

This study was carried out to evaluate variation in glycolytic potential (GP), pH, and quality traits in the longissimus dorsi (LD) of slaughter weight pigs (118–9.5 kg). Twenty-four hours postmortem the LD was removed from both sides of 18 carcasses between the 6th rib and 6nd lumbar vertebrae. A 5-cm section was discarded from each end of the LD, and the remaining portion was divided in seven 5-cm sections for the determination of Minolta L\*, a\*, and b\*, pH, and subjective color, firmness, and marbling. Each section was divided into 3 chops which were used for the determination of drip loss, GP, and Warner-Bratzler shear force, respectively. Marbling and ultimate pH were similar ( $P > 0.05$ ) in all locations. Subjective color and firmness increased ( $P < 0.01$ ) while drip loss, L\*, and a\* decreased ( $P < 0.01$ ) from the anterior to the posterior end of the loin ([1.9<sup>c</sup>, 2.0<sup>c</sup>, 2.3<sup>b</sup>, 2.6<sup>a</sup>, 2.7<sup>a</sup>, 2.7<sup>a</sup>, and 2.6<sup>a</sup>; 0.14 SEM], [1.9<sup>d</sup>, 2.5<sup>c</sup>, 3.1<sup>b</sup>, 3.5<sup>a</sup>, 3.6<sup>a</sup>, 3.6<sup>a</sup>, and 3.6<sup>a</sup>; 1.82 SEM], [7.7<sup>a</sup>, 7.6<sup>a</sup>, 6.5<sup>b</sup>, 6.1<sup>b</sup>, 5.9<sup>b</sup>, 5.9<sup>b</sup>, and 6.0<sup>b</sup>%; 0.37 SEM], [51.7<sup>a</sup>, 51.7<sup>a</sup>, 50.3<sup>c</sup>, 48.4<sup>e</sup>, 48.7<sup>de</sup>, 48.6<sup>de</sup>, and 49.6<sup>cd</sup>; 0.53 SEM], and [8.7<sup>a</sup>, 8.3<sup>b</sup>, 8.1<sup>bc</sup>, 7.7<sup>d</sup>, 7.8<sup>cd</sup>, 7.8<sup>cd</sup>, and 8.0<sup>bcd</sup>; 0.25 SEM], resp.). Glycogen, lactate, and GP were higher ( $P < 0.01$ ) in samples from the middle of LD than the extremities ([18.3<sup>c</sup>, 19.9<sup>ab</sup>, 20.5<sup>a</sup>, 20.5<sup>a</sup>, 20.8<sup>a</sup>, 20.6<sup>a</sup>, and 19.3<sup>b</sup> μmol/g; 1.71 SEM], [95.1<sup>c</sup>, 97.5<sup>ab</sup>, 98.4<sup>a</sup>, 97.9<sup>ab</sup>, 97.9<sup>ab</sup>, 97.7<sup>ab</sup>, and 96.7<sup>b</sup> μmol/g; 1.40 SEM], and [131.7<sup>c</sup>, 137.4<sup>ab</sup>, 139.5<sup>a</sup>, 138.8<sup>a</sup>, 139.5<sup>a</sup>, 138.9<sup>a</sup>, and 135.3<sup>b</sup> μmol/g; 2.89 SEM], resp.). Minolta b\* values were lower ( $P < 0.01$ ) in the middle sections of the LD than at the extremities (6.0<sup>a</sup>, 5.3<sup>bc</sup>, 5.1<sup>cd</sup>, 4.2<sup>f</sup>, 4.5<sup>ef</sup>, 4.8<sup>de</sup>, and 5.5<sup>abc</sup>; 0.21 SEM). The results of this study suggest that meat quality traits and GP vary throughout the LD. Therefore, when performing repeated measures in the loin it is necessary to consider this variation in quality attributes.

**Key Words:** Longissimus, Glycolytic Potential, Pork Quality

**97 Effect of supplementary magnesium and preslaughter handling on blood acid-base responses in finishing pigs.** D. N. Hamilton\*<sup>1</sup>, M. Ellis<sup>1</sup>, and T. M. Bertol<sup>1,2,3</sup>, <sup>1</sup>University of Illinois at Urbana-Champaign, <sup>2</sup>Empresa Brasileira de Pesquisa Agropecuária - Brasil, <sup>3</sup>Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil.

Preslaughter handling of pigs may influence the animal's physiological responses, and ultimately can influence pork quality. Thus, the objective of this study was to determine the effects of a magnesium-fortified diet (Mg) on changes in the blood acid-base status in response to different preslaughter handling intensities. Forty pigs were used in a 2x2x2 factorial with the treatments being: 1) Diet (control [0 g] vs 3.2 g of Mg pig<sup>-1</sup> d<sup>-1</sup>), 2) handling intensity (low vs high), and 3) gender (barrows vs gilts). Pigs were fed the diets for five-d and baseline measures of blood parameters and live weight (118±1.8 kg) were collected two-h before pigs were subjected to the handling protocol, which consisted of moving the pigs through a passage (12.2 x 0.91 m) for a total of 8 laps. Pigs on the high intensity treatment were moved rapidly through the passage and received 2 shocks/lap from an electric goad while pigs on the low intensity moved at their own pace with the aid of a livestock panel and paddle. Animals fed the Mg diet had lower blood PO<sub>2</sub> (38.4 vs 47.0, SE = 2.64 mm Hg, P = 0.03) than controls, however, no other differences were found for baseline values. Post-handling, pigs fed the Mg diet had lower lactate (9.4 vs 11.4, SE = 0.82 mmol/L, P = 0.04) than controls. Animals on the high compared to the low intensity handling treatment had higher blood lactate (16.6 vs 4.2, SE = 0.82mmol/L, P < 0.001) and rectal temperatures (39.8 vs 39.6, SE = 0.08°C, P < 0.01) with lower blood pH (7.10 vs 7.34, SE = 0.020, P < 0.001), HCO<sub>3</sub><sup>-</sup> (21.8 vs 33.5, SE = 0.93 mmol/L, P < 0.001), and base excess (-7.9 vs 9.2, SE = 1.50 mmol/L, P < 0.001). Gender had little effect on blood acid-base measurements post-handling; gilts had lower base excess (-1.6 vs 2.9, SE = 1.50 mmol/L, P = 0.04) with a tendency (P = 0.11) for lower pH and HCO<sub>3</sub><sup>-</sup> values than barrows. Results from this study highlight the major impact of pig handling intensity on blood acid-base balance and suggest that dietary supplementation with Mg did not moderate the effects of handling on blood acid-base status.

**Key Words:** Magnesium, Acid-base, Preslaughter Handling

**98 Characterization of color uniformity of the cut lean surface in fresh ham.** M. T. See\* and B. A. Belstra, *North Carolina State University, Raleigh NC.*

Data were collected on fresh hams to evaluate quality characteristics across groupings with decreasing uniformity of visual color. Carcasses were identified and hot carcass weight (87.8 kg), fat depth and loin depth were collected at 45 m postmortem from pigs representing nine producer lots. Hams were fabricated under normal commercial conditions at 24 h postmortem. Hams were visually classified as normal (n = 140), slightly two-toned (n = 77), moderately two-toned (n = 29) or two-toned/PSE (n = 13). Ultimate pH, Minolta L\* value, and fluid loss were measured on the cut lean surface of the gluteus medius, psoas major and quadriceps femoris. As a check on visual classification, color difference was calculated for each ham as the sum of the squared deviations of the Minolta L\* value of each muscle from the average Minolta L\* value of all three muscles. Hot carcass weight, fat depth, and ham weight did not differ (P > 0.05) across color classifications. However, loin muscle depth increased linearly (55.2, 54.3, 57.9, 57.3 ± .8; P < 0.01) with decreasing color uniformity. Calculated color difference was in strong agreement with visual color classification showing a linear increase (53, 74, 92, 106 ± 7; P < 0.001) as visual uniformity decreased. For the quadriceps femoris, ultimate pH decreased linearly (6.01, 5.96, 5.96, 5.86 ± .03; P < 0.05), and Minolta L\* value (52.5, 54.2, 54.8, 58.3 ± .6; P < .001) and fluid loss percentage (2.1, 2.5, 3.1, 3.3 ± .2; P < 0.001) linearly increased with decreasing uniformity of color in the ham face. Likewise for the gluteus medius, ultimate pH decreased linearly (5.92, 5.87, 5.84, 5.75 ± .02; P < 0.001), and Minolta L\* value (47.8, 49.0, 51.8, 55.2 ± .7; P < 0.001) and fluid loss percentage (2.6, 2.8, 3.5, 3.8 ± .2; P < 0.001) linearly increased with decreasing uniformity of color in the ham face. However, no differences (P > 0.05) were observed across color classifications for ultimate pH, Minolta L\* value or fluid loss percentage of the psoas major. These results indicate that differences in color uniformity are more closely related to quality differences of the gluteus medius and the quadriceps femoris than the psoas major.

**Key Words:** Pork, Quality, Color

**99 Effects of dietary electrolyte balance on blood acid-base balance in finishing pigs.** D. N. Hamilton\*<sup>1</sup>, M. Ellis<sup>1</sup>, and T. M. Bertol<sup>1,2,3</sup>, <sup>1</sup>University of Illinois at Urbana-Champaign, <sup>2</sup>Empresa Brasileira de Pesquisa Agropecuária - Brasil, <sup>3</sup>Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil.

Loss of animals during transport and poor meat quality are interrelated issues that are associated with stress leading to metabolic acidosis. Thus, the objective of this study was to determine the effects of dietary electrolyte balance (DEB) on blood acid-base parameters in pigs subjected to a high intensity handling model. Thirty pigs were used in a completely randomized design with the following three DEB (Na<sup>+</sup> + K<sup>+</sup> - Cl<sup>-</sup> meq/kg) treatments: Low (-38 meq/kg; 1.15 % CaCl<sub>2</sub>) vs Control (122 meq/kg) vs High (326 meq/kg; 2.5 % NaHCO<sub>3</sub><sup>-</sup>). Pigs were given a one-week period to acclimate and were then fed the DEB diets for a period of five d. Baseline measurements of blood acid-base parameters and live weight (113.9 ± 2.10 kg) were collected two-h before the handling procedure, which consisted of moving each pig individually through a passage (12.2 ± 0.91 m) for a total of eight laps and with each pig receiving 2 shocks/lap from an electric livestock goad. Control and High DEB treatments had greater (P < 0.05) baseline TCO<sub>2</sub>, HCO<sub>3</sub><sup>-</sup>, and base-excess while tending (P = 0.06) to have lower rectal temperature when compared to Low DEB pigs. Baseline blood pH showed a quadratic response (P = 0.01); as pigs fed the Control DEB diet had greater (P < 0.03) blood pH than pigs fed the Low DEB diet, while pigs on the High DEB diets were intermediate and similar to both. Levels of TCO<sub>2</sub>, HCO<sub>3</sub><sup>-</sup>, and base-excess increased linearly (P < 0.02) as DEB level increased. Post handling, blood pH was greater (P < 0.05) for pigs on the Control and High DEB diets when compared to the pigs on the Low DEB diet. Base excess was lowest for pigs on the Low DEB diet and highest for the pigs on the High DEB diet, while pigs on the Control DEB diet were intermediate and similar to the both. Furthermore, post-handling levels of TCO<sub>2</sub>, pH, HCO<sub>3</sub><sup>-</sup>, and base-excess increased linearly (P < 0.05) as the DEB level increased. In conclusion, these data indicate that feeding a low DEB diet increases handling-induced acidosis owing to a decrease in blood pH, base-excess and HCO<sub>3</sub><sup>-</sup>.

**Key Words:** Pigs, Acid-base, Handling

**100 Growth, carcass and bone integrity of pigs fed conjugated linoleic acid during the early finishing phase.** B. R. Wiegand\*, M. A. Fritsch, B. M. Kolb, and J. A. Robb, *Illinois State University Normal, IL/USA.*

The main objective of this study was to determine if a performance advantage could be gained by supplementing pigs with conjugated linoleic acid (CLA) during the high growth phase of grow-finish swine production. Dietary CLA was fed (0.6 % of the total diet) to crossbred (Large white × Landrace × Duroc) growing-finishing pigs (n=48). Diets were isocaloric and CLA replaced soy oil in the control diet. Pigs started the trial at an average body weight of 40.4 kg and remained on experimental diets until 30 d prior to slaughter (93 kg body weight). All pigs were fed the control diet for the remaining 30 d period. Pigs were humanely slaughtered at an average body weight of 116.5 kg. Growth performance, carcass, and bone integrity data were collected and statistically analyzed according to a 2 × 2 factorial arrangement within a randomized complete block design. Pigs were randomly assigned to control or CLA diets by sex and blocked on litter. Gilts fed CLA exhibited higher (P < 0.05) ADG compared with gilts fed the control diet (0.84 kg/d vs. 0.80 kg/d). All pigs fed CLA had lower (P < 0.04) last rib fat depth compared with pigs fed the control diet (2.54 cm vs. 2.31 cm). Dexascan measurements of bone mineral density (BMD) and bone mineral content (BMC) of the femur revealed no differences (P = 0.23 and P = 0.38, respectively) when comparing all pigs fed CLA with all pigs fed the control diet. While some advantages in performance and carcass traits were realized in this trial, the removal of CLA in the diet 30 d prior to slaughter negated expected growth performance and carcass trait improvements reported in previous studies.

**Key Words:** Swine, Linoleic Acid, Bone Integrity

**101 Effects of dietary inclusion level of manganese on live swine performance and quality characteristics of longissimus muscle (LM) chops during retail display.** W. J. Roberts<sup>1</sup>, J. K. Apple<sup>\*1</sup>, C. V. Maxwell<sup>1</sup>, C. B. Boger<sup>1</sup>, K. G. Friesen<sup>1</sup>, T. M. Fakler<sup>2</sup>, and Z. B. Johnson<sup>1</sup>, <sup>1</sup>University of Arkansas, Fayetteville, AR, <sup>2</sup>Zinpro Corp., Eden Prairie, MN.

To test the effects of dietary inclusion level of manganese (Mn) on performance and quality traits of LM chops during retail display, crossbred pigs (n = 212) were blocked by BW, assigned to pens (6 pigs/pen) within blocks, and pens (6 pens/block) were allotted randomly to either a corn-SBM starter (23.6 to 36.4 kg), grower I (36.4 to 68.2 kg), grower II (68.2 to 90.9 kg), and finisher (90.9 to 106.8 kg) diets with no supplemental Mn or diets supplemented with 20, 40, 80, 160, or 320 ppm of Mn from Availa<sup>®</sup>-Mn (Mn-amino acid complex). When the lightest block averaged 106.8 kg, pigs were harvested, and boneless pork loins were captured during fabrication. Loin chops were weighed, placed on foam trays, and overwrapped with PVC film for retail display (4C; deluxe warm white light; 1600 lx). On d 0, 1, 4, and 7 of display, subjective and instrumental color was measured, and chops were removed from packages and re-weighed to calculate moisture loss. Pigs fed 40, 80, and 320 ppm Mn consumed less (P < 0.02) feed than pigs fed un-supplemented diets or 20 ppm Mn during the starter phase. Although dietary Mn had no (P > 0.71) effect on performance during the early grower phase, pigs fed 40 and 320 ppm Mn had higher ADG and G/F than pigs fed the control diet or diets fortified with 20, 80, and 160 ppm Mn (cubic effect; P < 0.02 and P < 0.06, respectively) during the late grower phase. Across the entire trial, there was a trend (cubic effect; P < 0.09) for G/F to be higher in pigs fed diets containing 320 ppm than those fed the control diets or diets containing 20, 80, and 160 ppm Mn. Dietary Mn did not affect (P ≥ 0.18) pork carcass composition or LM quality characteristics during retail display. Even though Mn supplementation had no appreciable effects on pork quality during display in the present study, results indicate that supplementing diets with 40 or 320 ppm Mn from Availa<sup>®</sup>-Mn may enhance pig performance, especially feed efficiency.

**Key Words:** Manganese, Performance, Pork Quality

**102 Effects of ractopamine step-up programs on finishing pigs fed under commercial conditions.** T.A. Armstrong<sup>\*</sup>, T.A. Marsteller, B.T. Kremer, R.D. Muller, and J.E. Weatherford, *Elanco Animal Health, Indianapolis, IN.*

A total of 1050 pigs were used to determine the effectiveness of ractopamine (RAC; Paylean<sup>®</sup>, Elanco Animal Health) step-up programs in extending the RAC response when compared to a constant RAC feeding program. Pigs were housed in a commercial finishing barn with an average stocking density of 22 pigs/pen. Pens were randomly assigned to receive 1 of 4 dietary treatments, with 12 replications/treatment. Dietary treatments were: 1) control, no RAC; 2) 5.0 ppm RAC for 35d (Constant); 3) 5.0 ppm RAC for 14d, followed by 10.0 ppm RAC for 21d (Step1); and 4) 5.0 ppm RAC for 21d, followed by 10.0 ppm RAC for 14d (Step2). All dietary treatments were based on a basal diet that was analyzed to contain 18.1% CP and 1.0% lysine. Pen and feed weights were collected weekly from time of trial initiation (average BW = 78.5 kg), and pens were marketed after the 35d experimental period (average BW = 105.4 kg). Total weight gain, ADG, and feed efficiency were improved (P < 0.01) by RAC, and RAC step-up programs (Step1 and Step2) resulted in further improvements in these growth parameters (P < 0.01) compared to the Constant treatment; however, there were no differences (P > 0.05) in animal performance between Step1 and Step2. There were no effects (P > 0.05) of RAC, regardless of feeding program, on ADFI. Increases (P < 0.02) in hot carcass weight (HCW), loin depth, lean percent, total kg lean, percent yield, carcass grade, carcass value, and base meat price were achieved with RAC feeding. There was no effect (P > 0.05) of RAC on 10th rib fat depth. Implementing either Step1 or Step2 tended to increase (P = 0.09) HCW and carcass grade, and increased (P < 0.05) loin depth and total kg lean compared to the Constant treatment. No differences (P > 0.05) were evident for carcass measures between either step-up program. These data demonstrate the effectiveness of RAC in improving growth performance and carcass characteristics. In addition, RAC step-up programs were effective in extending the RAC response under commercial conditions.

**Key Words:** Ractopamine, Growth, Carcass

**103 Performance and carcass effects of ractopamine fed to finishing pigs in commercial conditions.** G Armbruster<sup>1</sup>, T Marsteller<sup>1</sup>, T Armstrong<sup>\*1</sup>, E Berg<sup>2</sup>, J Wagner<sup>1</sup>, R Muller<sup>1</sup>, and J Weatherford, <sup>1</sup>Elanco Animal Health, Indianapolis, IN, <sup>2</sup>University of Missouri, Columbia, MO.

A total of 2911 pigs, in three separate commercial research facilities, were used to determine performance and carcass benefits of finishing pigs fed ractopamine (RAC; Paylean<sup>®</sup>, Elanco Animal Health). Different genetic sources were used at each site. Each barn was double curtain sided, and housed 1000 to 1200 finishing pigs. Pen size varied between sites, but was identical within a site. Stocking density was typical of modern production (19 to 30 pigs/pen). Pigs were blocked by gender and weight, and pens within a barn were randomly assigned to 1 of 4 dietary treatments (0, 5, 10, or 20 ppm RAC), with 32 reps/treatment. Pigs on all treatments received meal diets containing a minimum of 16% CP and 1.0% lysine. Treatments were administered for 28 days beginning at an average body weight of 85 kg and ending at 110 kg. On d 28, one pig, representative of other pigs in a pen (within 5 pounds of average pen weight on both d 0 and d 28), was selected for carcass evaluation. Data were analyzed by pre-planned single degree of freedom orthogonal contrasts. Contrasts were: 0 vs 5 and 10 ppm RAC, 5 vs 10 ppm RAC, and 10 vs 20 ppm RAC. Total gain, ADG, and gain:feed were improved (P < 0.01) by RAC. RAC decreased (P < 0.01) ADFI and improved (P < 0.01) gain:feed in a dose dependent manner. Gain:feed was improved by 14.9, 17.3, and 20.1%, and ADG was improved by 11.5, 12.6, and 14.2% at 5, 10, 20 ppm RAC, respectively. RAC increased (P < 0.01) chilled carcass weight, and the following deboned, trimmed primal weights were increased (P < 0.05) by RAC: ham, loin, tenderloin, boston butt, and picnic. There was no impact (P = 0.36) on loin marbling, and RAC, at 5 and 10 ppm, had no effect (P = 0.47) on color. Trimmed, deboned ham, loin, and tenderloin weights were improved (P < 0.04) by 5 and 10 ppm RAC when compared to 0 ppm. These data demonstrate the beneficial effects of RAC on growth performance and carcass characteristics.

**Key Words:** Ractopamine, Carcass, Growth

**104 Finishing performance and ultrasound composition of Paylean<sup>®</sup> supplemented pigs sorted into backfat thickness classes.** K. J. Mims<sup>\*1</sup>, T. D. Pringle<sup>1</sup>, S. A. Meers<sup>1</sup>, M. J. Azain<sup>1</sup>, and T. A. Armstrong<sup>2</sup>, <sup>1</sup>The University of Georgia, Athens, GA, <sup>2</sup>Elanco Animal Health, Greenfield, IN.

This study was conducted to determine the response in animal performance and ultrasound fat and muscle measurements of pigs varying in prefinishing 10<sup>th</sup> rib backfat to Paylean<sup>®</sup> supplementation. Crossbred barrows (n = 144) were assigned to a factorial arrangement with two backfat (BF) classes (fat, F vs lean, L) and two levels of Paylean<sup>®</sup> (PL; 0 vs 10 ppm). Pigs (80 kg) from four farrowing groups were ranked using ultrasound backfat and sorted into L and F groups (difference ≥ .5 cm). Selected pigs were penned by BF class and randomly assigned to PL treatment. Pigs were fed a corn/soybean diet containing 18% CP and 1.1% lysine for 28 d. Feed consumption, liveweight and ultrasound backfat (UBF) and Longissimus muscle area (ULMA) was recorded every 7 d. Data were analyzed using ANOVA for a replicated (n = 4), 2 x 2 factorial arrangement with the main effects of PL treatment and BF class and their interactions. Replicate and replicate interactions were included in the model to remove replicate variation. Pigs supplemented with PL had higher daily gain:feed (C = .36 vs PL = .38; P < .01), and lower daily feed intake over the 28 d study (C = 2.96 vs PL = 2.75 kg/pig/d; P < .01). Reductions in feed intake by PL versus C pigs were greatest during wk 3 and 4 of the study. Paylean<sup>®</sup> had no effect on ADG (P > .05). Neither BF class nor the interaction of BF class with PL treatment affected (P > .05) ADG, gain:feed or feed intake. As expected, L pigs had less UBF than F pigs (L = 1.89 vs F = 2.40 cm; P < .01). Treatment x time interaction for UBF was significant (P < .03) as PL supplemented pigs were significantly leaner than C pigs after 21 and 28 d. While BF class did not affect UBF accretion rates, UBF accretion was significantly slower in PL pigs (.011 cm/d) than C pigs (.017 cm/d). Lean pigs had larger ULMA than C pigs (L = 30.6 vs F = 29.1 cm<sup>2</sup>; P < .04), and while ULMA accretion was not different across PL treatment, PL pigs tended (P = .10) to have larger ULMA than C

pigs. Regardless of initial fatness, Paylean® improved gain:feed, primarily through reduced feed intake, and increased carcass lean of finishing pigs.

**Key Words:** Pork,  $\beta$ -Agonist, Growth

**105 Carcass yield and quality traits of Paylean® treated pigs differing in prefinishing ultrasound 10<sup>th</sup> rib fat thickness.** K. J. Mims<sup>1</sup>, T. D. Pringle\*<sup>1</sup>, M. J. Azain<sup>1</sup>, and T. A. Armstrong<sup>2</sup>, <sup>1</sup>The University of Georgia, Athens, GA, <sup>2</sup>Elanco Animal Health, Greenfield, IN.

This study was conducted to determine the effects of prefinishing backfat (BF) levels and Paylean® (PL) treatment on pork carcass yield and quality attributes. Crossbred barrows were assigned to a factorial arrangement with two BF classes (fat, F vs lean, L) and two levels of Paylean® (0 vs 10 ppm). Pigs (80 kg) from four farrowing groups were ranked using ultrasound BF and sorted into L and F groups (difference was  $\geq .5$  cm). Selected pigs were penned by BF class and randomly assigned to PL treatment. Pigs were fed a corn/soybean diet (18% CP; 1.1% lysine) for 28 d. After finishing, the two average gaining pigs from each pen were harvested (n = 56). Following a 48 h chill, carcass fat (last rib; 10<sup>th</sup> rib, TRIB and last lumbar vertebrae, LLV); muscle (longissimus area, LMA, and depth, LED; and USDA muscle score, CMS) and quality (marbling, color, firmness, L\*, a\*, b\* and pHu) traits were measured. Data were analyzed using ANOVA for a replicated (n=4), 2x2 factorial arrangement with PL treatment, BF class and their interaction as main effects. Replicate and replicate interactions were included in the model to remove replicate variation. Hot carcass weight was not affected (P > .10) by PL or BF class. As expected, fat depths were lower (P < .05) in the L vs F pigs and TRIB was lower for PL vs C pigs (2.08 vs 2.29 cm, P = .06). Backfat and PL treatment interacted to affect LLV, with the L,C and L,PL pigs being leaner (P < .05) than the F,C pigs and the F,PL pigs being intermediate. The muscling measurements, LEA (45.9 vs 40.0 cm<sup>2</sup>), LED (6.2 vs 5.5 cm), and CMS (2<sup>+</sup> vs 2) were greater (P < .05) for the PL vs C pigs and CMS was higher (P < .05) in the L vs F pigs. Backfat class did not affect (P > .25) quality measures and PL did not affect (P > .3) color or L\*. Marbling (P = .07) and firmness (P < .01) scores and pHu (5.62 vs 5.53, P < .01) were higher for PL vs C pigs. Regardless of the BF levels prior to finishing, carcass composition of PL-fed pigs was improved, primarily through increases in muscling. Additionally, carcass quality, based on marbling and firmness scores and pHu, was improved slightly with PL treatment.

**Key Words:** Pork,  $\beta$ -Agonist, Composition

**106 Ractopamine may improve meat quality by altering postmortem metabolism.** Q. Guo\*<sup>1</sup>, A.L. Grant<sup>1</sup>, B.T. Richert<sup>1</sup>, A.P. Schinckel<sup>1</sup>, and D.E. Gerrard<sup>1</sup>, <sup>1</sup>Purdue University, West Lafayette, IN.

Variation in pork quality represents one of the most important issues impeding increased export of US pork. Of particular concern is the incidence of pale, soft, exudative pork, which further exacerbates the normal variation in pork color. Pork quality development essentially is a consequence of the rate and extent of carbohydrate metabolism in muscle postmortem. Curiously, increased muscle growth has a negative impact on pork quality, yet numerous researchers report that ractopamine (RAC), a beta-adrenergic agonist that stimulates muscle growth, has no impact on pork quality. Therefore, the objective of this study was to determine the effect of feeding RAC to gilts on subsequent postmortem muscle carbohydrate metabolism. Gilts had ad libitum access to a 1.1% lysine commercial finishing diet containing RAC (20 mg/kg) for 0, 1, 2 or 4 wk prior to slaughter (12 gilts/time). Longissimus muscle samples were collected at 0, 30, 60, 90, 120 min, and 24 hr postmortem and snap frozen in liquid nitrogen. Muscle samples were powdered and glycogen, glucose-6-phosphate, glucose and lactate concentrations were determined. No differences were observed in any of the NPPC loin quality parameters investigated. Higher loin muscle pH values were noted (P < 0.05) at 10 min postmortem in pigs fed RAC for 1 or 2 wk, however, pH values at all other times were not affected by treatment. Compared to controls, pigs fed RAC for 4 wk had reduced (P < 0.05) muscle glycogen levels at all times postmortem. In addition, muscle glucose levels were greater (P < 0.05) in pigs fed RAC for 4 wk. Muscle lactate levels were reduced (P < 0.05) after feeding RAC 1 wk, whereas no reduction was observed in pigs fed RAC for 4 wk. These data show that increased time of feeding RAC results in altered muscle glycogen content and the

ability of muscle to generate lactate, and suggest that RAC may improve pork quality by altering energy metabolism early postmortem.

**Key Words:** Ractopamine, Pork Quality, Glycogen

**107 Relationships between environmental conditions on trucks and losses during transport to slaughter in finishing pigs.** D. N. Hamilton\*<sup>1</sup>, M. Ellis<sup>1</sup>, G. E. Bressner<sup>1</sup>, B. F. Wolter<sup>2</sup>, D. J. Jones<sup>3</sup>, and L. E. Watkins<sup>3</sup>, <sup>1</sup>University of Illinois at Urbana-Champaign, <sup>2</sup>The Maschhoffs, Carlyle, IL, <sup>3</sup>Elanco Animal Health, Greenfield, IN.

The objective of this study was to evaluate relationships between environmental conditions on a commercial livestock trailer and losses during transport from the farm to the packing plant. A total of 93 loads with  $169 \pm 11.2$  pigs per load with a live weight of  $128 \pm 14.0$  kg were evaluated. The trailer was divided into nine compartments and the pigs were loaded at a stocking density  $0.47 \pm 0.126$  m<sup>2</sup>/pig. Percent dead and subjects (pigs that were unable to walk, sustained an injury, or showed signs of exhaustion) on arrival at the plant was  $0.19 \pm 0.530$  and  $0.62 \pm 0.979$ , respectively. Temperatures at the start and end of loading, halfway through the journey, on arrival at the plant, and at unloading were 16.6, 19.2, 19.7, 20.3, and 20.5°C, respectively (SE = 0.21; P < 0.05) and relative humidities were 72.7, 72.7, 64.8, 64.4, and 62.1 %, resp. (SE = 0.71; P < 0.05). Of all the factors evaluated, number of pigs per load was the most strongly correlated to the subjects, deads, and total losses (r = -0.23, -0.29, -0.27, resp.; P < 0.05). Average temperature during loading, transport and unloading was inversely correlated to the percentage of subjects and total losses (r = -0.20 and -0.15, resp.; P < 0.05). Average relative humidity during loading, transport and unloading was positively correlated to the percentage of subjects and total losses (r = 0.27 and 0.21, resp.; P < 0.05). Transport time was correlated with losses during transit (r = 0.30, 0.25, and 0.16, for subjects, deads, and total losses, resp.; P < 0.05). All of the correlations in this study were relatively low, indicating that there was no single factor responsible for the transport losses or that the issue may be caused by a combination of factors. Further research is warranted to evaluate other factors that may contribute to losses during transport.

**Key Words:** Pigs, Transport Losses, Temperature

**108 Effects of removing slaughter weight pigs from single-sex pens on subsequent growth performance of finishing pigs.** J. M. DeDecker\*<sup>1</sup>, M. Ellis<sup>1</sup>, B. F. Wolter<sup>1</sup>, B. P. Corrigan<sup>1</sup>, S. E. Curtis<sup>1</sup>, E. N. Parr<sup>2</sup>, and D. M. Webel<sup>2</sup>, <sup>1</sup>University of Illinois at Urbana-Champaign, <sup>2</sup>United Feeds, Inc. Sheridan, IN.

The objective of this study was to determine the effects of removal rate and sex (barrow vs gilt) on the performance of finishing pigs. Sixty single-sex pens of crossbred pigs (n = 1537) were used in a randomized complete block design with a 2 x 3 factorial arrangement of treatments. Factors included 1) sex (barrows vs gilts) and 2) removal rate (0, 12 and 24% of pigs removed). Pens (25 pigs; mean BW =  $105.6 \pm 0.37$  kg) were randomly allocated to treatment, and the heaviest animals were removed as dictated by treatment. Floor and feeder spaces/pig were 0.64 m<sup>2</sup> and 2.7 cm, 0.72 m<sup>2</sup> and 3.1 cm, and 0.84 m<sup>2</sup> and 3.6 cm for the 0, 12 and 24% removal treatments, respectively. Two statistical analyses were conducted. The first compared 20-d growth performance between the entire group of pigs after removal (25 vs 22 vs 19 pigs/pen for the 0, 12 and 24% removal treatments, respectively). The second analysis compared the 20-d growth performance of the lightest 19 pigs in each treatment. Daily weight gain post-removal was similar (P > 0.05) for the 0, 12 and 24% removal rate treatments ( $792, 810, \text{ and } 826 \pm 26.6$  g/d, respectively) as well as for the lightest 19 pigs ( $776, 819, \text{ and } 826 \pm 25.1$  g/d, respectively). Therefore, the average weight of pigs produced decreased linearly (P < 0.01) as the percentage of the heaviest pigs/pen removed increased ( $121.1, 118.9, \text{ and } 117.8 \text{ kg} \pm 0.84$  for the 0, 12 and 24% removed treatments, respectively). The within-pen coefficient of variation for the entire group at d 20 post-removal decreased quadratically (P < 0.05) with increasing pig removal rate ( $8.74, 7.10, \text{ and } 7.38 \pm 0.293$  for the 0, 12 and 24% removed treatments, respectively). Pens of barrows and gilts responded similarly to pig removal. Overall, barrows consumed more feed (P < 0.001), were heavier (P < 0.001), and had a lower (P < 0.01) gain:feed ratio than gilts. In summary, these results suggest that removing 12 or 24% of the heaviest pigs in pens averaging

105 kg BW does not impact the subsequent growth performance of the remaining barrows or gilts.

**Key Words:** Pigs, Removal, Sex

**109 Effects of dexamethasone injection at birth on growth performance of pigs from birth to weaning.** M. G. Young, M. D. Tokach, S. S. Dritz, R. D. Goodband, and J. L. Nelssen, *Kansas State University*.

A total of 82 litters were used in a 21-d study to evaluate the effect of injecting litters of pigs with dexamethasone on growth rate from birth to weaning. In dexamethasone treated litters, all pigs within a litter were administered 1 mg dexamethasone per pig intramuscularly when the litter was processed (within the first 24 h after birth). Control pigs were processed according to standard practice and did not receive a dexamethasone injection. The standard processing practices included clipping needle teeth, docking tails, notching ears, and intramuscular iron injection. Pigs were weighed at birth and weaning, and litter size within treatment was equalized after processing. There was no difference ( $P > 0.28$ ) in sow weight change, litter growth rate from birth to weaning, mortality, or number of pigs weaned between pigs injected with dexamethasone compared to the control pigs. Administration of 1 mg/pig of dexamethasone within 24 hours of birth to whole litters of pigs did not improve pig performance from birth to weaning.

Item	Dexamethasone	Control	SEM	P<
Lactation length, days	20.8	21.0	0.71	0.60
Sow weight, kg				
Entry farrowing	237.0	246.6	4.35	0.26
Weaning	227.2	231.2	4.15	0.55
Loss	9.8	15.4	2.70	0.28
ADFI lactation, kg	5.8	6.0	0.18	0.46
Number of pigs				
Day 1	10.0	10.0	0.40	0.95
Weaning	9.1	9.1	0.31	0.97
Preweaning mortality, %	8.7	8.3	1.56	0.85
Piglet weight, kg				
Birth	1.50	1.51	0.07	0.93
Weaning	6.67	6.68	0.48	0.95
Piglet ADG, kg	0.235	0.231	0.01	0.67

**Key Words:** Dexamethasone, Pigs, Growth

**110 Effects of dietary energy density and frame size on the concentration of plasma leptin and insulin of feedlot steers.** C. C. Ribeiro-Filho<sup>\*1</sup>, A. H. Trenkle<sup>1</sup>, D. D. Loy<sup>1</sup>, D. H. Keisler<sup>2</sup>, and P. M. Dixon<sup>1</sup>, <sup>1</sup>*Iowa State University, Ames*, <sup>2</sup>*University of Missouri, Columbia*.

Circulating plasma leptin and insulin concentrations are dependent on the degree of fatness and energy intake of cattle. A feedlot trial was conducted to evaluate the effects of dietary energy concentration and animal frame size on plasma concentration of leptin and insulin of beef steers. Thirty-six steers with average weight of 325 kg were fed individually for 196 days. Treatments were composed of diets with energy concentration of 2.4, 2.7, or 3.0 Mcal of ME/kg of DM and animal frame size (small and large) by a 3 × 2 factorial design. Blood samples were taken by jugular venipuncture on days 0, 28, 56, 84, 112, 140, 168, and 196 for measurement of plasma leptin and insulin. Plasma leptin concentration was determined using a ruminant specific RIA, and plasma insulin concentration was determined using a commercial RIA kit. There was no significant ( $P > .05$ ) effect of frame size on leptin concentration. The steers fed 2.7 or 3.0 Mcal/kg diets had significantly ( $P < .05$ ) higher leptin concentration than those fed 2.4 Mcal/kg from day 84 to 168. At end of trial, plasma leptin concentrations were 10.2, 7.7, and 6.8 ng/mL for 3.0, 2.7, and 2.4 Mcal/kg diets, respectively, and the steers fed the 3.0 Mcal/kg diet had significantly ( $P < .05$ ) higher leptin concentration than those fed the other two diets. Concentration of plasma insulin was significantly ( $P < .05$ ) higher for small frame than large frame steers for days 112 and 140. There was no significant difference ( $P > .05$ ) in plasma insulin concentration due to diets. Small frame steers fed the 3.0 Mcal/kg diet tended to have higher plasma leptin and insulin concentration than the other treatment combinations from day 84 to 196. The results indicated that plasma concentrations of hormones were affected by energy density of diet and frame size. These effects may be

explained in part by the result of differences in body fatness related to diet and frame size.

**Key Words:** Leptin, Insulin, Cattle

**111 Effects of adiposity and energy intake on plasma leptin concentration in beef cattle.** C. C. Ribeiro-Filho<sup>\*1</sup>, A. H. Trenkle<sup>1</sup>, D. D. Loy<sup>1</sup>, D. H. Keisler<sup>2</sup>, and P. M. Dixon<sup>1</sup>, <sup>1</sup>*Iowa State University, Ames*, <sup>2</sup>*University of Missouri, Columbia*.

Leptin, a hormone produced by adipocytes, plays an important role in the regulation of feed intake and body composition. A feedlot trial was conducted to evaluate the effects of fat deposition and energy intake on plasma concentration of leptin in beef steers. Thirty-six steers with average weight of 325 kg were fed individually for 196 days. Dietary treatments were rations containing 2.4, 2.7, or 3.0 Mcal of ME/kg of DM. Daily dry matter and energy intake were measured. Blood samples were taken by jugular venipuncture on days 0, 28, 56, 84, 112, 140, 168, and 196 for measurement of plasma leptin. Plasma leptin concentration was determined using a ruminant specific RIA. Subcutaneous fat thickness (FT), the carcass measurement with the highest correlation to body fat, measurements were taken between the 12th and 13th ribs by ultrasound at the same days. Dietary treatments affected significantly ( $P < .05$ ) dry matter intake during the late phase of the feeding period (after day 112), steers fed 2.4 or 2.7 Mcal/kg diets had greater DMI than those fed the 3.0 Mcal/kg diet. However, ME intake was not significantly ( $P > .05$ ) different among treatments during this period. FT increased linearly as the steers progressed into feeding period, and those fed higher energy concentration diets tended to have higher FT than those fed lower energy concentration diets. Plasma leptin concentration was higher ( $P < .05$ ) for steers fed the 3.0 or 2.7 Mcal/kg diet than those fed the 2.4 Mcal/kg diet during the late phase of the feeding period. FT and leptin concentration were positively and significantly correlated ( $r = 0.33$ ,  $P < .0001$ ). These data suggested that leptin concentration in cattle may be more dependent on degree of fatness rather than dietary energy intake.

**Key Words:** Leptin, Adiposity, Cattle

**112 Influence of weaning age and implant strategy on serum concentrations of leptin in beef cattle.** D. L. McNamara<sup>\*</sup>, E. L. McFadin, M. S. Kerley, D. H. Keisler, V. L. Pierce, T. B. Schmidt, C. A. Stahl, M. L. Linville, and E. P. Berg, *University of Missouri, Columbia, Missouri*.

In the cow calf industry, calf management strategies can affect producer profitability. Herein, the influence of calf weaning age on returns to the producer and calf performance was investigated. A specific objective within this study was to assess the relationship between live body composition and peripheral concentrations of leptin. Angus and Gelbvieh cross steers (n=136) were randomly assigned to a 2x2 arrangement of treatments consisting of: 1) early weaned calves implanted with 36 mg zeranol at weaning and reimplanted at 174d (EWI; weaning age=90 d; n=35), 2) early weaned calves not implanted (EWNI; weaning age=90d; n=34), 3) normal weaned calves implanted with 36mg zeranol at weaning (NWI; weaning age=200 d; n=33), and 4) normal weaned calves not implanted (NWNi; weaning age=200 d; n=34). All calves were weaned and acclimated to a traditional feedlot ration over a 21d period prior to the trial start date. Blood samples were collected from calves at trial start date and at 28d intervals thereafter to monitor serum concentrations of the adipocyte derived hormone leptin. Fat thickness (FT) and ribeye area (REA) measurements were obtained using ultrasound at 28d intervals. Pearson correlation coefficients were determined to assess the relationship between serum leptin and carcass compositional measurements. Weight of the steers at 200d of age accounted for a significant portion of the variation in serum leptin ( $p < 0.001$ ) such that the heavier steers had the greatest concentrations of leptin ( $r = 0.43$ ,  $p < 0.0001$ ). In addition, serum leptin was positively correlated with 12<sup>th</sup> rib FT ( $r = 0.58$ ,  $p < 0.0001$ ) and REA ( $r = 0.40$ ,  $p < 0.0001$ ). Early weaned calves were heavier and had more serum leptin than NW calves ( $p < 0.0001$ ) at 200d of age. Presence or absence of zeranol implants did not affect serum leptin ( $p > 0.1$ ). These data provide evidence that leptin is positively correlated with fat mass in growing steers and that early weaned steers begin to deposit fat at an earlier age than normal weaned steers.

**Key Words:** Leptin, Early Wean, Beef

**113 Localization of intermediate filament proteins in developing avian skeletal muscle cells.** S. A. Lex, T. W. Huiatt, M. H. Stromer, and R. M. Robson\*, *Iowa State University, Ames, Iowa.*

Intermediate filaments (IFs) are an integral part of the muscle cell cytoskeleton. In adult muscle cells, IFs function in the maintenance of cell integrity by linking Z-lines of adjacent myofibrils and by linking the Z-lines of the peripheral layer of myofibrils to the sarcolemma. Desmin is the major IF subunit protein in adult muscle cells. Synemin and paranemin are very large, novel IF proteins that are present in small amounts relative to desmin, but appear to function in linking IFs to other cytoskeletal components. To determine the order of expression, location and possible roles of these IF proteins in developing muscle, we used immunofluorescence and immunoelectron microscopy to localize these IF proteins in 12-day embryonic chick breast muscle cell cultures. After 1, 2, 4, 8 and 12 days in culture, cells were labeled with pairs of antibodies to the IF proteins or the Z-line protein  $\alpha$ -actinin. Immunofluorescence demonstrated that paranemin was expressed earlier than either synemin or desmin as shown by the presence of myoblasts or early myotubes that were positive for paranemin, but not for either synemin or desmin, in 1- and 2-day cultures. At later stages of development, when all three proteins were expressed, paranemin, synemin, and desmin were colocalized, but paranemin labeling was more prominent at growth tips of elongating myotubes. Organization of all three IF proteins changed from a diffuse pattern at early stages to a longitudinal filamentous pattern. In 8-day cultures, the IF proteins began to colocalize with  $\alpha$ -actinin at the myofibrillar Z-lines. In more mature myotubes in 12-day cultures, IFs were clearly localized at Z-lines, but paranemin expression was decreased relative to that of synemin. Immunoelectron microscopy clearly demonstrated localization of paranemin and synemin along IFs, located mainly near the ends of developing myofibrils and at cytoskeletal filament junctions. These results suggest that paranemin and synemin function in the organization of IFs in developing muscle cells, but appear to have distinct roles in IF organization. (Supported in part by USDA-NRICGP)

**Key Words:** Muscle Cell Cytoskeleton, Intermediate Filaments, Desmin

**114 Comparison of performance, carcass traits, and economic returns of single versus reimplant strategies for finishing steer calves.** J.D. Arseneau\*<sup>1</sup>, M.C. Claeys<sup>1</sup>, J.W. Leininger<sup>2</sup>, J.P. Hutcheson<sup>2</sup>, and R.P. Lemenager<sup>1</sup>, <sup>1</sup>*Purdue University, West Lafayette, IN*, <sup>2</sup>*Intervet Inc., Millsboro, DE.*

The objective of this study was to compare growth performance, carcass traits, and net return of finishing beef steer calves administered a moderate dose trenbolone acetate/estradiol combination implant as a single initial or re-implant strategy. Forty-eight British cross steer calves (initial BW 283.7  $\pm$  6.8 kg) were randomly assigned by weight to one of four implant treatments: 1) no implant (CON), 2) Ralgro Magnum day 1 of the finishing period (MAG), 3) Revalor-IS day 1 (IS), or 4) Revalor-IS day 1 and day 80 (IS/IS). Steers were individually housed and fed a final finishing diet formulated for 13.0% CP and 1.38 Mcal NEg/kg DM. All steers were harvested after 165 d on feed. IS and IS/IS steers were 44.5 kg heavier ( $P < 0.05$ ) than CON steers at harvest, whereas final weights for MAG were intermediate and not significantly different ( $P > 0.05$ ) than IS, IS/IS or CON. For the overall 165 d feeding period, IS and IS/IS steers gained 9% and 18% more ( $P < 0.10$ ) per day than MAG and CON, respectively, and were 11.5% more efficient ( $P < 0.05$ ) than CON steers. MAG steers had 8% higher ( $P < 0.10$ ) daily gains than CON steers, however, feed conversions were not different between MAG and CON. Hot carcass weights were 32.4 kg and 29.8 kg heavier ( $P < 0.05$ ) for IS/IS and IS, respectively, compared to CON. Hot carcass weights did not differ between implant treatments. No statistical differences were detected for other carcass traits, including yield grade and quality grade distributions. Feed cost/.45 kg gain and total cost/.45 kg gain were identical for IS and IS/IS treatments (\$0.25 and \$0.38, respectively), and were lower ( $P < 0.10$ ) than CON (\$0.29 and \$0.43) and MAG (\$0.27 and \$0.41). Non-implanted cattle returned a respectable \$76.55/head, however, implanting resulted in significantly higher ( $P < 0.10$ ) net returns over CON steers (range of \$33.41 to \$58.39/head higher than CON). These results demonstrate that either a single initial or reimplant program using Revalor-IS will improve ADG compared to either no implant or a zeranol implant. Carcass quality traits were not negatively affected by

implanting in this study. Additional studies with greater animal numbers should be conducted to more thoroughly determine and document the economic affects of reimplanting with Revalor-IS.

**Key Words:** Beef Cattle, Finishing, Implant

**115 Cow muscle profiling: Comparison of processing traits and shear forces of 21 muscles from beef and dairy cow carcasses.** M.L. Buford\*<sup>1</sup>, C.R. Calkins<sup>1</sup>, D.D. Johnson<sup>2</sup>, and B.L. Gwartney<sup>3</sup>, <sup>1</sup>*University of Nebraska-Lincoln*, <sup>2</sup>*University of Florida, Gainesville*, <sup>3</sup>*National Cattlemen's Beef Association, Denver, CO.*

Previous research has revealed that 43% of the cow carcass is sold as boxed beef. Much of the rest is merchandised as beef trim for grinding and processing. Opportunities may exist to add value into underutilized muscles from beef and dairy cows currently sold as boxed beef. To identify differences in composition of muscles from beef and dairy cows, 21 muscles from each of 74 carcasses (harvested from 4 geographic locations in the U.S. over a five-month period) weighing 249.7 to 340.7 kg were examined for various processing traits. Carcasses were selected based on body type (beef and dairy), twelfth-rib fat thickness ( $< 2.5$  mm or  $> 2.5$  mm), muscling level (heavy/medium or light), and skeletal maturity (C/D or E) and fabricated into denuded Adductor, Biceps femoris, Complexus, Deep pectoral, Gluteus medius, Infraspinatus, Latissimus dorsi, Longissimus dorsi, Multifidus/Spinalis dorsi, Psoas major, Rectus femoris, Semimembranosus, Semitendinosus, Serratus ventralis, Supraspinatus, Tensor fascia latae, Teres major, Triiceps brachii, Vastus intermedius, Vastus lateralis, and Vastus medialis muscles. Muscles from 3/5 of the carcasses were used for determination of composition (% fat, moisture and ash), pH, expressible moisture (WHC, by centrifugation), objective color ( $L^*$ ,  $a^*$  and  $b^*$ ), heme-iron, and total collagen. On muscles from 2/5 of the carcasses, Warner-Bratzler shear force (WBSF) values (dry heat cooked to 71 C; 1.27 cm cores) were measured. The data were analyzed to determine significant differences between traits for specific muscles from beef and dairy type carcasses. Beef muscles had a higher percent moisture (9 of 21 muscles), exhibited a darker color (lower  $L^*$  for 4 of 21 muscles), and were less tender (higher WBSF for 4 of 21 muscles) than muscles from dairy carcasses ( $P < 0.05$ ). Significant differences were found less frequently for percent fat (2 of 21 muscles), heme-iron (1 of 21 muscles), expressible moisture (1 of 21 muscles), total collagen (1 of 21 muscles), and percent ash (1 of 21 muscles). These data indicate that, other than percent moisture, only minor differences exist between muscles from beef and dairy cow carcasses of similar weight.

**Key Words:** Muscle Characteristics, Composition, Dairy and Beef

**116 Mathematical modeling of cooking longissimus lumborum and biceps femoris steaks.** E Obuz\* and M. E Dikeman, *Kansas State University.*

Modeling studies of meat cooking have gained popularity because they provide greater understanding of the dynamics of meat cooking. The objectives of our study were to model cooking time and temperature histories for longissimus lumborum and biceps femoris steaks. Each biceps femoris ( $n=10$ ) and longissimus lumborum ( $n=10$ ) steak was cooked in a gas-fired, forced-air convection oven at 163C individually until the center temperature of a steak reached 70C. Temperature histories for each steak were recorded by a Doric temperature recorder and the recorded time and temperature data were imported into a spreadsheet. A model was developed to predict cooking time and temperature histories for each steak. No significant differences ( $P < 0.05$ ) were found in cooking times between experimental and model values for either longissimus lumborum or biceps femoris steaks. Modeled temperature histories were consistently higher than the experimental values up to 65C in the cooking cycle for biceps femoris steaks, whereas a better agreement between experimental and modeled values was found for longissimus lumborum. A highly positive linear relationship was found between experimental and modeled temperature histories for both longissimus lumborum ( $R^2 = 0.99$ ) and biceps femoris ( $R^2 = 0.96$ ) steaks. The developed model might be useful for cooking steaks for a constant time to a given degree of doneness and might increase consumer satisfaction by reducing variation in degree of steak doneness.

**Key Words:** Modeling, Cooking, Heat Transfer

**117 The effects of cattle gender on feedlot performance, carcass characteristics and muscle tenderness.** W. T. Choat<sup>\*1,2</sup>, J. A. Paterson<sup>1</sup>, G. C. Smith<sup>2</sup>, B. Rainey<sup>1</sup>, M. King<sup>1</sup>, and R. J. Lipsey<sup>3</sup>, <sup>1</sup>Montana State University, Bozeman, <sup>2</sup>Colorado State University, Fort Collins, <sup>3</sup>American Simmental Association, Bozeman, MT.

Rate of gain, carcass traits and beef tenderness of 202 progeny of Angus or Simmental sires were compared. Steers (N=99), heifers (N=57) and intravaginally spayed heifers (N=46) were commercially fed (161 d). No implants were administered and heifers were not fed melengestrol acetate to control estrus. Strip loin sections from each carcass were aged for 7, 14 or 21d. Steaks (2.54cm) were cooked to an internal temperature of 70 °C and four to eight cores from each steak were sheared once using an Instron<sup>®</sup> 3100, fitted with a Warner Bratzler shear head. Data were analyzed using the GLM procedure of SAS. Steers had faster ( $P < 0.01$ ) rates of gain than spayed and intact heifers. Heavier ( $P < 0.01$ ) final live weights of steers resulted in 25 kg heavier ( $P < 0.01$ ) hot carcass weights at similar ( $P = 0.86$ ) levels of fat thickness compared with heifers. Spayed heifers had a 5.7% smaller REA ( $P < 0.05$ ) compared with steers and intact heifers which were similar. Calculated yield grades and USDA quality grades were similar ( $P = 0.21$ ) among treatments, although marbling scores were lower ( $P < 0.01$ ) for steers compared to intact and spayed heifers. Shear force values after 7 d of aging were lower ( $P < 0.01$ ) for steers (3.32) compared to intact and spayed heifers (3.77 and 3.56) which were not different. A similar response ( $P < 0.01$ ) was also measured after 14 d for steers (3.29) compared to intact (3.62) or spayed heifers (3.52). Results revealed that intact and spayed heifers with comparable marbling had greater ( $P = 0.05$ ) shear force values after 7 and 14 d of aging compared with steers. Under the genetic and environmental conditions of this experiment, steers had faster daily gains and produced heavier carcasses at similar levels of subcutaneous fat compared to heifers. Intact and spayed heifers produced strip loin steaks that had higher average shear force values (e.g., were less tender) than those from steers.

**Key Words:** Steers, Heifers, Shear Force

**118 Effect of flax supplementation and growth promotants on steady-state lipoprotein lipase and glycogenin mRNA concentrations in finishing cattle.** A. T. Waylan<sup>\*</sup>, J. P. Kayser, J. D. Dunn, E. K. Sissom, and B. J. Johnson, *Kansas State University, Manhattan.*

Dietary triacylglycerols are packaged into chylomicrons and are stored on the inner surface of the capillaries in skeletal muscle and adipose tissue. Lipoprotein lipase (LPL) hydrolyzes triacylglycerols into monoacylglycerol and fatty acids, which are taken up by the tissues and utilized for energy. Glycogenin is the core protein upon which glycogen molecules are synthesized. There is one molecule of glycogenin per molecule of glycogen in skeletal muscle therefore glycogen storage is limited by the amount of glycogenin. The objective was to investigate the effect of feeding flax, a source of polyunsaturated fatty acids, and administering growth promotants on steady-state LPL and glycogenin mRNA content of muscle in finishing cattle. Sixteen crossbred steers (BW = 397 kg) given ad libitum access to a 93% concentrate diet for 28 d were used in a four-treatment, 2 x 2 factorial experiment with main effects of flax (non-flax or flax, 5% supplementation) and implantation (non-implant and implant of Revalor-S; 120 mg trenbolone acetate + 24 mg estradiol). Muscle biopsies were obtained from the longissimus muscle at 0, 14, and 28 d. Muscle samples were used to quantify LPL and glycogenin mRNA concentrations by using real-time quantitative PCR. Revalor-S did not affect LPL or glycogenin mRNA concentrations ( $P \geq .13$ ). A day x flax interaction ( $P \leq .0001$ ) was observed for both LPL and glycogenin mRNA concentrations. At 0 and 14 d, no differences ( $P \geq .15$ ) were observed between non-flax and flax steers. At 28 d, non-flax steers had a 4.1 and 5.7-fold increase ( $P < .0001$ ) over flax steers for LPL and glycogenin mRNA concentrations, respectively. These data suggest that flax supplementation to finishing steers for 28 d reduced gene expression of both LPL and glycogenin as compared to non-flax steers. Alterations in local concentrations of these two proteins could impact skeletal muscle's ability to utilize fatty acids and glucose for energy.

**Key Words:** Lipoprotein Lipase, Glycogenin, Beef Cattle

**119 Evaluation of dexamethasone injection on preweaning growth performance of neonatal pigs under commercial conditions.** A.M. Gaines<sup>\*1</sup>, J.A. Carroll<sup>2</sup>, G.L. Allee<sup>1</sup>, J. Connor<sup>3</sup>, and D.C. Kendall, <sup>1</sup>University of Missouri-Columbia, <sup>2</sup>Animal Physiology Research Unit, ARS-USDA, <sup>3</sup>Carthage Veterinary Service.

Two commercial trials were conducted evaluating the use of dexamethasone (Dex) in improving preweaning growth performance of neonatal pigs. The objectives of the commercial trials were two-fold: To evaluate the sexual dimorphic growth response observed in a previous commercial trial and to determine whether there is any benefit of providing Dex treated pigs supplemental milk. In Exp.1, 703 pigs (TR-4 x PIC C-22) were assigned according to birth weight and sex to three treatments. Treatments included either an i.m. injection of saline (Control), Dex1 (1 mg/kg BW of Dex) or Dex2 (2 mg/kg BW of Dex) within 24 hr after birth. Birth weights ( $1.69 \pm 0.01$  kg) did not differ among treatment ( $P = 0.96$ ) or between sexes ( $P = 0.18$ ). No treatment effects were observed for BW at weaning ( $P \geq 0.76$ ) or ADG ( $P \geq 0.62$ ). The BW at weaning for Control, Dex1 and Dex2 treated pigs was  $4.65 \pm 0.06$ ,  $4.62 \pm 0.06$ , and  $4.59 \pm 0.06$  kg, respectively. The ADG of Control, Dex1 and Dex2 treated pigs were  $230.6 \pm 3.75$ ,  $225.8 \pm 3.86$ , and  $226.4 \pm 3.82$  g, respectively. In Exp. 2, 342 pigs (Genetiporc) were assigned according to birth weight and sex to two treatments. Treatments included either an i.m. injection of saline or Dex (2 mg/kg BW) within 24 hr after birth. All pigs were provided supplemental milk from the time of treatment until weaning age. Birth weights ( $1.58 \pm 0.02$  kg) did not differ among treatment ( $P = 0.95$ ) or between sexes ( $P = 0.10$ ). No treatment effects were observed for BW at weaning ( $P \geq 0.19$ ) or ADG ( $P \geq 0.13$ ). The BW at weaning for Control and Dex treated pigs was  $5.09 \pm 0.09$  and  $4.92 \pm 0.09$  kg, respectively. The ADG of Control and Dex treated pigs were  $229.4 \pm 5.28$  and  $218.1 \pm 5.15$  g, respectively. In contrast to our previous findings, Dex did not improve preweaning growth performance regardless of dosage or supplemental milk. Further studies are warranted to discern other factors encountered under commercial conditions that may influence growth responses observed with Dex treatment.

**Key Words:** Dexamethasone, Pigs, Growth

**120 Effects of acute enteric disease challenge on the insulin-like growth factor system in nursery pigs.** J. P. Kayser<sup>\*</sup>, J. D. Dunn, A. T. Waylan, S. S. Dritz, J. C. Niefeld, J. E. Minton, and B. J. Johnson, *Kansas State University, Manhattan.*

The goal of this study was to examine the effects of an acute Salmonella disease challenge on circulating IGF-1 and IGFBP-3 and steady-state IGF-1 and IGFBP-3 and -5 mRNA levels in skeletal muscle of nursery pigs. Weaned crossbred pigs (n=18, BW=11 kg) were blocked by weight into pens in an environmentally controlled nursery. Pigs had free access to water and were fed a standard corn-soybean meal diet free of added antimicrobials. After a 2 wk acclimation period, pigs received either one of two treatments (trt): 1) oral dose of  $1.1 \times 10^{10}$  CFU *Salmonella enterica* serotype typhimurium (ST, n=9) or 2) sterile broth (control, n=9). Serum was harvested from blood collected via jugular venipuncture and biopsies of the *gluteus medius* were obtained from all pigs on d 0, 3, 7 and 14 relative to ST-challenge. Serum IGF-1 and IGFBP-3 levels were determined by immunoassay. Total RNA was isolated from the muscle samples and real-time quantitative-PCR was used to evaluate differences in gene expression. ST-challenge reduced ( $P < .05$ ) serum IGF-1 by 66% on d 3 as compared to d 0. Sera from ST pigs had lower ( $P < .05$ ) IGF-1 on d 3 and d 7 as compared to sera from control pigs (51% and 43%, respectively). No significant ( $P > .10$ ) trt or trt x d interaction was detected for circulating IGFBP-3. However, serum IGFBP-3 levels were higher ( $P < .01$ ) on d 7 and 14 as compared to samples on either d 0 or d 3. No trt or trt x d interaction ( $P > .10$ ) was detected for muscle IGF-1 mRNA concentration. Muscle IGF-1 mRNA abundance was greater on d 14 than d 0, 3 or 7 (2.0, 2.8, 1.6-fold, respectively,  $P < .01$ ). Muscle IGFBP-5 mRNA concentration was 2.2-fold higher ( $P < .05$ ) on d 14 in control pigs as compared to ST pigs. No trt effect ( $P > .10$ ) was observed for IGFBP-3 mRNA levels in muscle. These data indicate that acute enteric disease challenge affects circulating IGF-1 levels, but not local muscle IGF-1 mRNA levels in nursery pigs. Alterations in local IGFBP-5 mRNA levels may affect the bioactivity of IGF-1 in skeletal muscle.

**Key Words:** IGF-1, IGFBP, Pigs

**121 Effect of conjugated linoleic acid on DNA fragmentation of preadipocytes in culture.** K.M. Hargrave\* and J.L. Miner, *University of Nebraska*.

Conjugated linoleic acid (CLA) reduces body fat and increases DNA fragmentation in fat pads of mice. CLA also reduces proliferating 3T3-L1 preadipocyte cell number and differentiating 3T3-L1 cell size and triglyceride content. The hypotheses were: (1) that CLA, and (2) that serum from mice fed CLA, can increase DNA fragmentation and reduce triglyceride content of 3T3-L1 cells. 3T3-L1 preadipocytes were plated in 12-well plates with DMEM and 10% calf serum plus 0, 50, 100, or 200  $\mu$ M linoleic acid (LA) or CLA complexed to albumin (6.6:1), or 50 nM Staurosporine (4 wells per treatment). Media were changed every 2 d. Detached and attached cell number was determined during proliferation (2 d of treatment), confluence (4 d of treatment), and at three stages of differentiation (8, 10, and 12 d of treatment). Additional cells were supplied with DMEM containing 10% mouse serum from mice fed for 1 wk either a control (7% soy oil) or CLA (6% soy oil + 1% CLA) diet and cells were harvested at 2 d (proliferating) and 4 d (confluence). DNA fragmentation is expressed as the percent of fragmented to total DNA. Intracellular triglyceride content was determined enzymatically. Cell number was reduced ( $P < 0.001$ ) in proliferating and confluent wells treated with 50 or 200  $\mu$ M of either LA or CLA compared to the control. The 200  $\mu$ M dose of each fatty acid also reduced ( $P < 0.001$ ) cell number in the first stage of differentiation. The effect of CLA on cell number did not differ from the effect of LA at any stage. However, CLA caused an increase in DNA fragmentation compared to LA in proliferating ( $P < 0.001$ ) and confluent ( $P < 0.01$ ) cells (10.03 vs 1.72 and 3.61 vs 0.67% respectively), but not in differentiating cells. Triglyceride content was increased ( $P < 0.01$ ) by both LA and CLA at the first stage of differentiation. CLA and LA caused a reduction in cell number, but only CLA caused an increase in DNA fragmentation. Interestingly, this increase was present only in preadipocytes, not in cells undergoing differentiation.

**Key Words:** Conjugated Linoleic Acid, DNA Fragmentation, 3T3-L1 Preadipocytes

**122 Fibroblast growth factor receptor 1 mediates disuse atrophy in gastrocnemius and soleus muscles of mice.** J.K. Eash\*, A. Olsen, A.L. Grant, D.E. Gerrard, and K.M. Hannon, *Purdue University, West Lafayette, IN*.

Skeletal muscles exhibit atrophy following periods of reduced weight bearing. During this atrophy, there is an increased expression of fibroblast growth factor (FGF) in those fibers resistant to atrophy. Members of the FGF family are involved in muscle hypertrophy, however, their effects on muscle atrophy are not known. Therefore, the objective of this study was to determine if changes in FGF signaling alters muscle atrophy. The gastrocnemius and soleus muscles of the left limb of six mice were injected with plasmid DNA containing a cytoplasmic  $\beta$ -galactosidase ( $\beta$ -gal) reporter gene construct with a constitutively active (CMV) promoter (15  $\mu$ g/limb). Contralateral limb muscles received the same reporter gene construct and 30  $\mu$ g of plasmid DNA encoding fibroblast growth factor receptor 1 (FGFR-1). Limbs were then subjected to 16 pulses of 150 V of electricity using a pulse stimulator to facilitate

plasmid uptake. Mice were randomly assigned to hindlimb suspension (HS) for 7 or 14 d. Another group was suspended for 7 d, then allowed to recover for 7 d. Muscle samples were collected, sectioned, and stained for  $\beta$ -gal. The cross sectional area (CSA) of  $\beta$ -gal positive fibers was determined using light microscopy and image processing software. After 7 d of suspension,  $\beta$ -gal fibers were 20.8 % larger ( $P < 0.05$ ) in FGFR-1 injected muscles than contralateral controls. Similarly,  $\beta$ -gal positive fibers in FGFR-1 treated muscles of animals suspended 14 d were 17.9 % larger ( $P < 0.01$ ) than contralateral muscles. In animals allowed to recover, fibers remained 13.9 % larger ( $P < 0.01$ ) in FGFR-1 injected muscles than controls. These data suggest that fibers expressing FGFR-1 experienced less atrophy and exhibited improved muscle recovery, suggesting that elements of FGF signaling may mediate changes in protein metabolism during disuse atrophy.

**Key Words:** Muscle Atrophy, Fibroblast Growth Factor, Hindlimb Suspension

**123 Regulation of Ankyrin Repeat and SOCS Box Protein (ASB) 15 mRNA Expression in Models of Skeletal Muscle Development.** T.G. McDanel\*<sup>1</sup> and D.E. Moody<sup>1</sup>, <sup>1</sup>Purdue University, <sup>1</sup>Purdue University.

Ankyrin repeat and SOCS box protein (ASB) 15 belongs to a family of genes characterized by the presence of both an ankyrin repeat and SOCS (suppressor of cytokine signaling) box motifs. Bovine ASB-15 mRNA was previously shown to be down-regulated in skeletal muscle in response to an anabolic compound. The objectives of this research were to further evaluate ASB-15 mRNA expression in additional models of muscle accretion and cell culture. Regulation of ASB-15 mRNA expression in response to various anabolic compounds was determined in rats. Thirteen 7-wk-old female rats were randomly assigned to each of four treatment groups: control, clenbuterol, trenbolone acetate (TBA), and growth hormone (GH). Changes in blood urea nitrogen (BUN) and ASB-15 mRNA expression were measured at 30 min, 12 h, and 24 h following intraperitoneal injections of each compound (50g/kg). Rats were humanely killed by CO<sub>2</sub> asphyxiation prior to collection of blood and tissue samples. Clenbuterol treatment decreased ASB-15 mRNA expression in skeletal muscle at 12 and 24 h ( $P < 0.01$ ) and also decreased mRNA expression in lung at 12 h ( $P < 0.05$ ). BUN levels were also decreased for clenbuterol treated rats at 12 and 24 h ( $P < 0.05$ ) indicating an anabolic response corresponding to the decrease in ASB-15 mRNA expression. TBA treatment decreased BUN levels at 12 h ( $P < 0.05$ ), yet ASB-15 mRNA expression was not changed in any of the tissues evaluated ( $P > 0.10$ ). GH treatment had no effect on BUN or ASB-15 mRNA expression ( $P > 0.10$ ). Expression of ASB-15 mRNA was also measured in C2C12 myoblasts (day 0) and 1, 3, 5, and 7 days after induction of differentiation. ASB-15 mRNA expression increased with differentiation of myoblast to myotubes when compared to day 0 myoblasts ( $P < 0.01$ ). We conclude that ASB-15 mRNA is regulated by the anabolic compound clenbuterol and also differentiation of myoblasts. Our data, combined with previous reports of other ASB genes involved in progression of cellular growth, suggest that ASB-15 has a potential role in signaling pathways that regulate skeletal muscle development.

**Key Words:** Ankyrin, SOCS Box, Muscle Accretion

## Nonruminant Nutrition

**124 Effects of a growth-altering pre-pubertal feeding regimen on gilt growth and reproductive longevity.** P. A. Lyvers-Peffer, J. J. Peng\*, J. A. Snedegar, and D. W. Rozeboom, *Michigan State University, East Lansing*.

Two hundred fifty-four crossbred gilts were allotted to one of two rearing nutrition regimens (Moderate or Control) from 9 to 25 wk of age to determine the effects of a high-fiber diet fed intermittently on gilt growth and reproductive longevity. The Moderate regimen used dietary fiber to achieve alternating phases of moderate and maximum growth during four distinct pre-pubertal periods. High-fiber diets, containing 35% ground sunflower hulls, were fed during periods 1 and 3 (3 and 5 wk, respectively) to slow growth. During periods 2 and 4, low-fiber corn-soybean meal (CSBM)-based diets were fed for 3 and 5 wk, respectively, to maximize growth. Control gilts were fed CSBM-based diets in all periods to maximize growth. Ad-libitum access to feed was allowed at all times with both regimens. After 25 wk of age, both treatment

groups were managed similarly. Average daily gain was lower ( $P < 0.01$ ) for the Moderate gilts during periods 1 and 3, and greater ( $P = 0.03$ ) for the Moderate gilts during period 4. Moderate gilts consumed more feed during period 4 ( $P < 0.01$ ). During periods 1 and 3, feed efficiency was lower for Moderate gilts ( $P < 0.01$ ). Plasma concentrations of IGF-1 were decreased for Moderate gilts during period 1 and the first wk of period 3 ( $P < 0.01$  and  $P = 0.03$ , respectively). However, there were no differences in plasma IGF-1 concentrations during the last wk of period 3. At puberty, Moderate gilts weighed less than Control gilts ( $P = 0.001$ ;  $136.5 \pm 1.56$  versus  $144.1 \pm 1.74$  kg), but age was similar. All subsequent measures of weight, backfat depth, and loin-eye area were similar. More ( $P < 0.05$ ) Control gilts were culled during rearing and pre-breeding than Moderate gilts, with locomotive failure being the most prevalent reason. Of sows successfully completing parity one, 17% fewer ( $P < 0.05$ ) Control females went on to complete three parities. Altering pre-pubertal growth of developing gilts by intermittent inclu-