

Graduate Student Competitive Research Papers M.S. Divisions

74 Pre- and postweaning performance of pigs injected with dexamethasone at birth. A.M. Gaines^{*1}, J.A. Carroll², G.L. Allee¹, G.F. Yi¹, J.D. Spencer¹, J.W. Frank¹, and D.C. Kendall¹, ¹University of Missouri-Columbia, ²Animal Physiology Research Unit, ARS-USDA, Columbia, Missouri.

A trial was conducted to determine pre- and postweaning performance of pigs injected with dexamethasone (Dex) either 1 or 24 hr after birth. In Exp1, at an 1800 head commercial sow unit, 225 pigs (TR4 x C22) were assigned according to birth weight and sex to three treatments. Treatments (Trt) included either saline (Cont), Dex1 (2-mg/kg BW i.m. injection of Dex within 1 hr of birth) or Dex24 (2-mg/kg BW i.m. injection of Dex within 24 hr after birth). Birth weights (1.56 ± 0.36 kg) did not differ among Trt ($P > 0.96$) or between sexes ($P > 0.70$). For body weight (BW) at weaning (15d), there was a Trt x Sex interaction ($P < 0.02$) with Dex males 12% heavier than Cont males (4.8 vs. 4.3 kg, respectively) and Dex females lighter than Cont females (4.5 vs. 4.8 kg, respectively). In Exp2, 186 pigs from Exp1 were transported to a nursery facility. There were 10 pens/Trt/Sex (60 pens). Pigs were fed fortified corn-soybean meal diets in a three-phase feeding program. At the end of Exp2 (49d period) there was a Trt x Sex interaction ($P < 0.01$) for BW with Dex barrows 8% heavier than the Cont barrows (30.0 vs. 27.8 kg, respectively) and no difference in gilts. No differences in feed efficiency (G:F) were observed during the nursery period. In Exp3, pigs from the nursery were moved to a finishing facility where there were 4 pens/Trt/Sex (24 pens). All pigs were fed fortified corn-soybean meal diets in a four-phase feeding program with sexes fed separately. Real-time ultrasound was used to measure 10th rib backfat depth (BF) and loin-eye area (LEA). At the end of Exp3 (83d period) there was a Trt x Sex interaction ($P < 0.04$) for final BW with Dex barrows being 4.9 kg heavier than Cont barrows (119.6 vs. 114.7 kg, respectively) and no difference in gilts. No treatment differences were observed for BF, LEA or G:F ($P > 0.10$). These studies demonstrate that Dex given within 24 hours of birth significantly improves both pre- and postweaning performance of barrows with no beneficial effects on gilts.

Key Words: Dexamethasone, Pigs, Birth

75 Effect of formulating grow-finish swine diets using standardized ileal amino acid digestibility values on nutrient excretion and odor emissions from slurry. J. S. Knott^{*} and G. C. Shurson, University of Minnesota, St. Paul, MN.

Effect of diet formulation on nutrient excretion, gas and odor emissions from slurry was evaluated in a 16-wk study. Barrows (n=16) received either a corn-soybean meal diet containing 0.075% synthetic lysine (CTL) and formulated on a total amino acid basis, or a diet low in N and S formulated on a standard ileal digestible amino acid basis using synthetic amino acids (SID). Feces and urine were collected and mixed daily from four metabolism crates per treatment, separated into four equal subsamples, and added to one of four DPSM corresponding to the assigned crate. Eight pairs of pigs were assigned to crates and alternated in and out of crates every two wks during the experiment. Nutrient balance (GE and N) was determined using a 3d total collection period four times throughout the experiment. Hydrogen sulfide (H₂S) and ammonia

(NH₃) concentrations were measured weekly. Air samples were collected at 5 wk intervals and analyzed for odor detection threshold (ODU), intensity (OI), and hedonic tone (OHT). Feeding SID diets had no effect on GE and N retention or excretion. During wk 4, H₂S emissions were low (< 1.8 ppm), but were greater ($P < .10$) from manure produced by pigs fed the SID diets. During wks 7, 11 ($P < .15$) and 16 ($P < .05$), there was a reduction in H₂S emissions from manure of pigs fed SID diets, and differences in H₂S emissions between treatments were greatest during wk 16 (3.41 vs 8.06 ppm for CTL and SID, respectively). Manure from pigs fed SID diets had lower NH₃ emissions for wks 11 ($P < .15$) and 14 ($P < .05$). No differences between treatments were observed for ODU, OI, and OHT. Slurry samples from each DPSM were collected at the end of wk 16 and analyzed for DM, N, and S. Slurry from pigs fed the SID diets had higher ($P < .05$) DM, N, and S concentrations compared to slurry from pigs fed CTL diets. These results suggest that formulating grow-finish diets using SID may be effective in reducing NH₃ and H₂S emissions in slurry, but has no effect on ODU, OI, and OHT, or GE and N balance.

Key Words: Amino Acids, Odor, Swine

76 Influence of linoleic acid isomers on body fat in mice. K. M. Hargrave^{*} and J. L. Miner, University of Nebraska - Lincoln.

Conjugated linoleic acid (CLA) causes a loss of body fat when fed to mice, rats, and pigs. Elongation and desaturation of CLA in animal tissues produces conjugated isomers of arachidonic acid. We hypothesize that this metabolism is required for the CLA-mediated reduction in body fat and that this metabolism is enhanced during linoleate deficiency. Our objective was to determine whether mice fed a diet deficient in essential fatty acids (EFAD) are more sensitive than mice fed a control diet to the anti-obesity effect of CLA. Eighty, newly weaned male mice (3 wk of age, 14 g BW) were blocked by weight and allotted to a 2 x 2 factorial arrangement of dietary treatments: Control = 7% soy oil diet for 8 wk; Control + CLA = Control diet for 6 wk then 6.5% soy oil + 0.5% CLA diet for 2 wk; EFAD = 7% coconut oil diet for 8 wk; EFAD + CLA = EFAD diet for 6 wk then 6.5% coconut oil + 0.5% CLA diet for 2 wk. Feed intake and BW were measured weekly. After 8 wk the mice were killed, and liver, and retroperitoneal (RP), and epididymal (Epi) fat pads were removed and weighed. Body fat percentage (BF%) was determined by ether extraction. Addition of CLA to the Control diet reduced ($P < 0.05$) BW by 8% and feed intake by 11%, and reduced ($P < 0.01$) fat pad weights (0.37 vs 0.19 g and 0.61 vs 0.45 g for RP and Epi pads, respectively) and BF% (21.08 vs 15.37%). There was no Control vs EFAD diet main effect. However, there was a pronounced CLA x EFAD interaction ($P < 0.001$). Body fat depletion by CLA was 40% greater in mice fed the EFAD diet than in mice fed the Control diet. We conclude that mice fed essential fatty acid deficient diets are especially sensitive to the anti-obesity effect of CLA. This supports our hypothesis that the anti-obesity effect of CLA involves elongation and desaturation of CLA.

Key Words: Conjugated Linoleic Acid, Body Fat, Essential Fatty Acids

Growth, Development, Muscle Biology, And Meat Science

77 Effect of feather meal on live animal performance and carcass quality and composition of growing-finishing swine. C. B. Boger^{*}, J. K. Apple, C. V. Maxwell, W. J. Roberts, and K. G. Friesen, University of Arkansas.

Crossbred pigs (n=120; BW=24.5±0.1 kg) were used to assess the effects of dietary valine (VAL), from hydrolyzed feather meal (FM), on performance and carcass traits of growing-finishing swine. Pigs were blocked by BW, allotted to 24 pens (5 pigs/pen), and pens were assigned randomly to 1 of 4 treatments: 1) positive control (PC) corn-soybean meal (SBM) starter, grower, and finisher diets; 2) negative control (NC) corn-SBM-wheat middlings starter, grower, and finisher diets that met minimum requirements for VAL; 3) NC-diets supplemented with 3% FM; and 4) NC-diets supplemented with 6% FM. Within FM-diets, FM was substituted for SBM on an equal lysine basis at the expense of

wheat middlings. All diets were formulated to be isocaloric, and fed in 4 phases with diet transition occurring when mean block weight was 36, 68, and 91 kg, respectively. When the lightest block averaged 107 kg, all pigs were harvested, and Fat-O-Meater fat and longissimus muscle (LM) depths and hot carcass weight were recorded. After a 24-h chilling period, Lean content of hams from left side of carcasses was determined using TOBEC. Loins were captured and used to measure instrumental color and drip loss. Neither PC, NC, nor FM-supplemented diets affected ($P > 0.10$) ADG, ADFI, or G:F, and dietary treatments had no effect ($P > 0.10$) on fat and LM depths, or lean composition of the carcass and ham. There was a linear trend ($P < 0.07$) for L* values to increase as FM increased in the wheat middlings-based diets; however, the LM of pigs fed NC-diets was redder ($P < 0.01$) than the LM of pigs fed PC or FM-supplemented diets, and the LM from pigs fed FM-supplemented

diets had higher ($P < 0.01$) a^* values than pigs fed PC-diets. LM chops from pigs fed NC- and FM-supplemented diets were more ($P < 0.02$) yellow than LM chops of pigs fed PC-diets. Results suggest that altering dietary VAL content by supplementing diets with FM had little to no effect on pig performance or carcass composition, but may have some beneficial effects on pork color.

Key Words: Feather meal, Swine, Valine

78 Effects of dietary manganese on quality characteristics of pork longissimus muscle (LM) chops during retail display. W. J. Roberts^{*1}, J. K. Apple¹, C. B. Boger¹, C. V. Maxwell¹, K. G. Friesen¹, and T. M. Fakler^{2, 1} *University of Arkansas, ²Zinpro Corporation.*

The objective of this experiment was to test the effects of dietary manganese (Mn) source and inclusion level on quality traits and lipid oxidation of LM chops during retail display. Pigs ($n=100$) were blocked by BW, assigned to pens (4 pigs/pen) within blocks, and pens (5 pens/block) were allotted randomly to either control corn-soybean meal starter, grower, and finisher diets (C), or Mn-supplemented diets arranged in a 2×2 factorial design with 2 inclusion levels (350 or 700 ppm) and 2 Mn-sources (Availa[®]-Mn [Mn-amino acid complex] or $MnSO_4$). When the lightest block averaged 107 kg, all pigs were harvested, and pork loins were captured from left sides after a 24-h chilling period. Loins were processed into 2.5-cm thick LM chops, placed on foam trays, and overwrapped with polyvinyl chloride film for retail display (4°C; deluxe warm white light; 1630 lx). On d 0, 2, 4, and 6 of display, subjective (American and Japanese color scores) and instrumental color were measured, then chops were removed from packaging material and LM samples were assayed for TBARS. No ($P > 0.10$) display day \times diet interactions were noted for color, drip loss, or TBARS. Dietary Mn had no effect ($P > 0.10$) on drip loss during display, but chops from pigs fed 350 ppm Mn from Availa-Mn received higher Japanese ($P < 0.05$) and American ($P < 0.12$) color scores than pigs fed C, 700 ppm Mn from Availa-Mn, or 350 and 700 ppm Mn from $MnSO_4$. The LM from pigs fed 350 ppm Mn from Availa-Mn tended to be darker ($P < 0.12$) and less yellow ($P < 0.05$) than the LM from pigs fed C or 700 ppm Mn from Availa-Mn. The LM from pigs fed 350 ppm Mn from $MnSO_4$ tended to have lower ($P < 0.10$) TBARS values than the LM from pigs consuming C or diets containing 700 ppm Mn from Availa-Mn. Results indicate that supplementing diets with 350 ppm Mn may enhance pork quality during retail display; however, inclusion of 700 ppm Mn, regardless of source, had no beneficial effects on pork color or lipid oxidation.

Key Words: Manganese, Pork Quality, Retail Display

79 The effect of feeding Ractopamine (PayleanTM) on loin quality and sensory characteristics in three genetic lines of swine. G.M. Stoller^{*1}, H.N. Zerby¹, S.J. Moeller¹, T.J. Baas², C.D. Johnson², and L.E. Watkins^{3, 1} *The Ohio State University, Columbus, OH, ²Iowa State University, Ames, IA, ³Elanco Animal Health, Greenfield, IN.*

This experiment was designed to evaluate the effects of ractopamine hydrochloride (RAC) on meat quality and sensory attributes of three genetic lines of swine. Berkshire ($n = 76$), Duroc ($n = 81$), and high-lean (HL) commercial crossbred ($n = 75$) barrows and gilts were allocated to be fed standard commercial diets supplemented with two different levels of RAC (0 or 10 ppm). The trial was conducted using a randomized complete block design, with animals blocked according to litter, gender, and starting weight. Pigs were started on the experimental diet at approximately 85.1 kg and remained on test for a period of 28 d. Pigs were harvested at a commercial abattoir and muscle quality measurements taken at 24 and 48 h post-mortem. Quality traits measured were visual firmness (24 h), visual wetness (24 h), ultimate pH (24 h and 48 h), visual marbling (48 h), visual color (48 h), Minolta color scores (24 h and 48 h) and water-holding capacity (WHC). Sensory attributes of the loin were assessed by a three-person trained sensory panel 7 to 10 d after harvest. Sensory traits included: juiciness, tenderness and chewiness (sustained tenderness). Instrument measurements of tenderness (Instron), percentage cooking loss and chemically separated loin lipid content (intramuscular fat, IMF) were obtained. The RAC treatment had no significant effect on muscle quality assessments, sensory attributes or instrument measures of palatability. Differences were observed between genetic lines for most quality and sensory traits, with Berkshire pigs generally being superior. Loins from barrows were firmer

($P < .05$), had a higher pH at 48 h pH ($P < .05$), had less drip loss ($P < .05$) and had improved sensory tenderness scores ($P < .05$) when compared with loins from gilts. For IMF, genetic line by treatment and genetic line by gender interactions were discovered. Berkshire pigs fed RAC had a lower ($P < .05$) percentage of IMF than control pigs. The purebred barrows (Berkshire and Duroc) had higher ($P < .001$ and $P < .05$, respectively) IMF than their respective purebred gilts, with no gender difference in IMF in the HL line. The results from this experiment support the findings that feeding RAC does not affect muscle quality and palatability characteristics.

Key Words: Swine, Ractopamine, Muscle Quality

80 Fresh pork loin quality associated with domestic or export storage. D. M. McNamara^{*1}, T. W. Holthaus², R. C. Johnson³, C. R. Calkins², and E. P. Berg^{1, 1} *University of Missouri, ²University of Nebraska, ³Triumph Pork Group, LLC.*

Data were collected on 479 fresh, boneless, center-cut pork loins (NAMP 412B) to evaluate quality characteristics after storage for 21 or 42 days at 2°C. Loins were collected from commercial hybrid pigs harvested in eight groups in August and September. Loins were fabricated under normal commercial conditions at 24h postmortem, weighed, vacuum packaged, boxed and delivered via refrigerated truck (550 km) to the University of Missouri. Storage durations were chosen to simulate domestic (21d) or export (42d) storage intervals. After storage, purge loss, color scores (instrumental and subjective), subjective marbling scores, pH, Warner-Bratzler shear force measurements, and percentage cooking loss were obtained for each loin. CIE L*, a^* , and b^* values were recorded on the cut lean surface (15 min bloom) of the blade, center, and sirloin sections using a Color-TEC PCM color meter (Color-Tec Associates, Inc. Clinton NJ). Center-loin pH (approx. 10th rib) was recorded using the SFK Technology, Inc. (Cedar Rapids, IA) PH Star probe. Chops were cut from each loin (approx. 10th rib), weighed, and cooked to 70°C on a MagiKitchen belt grill (Blodgett Co., Quakertown, PA), allowed to cool (approx. 5 h), then reweighed to determine percentage cooking loss. Six, 1.3-cm cores were removed parallel to the muscle fibers and measured for Warner-Bratzler shear force. Compared to domestic storage (21d), loins stored for simulated export (42 d) had lower L* values recorded on the blade (53.19 vs. 51.44), center (49.56 vs. 48.44), and sirloin (48.38 vs. 47.57) surfaces ($P < 0.05$). Subjective NPPC color scores were contrary to L* values with domestic color scores higher ($P < 0.001$) than export on the blade (3.2 vs. 2.8) and sirloin end (3.4 vs. 3.0). Export purge loss (3.26%) was higher ($P < 0.05$) than domestic (2.97%) and shear force was higher for export (3.25 kg) compared to domestic (3.06 kg) loins. No differences were observed for pH and cooking loss.

Key Words: Pork, Quality, Export

81 Antemortem use of infrared thermography to predict pork quality. T. E. Lawrence^{*}, M. F. Spire, M. E. Dikeman, M. C. Hunt, S. B. Hogge, and B. W. James, *Kansas State University.*

Currently, methods for identifying individuals or groups of pigs likely to result in PSE meat quality are not in commercial use. A proposed method is infrared thermography, which is a rapid, non-invasive procedure used to measure the surface temperature of an object without physical contact. Three experiments were conducted to determine if antemortem infrared measurements of surface temperature could segregate pigs based on subsequent pork quality. Pigs were classified subjectively as either hot (pigs with thermal images in the warmest 1.5°C of the temperature spectrum) or normal based on infrared surface temperature of the loin region. In the first experiment, pigs ($n = 18$) were transported, imaged by infrared thermography, held in lairage for 1 to 4 h, and then slaughtered. Hot pigs ($n = 4$) had less red 10th rib longissimus color than normal pigs ($n = 14$) as indicated by lower ($P < .05$) a^* ($5.1 \pm .27$ vs. $6.8 \pm .51$) and chroma ($14.8 \pm .55$ vs. $16.4 \pm .30$) values, and higher ($P < .05$) hue angle (69.9 ± 1.72 vs. $65.4 \pm .92$) values. No differences between hot and normal pigs were detected for 45 min or 24 h pH, 45 min temperature, visual color score, L*, b^* , firmness, marbling, or percentage drip loss of 10th rib longissimus. In the second experiment, pigs ($n = 27$) were transported, held in lairage for 12 to 16 h, imaged by infrared thermography, and then slaughtered. In the third experiment, pigs ($n = 18$) were transported, imaged by infrared thermography, held in lairage for 12 to 16 h, and then slaughtered. Regardless of the time

antemortem that infrared images were taken, no meat quality differences between hot and normal pigs were detected after a 12 to 16 h lairage. These data indicate that measurement of surface temperature by infrared thermography may allow for detection of poor meat quality if pigs are slaughtered without extended lairage.

Key Words: Pork, Infrared Thermography, Meat Quality

82 Influence of harvest processes on pork loin and ham quality. M.A. Gardner¹, S.M. Lonergan¹, E. Huff-Lonergan¹, L.J. Rowe¹, and C.M. Schultz-Kaster², ¹Iowa State University, ²Premium Standard Farms.

The objective of this trial was to determine the impact of harvest processes on pork quality characteristics. Sixty-four Duroc X Yorkshire pigs were randomly assigned to a 2X2-treatment arrangement to determine the effect of the interval between sticking and scalding (dwell time 5 or 10 min) and duration of scalding (5 or 8 min) on pork loin and ham quality. All carcasses entered the cooler 50-min postmortem (PM). Blood was collected per minute for the first three minutes after sticking and total blood yield was determined after five minutes. Temperature and pH of the longissimus (LD) and semimembranosus (SM) were measured at 45 min, 2, 4, 6, and 24-h PM. Hunter L*, a*, and b* values were determined on the LD, SM, and biceps femoris (BF). Purge loss was measured on the SM, BF, and the sirloin. Drip loss was measured from LD chops after 1 and 5 d of storage. Warner-Bratzler shear force (WBS) measurements were determined on LD chops aged 1, 3, 5, and 7 d PM. The first three minutes after sticking yielded 99.2% of the total collected blood. Temperature and pH of the LD and SM were not influenced by dwell time or scald time. Purge and drip loss values were not different among treatments. Hunter L* values showed no treatment effects for the LD, SM, or BF. The 8 min scald treatment resulted in significantly higher ($P < 0.01$) LD a* values than the 5 min scald time. SM muscles in the 10 min dwell time treatment had significantly lower ($P < 0.05$) b* values than 5 min dwell times. BF muscles had significantly lower ($P < 0.01$) a* and b* values in the 10 min dwell time compared to the 5 min treatment. The 10 min dwell time resulted in significantly higher ($P < 0.02$) WBS measurements (d 1 and d 3) compared to the 5 min dwell time. The 8 min scald time resulted in significantly higher ($P < 0.05$) WBS values (d 7) compared to the 5 min treatment. Dwell time and scald time did not influence overall pork quality when carcasses entered the cooler at the same time point PM. (Sponsored by the National Pork Board)

Key Words: Pork Quality, Harvest Process, Blood Yield

83 μ -Calpain autolysis and calpastatin activity influences drip loss and tenderness of three porcine muscles. J.L. Dodge*, E. Huff-Lonergan, S.M. Lonergan, and L.J. Rowe, Iowa State University Ames, Iowa.

Accelerated μ -calpain autolysis and lower calpastatin (CPST) activity were hypothesized to result in increased proteolysis and subsequently affect drip loss and meat tenderness. Halothane negative Duroc pigs (n=16) were harvested. Temperature and pH measurements were made on the longissimus dorsi (LD), semimembranosus (SM), and psoas major (PS) at 45 min, 6 h, 12 h, and 24 h postmortem (PM). Samples were taken from the LD, SM, and PS at 45 min, 6 h, and 24 h PM and extracted in 3 vols of 10 mM EDTA, 0.1% β -mercaptoethanol, 2 mM PMSF, 100 mg/L ovomucoid and 100 mM Tris, pH 8.3. After centrifugation, a portion of each supernatant was used for immunoblotting with an antibody against the μ -calpain 80-kDa subunit. The remainder of the supernatant was used to determine CPST activity. Samples were collected from each muscle at 45 min, 6 h, 24 h, 48 h, and 120 h PM for examination of titin and nebulin by SDS-PAGE. Drip loss was measured on LD, SM, and PS chops taken at 24 h PM and held for an additional 24 h and 96 h at 4°C. Warner-Bratzler shear (WBS) force measures were evaluated on chops (LD, SM, and PS) at 24 h, 48 h, and 120 h PM. At 45 min, the PS had a significantly lower pH (5.50) than the LD (5.97) and SM (6.05) and had partial autolysis of the μ -calpain 80-kDa subunit. All PS samples showed degradation of titin by 24 h PM. The PS had lower ($P < .01$) drip loss (.87%) after 96 h of storage than the SM (2.23%) and LD (2.48%). The SM had higher ($P < .0001$) WBS (5.37 kg) at 48 h PM than the LD (3.62 kg) and PS (3.73 kg). The SM had higher ($P < .05$) CPST activity at 6 h (2.12 u/g tissue) and 24 h (2.09 u/g tissue) compared to the LD (1.86 u/g tissue at 6 h and 1.72 u/g tissue at 24 h) and PS (1.48 u/g tissue at 6 h and 1.41 u/g

tissue at 24 h). The LD also had higher ($P < .05$) CPST activity than the PS at 6 h and 24 h PM. These results indicate differences between muscles in μ -calpain autolysis, pH, and calpastatin activity play a role in the tenderness and drip loss of fresh pork products. (Supported by the National Pork Board).

Key Words: Pork, Drip Loss, Tenderness

84 Descriptive analysis and consumer acceptance of irradiated beef patties. J. L. Norman*, C. L. Lorenzen, and H. Heymann, University of Missouri-Columbia.

The objectives of this study were to evaluate irradiated and non-irradiated beef patties of good and poor color using descriptive analysis and consumer panels. Samples were non-irradiated control, irradiated good color, and irradiated poor color. Good and poor color irradiated patties were batch processed together. All patties were frozen prior to packaging in individual, barrier vacuum pouches. Frozen patties were irradiated using electron beam technology at 1.0 kGy. University of Missouri personnel subjectively assigned color treatments in the raw state to patties. A trained descriptive analysis panel (n = 10) evaluated samples and generated verbal descriptors to depict sample differences. Attributes were rated on a 10-point unstructured line scale anchored on both ends. Significant attributes for the patties included red, gray, moist appearance and moist mouthfeel. Consumers (n = 94) were asked to rate patties for overall liking, liking of tenderness, liking of juiciness, and liking of flavor. Samples were rated on a nine-point sensory scale for liking where 1 = dislike extremely and 9 = like extremely. Irradiated patties were less gray and redder ($P < 0.05$) in external appearance than patties not irradiated. Irradiated patties with poor color had a drier ($P < 0.05$) surface appearance than non-irradiated controls and irradiated patties with good color. Irradiated patties with good color had a moister mouthfeel ($P < 0.05$) than irradiated patties with poor color. Irradiated beef patties with good color had higher liking of juiciness ratings than non-irradiated control patties ($P < 0.05$). However, no difference in liking of juiciness was detected between good and poor color irradiated patties ($P > 0.05$). There were no treatment differences for overall liking of the beef patties ($P > 0.05$). When panelists, descriptive and consumer, were not allowed to view the raw, uncooked beef patties few differences were found between the treatments.

Key Words: Beef, Irradiation, Color

85 Improving foodservice consumer satisfaction of beef. T. B. Schmidt*, C. L. Lorenzen, and M. P. Keene, University of Missouri - Columbia.

The objectives of this study were to determine if visual and verbal aid and use of thermometers to determine end-point degree of doneness would improve consumer's liking of flavor (LFLAV), liking of juiciness (LJUIC), liking of tenderness (LTENDER), and overall liking (OLIKE) of beef steaks using a 9-point scale (1 = dislike extremely and 9 = like extremely). Consumers (n = 210) received a dinner to simulate a meal served in a medium priced steak house. Degrees of doneness on half of the steaks were determined using a thermometer; the others were determined by using the touch method. During two sessions, (n = 105) wait staff took the consumers order; during the remaining two sessions, (n = 105) wait staff provided the consumers with visual and verbal aid for the various degrees of doneness. Mean temperature of steaks ordered using the touch method was 67.6°C; the temperature served was 48.8 °C. Mean temperature of steaks ordered using the thermometers was cooked to 69.6 °C; the temperature served was 68.6 °C. Steaks cooked using the touch method were rated higher ($P < 0.05$) for OLIKE, LTENDER, LJUCI, and LFLAV compared to those cooked using thermometers. Aided consumers rated OLIKE and LFLAV higher ($P < 0.05$) compared to consumers with out aid. Steaks cooked to the appropriate degree of doneness were rated higher ($P < 0.05$) for OLIKE and LFLAV than steaks over and (or) under cooked. Results show that steaks under cooked and (or) correctly cooked were higher ($P < 0.05$) for LTENDER and LJUCI compared to steaks that were over cooked. The use of thermometers produced a more consistent in achieving more desirable end-point temperatures. However, consumers were more satisfied with steaks cooked using the touch method. Providing consumers with aid in selecting degree of doneness can improve consumer's satisfaction of steaks. Furthermore, results show that cooking steaks to the

degree of doneness ordered may improve consumer liking for OLIVE, LTENDER, LJUIC, and LFLAV.

Key Words: Degree of Doneness, Consumer Satisfaction, Beef

86 Cooking Rate Effects on Beef Tenderness, Cooking Losses, Sarcomere Length, and Collagen Solubility. D. A. King*, M. E. Dikeman, M. C. Hunt, and C. L. Kastner, *Kansas State University, Manhattan, KS.*

An experiment was conducted to evaluate the effects of cooking rate on tenderness, cooking losses, sarcomere length, and collagen solubility of beef *triceps brachii*, long head muscles. Muscles were excised from the right side of 12 carcasses at 24 h postmortem and cut into 2.54 cm thick steaks that were either frozen immediately or aged for 14 d. Steaks were cooked in a forced-air convection oven set at either 93° C (SLOW) or at 260° C (FAST) to an internal temperature of 70° C. Warner-Bratzler shear force, cooking losses, cook time, sarcomere length, total collagen, percent Ringer's soluble collagen, and enzyme resistant collagen were measured. The enzyme used was a non-specific protease of *Streptomyces griseus*. As expected, FAST cooking resulted in much shorter ($P < 0.01$) cooking time, and increased ($P < 0.01$) Warner-Bratzler shear force values compared to SLOW cooking (19.80 versus 100.84 min, and 5.04 versus 4.23 kg, respectively). Additionally, FAST cooked steaks had greater ($P = 0.02$) cooking losses, and shorter ($P = 0.03$) sarcomere lengths compared to SLOW cooked steaks. No differences were observed in total collagen, Ringer's soluble collagen, or enzyme resistant collagen. Aging for 14 d tended ($P = 0.10$) to improve tenderness, but did not affect any other trait measured. Differences in tenderness created by cooking rate are often attributed to differences in collagen solubilization. However, in our study no differences in either total collagen or collagen solubility were observed. Thus, we suggest that the observed differences in Warner-Bratzler shear force are attributable to the greater cooking losses and reduced sarcomere lengths caused by FAST cooking. We further suggest that the increased cooking losses associated with FAST cooking could be explained by more severe shortening of collagen fibers, which likely compressed myofibrils and forced fluid expulsion.

Key Words: Beef, Tenderness, Cooking Rate

87 Effects of cooking beef muscles from frozen or thawed on cooking traits and palatability. E. Obuz*, M. E. Dikeman, T. E. Lawrence, and E. J. Yancey, *Kansas State University Department of Animal Sciences and Industry.*

The objective of our study was to investigate the effects of cooking beef directly from a frozen versus thawed state on color, cooking time, cooking loss, and palatability attributes. Subprimals (n=20) from USDA Choice beef carcasses were purchased, frozen 19-d postmortem and sawed into 2.54-cm thick longissimus lumborum(LL) and biceps femoris (BF) steaks. Steaks were cooked on a MAgiKitch'n electric belt grill at 93C to the end-point temperature of 70C. Cooking loss, cooking time, Warner-Bratzler shear force (WBSF), and color (Illuminant A, L*, a*, b*) were evaluated on each steak. Trained panelists (n=6) evaluated palatability attributes on an 8-point scale for myofibrillar tenderness, juiciness, flavor, overall tenderness, and connective tissue amount (1= extremely tough, dry, bland, tough, and abundant; 8= extremely tender, juicy, intense, tender, and none). No significant differences ($P > 0.05$) in L*, a*, WBSF, juiciness, flavor, connective tissue amount, or overall tenderness were found between steaks cooked from frozen (FS) and thawed state (TS). However, FS steaks required more cooking time ($P < 0.01$), had higher cooking loss ($P < 0.01$), lower b* values ($P < 0.05$), and lower myofibrillar tenderness scores ($P < 0.05$) than TS steaks. The BF required more time to cook ($P < 0.05$), had more connective tissue ($P < 0.01$), lower flavor score ($P < 0.05$), higher WBSF ($P < 0.05$), was less tender ($P < 0.01$), and had higher post-cooking temperature rise ($P < 0.05$) than the LL. No differences in color, juiciness, or cooking loss were found. Cooking from the FS might be preferred over the TS because thawing is much faster, drip loss does not occur, and microbial growth risk associated with slow thawing may be reduced. However, higher cooking losses and a greater energy requirement might outweigh these advantages.

Key Words: Cooking, Frozen Versus Thawed, Tenderness

88 Muscle satellite cell research in meat animals. A. L. Grant* and D. E. Gerrard, *Purdue University, West Lafayette, IN.*

Skeletal muscle satellite cells reside between the sarcolemma and basal lamina of myofibers. Representing a very small percentage of the total nuclei density of muscle tissue, satellite cells are responsible for postnatal myofiber DNA accretion, which accounts for more than one-half of the DNA accumulated after birth. Recruitment of satellite cell nuclei by myofibers is a requisite for postnatal muscle hypertrophy. Therefore, it is obvious why factors regulating activation, proliferation, differentiation, and ultimate fusion of satellite cells to myofibers in meat-animal muscle are being studied. Most studies, including those involving meat-animals, have been performed using cell culture. To facilitate culture studies, fluorescence-activated cell sorting of muscle cells provides populations of satellite cells that retain the majority of replicative capacity and are not contaminated with non-myogenic cells. Such methodology is also ideal for studying sub-populations of satellite cells and for myoblast-mediated gene transfer in which these cells are used as vehicles for the delivery of foreign genes to skeletal muscle. Recruitment of satellite cells by myofibers likely requires tightly controlled expression of growth factors at appropriate times. Many of these growth factors exhibit paracrine and autocrine effects after being secreted by fibroblasts, myoblasts, myotubes, and myofibers. Because satellite cell recruitment involves activation of cells, followed by proliferation and differentiation before fusing with myofibers, hepatocyte growth factor and insulin-like growth factor-I are obvious candidates for regulating these processes. The extent to which muscle growth can be enhanced by stimulation of satellite cell activity has not been directly tested. Activating satellite cells and promoting proliferation and fusion is a strategy for investigating this in vivo. Models for accomplishing this may involve localized infusion of growth factor peptides into muscle, injection of DNA that encodes the growth factor of interest, or implantation of cells that over-express growth factors.

Key Words: Satellite Cells, Muscle, Growth Factors

89 Recent advances in our understanding of skeletal muscle satellite cells. J. Reecy*, *Iowa State University, Ames.*

Skeletal muscles of mammalian species exhibit a remarkable ability to adapt to physiological demands such as growth, injury and training. This ability to adapt is largely attributed to a small population of cells, which reside within the skeletal muscle, termed satellite cells. The objective of this presentation is to review some of recent findings on the functional responses of satellite cells to physiological stimuli. Increased workload is a physiological stress that results in skeletal muscle hypertrophy. Load-induced hypertrophy involves satellite cell activation, proliferation, chemotaxis and fusion with the existing myofiber. However, the molecular mechanisms underlying these processes remain largely unknown. Recently, we reported on the changes in gene expression that accompany work overload induced skeletal muscle hypertrophy. Interestingly, we could classify the function of differentially expressed genes to each of these processes, suggesting that some adaptation occurs at the level of gene expression. Skeletal muscle hypertrophy does not occur in aged animals, suggesting a physiological adaptation with increasing age. Recent advances have suggested that the model utilized can greatly influence the results and conclusions obtained from an experiment. Under standard culture conditions, satellite cells obtained from aged rats proliferate at a slower rate and are capable of fewer rounds of replication. However, under conditions of reduced oxygen content, no observable difference in proliferation can be detected. These results demonstrate that experiments using traditionally accepted in vitro culture conditions might be flawed. Finally, recent studies have identified a population of pluripotent stem cells in skeletal muscle termed side population cells. These cells possess the ability to efflux the Hoechst dye, which distinguishes them from all other cells, which cannot efflux the dye. These cells are capable of differentiating into many other tissue types in vitro and in vivo. Since their discovery 40 years ago, we have learned a lot about satellite cells. However, we have only begun to examine the molecular mechanisms underlying the development and maintenance of satellite cells, satellite cell activation and proliferation, and potentiality.

Key Words: Skeletal Muscle, Satellite Cell, Muscle Growth

90 How do satellite cells respond to mechanical changes in muscle?. Ronald Allen*¹ and R. Tatsumi², ¹University of Arizona, ²Kyushu University.

Satellite cells divide and differentiate during normal muscle growth and during repair, but they are quiescent for long periods of time. The work described here was designed to investigate how satellite cells are awakened from their quiescent state by mechanical changes in muscle such as stretch or damage. Cultured quiescent satellite cells were subjected to mechanical stretch in a FlexerCell System. In response to stretch, satellite cells entered the cell cycle earlier than if they were under control conditions. Only a brief period of stretch, as short as 2 hr, was necessary to stimulate activation. Additionally, conditioned medium from stretched cells could activate un-stretched satellite cells. The presence of HGF on c-met positive myogenic cells was detected by immunofluorescence at 12 hr in culture, and immunoblots demonstrated that HGF was released by stretched satellite cells into medium. Also, stretch activation could be abolished by the addition of anti-HGF antibodies to stretched cultures, and activity in conditioned medium from stretched cells could be neutralized by anti-HGF antibodies. In addition, stretch appeared to cause release of pre-existing HGF from the extracellular matrix. The stretch activation effect and the stretch-induced release of HGF from satellite cell extracellular domain occurred only over a narrow pH range with optimum activity around pH 7.2. The action of exogenous HGF, however, showed a broader range of pH dependence. Furthermore, the stretch-induced satellite cell activation effect and HGF release was inhibited by an inhibitor of nitric oxide synthase (NOS). It is interesting to note that NOS can be activated in muscle when mechanical changes in muscle fibers. These experiments suggest that HGF may be involved in linking mechanical perturbation of muscle to satellite cell activation and that this activity is mediated by NOS.

Key Words: Muscle, Satellite Cell, Growth Factor

91 Repression of skeletal myogenesis by intracellular signaling modules that activate members of the MAPK family. S.E. Johnson*, S.R. Thomson, J.L. Page, S.A. Bolanowski, X. Wang, and C.M. Dorman, *The Pennsylvania State University.*

The formation of skeletal muscle is controlled, in part, by the intracellular transmission of external signals to the nucleus to affect gene transcription. A vast majority of growth factors and morphogens exert their effects through the induction of signaling pathways that culminate in mitogen-activated protein kinase (MAPK) activity. The MAPK family of signal transducers is comprised of ERK1/2, SAPK (or JNK) and p38. Overexpression studies clearly denote a negative impact of ERK1/2 on avian myogenesis. Retroviral misexpression of activated Raf alleles into avian myoblasts suppresses muscle gene expression and myofiber formation. These effects can be reversed by inhibition of MEK, the ERK1/2 activating kinase. Interestingly, Raf kinase also appears to signal through non-MEK dependent kinases to block myogenesis. MEK kinase I (MEKK1) strongly activates the JNK signaling pathway but also can interact with Raf and induce a modest level of ERK1/2 activity. However, the kinase does not participate in the Raf-imposed block to myogenesis, as coexpression of MEKK1 with dominant inhibitory Raf or MEK does not alleviate the repressive effects of the kinase. Thus, we conclude that chronic activation of components of the MEKK1/SEK/JNK and Raf/MEK/MAPK pathways result in biochemical and morphological disruption of the myogenic program independent of one another. However, the identities of the nuclear targets of the MAPK pathways that are responsible for the repression of skeletal myogenesis remain elusive. Our work demonstrates that the myogenic regulatory factors (MRFs) retain their inherent DNA binding capacity and are able to direct transcription from minimal E-box promoter reporter genes in cells directing high levels of ERK1/2 activity. In addition, myogenic cells constitutively expressing components of the MEKK1/SEK/JNK pathway demonstrate no detectable reduction in MRF-directed E-box transcription. As such, it is apparent that neither ERK1/2 nor JNK direct their inhibitory effects through disruption of intrinsic MRF function. Further work is required to define the means by which the MAPK family members perturb muscle-specific gene transcription and myocyte formation.

Key Words: MAPK, MRF, Skeletal Myogenesis

92 Characterization of muscle glycogen storage and utilization: Influence on pork quality. S. M. Lonergan*, E. Huff-Lonergan, and M. F. Rothschild, *Iowa State University.*

Pork water holding capacity and color are dictated by the rate and extent of postmortem pH decline. The objective of this trial was to determine if differences in glycogen fractions or expression of glycogenin explain variation in the rate or extent of pH decline in pork longissimus. In experiment 1, 60 pork loins were collected at a commercial packing plant. Pork loins with the highest (n=12) and lowest (n=12) pH were grouped for analysis. Loin samples were aged 7 days prior to macroglycogen, proglycogen, and glucose determination. Glycogenin was evaluated using immunoblots. In experiment 2, 20 Berkshire x Yorkshire pigs were harvested. pH was measured at 2 and 24 hours postmortem. Macroglycogen, proglycogen, and glucose were measured in longissimus samples taken at 2 hours postmortem. In experiment 1, the low pH group had higher residual glucose and proglycogen than the high pH group. Immunoblots for glycogenin indicated a greater amount of glycogenin in samples with low ultimate pH. Since one glycogenin molecule remains covalently bound to the glycogen molecule, it is reasonable to hypothesize that the amount of glycogenin could be a limiting factor in determination of total glycogen in muscle and potentially ultimate pH in pork. In experiment 2, a greater proportion of the glucosyl units were detected with the macroglycogen fraction at 2 hours in samples that had a lower ultimate pH. Conversely, when a greater proportion of the glucosyl units were in the proglycogen fraction, a higher ultimate pH was attained. This indicates the rate of conversion of macroglycogen to proglycogen is related to ultimate pH. These results suggest that developing a more thorough understanding of glycogenin and glycogen metabolism in muscle and meat will aid efforts to improve overall quality of fresh pork. (Sponsored by the National Pork Board)

Group	High pH (n=12)		Low pH (n=12)		P value
	Mean	S.E.	Mean	S.E.	
pH	6.04	0.07	5.47	0.05	
Glucose $\mu\text{M/g}$ tissue	4.7	0.3	35.4	3.0	<.01
Proglycogen $\mu\text{M/g}$ tissue	0.96	0.15	5.92	0.25	<.01
Macroglycogen $\mu\text{M/g}$ tissue	0.10	0.04	0.10	0.04	.87

Key Words: Glycogenin, Glycogen, Pork Quality

93 Performance of growing-finishing pigs in pens with low or high variation in body weight. B. F. Wolter*¹, M. Ellis¹, S. E. Curtis¹, B. P. Corrigan¹, J. M. DeDecker¹, E. N. Parr², and D. M. Webel², ¹University of Illinois, Urbana, ²United Feeds, Sheridan, IN.

It is common practice to double-stock wean-to-finish buildings for an initial period post-weaning to increase total weight of pigs produced in a building. The objective was to investigate the effect of body weight (BW) variation within a pen after double-stocked pens of pigs were split into two groups on pig performance to slaughter (112 SD = 2.2 kg). A randomized block design was used with three treatments. At weaning, pigs (n = 1,728) were double-stocked in a wean-to-finish building in groups of 108 pigs. At the end of wk 8 post-weaning, pens were split into two mixed-sex (equal ratio of barrows to gilts) groups of 54 animals to give three treatments: 1) Low range in BW (6.3% CV) with Heavy mean BW (34.2 kg; n = 8), 2) Low range in BW (7.6% CV) with Light mean BW (28.6 kg; n = 8), and 3) High range in BW (10.7% CV) with Intermediate mean BW (31.1 kg; n = 16). Floor- and feeder-space allowances (0.60 m²/pig and 4 cm/pig), and drinker allocation (14 pigs/drinker) were the same for all treatments. Pigs had free access to feed and water. Pen-BW treatment did not impact ADG (792, 775, and 780 10.9 g for treatment 1, 2, and 3, respectively; P > 0.05) or gain:feed ratio (0.34, 0.35, and 0.34 0.009; P > 0.05), but ADFI (2375, 2244, and 2301 17.1 g) was higher for Trt 1 compared to Trt 2 with pigs in Trt 3 being intermediate and different (P < 0.01) from the other treatments. At 112 kg BW, CV of BW within a pen was similar (P > 0.05) across treatments and there was no treatment effect (P > 0.05) on backfat or loin depths. However, days to reach 112 kg BW increased with decreasing initial BW (96.9, 105.5, and 102.4 1.4 days; P < 0.01). In summary, reducing variation in BW when splitting double-stocked wean-to-finish pens at wk 8 post-weaning did not impact growth or feed

efficiency during the growing-finishing period, although, pens of pigs that were heavier at the end of wk 8 post-weaning required fewer days to reach slaughter.

Key Words: Pigs, Body Weight, Wean-to-Finish

94 Effects of feed form and placement immediately postweaning on the growth performance of piglets. B. P. Corrigan*, M. Ellis, B. F. Wolter, J. M. DeDecker, and S. E. Curtis, *University of Illinois, Urbana IL/USA.*

This study evaluated effects of providing feed as a gruel and feeding on floor mats on pig performance for three weeks postweaning. It was carried out in a commercial wean-to-finish facility and used a randomized complete block design with a 2 # 2 factorial arrangement with treatments being feed form (dry-pellet vs gruel [1:1 water to pellet ratio]) and feed placement (in the feeder trough only vs on the floor mat and in the feeder trough). Treatments were applied for 4 d postweaning and consisted of feed delivery four times per d (0600, 1000, 1400, and 1800 h). In addition, pigs had ad libitum access to water and pelleted starter feed. Pigs (n=864) were allotted at weaning (4.9 ± 0.02 kg BW; 17 ± 2 d of age) to pens of 27 animals on the basis of sex (equal ratio of barrows to gilts) and weight. Floor, feeder-trough, and mat spaces were 0.64 m², 2.26 cm, and 0.05 m²/pig, respectively. Pig BW was taken at the start, end of wk 1, and end of study (wk 3), and feed disappearance measured at end of wk 1 and 3. Feed form did not affect (P>0.05) growth rate, however, feed disappearance was higher (P<0.05) in wk 1 (216 vs 180 8.4 g) and from wk 1 to 3 (328 vs 289 10.8 g) for the gruel, and there was a trend (P=0.10) for a decreased gain:feed ratio (0.595 vs 0.660 0.0226) for gruel fed pigs. Feeding pigs on the mat and at the trough compared with trough only resulted in greater growth rate (92 vs 76 4.6 g; P<0.05) in wk 1, increased feed disappearance during wk 1 (246 vs 150 8.4 g; P<0.001) and for wk 1 to 3 (331 vs 286 10.8 g; P<0.05), and tended (P=0.06) to increase growth rate (197 vs 186 3.3 g) for the study period. There was a significant (P<0.05) interaction between feed form and feed location for gain:feed during wk 1. For pigs fed on the mat and at the trough, there was no effect of gruel vs dry feed on gain:feed (0.371 vs 0.387 0.0273); in contrast, for pigs fed only at the trough, gain:feed was substantially greater with the dry compared to the gruel (0.622 vs 0.395 0.0273). However, feed efficiency for the overall study was not affected (P>0.05) by feed location. Results suggest providing newly-weaned pigs access to feed on floor mats and feeder troughs increased growth rate initially after weaning, however, gruel feeding produced no improvement in weight gain.

Key Words: Weaning, Pigs, Feed Management

95 Effect of excess dietary leucine on growth and carcass characteristics, intramuscular fat level, and pork quality in finishing pigs. Y. Hyun*, M. Ellis, and F. McKeith, *University of Illinois at Urbana-Champaign.*

Previous research has suggested that feeding excess dietary leucine to finishing pigs increased intramuscular fat levels and improved muscle color. This study was conducted to validate this finding. A completely randomized design using a 2 X 2 factorial arrangement of treatments was used. The treatments were: 1) dietary leucine level (normal [1.22 %] vs high [3.22 %]) and 2) gender (barrows vs gilts). Forty crossbred pigs (Duroc x Yorkshire) were reared from 78.4 ± 3.5 to 114.8 ± 7.3 kg BW over a 39 day study period. Pigs were housed and fed individually in fully slatted pens that provided 1.6 m²/pig of floor space. Temperature in the building averaged 21.2 ± 3 °C over the study period. Pigs were given ad libitum access to feed and water. Diets were formulated using corn and soybean meal to meet or exceed the nutrient requirements recommended by NRC (1998). The high leucine diet contained 13.2 % CP, 0.79 % lysine, 1.22 % leucine and 3,420 kcal ME/kg, and the normal leucine diet contained 15.2 % CP, 0.79 % lysine, 3.22 % leucine and 3,400 kcal ME/kg. At 24-h postmortem, carcass and meat quality evaluation was carried out. Carcass measurements included carcass weight, midline and 10th rib fat depth and 10th rib loin eye area. Pork quality measurements were taken on the longissimus and included subjective color, firmness, marbling scores (scale: 1 = pale, soft and devoid of marbling to 5 = dark, firm and abundant or greater marbling), Hunter color (L*, a* and, b*), drip loss, and fat and water content. Pigs fed high compared with the normal leucine level were lighter (111.1 vs 115.4 kg, sem 1.39; P < 0.05) at the end of study, and grew more slowly (829 vs 930 g/d, sem 32.2; P < 0.05). However, the high leucine level

increased marbling score (3.9 vs 3.2, sem 0.24, P < 0.05) and muscle fat content (3.4 vs 2.4 %, sem 0.33; P < 0.05) compared to the normal leucine level. There was no effect of dietary leucine level on other meat quality measurements. As anticipated barrows grew faster, were fatter, and had higher marbling and intramuscular fat levels and firmer muscle scores than gilts. The results of the present study suggest that feeding excess leucine increased intramuscular fat content but reduced growth rates and had no effect on muscle color.

Key Words: Leucine, Meat Quality, Finishing Pigs

96 Effect of a step-up or step-down ractopamine sequence on carcass primal cut weights. A. P. Schinckel*, C. T. Herr, D. C. Kendall, K. A. Bowers, S. L. Hankins, T. E. Weber, and B. T. Richert, *Purdue University; West Lafayette, IN.*

One-hundred sixty pigs, 80 barrows (B) and 80 gilts (G) with an initial BW of approximately 71.9 ± 3.8 kg were allotted by sex and weight to evaluate the effect of feeding a constant or a phase feeding treatment (TRT) of varying ractopamine (RAC) levels on growth performance and carcass traits. Pigs were fed one of four dietary TRT for 42 days. Treatments were as follows: 1) Control diet containing no RAC wk 0-6; 2) Step-down RAC sequence: 20 ppm RAC wk 1 and 2, 10 ppm RAC wk 3 and 4, and 5 ppm RAC wk 5 and 6; 3) Step-up RAC sequence: 5 ppm RAC wk 1 and 2, 10 ppm RAC wk 3 and 4, and 20 ppm RAC wk 5 and 6; and 4) Constant RAC, 11.6 ppm wk 0-6. A 19.6% CP diet, 1.2% lys, and an 18.5% CP diet with a 1.1% lys level were fed to G and B respectively. One side of the carcasses from a subset of 64 pigs (16/TRT) was fabricated into primal and trimmed subprimal cuts and weighed. The four major muscles of the ham were dissected and weighed. The step-up and constant TRT had greater (P < .05) carcass weight (91.4 and 90.3 kg) than the step-down or control TRT (87.2 and 84.5 kg). All RAC pigs had greater (P < .05) rough cut shoulder weight than control pigs. Pigs of the step-up and constant TRT had greater (P < .05) rough cut ham and loin weights than the control pigs. Step-up and constant pigs had greater (P < .05) boneless trimmed loin weight (11.3 and 11.1 kg) than the step-down and control pigs (10.6 and 10.3 kg). Rough cut ham weights were greater (P < .05) for the step-up and constant TRT (11.9 and 11.7 kg) than the step-down (11.0 kg) and control (10.5 kg) TRT. Total ham lean, bicep femoris and quadriceps femoris weights were similar for the step-up and constant TRT and greater (P < .05) than the step-down TRT, which in turn was greater (P < .05) than the control TRT. Dietary RAC TRT did not affect (P > .05) rough cut belly weight, trimmed belly weight, sparerib weight or baby back rib weight. The step down program had reduced carcass lean cut and muscle weight compared to the step-up and constant TRT.

Key Words: Finishing Pigs, Ractopamine, Carcass Composition

97 Effect of ractopamine and dietary crude protein on carcass cut and tissue weights. A. P. Schinckel*, C. T. Herr, D. C. Kendall, and B. T. Richert, *Purdue University; West Lafayette, IN.*

Ninety-six barrows (initial BW 69.6 ± 4.0 kg) were allotted by weight to evaluate the effects of dietary lysine levels while feeding ractopamine (RAC) on growth performance and carcass traits. Treatments (TRT) 1 and 2 were fed throughout the six-week trial, while TRT 3 changed weekly. Treatments were as follows: 1) 16% CP, .82% lys control diet; 2) 16% CP diet, .82% lys; 3) a phase fed diet sequence, 18% CP, 1.08% lys during wk 1 and 4, 20% CP, 1.22% lys during wk 2 and 3, 16% CP, .94% lys during wk 5, and a 16% CP diet .82% lys during wk 6. All diets in TRT 2 and 3 contained 20 ppm RAC. Diets for TRT 3 were designed to meet the estimated lys requirements based on the modeled RAC lean growth from previous research. Pigs were marketed when the block weight reached 108.8 kg. The right sides of carcasses from pigs (n = 15/TRT) were fabricated to determine rough and trimmed cut weights. The four major cuts (ham, loin, picnic, Boston butt) were dissected into fat and muscle tissue. Pigs fed RAC had increased rough (9.55, 10.29, 10.82; P < 0.05) and trimmed ham (8.97, 9.74, 10.11 kg; P < 0.05, TRT 1-3 respectively), loin (7.62, 7.81, and 8.26 kg; P < 0.05), and Boston butt weight (4.15, 4.32, 4.70 kg; P < 0.05). Pigs fed RAC had greater dissected lean in the ham (6.30, 7.10, 7.48 kg; P < 0.05), loin (5.13, 5.47, 5.87; P < .05), Boston butt (2.94, 3.24, 3.64; P < 0.01) and four major cuts (16.57, 18.08, 19.35 kg; P < 0.01). Overall, RAC decreased the dissected fat tissue in the four lean cuts (7.18, 6.68, and 6.21 kg; P < .05). The weight of the semimembranosus (1.47, 1.61, 1.76

kg; $P < .01$) and semitendinosus muscles (0.45, 0.52, 0.56 kg; $P < .05$) was increased by RAC. In general, the RAC response for TRT 2 was less than TRT 3. The data indicate that the response of RAC to alter carcass cut, muscle, and fat weight is dependent on both dietary RAC and lysine levels.

Key Words: Pigs, Carcass Composition, Ractopamine

98 A three year summary of finishing pig performance in hoop structures and confinement during winter and summer in Iowa. M. S. Honeyman, J. D. Harmon, and A. D. Penner*, *Iowa State University*.

Six trials (three summer and three winter) were conducted over three years with 3,517 pigs. The objective was to compare the performance of finishing pigs in hoop structures during summer and winter in Iowa with pigs in confinement. For each trial, three groups of pigs were placed in three (9.1m x 18.3m) cornstalk bedded hoop structures (150 pigs per group). The fourth group was in six pens in a mechanically ventilated confinement building with slatted floors (22 pigs/pen). The pigs weighed 16 kg at the start of the trials and were fed corn-soy diets in phase until weighing 118 kg. The pigs were scanned at 112 kg. Overall, the pigs in hoop structures ate 5% more feed ($P < 0.001$), grew 2% faster ($P < 0.01$), and were 4% less efficient than pigs in confinement ($P < 0.001$). Overall, the pigs in hoop structures had 4.4% more backfat ($P < 0.05$), 4.7% smaller loineyes ($P < 0.001$), and lower yield (0.9 percentage units) than pigs in confinement. Bedding use was 92 kg/pig in summer and 122 kg/pig in winter. In summer, pigs in hoop structures ate 3.1% more feed ($P < 0.01$), grew 4.0% faster ($P < 0.001$), had 7.4% more backfat ($P < 0.01$), but did not differ in feed efficiency or loineye size compared to the pigs in confinement. In winter, the pigs in hoop structures ate 6.7% more feed ($P < 0.01$), and had 7.1% poorer feed efficiency ($P < 0.05$), but there was no difference in growth rate, backfat thickness or loineye size compared to the confinement pigs. The hoop environment (both seasons) encouraged the pigs to consume more feed, and during the winter caused the pigs to use more of the feed energy for maintaining body temperature rather than for growth. Hoop pig mortality was lower in summer (1.8 vs. 2.7%) but higher in winter (3.8 vs. 2.3%) compared to confinement. The percentage of cull and light pigs was similar in the summer (2.5 vs. 2.7%) but was higher in the hoops for winter (5.5 vs. 2.3%). This may have been due to the larger hoop group size and the much colder winter hoop environment. Research is needed to improve feed efficiency and leanness of pigs in hoop structures.

Key Words: Finishing Pig Performance, Bedded Hoop Structures, Pig Leanness

99 The muscle cell intermediate filament protein synemin interacts with the universal cytolinker plectin. D. Walker* and R. Robson, *Iowa State University*.

Determining the nature of the complex interactions of the cytoskeletal proteins within muscle cells is essential to our understanding of developing muscle. Synemin is a large (183 kD) member of the intermediate filament (IF) protein superfamily and is present primarily in muscle cells. We have shown previously that synemin interacts with other members of the IF superfamily such as desmin and vimentin, and with cytoskeletal proteins at the costameres and myofibrillar Z-lines, helping to provide the mechanical stability essential in muscle cells. In this study we tested the hypothesis that synemin also interacts with the large universal cytolinker protein plectin, thereby contributing to the formation of a network of linkages extending from the sarcolemma to the Z-lines of the peripheral layer of myofibrils and between Z-lines of neighboring myofibrils. Plectin (300 kD by SDS-PAGE) has been shown in mammalian cells to be a widely expressed, multifunctional protein capable of interconnecting different cytoskeletal filaments and other components such as IFs and desmosomes. Using antibodies known to cross-react with plectin in cells of several different mammals and on Western blots, we show for the first time that plectin is also present in several avian tissues, and migrates at 300 kD by SDS-PAGE. Immunofluorescent labeling of chicken myofibrils with anti-plectin antibodies showed strong labeling at the Z-lines, consistent with the localization of plectin in mammalian striated muscle. Tissue-purified synemin was shown to interact with a bacterially expressed domain of plectin by gel blot overlay assays. The interaction between plectin and synemin should provide an important additional structural linkage involving the IFs between the Z-lines of adjacent myofibrils and between the peripheral myofibrils and

the costameric sites located along the sarcolemma, thus providing the integrity needed for promoting the efficient growth and development of muscle. (Supported by USDA-NRICGP 99-35206-8676)

Key Words: Muscle Cell Cytoskeleton, Intermediate Filaments, Plectin

100 The effect of initial stocking rate on pig performance in a wean-to-finish system. J. M. DeDecker*, M. Ellis, B. F. Wolter, B. P. Corrigan, S. E. Curtis, and G. R. Hollis, *University of Illinois, Urbana*.

Double stocking of wean-to-finish facilities for a period after weaning is an approach being used by producers to increase weight of pigs produced from a given facility. This study evaluated the effect of double stocking for a 10-wk period post-weaning on growth performance from weaning to slaughter weight. Pigs ($n=1,458$) were used in a randomized block design to compare two stocking rate treatments (Single [27 pigs/pen] vs Double [54 pigs/pen]) on pig performance from weaning (4.8 0.004 kg BW; approximately 15 1 day of age) to 24 wk post-weaning (113.7 0.74 kg BW). Floor and feeder spaces per pig were 0.64 m² and 3.4 cm and 0.32 m² and 1.7 cm for the single- and double-stocked pens, respectively. At the end of wk 10 post-weaning, double-stocked pens of pigs were split into two equal-sized groups with similar mean BW and CV of BW, and one of the groups was moved to a different identical pen within the room. Therefore, from 10 to 24 wk, three treatments were compared: single-stocked, pigs remained in the same pen (single-stocked) vs double-stocked, pigs remained in same pen after splitting the pen (double-stayed) vs double-stocked, pigs moved to new pen after splitting the pen (double-moved). Pigs had free access to feed and water. In the first 10 wk post-weaning, double- compared to single-stocking resulted in a lower ADG (7.9%; $P < 0.001$) and lighter pigs (7.3%; $P < 0.001$). From wk 10 to slaughter, pigs previously housed at double- compared to single-stocking rate had similar ($P > 0.05$) growth rates (772, 767, and 767 8.1 g for single-stocked, double-stayed, and double-moved, respectively) but, were lighter (116.6, 112.6, and 112.0 0.74 kg BW; $P < 0.001$ for single-stocked, double-stayed, and double-moved, respectively) at end of wk 24 post-weaning. Moving double-stocked animals to a new pen at the end of wk 10 did not impact ($P > 0.05$) subsequent growth rates (767 vs 767 9.4 g for double-stayed and -moved, respectively). Coefficient of variation in pig BW within a pen were similar ($P > 0.05$) among stocking rates at wk 10 and wk 24. Mortality and morbidity were similar from start to wk 10 and from wk 10 to slaughter. In support of previous findings, double stocking reduced growth rate to 10 wk post-weaning, but did not impact subsequent growth, and therefore, resulted in lighter pigs at 24 wk post-weaning.

Key Words: Pigs, Stocking Rate, Wean-to-Finish

101 The effect of group size/floor space allowance on pig performance in a wean-to-finish production system. J. M. DeDecker*, M. Ellis, B. F. Wolter, B. P. Corrigan, S. E. Curtis, and G. R. Hollis, *University of Illinois, Urbana*.

A key decision relating to facility management is how many animals to place in a specific building. Historical research to optimize group size/floor space relationships was based on multiple-phase systems. This experiment was carried out to establish the relationship between group size/floor-space allowance on growth performance in a wean-to-finish production system. Pigs ($n = 1,296$) were used in a randomized complete block design to evaluate three group size treatments (22, 27, and 32 pigs/pen) on growth performance from weaning (5.0 0.01 kg BW; 15 1d of age) to 18 wk post-weaning. Floor and feeder spaces per pig were 0.78 m² and 4.2 cm, 0.64 m² and 3.4 cm, 0.54 m² and 2.9 cm for group sizes of 22, 27, and 32 pigs, respectively. Pigs had free access to feed and water. Pigs were weighed at start, wk 8, and wk 18 post-weaning. Group size did not impact ($P > 0.05$) pig performance during the first 8 wk post-weaning. Therefore, pig BW were similar ($P > 0.05$) among all treatments at end of wk 8. However, during the period from wk 8 to wk 18 post-weaning ADG decreased ($P < 0.001$) with increasing group size (894, 851, and 829 8.8 g for 22, 27, and 32 pigs/pen, respectively). For the overall study (start to wk 18) both ADG and BW were increased ($P < 0.001$) with decreasing group size. At end of 18 wk post-weaning, the coefficient of variation in pig BW within a pen and morbidity and mortality (removal rate) were similar among stocking rates. In conclusion, decreasing group sizes, thereby, increasing floor- and feeder-space allowance per pig increased growth rate after 8 wks post-weaning resulting in heavier pigs at 18 wk post- weaning for the smaller groups.

Group size	22	27	32	SEM
BW at start, kg	5.0	5.0	5.1	0.01
BW at 8 wk, kg	35.1	34.7	34.3	0.30
BW at 18 wk, kg	90.9	87.6	85.6	0.70*
ADG overall, g	676	650	633	5.3*
Removal rate, %	2.0	1.4	2.6	0.54

* Significant group size effect ($P < 0.001$)

Key Words: Pigs, Group size, Wean-to-finish

102 Effects of Sex and Market Weight on Growth Performance, Carcass Characteristics and Pork Quality. B. G. Kim*, J. R. Piao, Y. Y. Kim, and In K. Han, Dept. of Anim. Sci. & Tech., Seoul National University.

An experiment was conducted to examine the effect of sex and market weight on the carcass characteristics and pork quality. A total of 224 crossbred pigs (initial body weight = 26.6 kg) were allotted in a 2 x 4 factorial arrangement in a randomized complete block design. There were two sexes (112 gilts and 112 barrows) and four market weights (100, 110, 120 and 130 kg). Average daily gain (ADG) and average daily feed intake (ADFI) were higher significantly ($p < 0.01$) in barrows than gilts, ADFI and feed conversion ratio (FCR) were increased linearly as body weight increased ($p < 0.01$). Gender differences were observed in carcass characteristics. Backfat and drip loss were greater in barrows ($p < 0.01$) however, loin eye area, flavor score and lean content were higher in gilts ($p < 0.01$) regardless of body weight. Carcass grade and water holding capacity were the highest in 110 kg market weight pigs. The 100 kg market weight pigs showed lower juiciness, tenderness, shear forces and total palatability than the other market weights ($p < 0.01$). Hunter values (L^* , a^* and b^*) were increased as market weight increased ($p < 0.05$). Hunter a^* value was greater in gilts ($p < 0.01$) but L^* and b^* were not affected by sex of pigs. Net profit[(carcass weight x price by carcass grade)-total feed cost] was higher in gilts than barrows ($p < 0.01$), and was the highest in 110 kg market weight ($p < 0.01$). These results demonstrated that gilts showed higher carcass characteristics, pork quality, feed cost/kg body weight gain and net profit compared to barrows. Body weight of 110 kg is recommended to maximize pork quality and profit.

Key Words: Sex, Market Weight, Pork Quality

103 The effect of feeding ractopamine on growth and carcass traits in three genetic lines of pigs. T. J. Baas*¹, S. J. Moeller², C. D. Johnson¹, H. Zerby², G. M. Stoller², and L. E. Watkins³, ¹Iowa State University, ²The Ohio State University, ³Elanco Animal Health.

The influence of genetic line and gender on responses of pigs to ractopamine hydrochloride (RAC) on growth, efficiency, and carcass traits was determined in this study. Berkshire ($n = 76$), Duroc ($n = 81$), and high-lean (HL) commercial crossbred ($n = 75$) barrows and gilts were allocated to be fed standard commercial diets supplemented with RAC at 0 or 10 ppm. Pigs were started on the experimental diet at approximately 85.1 kg and remained on test for a period of 28 d. Traits were grouped as growth, carcass, and feed utilization traits. Genetic line, gender, treatment, and all two-way interactions were included as independent variables initially in all statistical models. Interactions were removed from subsequent analyses of dependent variables only if all dependent variables within a group of traits were not significant. Average daily gain (ADG) was evaluated over these periods: entry to market, start of grow-finish period to start of RAC feeding period, start of grow-finish period to market, week 1 on RAC, weeks 1 to 2 on RAC, weeks 1 to 3 on RAC, and start of RAC feeding period to market (weeks 1 to 4). Average entry and market weights in this trial were 4.9 kg and 111.4 kg, respectively. Feed efficiency (FE) and average daily feed intake on a pen basis were recorded for week 1, weeks 1 to 2, weeks 1 to 3, and for the entire 4-week RAC feeding period. Pigs were harvested and carcass measurements taken at 24 h post-mortem. Pigs fed RAC had increased average daily gain ($P < 0.01$), produced more gain per unit of feed ($P < 0.01$), and produced carcasses with more loin muscle area ($P < 0.05$). The response to RAC for ADG and FE was similar for all three genetic lines. Ractopamine reduced tenth rib backfat in HL pigs but a response was not evident in Duroc and Berkshire pigs. It appears RAC is a good

tool to improve the performance and carcass composition of industry genetic lines.

Key Words: Ractopamine, Growth, Carcass Composition

104 The relationship between serum leptin concentration and beef carcass composition and quality. E. L. McFadin*, D. H. Keisler, T. B. Schmidt, C. L. Lorenzen, and E. P. Berg, University of Missouri.

The protein hormone product of the ob gene, leptin, has been implicated in the control of food intake and body composition. The principal site of leptin production is the adipocyte and thus circulating concentrations of leptin have been positively correlated with body fat mass. Steers of various genotypes from the 2001 Missouri State Beef carcass contest were used to evaluate the relationship between serum concentrations of leptin and beef carcass composition and quality traits collected under normal commercial slaughter conditions. Cattle were shipped to a large-scale commercial beef packing plant where serum samples were obtained from steers during exsanguination. Carcass data including hot carcass weight (343.92 ± 3.5 kg), adjusted 12th rib fat thickness (0.93 ± 0.049 cm), percentage kidney, pelvic and heart fat (2.10 ± 0.053 %), marbling score (38.76 ± 0.95 marbling score units) and overall yield grades (2.29 ± 0.86 yield grade units) were obtained online by trained evaluators from the University of Missouri. Serum concentrations of leptin concentrations were determined using a leptin radioimmunoassay validated for use in our lab. Leptin concentrations were significantly correlated to fat thickness over the 12th and 13th rib, marbling score, calculated yield grade and calculated boneless, closely trimmed retail cuts ($r = 0.34$, $P = 0.001$; $r = 0.19$, $P = 0.08$; $r = 0.26$, $P = 0.02$; $r = -0.20$, $P = 0.08$, respectively). Leptin was not correlated with hot carcass weight, ribeye area or percentage kidney, pelvic and heart fat ($r = 0.16$, $P = 0.14$; $r = 0.11$, $P = 0.31$; $r = 0.13$, $P = 0.24$, respectively). We conclude that serum concentrations of leptin can be used to objectively assess whole carcass composition in fed cattle and may provide a means by which carcass quality can be predicted in the live animal.

Key Words: Leptin, Composition, Quality

105 Protein accretion in pigs infected with *Mycoplasma hyopneumoniae* and Porcine Reproductive and Respiratory Syndrome Virus. J. Escobar*¹, T.L. Toepfer¹, W.G. Van Alstine², D.H. Baker¹, and R.W. Johnson¹, ¹University of Illinois, Urbana, IL, ²Purdue University, W. Lafayette, IN.

Although *Mycoplasma hyopneumoniae* (Mh) and Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) are thought to depress growth performance, it is not known if they interact, or how they activate the immune system to impair growth. The objectives of this study were to evaluate the effects of Mh and PRRSV when presented either alone or in combination on growth performance in nursery pigs, and to determine if growth was negatively correlated with serum levels of interleukin (IL)-1 β and IL-6. Sixty-four pigs were subjected to one of four treatment combinations (2 X 2 factorial) of Mh [intratracheal inoculation with Friis or P5722-3 ($3 \text{ ml } 10^7 \text{ cfu/ml}$) at 4-wk of age] and PRRSV [intranasal inoculation with DMEM or VR-2385 ($5 \text{ ml } 10^5 \text{ 50\% TCID}_{50}$) at 6-wk of age]. FI, ADG and G:F ratio were determined postinoculation. One half of the pigs were killed 7 d after PRRSV inoculation and the remaining pigs were killed 7 d later. Whole-body CP was determined to estimate protein accretion (PA). IL-1 β and IL-6 were measured in sera collected 7 d after PRRSV inoculation using porcine-specific ELISA. Two-way ANOVA of FI, ADG, PA, IL-1 β and IL-6 detected a main effect of PRRSV ($P < 0.001$), but neither the Mh effect nor the Mh # PRRSV interaction were significant. Mh-induced lung lesions, however, were 3 to 5 times greater ($P < 0.001$) in pigs with both Mh and PRRSV than in those with Mh alone. PRRSV induced a marked increase in both IL-1 β and IL-6, and a concomitant decrease ($P < 0.001$) in FI, ADG and PA. There was a negative correlation ($P < 0.001$) between IL-1 β and ADG ($r = -0.72$), FI ($r = -0.80$) and PA ($r = -0.72$); IL-6 was negatively correlated ($P < 0.001$) with ADG ($r = -0.83$) and PA ($r = -0.71$). Collectively, these data suggest that the acute effects of PRRSV infection on FI and growth are independent of Mh infection. Furthermore, they suggest that the reduced FI and growth in sick pigs may depend on increased circulating levels of inflammatory and metabolically active cytokines like IL-1 β and IL-6.

Key Words: Inflammatory Cytokines, Growth, Mycoplasma and PRRSV

106 The use of nonlinear mixed models for swine growth. A. P. Schinckel* and B. A. Craig, *Purdue University, West Lafayette, IN.*

Alternative versions of a three-parameter nonlinear growth function (Bridges, 1986; $BW_{i,t} = C(1 - \exp(-M t^A)) + \text{birthweight} + e_{i,t}$, where t is days of age for the i th pig) were evaluated on two groups of gilts. The gilts were randomly assigned to be reared under all-in, all-out (AIAO, $n = 96$) or continuous flow management (CF, $n = 96$). The fixed effects version assumes the BW of each pig deviates from the BW growth function and that these deviations (i.e., residuals) are independent with constant variance. Empirically, these assumptions are not reasonable. As an alternative, we propose the use of random effects and investigate both one and two random effect models. The inclusion of random effects provides a flexible method to better reproduce the underlying variance-covariance structure of the serial live weights while still assuming the residuals are independent with constant variance. These models are also easily adaptable to stochastic modeling. For these data, the AIC (Akaike's Information Criteria) values for the fixed effects model were 2176 and 4116 for the AIAO and CF gilts. By allowing the mature body weight to vary pig to pig (i.e., $C + c_i$) the AIC values are reduced to 1904 and 3633 respectively, and the RSD's, the standard errors of the M and A parameters were reduced by over 50%. The addition of a second random effect for M (i.e., $M + m_i$) further reduced the AIC values (1883, 3568 for AIAO and CF) and the RSD's. The inclusion of the second random effect accounts for different patterns of growth between pigs thereby allowing more flexibility to model the observed variance-covariance structure. Also, algebraically, the age required for each pig to reach a specific BW can be predicted. The CF gilts had slightly greater SD in BW at 153 and 174 d of age (9.0 and 10.0 kg) than the AIAO gilts (8.5 and 9.0 kg). However, the SD in predicted days of age required to achieve 110 kg was greater for CF gilts (19.3 vs. 11.3 d). These data demonstrate an improved fit of the two random effects model in comparison to the single random effects model.

Key Words: Mixed Effects Model, Nonlinear Growth Functions, Pig Growth

107 Evaluation of biases in predicting fat-free lean mass of pigs fed ractopamine. A. P. Schinckel*, C. T. Herr, J. C. Forrest, B. T. Richert, and M. E. Einstein, *Purdue University; West Lafayette, IN.*

Barrows (BW 69.6 ± 4.0 kg) were allotted by weight to evaluate the effects of dietary lysine levels while feeding ractopamine (RAC) on carcass composition and growth. Treatments (TRT) 1 and 2 were fed throughout the six-week trial, while TRT 3 changed weekly. Treatments were as follows: 1) 16% CP, .82% lys control diet; 2) 16% CP diet, .82% lys; 3) a phase fed diet sequence, 18% CP, 1.08% lys during wk 1 and 4, 20% CP, 1.22% lys during wk 2 and 3, 16% CP, .94% lys during wk 5, and a 16% CP diet .82% lys during wk 6. All diets for TRT 2 and 3 contained 20 ppm RAC. The four lean cuts from the right side of the carcasses ($n = 15$ per TRT) were dissected into lean and fat tissue. The other cuts soft tissue was collected from the jowl, ribs, and belly. Proximate analyses were completed on these three tissue pools and a sample of fat tissue from the other cut soft tissue to determine fat-free lean mass (FFLN). Prediction equations were developed for FFLN. Independent variables included carcass weight (CW), last rib midline fat depth (BFLR), 10th rib fat depth (FD), and 10th rib loin muscle area (LMA). Live measurements included ultrasonic 10th rib fat depth (UFD) and loin muscle area (ULMA). Also, dissected ham lean (HL) and loin lean (LL) were

109 Effect of alpha-1,6-galactosidase, beta-1,4-mannanase, and beta-1,4-mannosidase on lactation performance in primiparous sows. S. W. Kim*, *Texas Tech University.*

Soybean meal contains 5.6% α -galactoside and 1.2% β -galactomannans that pigs can not utilize because of they lack appropriate enzymes, resulting in gas production. Twenty two primiparous sows (Newsham) were used to test a hypothesis that dietary supplementation of an enzyme mixture (mainly composed of α -1,6-galactosidase, β -1,4-mannanase, and β -1,4-mannosidase) reduces body weight loss and improves overall performance during lactation. On d 109 of gestation, sows were moved to farrowing crate. Immediately after farrowing (within 24

considered as independent variables. The mean residual values for the three TRT were evaluated as a measure bias. The FFLN was different ($P < 0.01$) for the RAC TRT (39.4, 42.4, and 46.5.3 kg). The prediction equations had significant TRT biases. The FFLN of TRT 1 pigs were overpredicted and TRT 3 pigs under predicted. Prediction equations underestimate the FFLN of pigs fed RAC with high lysine diets.

Equation	R ²	RSD, kg	Mean residual value	Probability		
			TRT 1	TRT 2	TRT 3	
CW, BFLR	0.49	3.11	-2.58	0.31	2.27	.001
CW, FD, LMA	0.62	2.55	-1.65	0.03	1.61	.001
BW, UFD, ULMA	0.59	2.61	-1.67	-0.09	1.75	.001
CW, FD, LL	0.74	2.15	-1.29	-0.02	1.31	.001
CW, FD, HL	0.75	2.06	-0.56	-0.62	1.18	.02
CW, FD, HL, LL	0.84	1.66	-0.39	-0.54	0.93	.02

Key Words: Pigs, Carcass Composition, Ractopamine

108 Effect of post-weaning growth rate, as affected by diet and floor space, on pig growth to slaughter in a wean-to-finish system. B. F. Wolter*¹, M. Ellis¹, S. E. Curtis¹, B. P. Corrigan¹, J. M. DeDecker¹, E. N. Parr², and D. M. Webel², ¹University of Illinois, Urbana, ²United Feeds, Sheridan, IN.

The objective was to study the effect of early post-weaning growth rate, as affected by diet and floor space, on subsequent growth to slaughter in a wean-to-finish system. Pigs ($n = 1,728$) were used in a randomized block design with a 2 X 2 factorial arrangement of treatments: 1) diet (Complex vs Simple) and 2) floor space (Unrestricted vs Restricted). Treatments were imposed the first 8 wk post-weaning (Period 1) and growth was measured from weaning (5.0 0.01 kg BW; 17 d of age) to 23 wk post-weaning. The Simple treatment consisted of corn-soy based diets with minimal milk products, processed cereals, and animal protein-based ingredients compared to Complex. Floor- and feeder-space were 0.63 m² and 4 cm and 0.21 m² and 2 cm per pig, respectively, for Unrestricted and Restricted. From end of wk 8 to end of wk 23 (Period 2), pigs on all treatments had the same floor- and feeder-spaces and were fed a common diet program. There were no treatment interactions ($P > 0.05$). In Period 1, pigs assigned to the Simple diet program had similar ADFI (639 vs 650 5.4 g; $P > 0.05$), but reduced ADG (408 vs 424 3.8 g; $P < 0.01$), gain:feed (G/F; 0.64 vs 0.65 0.002; $P < 0.001$), and were lighter (2.8%; $P < 0.01$) than those on Complex. In Period 2, growth was not affected ($P > 0.05$) by previous diet program, and pig BW was similar (114.7 vs 115.0 0.50 kg; $P > 0.05$) at the end of wk 23. Pigs kept at Restricted compared to Unrestricted space were lighter at end of wk 8 (6.5%; $P < 0.001$), and had lower ADG (398 vs 434 3.8 g; $P < 0.001$), ADFI (621 vs 668 5.4 g; $P < 0.001$), and G/F (0.64 vs 0.65 0.002; $P < 0.01$) in Period 1. However, Restricted pigs had higher ADFI (2215 vs 2261 12.0 g; $P < 0.01$) and tended to have greater ADG (820 vs 836 5.6 g; $P = 0.06$), but similar ($P > 0.05$) G/F compared to Unrestricted in Period 2. Pig BW were similar (114.5 vs 115.2 0.50 kg; $P > 0.05$) between space treatments at end of wk 23. Mortality and morbidity and backfat and loin depths were not influenced ($P > 0.05$) by either diet program or space. Both the simple diet program and reduced space allowance used in the early period post-weaning resulted in reduced pig growth rate, but, early growth rate had little impact on pig BW or carcass measures at wk 23 post-weaning.

Key Words: Pigs, Diet Complexity, Floor Space

Nonruminant Nutrition

h), all sows and litters were weighed. Two sows with similar farrowing body weight were grouped and randomly allotted to one of two dietary treatments within a group. Sows in the control group were fed a diet containing 28% soybean meal and the enzyme was added at the level of 0.1% replacing corn. Within 48 h, litter size was standardized to 9 pigs by cross-fostering. Feed intakes of sows were measured individually on a daily basis. All the sows and litters were weighed on d 7, 14, and 21 after farrowing and all the litters were weaned on d 21. After weaning, sows were moved to gestation stalls and days return to estrus was recorded. At farrowing, sows from both treatments had the same body weight. However after a 21-d lactation, body weight loss from control group (12.8 kg) was greater ($P < 0.05$) than that from enzyme group