

**100 Effect of the RN gene, feed withdrawal and lysine deficient diet on fresh longissimus quality.** B.S. Bidner\*, M. Ellis, D.P. Witte, M. England, D. Campion, and F.K. McKeith, *University of Illinois, Urbana*.

Feed withdrawal and a lysine deficient diet were evaluated on different RN genotypes to determine the effect on fresh longissimus quality. Sixty-four gilts from a commercial hybrid line were allocated to feed withdrawal and dietary treatments based on live weight and glycolytic potential (GP) using live-animal biopsy. Diets containing 4.8 (deficient) or 6.4 g/kg lysine were fed for the last six weeks prior to slaughter. Pigs were fasted 12 or 36 hr prior to slaughter and were not commingled until loading. Mean biopsy GP values were  $215 \pm 17.5$  and  $314 \pm 23.2$   $\mu$  mole/g for pigs classified as  $rn^+rn^+$  and  $RN^-rn^+$ , respectively. Feed withdrawal for 36 hr did not affect the fresh muscle characteristics of the *longissimus thoracis* (LT) for either genotype. The  $RN^-rn^+$  genotype had a lower ultimate pH of the LT ( $P < .001$ ). The  $RN^-rn^+$  pork had a higher Japanese color score ( $P < .001$ ), a lower Hunter L\* ( $P < .0001$ ), and a higher Hunter a\* ( $P < .0001$ ). The lysine deficient diet increased intramuscular fat content of the LT by 24 % but reduced average daily gain ( $P < .01$ ), feed efficiency ( $P < .001$ ), and total carcass % lean. These data suggest that *longissimus* quality was not affected by a 36 hr feed withdrawal and the lysine deficient diet increased % intramuscular fat.

**Key Words:** Meat Quality, Feed Withdrawal, Lysine Deficient Diet

**101 Effect of the RN gene and feed withdrawal prior to slaughter on fresh longissimus quality and sensory characteristics.** B.S. Bidner\*, M. Ellis, K.D. Miller, M. Hemann, D. Campion, and F.K. McKeith, *University of Illinois, Urbana*.

This study was conducted to evaluate the effect of feed withdrawal on meat quality characteristics of  $RN^-rn^+$  (carrier) and  $rn^+rn^+$  (normal) pigs. Seventy-two pigs from a commercial hybrid line were allocated based upon live weight and RN genotype to feed withdrawal periods of 12, 36, or 60 hr prior to slaughter. The 36 and 60 hr treatments were removed from their rearing groups and commingled with other pigs in a holding pen at the start of feed withdrawal. The 12 hr treatment remained in their rearing group until they were loaded for transport to slaughter at a commercial facility. RN gene status was determined using glycolytic potential (GP) preformed on *longissimus lumborum* (LL) samples obtained using live-animal biopsy. Mean GP values were  $176 \pm 26.0$  and  $304 \pm 34.6$   $\mu$  mole/g for pigs classified as  $rn^+rn^+$  and  $RN^-rn^+$ , respectively. Feed withdrawal did not influence any meat quality characteristics of the  $RN^-rn^+$  genotype. The 60 and 36 hr feed withdrawal treatments resulted in a higher ultimate pH of the *longissimus thoracis* (LT) than the 12hr treatment in the  $rn^+rn^+$  genotype. Hunter L\* of the LT decreased from  $55.5 \pm 1.8$  at 12 hr to  $51.8 \pm 3.8$  after 60 hr off feed in the  $rn^+rn^+$  genotype ( $P < .05$ ). Subjective color and firmness were not affected by feed withdrawal for either genotype. The  $RN^-rn^+$  genotype had a higher % drip loss of the LT ( $P < .0001$ ), a higher % purge and cooking loss in the LL ( $P < .01$ ). LT from  $RN^-rn^+$  animals contained a higher % moisture ( $P < .05$ ) and a lower % protein ( $P < .0001$ ). A 13 cm LL section was aged 7 d, frozen, cut into 2.5 cm thick chops, cooked to 70° C internal temperature and served to a trained 6 member taste panel.  $RN^-rn^+$  pork rated higher for tenderness and juiciness ( $P < .05$ ). These results suggest that feed withdrawal can improve the meat quality of the  $rn^+rn^+$  genotype without affecting sensory characteristics.

**Key Words:** RN Gene, Meat Quality, Feed Withdrawal

**102 Yield and value of beef by-products from cull beef cows is affected by body condition scores.** J. K. Apple\*, J. C. Davis, J. D. Stephenson, and C. B. Boger, *University of Arkansas, Fayetteville*.

Mature beef cows ( $n = 122$ ) representing British and Continental genotypes were slaughtered to measure the effect of body condition scores (BCS) on by-product yields and value. All cows were weighed and assigned BCS, based on a 9-point scale, 24 h before slaughter. By-product yields were calculated as a percentage of the animal's live weight and as a percentage of the animal's shrunk (4.0 %) live weight. Cows assigned a BCS of 2 had the lightest ( $P < .05$ ), while cows given a BCS of 7 or 8 had the heaviest ( $P < .05$ ), live weights and total offal weights.

Weight of the hide, liver, oxtail, large intestines, and mesenteric fat increased linearly ( $P < .001$ ) as BCS increased from 2 to 8. Cows with a BCS of 2 had a higher ( $P < .05$ ) percentage of their live weight as hide, skull, oxlips, tripe, honeycomb tripe, heart, feet and hooves, and lungs than BCS-4 or higher cows. The hide, cheek meat, gullet, liver, oxtail, large intestines, and mesenteric fat from BCS-8 cows had the greatest ( $P < .05$ ) value. Total by-product value increased linearly ( $P < .001$ ) from a low of 79.55 for BCS-2 cows to a high of 111.10 for BCS-8 cows. Drop credit, however, was highest ( $P < .05$ ) for BCS-2 cows and lowest ( $P < .05$ ) for BCS-6 and BCS-8 cows. By-products from cows in thin condition were of less total value than those from cows in relatively heavy condition, with moderately-conditioned cows being intermediate in value. Thus, BCS appear to be good indicators of both by-product yields and value.

**Key Words:** Beef Cows, By-Products, Body Condition

**103 Influence of body condition scores on carcass characteristics and subprimal yields from cull beef cows.** J. K. Apple\*, J. C. Davis, J. D. Stephenson, J. E. Hankins, J. R. Davis, S. L. Beaty, C. S. Boger, and C. B. Boger, *University of Arkansas, Fayetteville*.

Mature beef cows ( $n = 111$ ) were used to measure the effect of body condition scores (BCS) on carcass characteristics and subprimal yields. All cows were weighed and assigned BCS, based on a 9-point scale, 24 h before slaughter. After a 48-h chilling period, carcass data were collected on left sides of each carcass. The right side was processed into boneless subprimal cuts, minor cuts, lean trim, fat, and bone. Cuts were progressively trimmed to 6.4 and 0.0 mm of external and visible seam fat, and yields were calculated as a percentage of the chilled side weight. Live wt, hot and chilled carcass wt, dressing percent, fat thickness, longissimus muscle area, internal fat percent, muscle:bone ratio, numerical yield grade, and quality grade increased linearly ( $P < .01$ ) as BCS increased from 2 to 8. Cows assigned a BCS of 5 had higher ( $P < .05$ ) shoulder clod yields than BCS-2, 3, 6, 7, or 8 cows. Carcasses from BCS-2 cows had lower ( $P < .05$ ) strip loin yields than all other cows. Cows assigned a BCS of 2, 3, 4, and 5 had higher ( $P < .05$ ) top sirloin butt yields than BCS-6, 7, or 8 cows. Tenderloin yields were greatest ( $P < .05$ ) for BCS-2 cows, while carcasses from BCS-8 cows had the lowest ( $P < .05$ ) tenderloin yields. Knuckle yields increased linearly ( $P < .001$ ) as BCS increased from 2 to 8. Total lean product yield at 6.4 mm of fat was quadratically ( $P < .001$ ) related to BCS, with BCS-3, 4, 5, and 6 cows having greater ( $P < .05$ ) yields than cows assigned a BCS of 2, 7, or 8. When lean product was trimmed to 0.0 mm of fat, total lean yields increased from 60.8% for BCS-2 cows to a high of 61.69% for BCS-5 cows, then declined to 58.66, 54.14, and 49.41% for BCS-6, 7, and 8 cows, respectively. Total trimmable fat yields increased ( $P < .001$ ) and total bone yields decreased ( $P < .001$ ) linearly as BCS increased from 2 to 8. Both cow producers and packers may benefit most by marketing BCS-6 cows, which had the highest yields of lean product with acceptable carcass quality.

**Key Words:** Beef Cows, Carcass Composition, Body Condition

**104 The effects of swine dietary supplementation of modified tall oil, chromium nicotinate, and L-carnitine on longissimus muscle quality characteristics and display color stability.** A. T. Waylan<sup>\*1</sup>, P. R. O'Quinn<sup>1</sup>, J. A. Unruh<sup>1</sup>, R. D. Goodband<sup>1</sup>, J. L. Nelssen<sup>1</sup>, J. C. Woodworth<sup>1</sup>, M. D. Tokach<sup>1</sup>, and K. Q. Owen<sup>2</sup>, <sup>1</sup>Kansas State University, Manhattan, <sup>2</sup>Lonza Inc., Fair Lawn, NJ.

Eighty pork loins were used to determine the effects of diet supplementation of modified tall oil (MTO), chromium nicotinate (CrNic), and L-carnitine on longissimus muscle (LM) quality. Gilts (PIC) were blocked by initial BW (45 kg) and ancestry and assigned to one of eight treatments in a 2 x 2 x 2 factorial design with main effects of MTO (0 or .5%), CrNic (0 or 50 ppb), and L-carnitine (0 or 50 ppm). Boneless loins were vacuum packaged at 24 h postmortem and cut into 2.54 cm chops at 7 d postmortem. Visual display color was evaluated by an 8-member panel on 0, 1, 3, 5, and 7 d of display. In addition, instrumental L\*, a\*, b\*, ratio of reflectance %R630/%R580, and saturation index values were determined. Separate display chops were evaluated for thiobarbituric acid-reacting substance (TBARS) on 0 and 4 d. Additional chops were used for Warner-Bratzler shear force (WBS). No differences ( $P > .05$ )

were detected for visual color. In a CrNic x L-carnitine interaction at 0 d, chops from pigs fed a combination of no CrNic and L-carnitine (50 ppm) had ( $P < .05$ ) lower L\* values than chops from pigs fed a combination of CrNic (50 ppb) and L-carnitine. At 1 and 7 d, chops from pigs fed CrNic had lower ( $P < .05$ ) saturation index values than chops from pigs fed no CrNic. At 3 and 5 d, LM chops from pigs fed MTO had ( $P < .05$ ) higher b\* and saturation index values than chops from pigs fed no MTO. No differences ( $P > .05$ ) were detected for TBARS and WBS evaluations. Dietary supplementation of MTO, CrNic, and L-carnitine had minimal effect on LM quality characteristics and color stability.

**Key Words:** Modified tall oil, Chromium nicotinate, L-carnitine

**105 Predicting component pieces of pork carcasses is improved by differential analysis of the industrial electromagnetic scan curve.** Berg, E. P., Ellersieck, M. R., Asfaw, A., and Linville, M.\*<sup>1</sup>, *University of Missouri-Columbia*.

The objective of this study was to test and validate existing electromagnetic (EM) scan equations for an existing industrial operation. Fifty-four whole, pre-rigor, eviscerated carcasses (avg 75 kg) were selected representing carcasses marketed to Sioux-Preme Packers Inc., Sioux Center,

IA. Carcasses (spanning 41–65% carcass lean) were electromagnetically (EM) scanned before entering the chill cooler. Selected carcasses were fabricated into primal cuts and individually dissected into subcutaneous fat, seam fat, lean, and bone. Weights were recorded for total dissected carcass (TOTLN), ham (HAM), loin (LOIN), and entire square cut shoulder (SHL) lean. Differential points (D) were determined as the numeric difference between EM phase index points located along the EM scan curve. Areas (A) under the EM curve were also obtained and used as independent variables for the prediction of carcass and component lean tissue. Previous analysis eliminated the lowest 10% of the EM scan curve to eliminate EM noise at the point of entry. This analysis examined the entire EM scan curve. Total area under the EM scan curve explained 93.5% of the variation in TOTLN. An equation using peak EM absorption and 3 additional A variables accounted for 94.3% of TOTLN variation ( $RMSE = 1.35\text{Kg}$ ). Equations were developed for HAM, LOIN, and SHL accounted for 84.3, 84.4, and 88.8% of the sample variation, respectively ( $RMSE = 0.77, 0.80$ , and  $0.51\text{kg}$ , respectively). Differential analysis of the entire EM scan curve improved R-square statistics from existing equations for TOTLN by 4.3%; HAM by 1.1%; SHL by 3.9%; and improved RMSE for TOTLN by 0.24kg.

**Key Words:** Pork, Electromagnetic scanning, Composition

## NONRUMINANT NUTRITION

**106 Effect of amino acid intake during gestation on sow body weight changes and litter size.** D.R. Ball\*, J.F. Patience, and R.T. Zijlstra, *Prairie Swine Centre Inc., Saskatoon, Canada*.

Nutrient intake during gestation will have an impact on gestation parameters and subsequent lactation performance. The objective of this experiment was to determine the impact of feeding two levels of amino acids in gestation [below or above NRC, 1998] on sow body weight changes in gestation and lactation and on litter size. At mating, 258 sows were randomly assigned within parities (PR) 1, 2 or 3+ to a gestation diet (GD) containing either 0.37 (LL) or 0.49% (HL) apparent ileal digestible lysine and 3100 kcal DE/kg; other indispensable amino acids were adjusted to lysine. Feed allowance in gestation was determined factorially using estimated DE requirements for maintenance, maternal gain and conceptus growth. Lactation diet was provided ad libitum. Gestation weight gain (GWG) from d 0 to 110 was affected by PR (63.0, 59.9 and 38.5 kg for PR1, 2 and 3+, respectively;  $P < 0.05$ ) but not ( $P > 0.10$ ) by GD. The GD x PR interaction was not significant ( $P > 0.10$ ). Sow lactation weight change from d 0 to 19 was affected by PR (1.3, 3.5 and 5.0 kg for P1, 2 and 3+, respectively;  $P < 0.01$ ) and GWG ( $P < 0.01$ ), but not by GD (4.4 vs. 5.3 kg for LL and HL, respectively;  $P > 0.10$ ). Lactation feed intake was affected by PR (6.3, 7.4 and 7.4 kg/day for PR1, 2 and 3+, respectively;  $P < 0.01$ ). Total piglets born was affected by PR (9.4, 11.2 and 13.4, for PR1, 2 and 3+, respectively;  $P < 0.01$ ) and by GWG; GD x PR and GWG x PR approached significance ( $P < 0.10$ ). Total piglets born alive (mean = 11.4) was affected by GWG and by GWG x PR ( $P < 0.05$ ); PR approached significance ( $P < 0.10$ ). Total litter weight born alive was affected by PR (13.5, 17.4 and 18.6 kg for PR1, 2 and 3+, respectively;  $P < 0.01$ ) and GWG ( $P < 0.05$ ); GD x PR approached significance ( $P < 0.10$ ). These results confirm the effect of parity on sow body weight changes and litter size, and highlight the effects of gestation weight gain on lactation weight changes. The amino acid levels in the two gestation diets had no effect on sow body weight changes or litter size.

**Key Words:** Sow, Amino Acids, Gestation

**107 Impact of dietary lysine intake during lactation on follicular development and oocyte maturation in primiparous sows.** H. Yang\*<sup>1</sup>, G. R. Foxcroft<sup>2</sup>, J. E. Pettigrew<sup>3</sup>, L. J. Johnston<sup>1</sup>, G. C. Shurson<sup>1</sup>, A. N. Costa<sup>4</sup>, and L. J. Zak<sup>2</sup>, <sup>1</sup>*University of Minnesota, St. Paul*, <sup>2</sup>*University of Alberta, Edmonton, Canada*, <sup>3</sup>*Pettigrew Consulting International, Louisiana, MO*, <sup>4</sup>*Universidade Federal Rural de Pernambuco, Recife, Brazil*.

Primiparous lactating sows ( $n = 36$ ) were used to evaluate the effects of dietary lysine intake on follicular development and oocyte maturation. Sows were assigned randomly to one of three diets containing .4% (L), 1.0% (Normal) or 1.6% (H) total lysine from intact protein, and nursed 10 piglets during an 18-d lactation. All diets contained 2.1 Mcal

NE/kg and exceeded NRC (1988) requirements for all other nutrients. Actual lysine intakes were 16, 36 and 56 g/d for sows consuming L, Normal and H, respectively. Sows were slaughtered during proestrus after weaning. The largest 15 preovulatory follicles per sow were classified by size (large:  $> 7.0$  mm; medium: 5.5 to 7.0 mm; small:  $< 5.5$  mm), and their follicular fluid (FF) was harvested for analysis. Compared to sows fed Normal or H, sows fed L tended to have lower uterine weight, FF volume, and FF estradiol content ( $P < .15$ ), but similar ovary weight and FF IGF-1 concentration. Sows fed L had a lower percentage (33 vs 50 or 58%;  $P < .01$ ) of large follicles, but a higher percentage (62 vs 44 or 39%;  $P < .01$ ) of medium follicles compared to sows fed Normal or H. Standardized pools of oocytes from prepubertal gilts were incubated for 44 h with FF recovered from experimental sows. Fewer oocyte nuclei matured to metaphase II of meiosis when cultured with FF recovered from sows fed L than from sows fed Normal or H ( $P < .01$ ). No differences ( $P > .15$ ) were noted for any response criteria between sows fed Normal and H. Our results suggest that low lysine intake in primiparous lactating sows impaired follicular development and reduced the ability of the follicle to support oocyte maturation, whereas high lysine intake had no positive or negative effects compared to normal lysine intake.

**Key Words:** Lysine, Follicle, Primiparous Sow

**108 Valine addition to a practical lactation diet did not improve sow performance.** R. D. Boyd\*<sup>1</sup>, M. E. Johnston<sup>1</sup>, J. L. Usry<sup>2</sup>, and K. J. Touchette<sup>3</sup>, <sup>1</sup>*PIC USA, Franklin, KY*, <sup>2</sup>*Heartland Lysine, Chicago, IL*, <sup>3</sup>*University of Missouri, Columbia, MO*.

The value of adding crystalline valine to a practical corn-soy diet for lactating sows was studied using 235 PIC commercial sows. Females were allocated to 4 dietary treatments by parity (1-4). Diets consisted of corn, soybean meal, 12% wheat midds and each contained .05% of synthetic lysine. Diets were formulated to contain .95% total lysine with the control diet having a total valine:lysine ratio of .90; test diets had ratios of 1.05, 1.20 and 1.20. Semi-essential arginine was added to the latter diet to achieve a ratio of 1.35 total arginine:lysine (similar to mammary uptake). The control diet had a ratio of 1.20 arginine:lysine. Relative concentrations of other amino acids exceeded NRC (1998) levels. Diets were fed from d 112 of pregnancy through a 19 d lactation. Litter size was standardized 24 h post-farrow ( $10.7 \pm 2$  pigs) and diets were fed ad libitum. Synthetic valine addition did not decrease sow weight or loin depth loss ( $P > .10$ ). Sows lost 7.17 to 9.52 kg BW, 1.6 to 2.3 mm BF and 1.7 to 2.0 mm loin depth, with no differences observed between treatments ( $P > .10$ ). Number of pigs weaned ranged from 10.0 to 10.3 ( $P > .10$ ) and litter growth rate was 2250, 2150, 2190 and 2150 g/d for control and respective diet groups ( $P > .10$ ). Average feed intake (corrected for a minimum 6% waste) was greater than expected and ranged from  $7.16\text{--}7.22 \pm .15$  kg/d ( $P > .10$ ). Calculated dietary lysine intake (67.3 to 67.9 g/d) vs lysine need suggests that the requirement slightly exceeded intake, which was critical to the test. A separate analysis of