618 Differential effects of leucine on translation initiation factor activation and protein synthesis in skeletal muscle, renal and adipose tissues of neonatal pigs. J. Escobar*, H. V. Nguyen, and T. A. Davis, *USDA/ARS, Children's Nutrition Research Center, Baylor College of Medicine*, *Houston, TX*.

In adult rats, protein synthesis in skeletal muscle and adipose tissue increases in response to pharmacological doses of leucine (Leu) administered orally. In neonatal pigs, a physiological increase in plasma leucine stimulates protein synthesis in skeletal muscle without increasing hepatic protein synthesis. However, the effect of a physiological increase in plasma leucine on renal and adipose tissue on protein synthesis has not been investigated in neonates, an anabolic population highly sensitive to amino acids and insulin. Thus, 11 crossbred pigs were food-deprived for 14 h and intra-arterially infused with Leu (0 or 400 $\mu mol \bullet kg^{-1} \bullet h^{-1}$). Protein synthesis and the activation of translation initiation factors were measured after 60 min in gastrocnemius muscle, kidney, and adipose. We have previously shown that this Leu infusion protocol increases plasma Leu to levels that mimic the physiological postprandial level. The elevation in plasma Leu increased the phosphorylation of eukaryotic initiation factor (eIF) 4E binding protein-1 (4E-BP1) in gastrocnemius muscle and kidney ($P < 0.0001$) and adipose tissue ($P = 0.06$). Infusion of Leu increased ($P < 0.04$) the phosphorylation of ribosomal protein (rp) S6 kinase (S6K1) in gastrocnemius muscle and adipose tissue but not in kidney ($P = 0.21$). A concomitant increase ($P < 0.03$) in the phosphorylation of rpS6 was measured in gastrocnemius muscle and adipose tissue but not in kidney ($P = 0.12$). Fractional rates of protein synthesis were increased in gastrocnemius muscle ($P = 0.003$) but not in adipose ($P = 0.29$) or renal ($P = 0.64$) tissues. The results show that a physiological increase in plasma leucine in neonatal pigs stimulates protein synthesis in skeletal muscle in association with the activation of translation initiation factors. However, leucine does not increase protein synthesis in adipose or renal tissues despite increased activation of translation initiation factors. (NIH AR 44474 and USDA 58-6250-6-001)

Key Words: Leucine, Protein Synthesis, Translation Initiation Factor

619 Developmental expression and resveratrol regulation of the porcine lipoprotein lipase (LPL) gene. T. Z. Shan*, Y. Z. Wang, J. X. Liu, and Z. R. Xu, *Institute of Feed Science*, *Hangzhou, Zhejiang,China*.

Two experiments were conducted to evaluate the developmental expression of the porcine LPL in porcine adipose tissues and resveratrol (RES) regulation of LPL in stromal-vascular (SV) cell cultures. In experiment 1, thirty female (Duroc – Landrace – Yorkshire) pigs in five groups of six pigs each, aged at 1 d, 7, 14, 21 and 28 wk were used to study the gene expression of LPL in subcutaneous adipose tissue (SAT), peritoneal adipose tissue (PAT) and omental adipose tissue (OAT) by means of semi-quantitative RT-PCR. In experimental 2, adipose tissue from 7 d-old female (Duroc – Landrace – Yorkshire) pigs was digested and SV cells were obtained and seeded at a density of 3 – 104 cells/cm2 on six-well (35-mm) tissue culture plates in DMEM/F12 medium containing 10% fetal bovine serum (FBS). After 10 d of growing, cultures were washed free and used for three treatments (6 replicates per treatment) for 24 h. The treatments were: control group, DMEM/F12 medium +10% FBS; RES group, DMEM/F12 medium + 10% FBS + 80 Î¼M RES; insulin group, DMEM/F12 medium +10% FBS + 100nM insulin. The results showed that there were two distinct phases of changes in adipose tissue LPL mRNA level. In the first phase (from 1 d to 7 wk), LPL mRNA level significantly increased ($P < 0.01$), and this phase was characterized by a strong positive correlation between LPL mRNA level and adipose index as well as body weight. In the second phase (from 7 to 28 wk), LPL mRNA level gradually decreased, and the LPL mRNA levels were inverse correlated significantly with both the body weight and the adipose index. Body weight and adipose index increased significantly with age ($P<0.01$). The SV cell cultures results showed that supplemental RES significantly increased the LPL gene expression by 33.0% ($P<0.05$) as compared with the control and increased by 39.7% ($P<0.05$) as compared with the insulin group. There were no difference between insulin treatment and the control. These results could provide some information for practical methods of regulating and improving efficiency of lean meat production and meat production quality.

Key Words: Lipoprotein Lipase, Resveratrol, Pig

620 Effects of dried distillers grains and conjugated linoleic acid on gene expression for key enzymes in fatty acid synthesis. H. M. White*, S. S. Donkin, M. A. Latour, and S. L. Koser, *Purdue University*, *West Lafayette, IN*.

Feeding distillers dried grains with solubles (DDGS) to swine may adversely affect carcass fat quality. Commercial gilts were fed DDGS at 0, 20, or 40 percent of total ration during the last 30 days of the finisher phase. Beginning ten days prior to slaughter, one-half of each DDGS group received either 1% conjugated linoleic acid (CLA) or 1% choice white grease. At slaughter, liver was collected for RNA isolation and backfat was collected for fatty acid and mRNA analysis. Abundance of fatty acid synthase (FAS), carnitine palmitoyl transferase I (CPT-I), acetyl-CoA-carboxylase (ACC), stearoyl-CoA desaturase (SCD1), and glycerol-3-phosphate dehydrogenase (GAPDH) mRNAs were determined using Quantitative Real-Time PCR. Abundances of mRNA for lipogenic genes were normalized to GAPDH expression within each sample. Abundance of FAS, CPT-I, ACC and SCD1 mRNAs in adipose and liver samples were not different ($P > 0.05$) for DDGS and control pigs. The addition of CLA to the diets did not alter ($P > 0.05$) FAS or CPT-I but tended to decrease abundance of ACC ($P = 0.10$) and SCD1 ($P < 0.15$) mRNA levels in adipose tissue. The ratio of saturated to unsaturated fatty acids was decreased ($P < 0.05$) with DDGS (0.64, 0.57, and 0.54 ± 0.01 for 0, 20, and 40% DDGS respectively) and was increased from 0.56 to 0.61 ± 0.01 with CLA. Feeding DDGS decreased pork quality as determined by decreased ratios of saturated:unsaturated fatty acids. There was no interaction effect ($P > 0.05$) for DDGS and CLA on any of the transcripts measured or measures of pork quality. These data indicate that the effects of DDGS to reduce pork quality are not linked to changes in lipogenic gene expression. Feeding CLA leads to increased pork quality through alterations in SCD1 to increase the ratio of saturated to unsaturated

fatty acids. Furthermore, DDGS and CLA appear to act in opposing directions on pork quality yet only CLA impacts lipogenic gene expression in adipose tissue.

Key Words: Distillers Grains, Conjugated Linoleic Acid, Gene Expression

621 Effect of dietary protein fluctuations and Paylean® on performance and carcass traits of finishing pigs. M. S. Edmonds*[1] and D. H. Baker[2], [1]*Kent Feeds, Inc.*, *Muscatine, IA*, [2]*University of Illinois*, *Urbana*.

Two trials with finishing pigs were conducted to evaluate the effects of fluctuating dietary CP levels and ractopamine (Paylean®, Elanco Animal Health) on performance and carcass traits. In Trial 1, 408 finishing pigs (mixed sex) were assigned to one of four treatments. Average initial and final weights were 89 and 123 kg, respectively. Pigs on treatments 1-4 were fed 16, 11, 16 or 13% CP from wk 0 to 2, respectively. During wk 2-5, the pigs were then fed 15, 18.33, 18 or 20% CP for treatments 1-4, respectively, with treatments 3 and 4 also containing supplemental Paylean (10 mg/kg) during wk 2-5. Overall (wk 0-5), gain, gain:feed, loin depth, percentage of lean and dressing percent were improved (P≤.05) from supplemental Paylean. No significant overall (wk 0-5) treatment differences due to protein regimen occurred between treatments 1 and 3 compared with treatments 2 and 4. Trial 2 involved 172 finishing pigs (mixed sex) in two treatments. Average initial and final weights were 91 and 136 kg, respectively. The diets consisted of: 1) control (16% CP from d 0-14, 18% CP + Paylean (5 mg/kg) from d 14-24, and 18% CP + Paylean (10 mg/kg) from d 24-35); 2) extreme CP variations (ECPV = 12.5% CP from d 0-14, 20.33% CP + Paylean (5 mg/kg) from d 14-24, and 20.33% CP + Paylean (10 mg/kg) from d 24-35. During d 0-14, pigs on the ECPV treatment (12.5% CP) had reduced (P≤.05) gains (-12.8%) and poorer gain:feed ratios (-11.7%) compared with those on the control diet (16% CP). During d 14-35, however, pigs on the ECPV treatment (20.33% CP) had improved (P≤.08) gains (+5.8%) along with a 5.1% improvement in gain:feed compared with those on the control diet (18% CP). Despite the wide dietary CP fluctuations for pigs in Trial 2, performance, gain:CP intake, and carcass traits were similar for both treatments over the 35-d test period. These data suggest that pigs can exhibit compensatory responses to varying CP levels and can perform as well as pigs fed diets with more constant levels of CP.

Key Words: Protein Level, Pigs, Compensatory Growth

622 Determining the optimum dietary tryptophan to lysine ratio in 25 to 40 kg growing pigs. A. D. Quant*[1], M. D. Lindemann[1], G. L. Cromwell[1], B. J. Kerr[2], and R. L. Payne[3], [1]*University of Kentucky*, *Lexington*, [2]*USDA*, *Ames, IA*, [3]*Degussa Corporation*, *Kennesaw, GA*.

There continues to be discussion regarding the optimum dietary Trp:Lys ratio in pigs. Some of the variation in results reported in the literature may be due to whether the ratios are stated on a total or digestible amino acid basis, and whether Lys was truly below a known requirement. After determination of a SID Lys requirement for similar size pigs, a 21-d study was conducted to determine the optimum standard ileal digestible (SID) Trp:Lys ratio in growing pigs fed a corn-soybean meal diet based on growth performance and plasma urea N (PUN) concentrations. Crossbred pigs (n=120; initial BW: 25.78 ± 2.47 kg) were blocked by gender and BW and allotted to 5 treatments with 5 pigs/pen. Graded levels of crystalline Trp were added to the basal diet, which contained 0.66% SID (0.75% total) Lys, to create various Trp:Lys ratios (SID/total basis; 12.43/14.22%, 13.92/15.54%, 15.42/16.86%, 16.92/18.18%, and 18.42/19.50%). Pigs were allowed ad-libitum access to feed and water throughout the entire experimental period. Following evaluation of the linear and quadratic nature of the responses by ANOVA, broken-line regression analysis was used to determine the optimum Trp:Lys ratio. As the SID Trp:Lys increased from 12.43% to 18.42%, ADG increased (0.56, 0.65, 0.79, 0.79, and 0.81 kg/d) linearly ($P < 0.001$) and quadratically ($P = 0.009$) with an optimum SID Trp:Lys ratio estimate for ADG of 15.70% ($P < 0.001$). ADFI increased (1.31, 1.46, 1.73, 1.67, and 1.73 kg/d) linearly ($P < 0.001$) and quadratically ($P = 0.007$) with an optimum SID Trp:Lys ratio of 15.50% ($P < 0.001$). Feed:gain decreased (2.34, 2.27, 2.19, 2.16, and 2.13 kg/d) linearly ($P < 0.001$) but not quadratically ($P = 0.36$). PUN decreased (10.43, 9.30, 8.21, 8.55, and 9.25 mg/dL) linearly ($P = 0.069$) and quadratically ($P = 0.015$) and the optimum SID Trp:Lys ratio was 15.64% ($P = 0.007$). The overall optimum SID Trp:Lys ratio was determined as 15.61% based on the mean of the estimates for growth performance and PUN concentrations which equates to 17.02% on a total amino acid basis.

Key Words: Lysine, Tryptophan, Pigs

623 Tryptophan improves weight gain associated with increased plasma ghrelin level induced by oral ingestion of tryptophan in weaned pigs. J. Yin*, H. Zhang, and D. Li, *China Agricultural University*, *Beijing, China*.

Two experiments were conducted to determine whether ghrelin, a 28-amino acid peptide produced mainly by the stomach, was involved in tryptophan-mediated growth stimulation in swine. In experiment one, 48 crossbred barrows (8.23±0.13 kg) were housed individually and randomly allotted to 6 treatments with a 2×3 factorial design to test the effects of food intake (ad lib vs. limit fed) and tryptophan level (0.12, 0.19 and 0.26%) on growth performance. At the end of the 21-day experiment, plasma was sampled and insulin and acylated ghrelin were assayed using commercial available kits. Ad lib fed pigs gained more weight, but had poorer feed conversion than limit fed pigs. Weight gain, food intake and feed conversion all improved with increased dietary tryptophan. In limited fed groups, pigs pair-fed the same amount of feed whose weight gain was improved by 0.19 and 0.26% tryptophan diet relative to 0.12% tryptophan diet. Ad lib feeding increased plasma insulin. However, plasma insulin was unaffected by the level of dietary tryptophan. Plasma ghrelin levels and ghrelin mRNA level in gastric fundus and duodenum were significantly higher in pigs fed 0.19 and 0.26% tryptophan diet compared with pigs fed 0.12%. In the second experiment, 18 weaned crossbred barrows were divided into three treatments involving oral infusion of saline, tryptophan (40 mg/kg BW) or 5-Hydroxytryptophan (40 mg/kg BW). After 7-day interval, pigs were subjected to jugular vein infusion of the same amount of saline, tryptophan or 5-hydroxytryptophan. Plasma ghrelin levels at 20, 40 and 60 min after treatment were increased by oral ingestion rather than vein infusion of tryptophan. Oral ingestion of tryptophan increased food intake 2, 8, and 24 hrs after ingestion.

Both oral ingestion and jugular vein infusion of 5-hydroxytryptophan induced lower food intake than the saline control. In conclusion, tryptophan increased weight gain and food intake may be induced by raised plasma ghrelin which triggered by oral ingestion rather than jugular vein infusion of tryptophan.

Key Words: Tryptophan, Ghrelin, Growth

624 Nitrogen balance, ammonia and odor emissions in growing pigs fed reduced crude protein diets. D. V. Braña*[1,2], H. A. Rachuonyo[1], and M. Ellis[1], [1]*University of Illinois*, *Urbana*, [2]*INIFAP*, *Queretaro, Mexico*.

The effect of reducing dietary CP level in the diet of growing pigs (20.5 ±1.8 kg) was evaluated in two experiments. The treatments consisted of 2 diets formulated to contain either a normal or a reduced CP level (19 or 14%), where the true ileal digestible lysine (0.85%), energy level (3.33 Mcal ME/kg), and ideal AA patterns (Lys, Thr, Met, and Trp) were kept constant. Study 1 was conducted to measure the amount of nitrogen loss as aerial ammonia and odor offensiveness in the air from pigs (n=24; from 17.9 ±0.76 to 30.5 ±1.02 kg of BW) confined in dynamic airflow chambers for 21 days. Study 2 was carried out using the same diets, to evaluate the impact on N balance from pigs (n=24; from 17.7 ±1.29 to 21.4 ±1.72) confined individually in metabolic crates. In Study 1, reducing dietary CP did not affect ($P > 0.05$) growth performance, but tended to decrease the slurry pH ($P = 0.09$) from 6.7 to 6.2 ±0.18. There was an interaction ($P < 0.001$) between diet and sampling day; initial ammonia levels were similar ($P > 0.1$) for the two dietary treatments, however, after 10 d on the study ammonia levels were lower ($P < 0.001$) for the reduced crude protein diet. Odor analyses from samples taken on d 14 and 21, assessed by olfactometry with an 8-member panel, did not differ by treatment (511.7 and 540.0 ±115.58 odor threshold, respectively, for the reduced and normal CP diets; $P > 0.2$), but did differ ($P < 0.01$) by sampling day, as the odor intensity in both diets increased with time (440.1 and 611.6 ±111.29 threshold values at day 14 and 21, respectively). For Study 2, N intake was reduced 26.6% ($P < 0.001$) by the reduced CP diet. Fecal N excretion was similar ($P > 0.2$) for both diets, however, urinary N excretion differed ($P < 0.001$). Reducing CP decreased ($P<0.001$) urinary N excretion by 56% and total N excretion by 41%. Overall, every one percentage unit reduction in CP (combined with AA supplementation) lowered total N losses (fecal + urinary) by 8% and ammonia production by 15%, but did not change odor intensity.

Key Words: Ammonia, Odor, Nitrogen Balance

625 Performance of pigs fed diets supplemented with DL-Methionine or liquid MHA-FA from 6 - 25 kg. O. S. Santos*[1], A. B. Borbolla[1], A. P. Pineda[1], R. F. Flores[1], A. P.-S. Pineli-Savedra[2], and D. H. Hoehler[3], [1]*Universidad Nacional Autónoma de México*, *Mexico City, Mexico*, [2]*CIAD*, *Hermosillo, Sonora, Mexico*, [3]*Degussa Corporation*, *Kennesaw, GA*.

One hundred and fifty weaned pigs (6.3 ± 1.3 Kg) were randomly allocated into five different treatments consisting of a control diet, and two sources (DL–Met or liquid methionine hydroxy analog MHA-FA), with two levels each of methionine. Pigs were fed a phase 1 (6–8 Kg), phase 2 (8–12 kg) and a phase 3 diet (12 – 25 kg). Lysine (%) and ME (Mcal/kg) of phase 1, 2 and 3 diets were 1.64/3.4; 1.42/3.4 and 1.28/3.3, respectively. Graded levels of DL–Met (treatments 2 and 3) and liquid MHA–FA (treatments 4 and 5) were supplemented at 65/100% corresponding weight/weight ratios. Feeding period was 8 days each for phases 1 and 2, and 20 days for phase 3. Data were subjected to GLM and LSM procedures of SAS. In phase 1, ADG was lowest ($P \leq 0.05$) for control pigs with no significant differences among the other treatment groups (212, 303, 285, 297 and 254 g/d for Trt 1, 2, 3, 4 and 5). ADFI was not different in any treatment evaluated (367, 392, 372, 383 and 367 g/d, for Trt 1, 2, 3, 4 and 5). FC was higher ($P \leq 0.05$) for control, with no difference in the other treatments (1.7, 1.3, 1.3, 1.3, 1.5 for Trt 1, 2, 3, 4, and 5). In phase 2, ADG was not different among Met-included groups, however, control pigs showed a reduced ($P = 0.08$) gain (430, 507, 508, 493 and 512 g/d for Trt 1, 2, 3, 4 and 5). ADFI was not affected by either source or level of Met (695, 728, 740, 732, and 747 g/d for Trt 1, 2, 3, 4 and 5). No differences were detected among the sources or levels of Met (1.6, 1.5, 1.5, 1.5 and 1.5 for Trt 1, 2, 3 , 4 and 5). In phase 3 –in contrast to previous phases– ADG was not different between control and treatment groups (562, 585, 577, 578 and 560 g/d for Trt 1, 2, 3, 4 and 5). ADFI increased ($P \leq 0.05$) when Met was included in treatment 2 and 4, as compared to control pigs (1038 and 1030 vs. 955 g/d, respectively). Trt 3 and 5 was not different to control. FC was not significantly influenced by either treatment (1.7, 1.8, 1.7, 1.8, 1.8 for Trt 1, 2, 3, 4 and 5).

Key Words: DL-Methionine, Pigs, MHA-FA

626 Low protein diets for pigs treated with ractopamine. G. E. Lanz A*[3,1] and J. A. Cuaron I[2], [1]*Paiepeme A.C.*, *Queretaro, Mexico*, [2]*CNI-Fisiologia Animal, INIFAP*, *Queretaro, Mexico*, [3]*FESC UNAM*, *Ajuchitlan, Queretaro, Mexico*.

The aim of this experiment was to demonstrate that RAC may be used with diets containing less than 16% crude protein (CP), as long as a 0.82% level of true ileal digestible lysine (LysD) is kept and the relation with the other limiting amino acids is maintained, obtaining favorable results for lean tissue gain. A total of 40 barrows were used with an initial weight of 80 ± 8.95 kg. Animals were allotted to 4 treatments 1) Positive Control: 16% CP + 0.60% LysD; 2) Negative Control: 14% CP + 0.60% LysD; 3) RAC normal protein: 16% CP + 0.82% LysD + RAC; 4) RAC lower protein: 14% CP + 0.82% LysD + RAC, each with 10 replicates per treatment. The RAC dosage was 5 ppm for the first 14 days and 10 ppm for the last 7 days. Levels of LysD were established as the population's requirement and according to the expected response of lean growth by RAC. According to LysD, limiting amino acids were included in concentrations sufficient to meet an Ideal Protein pattern, for control pigs, and adjusting the Threonine:Lysine ratio to 64% for pigs treated with RAC. Pigs were weighed every 7 days until the end of the experiment. Daily feed intake (DFI), daily bodyweight gain (DBG), feed efficiency (GxF), and daily lean tissue gain (DLTG), were estimated. Animals were humanly sacrificed to estimate carcass and industrial lean cuts yield. There were no differences by protein level and there were no interactions between RAC and protein level ($P \geq 0.05$). The RAC effects were clear, despite the protein level in diet. In both treatments with RAC, body weight gain (ADG), was improved by 11%; feed efficiency was improved by 15%, and FFLG was improved by 39%, compared to pigs not fed RAC. Also RAC improved carcass yield (head and feet on) by more than 1 percent unit; RAC augmented carcass lean cuts by more than

4 kg. Since there were no differences between treatments with RAC, but there were differences with those that did not contain RAC, we conclude that it is possible to use RAC with diets containing less than 16% CP.

Key Words: Ractopamine, Lean Tissue Gain, Carcass Yield

627 Effects of ractopamine level and feeding duration on the performance and carcass characteristics of late finishing market pigs. C. W. Parks*[1], G. L. Allee[2], R. B. Hinson[2], and S. N. Carr[1], [1]*Elanco Animal Health*, *Greenfield, IN*, [2]*University of Missouri*, *Columbia*.

A study was conducted to evaluate the effects of Ractopamine HCl (RAC; Elanco Animal Health, Greenfield, IN) on the performance and carcass characteristics of late-finishing pigs. A total of 1,680 pigs w/ an average BW of 101 kg were used in a 3x2x2 factorial design consisting of 3 RAC levels (0, 5, and 7.4 ppm RAC), 2 RAC feeding durations (21 or 28 d prior to slaughter), and 2 genders (barrows and gilts). Diets were corn-soybean meal based and were formulated to contain 0.94% TID lysine. There were no dose x duration, nor gender x dose interactions; therefore, main effects of dose are presented. Pigs fed 5 and 7.4 ppm RAC had greater ADG (P<0.0001) and G:F compared to controls (P<0.0001). In addition, pigs fed 7.4 ppm had improved ADG (P<0.0001) and G:F (P<0.0001) as compared to pigs fed 5 ppm RAC. Feed intake was unaffected by treatment (P<0.14). Carcass data indicated an increase in HCW (P<0.0001) and yield (P<0.03) in RAC-fed pigs compared to control pigs. There were no differences observed in back fat depth due to treatment (P<0.18). However, there was an increase in LM depth due to both RAC treatments compared to controls (P<0.0001), as well as a significant improvement in lean percentage when feeding 5 ppm RAC compared to controls (P<0.05). These results indicate that RAC at 5 and 7.4 ppm improve the growth performance and carcass characteristics of late-finishing pigs.

Effects of ractopamine dose on performance and carcass characteristics

Measurement	0 ppm RAC	5 ppm RAC	7.4 ppm RAC	SEM
ADG, kg	0.76[a]	0.85[b]	0.91[c]	0.010
ADFI, kg	2.57	2.56	2.60	0.017
G:F	0.30[a]	0.33[b]	0.35[c]	0.003
HCW, kg	89.7[a]	92.2[b]	93.6[c]	0.405
Yield, %	74.8[a]	75.6[b]	75.7[b]	0.260
LM depth, mm	56.1[a]	57.6[b]	58.8[b]	0.340
Backfat depth, mm	17.6	17.0	17.5	0.260
Lean, %	52.9[a]	53.3[b]	53.2[ab]	0.130

[a,b,c] Means differ (P<0.05)

Key Words: Ractopamine, Growth, Pigs

628 The effect of dietary lysine or methionine and copper/manganese on osteochondrosis lesions and cartilage properties in pigs. N. F. Frantz*, J. L. Nelssen, G. A. Andrews, M. D. Tokach, S. S. Dritz, R. D. Goodband, and J. M. DeRouchey, *Kansas State University*, *Manhattan*.

An 84-d growth study with 120 gilts (initially 40.5 kg BW, 10 replications with 2 gilts per pen) was conducted to determine the influence of dietary lysine level and added methionine, copper, and manganese on osteochondrosis (OCD) occurrence in swine. Gilts were fed below (0.71% phase I and 0.53% phase II), at (0.89% phase I and 0.71% phase II), or above (1.16% phase I and 0.98% phase II) their requirement for true ileal digestible lysine (Lys) with standard concentrations or high added methionine (1%), Cu (250 ppm) and Mn (220 ppm) in a 3 × 2 factorial. At the end of the experiment, the distal aspect of the left humerus and femur of 60 gilts (one per pen) was evaluated for incidence of OCD and cartilage samples tested for compression and shear properties. Each joint was sliced into 3 mm sections and given a severity score for abnormalities on the external joint, the underlying articular cartilage surfaces, and physeal growth plate. Increasing dietary Lys increased (P < 0.01) ADG, but feeding high Met/Cu/Mn decreased ADG (P < 0.02). In pigs fed standard Met/Cu/Mn, increasing dietary Lys decreased cartilage shear energy (quadratic, P < 0.01); however, no other instron measurements were affected by Lys (P > 0.24). The addition of high Met/Cu/Mn had no effect on any cartilage instron measurements (P > 0.23). All animals had OC lesions at either the humerus or femur. Overall severity score did not correlate with ADG (R2 = 0.03) or weight (R2 = 0.02). Increasing dietary Lys concentration (P > 0.64) did not effect the overall severity score (abnormalities × severity); however, the addition of high Met/Cu/Mn tended (P < 0.09) to reduce the overall severity score of OC compared to pigs fed diets with normal Met/Cu/Mn. Feeding growing gilts to maximize growth performance with high dietary Lys may increase the severity of OC lesions, while a diet with additional Met/Cu/Mn above requirements may aid in the reduction of OC abnormalities and severity.

Key Words: Finishing Pigs, Osteochondrosis, Cartilage

629 Effects of different Ractopamine withdrawal times on growth performance and fat free lean growth rate in finishing pigs. G. E. Lanz A*[3,1], M. Lucero P[3,1], and J. A. Cuaron I[2], [1]*Paiepeme A.C.*, *Queretaro, Mexico*, [2]*CNI-Fisiología Animal, INIFAP*, *Queretaro, Mexico*, [3]*FESC UNAM*, *Ajuchitlan, Queretaro, Mexico*.

Some programs for the use of Ractopamine–HCl (RAC) include resting periods to avoid receptors saturation. To identify the effects of RAC withdrawal on growth performance and fat free lean growth rate in finishing pigs, 159 pigs (BW = 82 kg) half gilts and barrows, were allotted to 3 diets: 1) Control: 3.35 Mcal ME and 17%CP; 2) RACHP: 3.35 Mcal, 19%PC, 10ppm RAC; 3)RACNP: as control plus 10 ppm RAC. After 21d on trial, all the animals changed to a finisher diet (3.35 Mcal ME/kg, 15%CP, 0.67% digestible Lys) consumed by 0, 7, 14, 21 or 28 d. After each withdrawal time animals were removed from the experiment (5 animals per withdrawal time per diet). Growth performance (ADFI, ADG, and Feed:Gain), and real time ultrasound (Aloka 500) measurements (back fat and loin depth) were taken weekly to estimate lean growth rate. After 21d on Study, RAC pigs were heavier (P≤0.001) than CON pigs; animals on RACNP consumed more feed than RACHP (3.23 vs 3.07 kg/day, respectively, P≤0.05). There was no difference in ADG or Feed:Gain by CP level, but between RAC and CON pigs (P≤0.001). The RAC diets improved FFLG (0.352 vs 0.430 kg/day P≤0.001) compared to CON pigs, but no differences

(P≥0.05) by CP level were detected. After 7 d of RAC withdrawal, ADG was depressed (P≤0.01) compared to CON pigs (0.650 vs 0.836 kg/day, respectively). However, no differences (P≥0.05) were detected at any time during RAC withdrawal for ADFI, F:G back fat or loin depth, as RAC pigs equal CON pigs' growth performance after day 7. The drop in ADG (after 7d) that resulted from RAC withdrawal, denied the advantages of RAC use, this should be considered in use–rest–use programs to establish a resting period no longer than 7 days.

Key Words: Ractopamine, Withdrawal, Finishing Pigs

Nonruminant Nutrition: Understanding Protein Synthesis and Degradation and Their Pathway Regulations

630 Postnatal ontogeny of skeletal muscle protein synthesis in pigs. T. A. Davis*, A. Suryawan, R. A. Orellana, and M. L. Fiorotto, *USDA/ARS Children's Nutrition Research Center, Baylor College of Medicine*, *Houston, TX*.

The neonatal period is characterized by rapid growth and elevated rates of synthesis and accretion of skeletal muscle proteins. The fractional rate of muscle protein synthesis is very high at birth and declines rapidly with development. The elevated capacity for muscle protein synthesis in the neonatal pig is driven by the high ribosome content and, together with an increased efficiency of the translation process, promotes accelerated protein synthesis rates. Feeding profoundly stimulates muscle protein synthesis in neonatal pigs and the response decreases with age. The feeding-induced stimulation of muscle protein synthesis is modulated by an enhanced sensitivity to the post-prandial rise in insulin and amino acids. The developmental decline in the response to insulin and amino acids parallels a marked fall in the feeding-induced activation of translation initiation factors that regulate the binding of mRNA to the 40S ribosomal complex. The abundance and activation of many known positive regulators of the nutrient- and insulin-signaling pathways that are involved in translation initiation are high and that for many negative regulators are low in skeletal muscle of younger pigs. Thus, the activation and/or abundance of the positive regulators, insulin receptor, insulin receptor-substrate-1, phosphoinositide-3 kinase, phosphoinositide-dependent kinase-1, protein kinase B, mammalian target of rapamycin, raptor, ribosomal protein S6 kinase-1, eukaryotic initiation factor (eIF) 4E-binding protein 1, and eIF4E associated with eIF4G are greater in 7- than in 26-day-old pigs. The activation of negative regulators, protein tyrosine phosphatase-1B, PTEN, protein phosphatase 2A, and tuberous sclerosis complex 1/2 are lower in 7- than in 26-day-old pigs. The developmental changes in the abundance and activation of these signaling components likely contribute to the high rate of protein synthesis and rapid gain in skeletal muscle mass in neonates. (NIH AR44474, USDA NRI 2005-35206-15273, USDA CRIS 58-6250-6-001)

Key Words: Swine, Protein Synthesis, Muscle

631 Measuring in vivo intracellular protein degradation rates in animal systems. W. G. Bergen*, *Auburn University*, *Auburn, AL*.

Whole body protein degradation, synthesis and accretion have been determined in animals utilizing isotopic tracers and urinary excretion of irreversible skeletal muscle metabolic end-products combined with various techniques to estimate changes in body protein content. Method refinements have centered on improvements of whole body isotope-kinetic approaches and explorations of tissue specific protein turnover of liver, small intestines and skeletal muscle proteins or specifically myofibrillar, sarcoplasmic, and connective tissue protein fractions of skeletal muscles. Utilizing contemporary GC-MS technology and isotopic infusion strategies, direct measurement of fractional protein synthesis (FSR) with stable isotopes of branched chain amino acids coupled with tissue amino acid specific activity values based on keto leucine or keto valine has emerged as the most robust technique to measure FSR in various tissues in animals and humans. Direct measures of whole body protein degradation or fractional breakdown rate (FBR) based on skeletal muscle irreversible metabolite excretion, such as 3- methyl histidine (3MH), in pigs has severe limitations. Some workers have addressed direct measures of skeletal muscle protein breakdown in pigs utilizing 3MH with compartmental kinetic models, but regrettably such procedures have not widely utilized. Contrariwise, the urinary 3MH excretion method has some merit in ruminants. Our understanding of the mechanisms and regulation of protein synthesis and protein breakdown has advanced to a point where it may be possible to use surrogates/markers to provide directional data, either enhanced or attenuated, for FSR and FBR. Rates of expression or activation status of regulatory transcription factors, initiation factors or signal pathway components, such as mTOR, eIF-4 and PKB, and abundance of mRNA for components of the intracellular proteolytic pathways may be exploited to study relative rates of FSR, FBR, muscle growth and metabolic efficiency in food producing animals.

Key Words: Protein Turnover, Isotope Kinetics, Proteasome

632 The non-lysosomal Ca^{2+}-dependent protein degradation pathway: The calpains, proteasome, and myofibrillar protein turnover. D. E. Goll*, G. Neti, S. W. Mares, and V. F. Thompson, *University of Arizona*, *Tucson*.

It is now clear that proteins in cells turnover metabolically, that the rate of this turnover can vary widely in response to physiological demand, and that turnover of proteins assembled in intracellular structures requires first disassembly of the proteins from the structure followed by their degradation. The proteasome is the major mediator of intracellular protein degradation, but the proteasome cannot degrade proteins assembled in intracellular structures, and the mechanism by which proteins are disassembled before their degradation remains unknown for most structures. It is also unclear how myofibrillar proteins, which must be assembled in myofibrils to be functionally contractile, are removed from this structure before degradation. It was proposed over 30 years ago that the calpains may initiate myofibrillar protein turnover by removing an outer layer of filaments from myofibrils, and that the calpain-removed proteins are then degraded by intercellular proteases, predominantly the proteasome. Studies have reported that striated muscle contains a group of myofilaments, ~ 10-15% of total myofibrillar protein, that can be released from myofibrils by triturating in the presence of ATP. These easily releasable myofilaments (ERMs)