

T115 Predicting beef tenderness: the relationship between myosin light chain 1 and fast myosin heavy chain fragments. R. Johnson*, J. Sawdy, M. Updike, N. St-Pierre, and M. Wick, *The Ohio State University, Columbus.*

A correlation study was conducted to determine the relationship between the electrophoretic fingerprint quantity of myosin light chain I (MLC1) and the electrophoretic fingerprint quantity of fast myosin heavy chain (fMyHC) fragments from longissimus dorsi taken at 36 h post-harvest from cattle with differing Warner-Bratzler shear force values at 7 d. Data were analyzed using SAS; Proc Corr. Although the electrophoretic fingerprint intensities of MLC1 and both fMyHC fragments were predictive of tenderness at 7 d, neither of the two fMyHC fragments band intensities were correlated with each other. However, MLC1 band intensity was found to have a correlation of 0.5 with the individual band intensities of each fMyHC fragment ($p \leq 0.05$). Analyses of these results support the hypothesis that an increased association of MLC1 with fMyHC results in an improvement in meat quality. This implies that fMyHCs that are associated with higher MLC1/MLC3 ratio are more susceptible to proteolytic digestion than are fMyHCs with lower MLC1/MLC3 ratios.

Key Words: Tenderness, Myosin, Fingerprinting

T116 Enhancement with varying phosphate types, concentrations, and pump rates, without sodium chloride on beef biceps femoris quality and sensory characteristics. R. T. Baublits*, F. W. Pohlman, A. H. Brown, and Z. B. Johnson, *University of Arkansas, Fayetteville.*

Beef biceps femoris muscles ($n = 45$) were used to evaluate the effect of enhancement with solutions containing either sodium hexametaphosphate (SHMP), sodium tripolyphosphate (STPP), or tetrasodium pyrophosphate (TSPP) at either 0.2% or 0.4% of product weight, without sodium chloride. All solutions were injected into muscle samples at either 112% (12% pump) or 118% (18% pump) of raw product weight. Muscles enhanced with STPP or TSPP had a higher ($P < 0.05$) pH than SHMP or untreated muscles (CNT), whereas there was no difference ($P > 0.05$) in pH between SHMP and CNT. Muscles enhanced with STPP had less ($P < 0.05$) free water than CNT, whereas SHMP and TSPP did not differ from CNT. However, direct comparison of phosphate types revealed no difference ($P > 0.05$) in free water. Steaks enhanced with SHMP had greater ($P < 0.05$) cooking losses than CNT, whereas steaks treated with STPP or TSPP did not differ ($P > 0.05$) from CNT. Additionally, phosphate inclusion at 0.2% allowed for greater ($P < 0.05$) cooking losses than CNT, whereas 0.4% phosphate inclusion exhibited similar ($P > 0.05$) cooking losses as CNT. Although there were no differences ($P > 0.05$) in cooking loss between pump rates, steaks enhanced at an 18% pump rate had greater ($P < 0.05$) cooking losses than CNT, whereas those enhanced at 12% had similar ($P > 0.05$) cooking losses as CNT. Enhancement with either of the three phosphate types or either concentration did not improve ($P > 0.05$) sensory tenderness or juiciness characteristics compared to CNT, but enhancement at an 18% pump rate al-

lowed for increased ($P < 0.05$) tenderness, compared to a 12% pump rate. These results suggest that, while phosphate enhancement independent of sodium chloride generally produced similar yields and palatability as untreated samples, utilizing higher phosphate concentrations, or utilizing STPP or TSPP effectively retained the additional water associated with solution enhancement, allowing for similar free water and cook yields as untreated samples.

Key Words: Beef, Phosphate, Sodium Chloride

T117 Enhancement effects of phosphate type, concentration, and pump rate, without sodium chloride on beef biceps femoris instrumental color characteristics. R. T. Baublits*, F. W. Pohlman, A. H. Brown, and Z. B. Johnson, *University of Arkansas, Fayetteville.*

Enhancement of beef biceps femoris muscles ($n = 45$) with solutions comprising sodium hexametaphosphate (SHMP), sodium tripolyphosphate (STPP), or tetrasodium pyrophosphate (TSPP) at either 0.2% or 0.4% of product weight, with the exclusion of sodium chloride, was performed to observe the independent phosphate effects on whole-muscle instrumental color during simulated retail display. All solutions were injected into muscle samples at either 112% (12% pump) or 118% (18% pump) of raw product weight. All three phosphate types maintained higher ($P < 0.05$) L^* values than untreated steaks (CNT) through 5 days of display, and SHMP had higher ($P < 0.05$) L^* values than STPP and TSPP through 7 days of display. Additionally, steaks with 0.2% phosphate inclusion were lighter (L^* ; $P < 0.05$) than CNT throughout display, and were lighter ($P < 0.05$) than steaks enhanced with 0.4% phosphates through 7 days of display. Steaks enhanced with TSPP had higher ($P < 0.05$) a^* values than CNT on days 5 and 7 of display, whereas SHMP- or STPP-enhanced steaks had similar ($P > 0.05$) a^* values as CNT. Direct comparison of phosphate concentrations revealed no differences ($P > 0.05$) in a^* values. Steaks enhanced with TSPP had higher ($P < 0.05$) proportions of oxymyoglobin (630/580 nm) than CNT on days 5 and 7 of display. However, direct comparison of phosphate types indicated that TSPP- and STPP-enhanced steaks had similar ($P > 0.05$) oxymyoglobin proportions during display. Phosphate inclusion at 0.4% maintained higher ($P < 0.05$) oxymyoglobin proportions than 0.2% phosphate inclusion through 5 days of display. These results indicate that while 0.2% phosphate concentrations maintain lighter color (L^*), 0.4% concentrations can more effectively retain oxymyoglobin during display. Additionally, steaks enhanced with TSPP were redder (a^*) and had higher oxymyoglobin proportions than untreated steaks during the latter stages of display.

Key Words: Beef, Phosphate, Instrumental Color

T118 Withdrawn.

Nonruminant Nutrition: Amino Acids and Dietary Restrictions

T119 Development of the enzymes of homocysteine metabolism from birth through weaning in the pig. D. M. Ballance* and J. D. House, *Department of Animal Science, University of Manitoba, Winnipeg, MB, Canada.*

In humans, non-human primates and rats, cysteine (CYS) is considered to be a conditionally indispensable amino acid. Developmental delays in the activity levels of a key enzyme from the transsulfuration pathway, cystathionine- β -synthase (CBS) and cystathionine- γ -lyase (CGL) may contribute to the limitation in endogenous CYS availability. As CYS is an important precursor for protein and glutathione synthesis, information on the developmental patterns of these enzymes for the pig is important for the optimization of diets for cysteine delivery, especially when pigs are weaned at an early age. To this end, a study was designed to measure the activities of CBS and CGL, and associated metabolite profiles, from birth through to post-weaning in the pig. Piglets were

collected from eight litters at six time points: Days 0 (pre-suckle), 1, 9, 18 (pre-wean), 19 (post-wean) and 26. Blood was collected and plasma retained for total CYS and homocysteine (HCY) measurements. Piglets were killed by overdose of barbiturates, and livers and kidneys were weighed and retained for CBS and CGL activity measurements and CYS levels. Hepatic activities for both CBS and CGL were low at birth and increased ($P < 0.001$) immediately thereafter. Plasma CYS and HCY levels were lowest at birth and increased 2.5- and 5-fold, respectively, up to weaning, with levels declining post-weaning ($P < 0.001$). Despite changes in enzyme activities and plasma concentrations, hepatic CYS levels were constant from birth through weaning, but increased by 50% at d 26. The current data provide evidence that hepatic CBS and CGL activities increase from birth, providing a partial explanation for changes in plasma CYS and HCY levels. However, hepatic CYS levels appear to be insensitive to changes

in key enzyme activity levels during the suckling period. Factors contributing to the post-weaning changes in metabolite profiles require further attention in order to optimize endogenous CYS supply to the young pig.

Developmental pattern of enzymes of homocysteine metabolism from birth through weaning in the pig

	d 0	d 1	d 9	d 18	d 19	d 26	SEM	P-value
CBS-L	116 ^a	347 ^{a,b}	458 ^{b,c}	471 ^{b,c}	589 ^c	578 ^{b,c}	54	< 0.001
CGL-L	96 ^a	527 ^c	383 ^{b,c}	316 ^c	380 ^{b,c}	359 ^{b,c}	38	< 0.001

Acknowledgements: NSERC

Key Words: Pig, Homocysteine, Sulfur Amino Acid Metabolism

T120 Effects of increasing true ileal digestible amino acid to lysine ratios on grower pig performance. A. Yager*, D. Sholly, L. Wilson, J. Beagle, R. Hinson, K. Saddoris, M. Walsh, B. Richert, A. Sutton, and J. S. Radcliffe, *Purdue University, West Lafayette, IN.*

Two experiments evaluated the effects of increasing the true ileal digestible (TID) amino acid ratios, relative to Lys, on grower pig performance. Pigs (Exp. 1, n = 210; Exp. 2, n = 120) were housed at seven pigs/pen in Exp. 1 and four pigs/pen in Exp. 2. Individual BW and pen feed intakes were recorded weekly and ultrasonic estimates of 10th rib LEA and BF thickness were determined at the start, middle, and end of each experiment on four pigs/pen. All diets were corn-soybean meal based and formulated to meet or exceed all the 1998 NRC nutrient requirements. Diets were fed in two, 3-wk phases. In Exp. 1, Diet 1 (0.35% Lys-HCl), contained 100% NRC TID Lys, TSAA, and Thr. Diets 2-4 were Diet 1 plus a 5% increase in TID Thr, TSAA, or both TSAA and Thr, respectively. Diet 5 was a commercial control (0.13% Lys-HCl). In Exp. 2, Diet 1 (0.35% Lys-HCl) contained 100% NRC TID Lys, Trp, Val, and Ile, and 105% NRC TID TSAA and Thr. Diets 2-5 were Diet 1 plus synthetic Met and Trp, Val, Ile, or all four amino acids to meet the TID amino acid levels in Diet 6, respectively. Diet 6 (0.13% Lys-HCl) served as a commercial control. In Exp. 1, increasing the TID TSAA:Lys and/or the TID Thr:Lys had no effect ($P > 0.10$) on ADG, ADFI, G:F, or 10th rib BF. Pigs fed Diet 5 (commercial control) had higher ($P < 0.05$) overall ADG than pigs fed Diet 1. The overall change in last rib BF tended ($P < 0.10$) to be lower for pigs fed Diet 5 compared to pigs fed Diets 2 and 3. In Exp. 2, increasing the TID amino acid content of the diet had no effect ($P > 0.10$) on ADFI, G:F, or 10th rib LEA. Overall ADG increased ($P < 0.01$) when the TID TSAA and Trp, or Val were increased compared to Diet 1. Increasing the TID Val content increased 10th and last rib BF ($P < 0.05$) compared to all other diets. Pigs fed Diet 4, with added Ile, had smaller increases in LEA compared to pigs fed Diets 1, 2, and 5 ($P < 0.05$). Based on these results, increasing the TID TSAA, Trp, or Val content in high synthetic amino acid diets is necessary to restore performance to that of a commercial diet.

Key Words: Pig, Amino Acids, Growth

T121 Effect of dietary L-Arginine inclusion rate on stress responses in pigs subjected to a high-intensity handling model. M. J. Ritter*¹, M. Ellis¹, D. H. Baker¹, C. R. Bertelsen¹, and K. K. Keffaber², ¹University of Illinois, Urbana-Champaign, ²ELANCO Animal Health, Greenfield, IN.

This study was carried out to investigate the impact of dietary L-arginine on stress responses and plasma acid-base status in finishing pigs subjected to high-intensity handling. A completely randomized design with a 4 × 2 factorial arrangement of treatments was used: 1) dietary arginine (ARG) level (0, 1, 2, and 3%) and 2) gender (barrows and gilts). At 110 kg BW, 96 pigs were allotted to treatments and allowed an 11 d acclimation period after which the treatment

diets were issued, fed for 7 d, and BW and feed intake were recorded. The higher ARG levels (2 and 3%) reduced ($P < 0.05$) final BW, ADG and ADFI when compared to 0 and 1% ARG, which did not differ for these traits. Also, 0 and 1% ARG had higher ($P < 0.05$) G:F ratios than 2% ARG. Gender had no effect on growth performance. At the end of the feeding period, pigs were subjected to a high-intensity handling model. Pigs were moved individually through a course for eight laps and each pig received four shocks from an electric goad per lap. Rectal temperature and blood acid-base status were measured 2 h before (baseline), immediately after, and 2 h post-handling. Diet did not affect acid-base status at any sampling time, while gender differences in acid-base status were small. Rectal temperature was lower ($P = 0.01$) at baseline in pigs fed 2% ARG than in the controls, was lower ($P < 0.05$) immediately after handling in pigs fed 1% ARG than in pigs fed 0 or 2%, but no effects of ARG on rectal temperature were seen 2 h post-handling. Gilts had lower ($P < 0.05$) rectal temperatures than barrows at all three sampling times. The percentage of pigs classified as non-ambulatory, non-injured after handling was lower ($P < 0.05$) in gilts (5.2%) than in barrows (18.8%), but only numerical reductions ($P = 0.28$) were observed for ARG (20.8, 8.3, 14.6, and $4.2 \pm 6.43\%$ for 0, 1, 2 and 3%, respectively). Feeding 2 and 3% ARG adversely affected growth performance, and ARG did not affect blood acid-base status before or after handling.

Key Words: Pigs, Acid-Base, Handling

T122 Effects of protein source and metabolizable energy concentration on the growth of the pancreas, stomach, and small intestine in early-weaned pigs. T. Buhay*, S. Carter, R. Cueno, M. Lachmann, J. Park, and J. Schneider, *Oklahoma State University, Stillwater.*

Previous work from our lab suggests that CP source may affect ME utilization in early-weaned pigs. Therefore, as part of a larger study to examine the effects of CP source (soy protein concentrate, SPC vs. spray-dried porcine plasma, SDPP) and ME level on organ and pancreatic enzyme development, an experiment utilizing 100 pigs (avg BW = 5.2 kg; avg age = 18 d) was conducted to determine the effects of these factors on the growth of the pancreas, stomach, and small intestine in weanling pigs. Pigs were allotted to four dietary treatments (five pigs/pen) in a 2 × 2 factorial arrangement with two CP sources (SPC vs. SDPP) and two ME levels (3,523 vs. 3,323). All diets (1.35% digestible Lys) contained corn, soybean meal, dried whey, lactose, and fishmeal. SDPP replaced SPC on an equivalent digestible lysine basis and the dietary ME level was adjusted using soybean oil. On d 0, 3, 7, and 14, one pig was removed from each pen, weighed, and euthanized. The pancreas, stomach, and small intestine (SI) were excised carefully, emptied and washed as needed, and weighed. Overall, the growth of the pancreas, stomach, and SI were highly correlated ($r > 0.85$, $P < 0.01$) with BW. Furthermore, the weights of these organs were associated with increasing BW and age ($R^2 > 0.70$, $P < 0.01$). There were no day by treatment interactions; and ME level did not affect ($P > 0.10$) the growth of the organs on any day. However, CP source affected the growth of the organs such that on d 7, SI weight was lower ($P < 0.05$) in pigs fed SDPP compared to pigs fed SPC. On d 14, both the individual and combined weights of the stomach and SI were lower ($P < 0.05$) in pigs fed SDPP compared to those fed SPC. There were no CP source by ME level interactions. These results suggest that CP source (SPC vs. SDPP), but not ME level, can dramatically affect the growth of the stomach and SI. Also, it appears that BW may be used to predict the weight of the pancreas, stomach, and small intestine in early-weaned pigs.

Key Words: Pig, Protein, Organ Weights

T123 Impact of spray-dried plasma form and feeding duration on broiler performance. J. M. Campbell*¹, J. D. Crenshaw¹, L. E. Russell¹, and H. J. Koehn², ¹APC, Inc., Ankeny, IA, ²ARKO Laboratories, Ltd., Jewell, IA.

An experiment was conducted with 240 Ross × Ross 308 male broilers (six broilers per pen, eight pens per treatment). The effect of duration of feeding (continuous or discontinued after d 14) and form (granular vs. powder) of spray-dried plasma (SDP) on performance and mortality of broilers under simulated

production conditions was evaluated. Dietary treatments were control (0% SDP) or SDP (1.0, 0.5, and 0.25% for day 0-14, 15-28, and 29-35, respectively) as powder or granular included in the pellet and fed continuously (d 0 to 35) or discontinued after d 14. During the experiment, broilers developed necrotic enteritis and tissue cultures were positive for *E. coli* and *Salmonella*. Addition of SDP to the feed improved ($P < 0.05$) ADG, feed intake, and feed efficiency for each time period of the study (d 0 to 14, 15 to 28, 29 to 35, and 0 to 35). Continuous feeding of SDP improved ($P < 0.05$) ADG, feed intake, and feed efficiency from d 15 to 35 compared to broilers fed SDP only to d 14. Survival was improved ($P < 0.05$) in broilers consuming SDP either for 14 d only or for 35 d continuously compared to control broilers. Spray dried granular plasma was more effective than spray dried powder plasma. The results of this experiment confirmed that SDP improved growth rate, feed intake and feed efficiency of broilers. The response to SDP was independent of age of the broiler.

Key Words: Broiler, Spray-Dried Plasma, Necrotic Enteritis

T124 Effect of mash conditioning temperature on performance of broilers fed pellets containing spray-dried plasma. J. M. Campbell^{*1}, J. D. Crenshaw¹, L. E. Russell¹, K. C. Behnke², and P. M. Clark², ¹APC, Inc., Ankeny, IA, ²Kansas State University, Manhattan.

Two experiments evaluated the effects of mash conditioning temperature on performance of broilers fed pelleted diets containing spray-dried plasma (SDP). In Exp. 1, 308 Ross x Ross male broilers were randomly assigned to one of three dietary feeding programs (six broilers per pen and 10 pens per treatment). The feeding program consisted of three phases with starter from d 0 to 14, grower from d 15 to 28, and finisher from d 29 to 42. Within each phase, treatments were formulated to be equal in lysine and metabolizable energy. All diets were conditioned for 15 seconds at 85°C then pelleted through a 4 mm x 32 mm die. Dietary treatments were: control (0% SDP); SDP (1.0, 0.5, and 0.25% for phase 1, 2, and 3, respectively) applied post-pelleting, and SDP (1.0, 0.5, and 0.25% for phase 1, 2, and 3, respectively) mixed into the mash and then pelleted. Exp. 2 was designed similarly to Exp. 1, with the exception that only eight pens (six broilers per pen) per treatment were used and two additional treatments were added to include SDP mixed into the mash then pelleted at either 90 or 95°C. In Exp. 1, ADG and feed intake were improved ($P < 0.05$) for broilers fed SDP from d 0 to 28 with greater body weight at d 42. In Exp. 2, both in early (d 0 to 28) phases and overall (d 0 to 42), broilers fed SDP had improved ($P < 0.05$) gain and efficiency. Body weight was improved ($P < 0.05$) due to plasma consumption compared to controls on d 14 to 42. Overall, results of both experiments indicated that mash conditioning temperature from 85 to 95°C does not impair the positive growth effects of SDP in pelleted broiler feed.

Key Words: Spray-Dried Plasma, Broiler, Mash Conditioning Temperature

T125 A spreadsheet program for identifying the limiting amino acids in various combinations of feed ingredients for swine. G. L. Cromwell* and B. G. Kim, University of Kentucky, Lexington.

One of the most effective methods of reducing N excretion by pigs is to reduce the dietary protein level and supplement with amino acids (AA). However, effective AA supplementation requires knowledge of the order in which AA become limiting as dietary protein is reduced in diets containing various combinations of feed ingredients, as well as knowledge of the relative magnitude of difference between the AA in their limitation order. This information is fairly well known for grain-soy diets, but is less well known for diets containing various combinations of feedstuffs. A user-friendly Microsoft® Excel program was designed to address this issue for pigs at all stages of growth and for gestating and lactating sows. The program allows users to include numerous feedstuffs that contribute AA to the diet and graphically illustrates the order that AA become limiting as the dietary level of the major protein source(s) decreases. The program converts the dietary concentrations of AA to a percentage of the pig's requirement, then regresses those percentages on the inclusion level of the major protein sources in the diet. As the protein source decreases from a level that

meets >100% of the pig's AA requirements to a level of zero, the regression line for each AA intersects a horizontal line, which is set as 100% of the requirement for each AA. Proceeding along the horizontal line, one can readily assess the order and spacing between the AA as they become limiting. The program is applicable for AA on a total, apparent digestible, or true digestible basis. An economic component also is included. The validity of the output is dependent upon the accuracy of the AA requirements and the accuracy of the AA analysis of the feedstuffs. Information generated from this program allows nutritionists to identify potentially limiting AA in different feedstuff or growth stage scenarios. It will also help to more precisely determine the amount of intact protein that can be replaced with AA to minimize N excretion when various combinations of feedstuffs are fed to pigs.

Key Words: Amino Acid, Diet Composition, Pig

T126 Apparent and true digestibility and endogenous urinary excretion of amino acids in adult roosters. L. Babinszky^{*1}, J. Tossenberger¹, and A. Lemme², ¹University of Kaposvár, Department of Animal Nutrition, H-7400 Kaposvár, POB 16, Hungary, ²Degussa AG, Feed Additives, D-63457 Hanau, Germany.

Digestibility of dietary amino acids (AA) might be most accurate considering both separation of faecal and urinary AA excretions, and endogenous AA excretion. Therefore, the aim of the experiment was to determine endogenous faecal and urinary AA excretions and to examine the difference between apparent [(AA intake - AA faeces)/AA intake] and true AA digestibility [(AA intake - AA faeces + AA faeces_{end})/AA intake] and apparent [(AA intake - AA faeces - AA urine)/AA intake] and true AA availability [(AA intake - AA faeces - AA urine + AA faeces_{end} + AA urine_{end})/AA intake] in adult roosters. Endogenous faecal and urinary AA excretions were measured by feeding a N-free diet. Using these data, apparent or true AA digestibility and availability of a test diet containing 13.4 MJ AMEn, 160 g CP, 9.9 g Lys, 0.37 g Met and 0.30 g Cys per kg was determined. Both trials were conducted with a total of 16 adult colon-cannulated Hy-Line brown roosters (four birds/treatment in two replicates). Trial data were analyzed by means of ANOVA. Adult roosters excreted a total of 4.7, 6.7, and 15.5 mg/kg^{0.75}/d endogenous Met, Cys and Lys, respectively, of which 9, 32 and 28 % were contributed by urinary excretions. The differences between apparent and true AA digestibility of the test diet, e.g. 0.902 vs. 0.939, 0.878 vs. 0.929 and 0.888 vs. 0.926 for Met, Cys and Lys, respectively, were significant ($P \leq 0.05$). The differences were also significant ($P \leq 0.05$) between the apparent and true availability of the dietary Met (0.895 vs. 0.936), Cys (0.831 vs. 0.905) and Lys (0.865 vs. 0.917), respectively. In conclusion, differences between true digestibility and true availability ranged only between 0.003 (Met) and 0.024 (Cys) suggesting only a marginal impact of urinary AA losses on their dietary availability. However, substantial differences between apparent and true AA digestibility/availability were confirmed.

Key Words: Rooster, Amino Acids, Endogenous Urinary Excretion

T127 Protein restriction during the weaner phase affects subsequent feed intake, growth performance and carcass characteristics. C. L. Collins^{*1,3}, D. J. Henman², B. J. Leury³, R. G. Campbell⁴, B. G. Tatham¹, and F. R. Dunshea^{1,3}, ¹Primary Industries Research Victoria, Werribee, Victoria, Australia, ²QAF Meat Industries, Corowa, NSW, Australia, ³Faculty of Land and Food Resources, University of Melbourne, Parkville, Victoria, Australia, ⁴Ausgene International, Gridley, IL.

Protein restriction during the early stages of rearing results in subsequent compensatory growth, although the impact of the severity and timing of the restriction is unclear. To examine these effects, 400 boars and 400 gilts were selected at 28 days of age and allocated to 40 pens of 20 pigs per pen. Pigs were offered ad libitum access to commercial weaner/grower/finisher diets from weaning to slaughter, except during their allocated restriction period. The periods of protein restriction were 4 to 7 weeks of age (Phase 1) and 7 to 10 weeks of age (Phase 2). Pens of 20 pigs of each sex were allocated to one of five treatments:

control, phase 1 available (Av) Lys:DE restricted by 20%, phase 1 Av Lys:DE restricted by 40%, phase 2 Av Lys:DE restricted by 20%, and phase 2 Av Lys:DE restricted by 40%. Daily gain was reduced ($P < 0.05$) during all periods and levels of restriction with the greatest effects occurring at the highest level of restriction and during the second period of restriction. Dietary protein restriction resulted in compensatory growth in all restriction groups with the responses being most pronounced in the early finisher (116-138 days of age) phase (746, 726, 847, 756 and 813 g/d for control, phase 1 20% restriction, phase 1 40% restriction, phase 2 20% restriction, and phase 2 40% restriction, respectively; SED = 34 g/d, $P < 0.001$). The improvements in daily gain over this period were largely due to an improvement in FCR (2.58, 2.73, 2.39, 2.48 and 2.39; SED = 0.092, $P < 0.001$). While the increased compensatory gain was insufficient to return carcass weights to control values (71.4, 68.8, 68.3, 67.8, 67.1 kg; SED = 1.40, $P < 0.024$) this may be offset by a reduction in P2 backfat (9.5, 8.9, 9.3, 9.2, 8.9 mm; SED = 0.24, $P = 0.079$) and cost of feed. These data suggest that strategic lysine restriction may be commercially applicable particularly when protein costs are high and when producers are penalised on backfat.

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Key Words: Compensatory Growth, Pig, Dietary Protein

T128 Effect of early dietary amino acid restrictions on serum metabolites in pigs selected for lean growth efficiency. H. R. Mule*, L. I. Chiba, J. Fabian, D. L. Kuhlert, S. B. Jungst, L. T. Frobish, K. Nadarajah, W. G. Bergen, and E. G. Welles, *Auburn University, Auburn, AL*.

Thirty-two select line (SL) and 32 control line (CL) pigs (average, 20 kg) were used in each of the two experiments to assess the effect of dietary AA restrictions during the grower (G) phase on serum metabolites. In Exp. 1, 16 pens with two gilts and 16 pens with two barrows per pen were assigned within the genetic line to G diets (6.1 or 11.1 g Lys/kg) and finisher (F) diets (6.1 or 8.9 g Lys/kg) in a 2 x 2 x 2 factorial arrangement. Similarly, 16 pens with two gilts and 16 pens with two barrows per pen were assigned within the genetic line to G diets (5.0, 7.0, 9.0, or 11.0 g Lys/kg) in a 2 x 4 factorial arrangement, and then offered common F 1 and 2 diets in Exp. 2. In both experiments, blood samples were collected at the end of the G and F phases. In Exp. 1, the SL pigs had higher concentrations of cholesterol (Chol; $P = 0.009$) during the G phase and triglyceride (TG; $P = 0.036$) and albumin (Alb; $P = 0.016$) during the F phase than the CL pigs. Serum concentrations of Alb ($P = 0.001$) during the G phase and Chol ($P = 0.029$) and Alb ($P = 0.001$) during the F phase were greater in pigs fed the high-Lys G diet than those fed the low-Lys G diet. During the F phase, TG ($P = 0.029$), Alb ($P = 0.005$), and glucose ($P = 0.027$) concentrations were reduced in pigs fed the high-Lys F diet as compared with those fed the low-Lys F diet. In Exp. 2, the SL pigs had greater concentrations of TG ($P = 0.001$), total protein (TP; $P = 0.041$), and glucose ($P = 0.005$) during the G phase and TG ($P = 0.031$) and TP ($P = 0.001$) during the F phase than the CL pigs. As the Lys content of G diets increased, Chol was reduced [linear (Ln), $P = 0.005$; quadratic, $P = 0.026$; cubic, $P = 0.039$], but TP (Ln, $P = 0.040$) and Alb (Ln, $P = 0.001$) concentrations were increased during the G phase. Serum Chol was correlated negatively with Lys intake ($r = -0.38$; $P = 0.039$) and urea N ($r = -0.39$; $P = 0.032$) during the G phase in Exp. 1 and positively with ultrasound backfat ($r = 0.78$; $P = 0.001$) at the end of the G phase in Exp. 2. The results indicated that the metabolic profile can be affected by both the genotype and early dietary AA restrictions.

Key Words: Pigs, Genotypes, Amino Acid Restrictions

T129 Effect of early feed restriction on carcass yield, carcass components and gonads of Japanese quail breeder. G. Contreras*, C. B. Castro, J. J. Portillo, and F. G. Rios, *FMVZ-Universidad Autónoma de Sinaloa, Culiacan, Sinaloa, Mexico*.

The objective of this study was to determine the effect of early feed restriction (FR) on carcass yield, carcass components and gonads weight of Japanese quail breeder. The breeders were restricted in rearing period during three weeks (two to five weeks old) by feeding ad libitum (Control, CO), FR-10%, FR-20% and FR-30%. Birds were fed a diet containing 25% CP and 2.85 Mcal ME/kg. After feed restrictions, 320 quails (240 females and 80 males) were allocated to two batteries with five levels, and each level with four cages (40 cages). Each cage contained six females and two males. Birds were fed a diet containing 21.43% CP and 2.86 Mcal ME/kg. Lighting program was 16L:8D (0630 to 2230). Levels were considered as blocks and cages as experimental units. Data were analyzed as a randomized block design. At the end of experiment, ten quails (five females and five males of 98 days old) of each feed restriction were stunned, slaughtered and carcass traits measured. Average final weight (299.04 g) and carcass yield (53.69%) were unaffected ($P > 0.05$) by feed restriction. Feed restriction did not influence ($P > 0.05$) carcass weight (160.35 g), total meat (88.67 g), total bone (42.56 g), or whole breast (47.31 g). Disectable fat of birds restricted at FR-20% was lower ($P < 0.05$) by 32.7% (24.51 vs. 16.5 g) compared to birds fed CO. Ovary weight (10.47 g) and testes weight (7.39 g) were not modified ($P > 0.05$) by feed restriction. It is concluded that feed restriction did not influence carcass yield neither gonad weight.

Key Words: Food Deprivation, Carcass Yield, *Coturnix coturnix japonica*

T130 Effect of early feed restriction on productive and reproductive performance of Japanese quail breeder. G. Contreras*, C. B. Castro, J. J. Portillo, and F. G. Rios, *FMVZ-Universidad Autónoma de Sinaloa, Culiacan, Sinaloa, Mexico*.

The objective of this study was to determine the effect of early feed restriction (FR) on productive and reproductive performance of Japanese quail. The breeders were restricted in rearing period during the 3-week (two to five weeks old) by feeding ad libitum (Control, CO), FR-10%, FR-20% and FR-30%. Birds were fed a diet containing 25% CP and 2.85 Mcal ME/kg. After feed restrictions, 320 quails (240 females and 80 males) were allocated to two batteries, each battery with five levels and each level with four cages (40 cages). Birds were fed a diet containing 21.43% CP and 2.86 Mcal ME/kg. Lighting program was 16L:8D (0630 to 2230). Cage levels were considered as blocks and cages as experimental units. Data were analyzed as a randomized block design. Specific predetermined contrasts were used to test differences between CO and FR. Average daily feed intake of quails restricted increased ($P < 0.05$) by 5.1% (42.2 vs. 44.3 g) than control. Feed restriction delayed ($P < 0.05$) age at the onset production by 6.3 days (42.0 vs. 48.37 d) and age at 5% production by 6 days (44.8 vs. 50.8 d). Weight of first egg was not affected by feed restriction (10.91 g). Percentage hen day production (79.12) was not modified ($P = 0.22$) by feed restriction. Weight of egg laying of birds restricted at 30% was heavier ($P < 0.05$) by 2.5% (13.34 vs. 13.68 g) than others treatments, although weight of hatching egg (13.66 g) was not affected ($P > 0.10$) by treatments. Percentage of hatching egg was diminished ($P > 0.06$) in 2.2% by feed restriction (79.19 vs. 77.44), but fertility (86.38%) and hatchability (82.60%) was not affected by restriction. Embryo mortality (17.4%) was not modified by feed restriction. Hatching egg of quails without restriction had 6.78% more living chick (59.98 vs. 53.2%) than feed restriction at 30%. It is concluded that feed restriction at 10 and 20% maintains the productive performance and chick production.

Key Words: Food Deprivation, Productive Performance, *Coturnix coturnix japonica*