

Nonruminant Nutrition: Carbohydrate and Lipids

W114 Effect of xylanase supplementation to wheat-rye based diet on the energy availability and the performance of ducks. L. Babinszky^{*1}, J. Tossenberger¹, and I. Kühn², ¹Kaposvár University, Kaposvár, Hungary, ²AB Enzymes GmbH, Darmstadt, Germany.

The objective was to determine the effect of dietary xylanase (xyl) supplementation on energy availability (intake-excretion/intake*100) and duck performance. The availability trial used 6 birds/Treatment (Trt) (Cherry Valley, Super M-3 Heavy drakes, individual keeping). Availability of energy was determined on the 2nd & 5th weeks of age. The performance trial was conducted with a total number of 756 birds (same hybrid) (252 birds/Trt, 50% male & 50% female, 49 days of age). Diets were formulated on a wheat-rye-soybean basis for a 2-phase feeding program. Birds were fed starter diets (days 1-14: AME: 11.0 MJ/kg, CP:208 g/kg, LYS: 10.0 g/kg) in crumbled form and grower diets (days 15-49: AME: 11.0 MJ/kg, CP:162 g/kg, LYS: 7.6 g/kg) in pelleted form. The trials consisted of 3 Trts. Birds in Trt1 were fed diets without added xyl. Diets in Trts 2 and 3 were supplemented with 6000 BXU/kg and 16000 BXU/kg ECONASE[®] XT (thermostable xylanase produced by *Trichoderma reesei*), respectively. Data were analyzed by ANOVA (SAS, 2004). According to our data xyl added at 6000 BXU/kg significantly increased the availability of energy ($P \leq 0.05$) (Wk2: 75.5 vs 77.2%; Wk5: 72.6 vs 76.7%). Xyl added at 16000 BXU/kg resulted further improvement of energy availability on Wk5 only.

The live weight of the ducks (49 days) was increased significantly ($P \leq 0.05$) by xyl supplementation added at the rate of 6000 BXU/kg (2974 g vs 3101 g). The higher enzyme dosage (16000 BXU/kg) was not associated with any further increase of the final weight of the ducks ($P \geq 0.05$). The xyl supplementation of the diets at the rate of 6000 BXU/kg, however, improved the feed conversion ratio of the birds by 3.1 % (2.92 kg/kg vs 2.83 kg/kg) while xyl added at the rate of 16000 BXU/kg improved it by 4.8 % (2.93 vs. 2.78 kg/kg). Based on these results xylanase supplementation to wheat-rye based duck diets starting from an inclusion rate of 6000 BXU/kg can be recommended.

Key Words: Duck, Xylanase, Availability

W115 Effect of phytase supplementation of the diets on the digestibility and urinary excretion of phosphorous and calcium in weaned piglets. J. Tossenberger¹, I. Kühn², and L. Babinszky^{*1}, ¹Kaposvár University, Kaposvár, Hungary, ²AB Enzymes GmbH, Darmstadt, Germany.

Aim was to determine the effect of dietary phytase supplementation on P and Ca digestibility and urinary excretion in weaned piglets. The trials used 4 hybrid barrows per treatment (Trt) in 2 replicates (8 pigs/Trt, individual keeping, initial live weight: 13.1±1.1 kg). The corn-soy based diets contained P_i supplementation at 1 g/kg of diet. The trial consisted of 5 Trts. The control diet contained no phytase supplementation (Trt1). Diets of Trts 2, 3, 4, 5, were supplemented with phytase (6-phytase produced by *Trichoderma reesei*) at the rate of 125, 250, 500 and 750 PPU/kg, respectively. Measured phytase activity of the diets was 90, 337, 424, 672 and 968 PPU/kg. Data were analyzed by ANOVA and regression analysis (SAS, 2004). According to our data phosphorous (P) digestibility (%) already showed a 17.0% increase (from .433 to .603) due to 125 PPU/kg phytase supplementation of the diet ($P < 0.05$).

According to the regression analysis the end value of P digestibility was 67.5% – 95% of which (i.e. 64.1%) was reached at 183 PPU/kg added phytase activity of the diets. Due to the restrictive P supply urinary P excretion was at a minimum. Retention of P (%) improved by 16.8% (from .425 to .593) when supplementing phytase at 125 PPU/kg of diet ($P < 0.05$). The 95% of the end value of P retention is estimated to occur at 185 PPU/kg added phytase activity of the diets. The limited P supply (1 g inorganic P/kg) and phytase activity (90 PPU/kg) has a negative impact on the digestibility of calcium (Ca). Calcium digestibility (%) already showed a 12.1% increase (from .656 to .777) due to 125 PPU/kg phytase supplementation of the diet ($P \leq 0.05$). Urinary Ca excretion – irrespective of the Trt – was on average about nine times higher than the (physiological) value characteristic of weaned piglets, suggesting a P deficiency. The 95% of the end value of P digestibility (i.e. 64.1%) is estimated to occur at 183 PPU/kg added phytase activity of the diets.

Key Words: Piglet, Phosphorous, Digestibility

W116 Ileal and post-ileal digestibility of heat treated cereals in weaners. J. Tossenberger¹, L. Babinszky^{*1}, and S. Reischl², ¹Kaposvár University, Kaposvár, Hungary, ²Agrokomplex C.S. Zrt., Zichyújfalu, Hungary.

Our study was aimed at evaluating the ileal and post-ileal digestibility of energy (E) and crude protein (CP) in heat-treated corn (C), wheat (W) and barley (B), using hybrid weaned piglets (barrows) (4 pigs/treatment, 2 replicates, initial weight: 9.4±0.8 kg, individual keeping), fitted with a simple T-cannula prior to the start of the trials. Both ileal and post-ileal (ileal undigestible-faecal undigestible/ileal undigestible*100) digestibilities were determined on the same animal using a marker (Cr₂O₃). Animals were provided with trial diets in an amount corresponding to 2.6 times their maintenance energy requirement (458 KJ MEs/kg^{0.75}/d). Cereals (C, W and B) were flaked after steam conditioning (125 °C) for ten minutes. GE levels were 16.2(C), 16.2(W) and 16.4(B) MJ/kg, CP contents were 87.0(C), 131.0(W) and 119(B) g/kg, respectively. Data were analyzed by ANOVA (SAS, 2004).

According to our data ileal digestibility of GE in the cereals studied was 85.1%(C), 70.6%(W) and 63.2%(B) ($P \leq 0.05$). A further 35.7%(C), 61.6%(W) and 52.4%(B) of GE reaching the post-ileal gut section was digested there ($P \leq 0.05$). Of total GE absorbed, 94%(C), 79.4%(W) and 76.3%(B) was digested in the ileal section, and 6.0, 20.5 and 23.6% in the post-ileal section. Accordingly, total tract GE digestibilities were 90.4%(C), 88.7%(W), and 82.7%(B) ($P \leq 0.05$), while DEs values were 14.6(C), 14.3(W) and 13.5(B) MJ/kg. Ileal digestibility of CP was found to be 73.4%(C) 61.4%(W) and 74%(B) ($P \leq 0.05$), CP post-ileal digestibility was 42.4%(C), 55.4%(W) and 34.50%(B) ($P \leq 0.05$), while total tract digestibility was 84.7%(C), 82.8%(W) and 83.0%(B). Our data highlight the possibility of substantial differences in the location of E absorption of the cereals studied, which should be considered for a more balanced energy supply of young pigs. In the interest of optimal protein supply the differences in the ileal digestibility of CP in heat treated cereals should also be considered.

Key Words: Ileal, Postileal, Digestibility

W117 Digestible and metabolizable energy content of high-oil corn for growing pigs. Y. L. Ma^{*1}, G. L. Cromwell¹, M. D. Lindemann¹, and K. E. Nestor, Jr.², ¹*University of Kentucky, Lexington*, ²*Mycogen Seed, Indianapolis, IN*.

An experiment was conducted to determine the DE and ME content of a high-oil corn (Supercede HE hybrid; Mycogen Seeds, Indianapolis, IN) based on energy balance with growing pigs. The corn analyzed 86.9% DM, 3,959 kcal GE/kg, 7.81% CP, 5.26% fat, and 0.26% lysine on an "as is" basis. Twelve crossbred barrows averaging 58 kg were assigned to one of two diets, placed in metabolism crates designed for separation of feces and urine, and fed a standard diet for a 7-d adjustment period. Pigs were then fed their assigned experimental diet twice daily for an additional 4 d of diet adjustment followed by a 5-d total collection of feces and urine. The experimental diets consisted of a basal diet (high-oil corn + minerals and vitamins) or the basal + supplemental AA to meet the estimated AA requirements. Indigo carmine was included at 0.25% in the morning feed of day 1 and day 6 to mark the beginning and end of the fecal collection period. Urine collection began and ended 4 hr after feeding the marked diet. The energy content of the diets, feces, and urine was determined by bomb calorimetry. Feed intake averaged 1.81 and 1.90 kg/d and GE intake averaged 6,973 and 7,313 (7,212 adjusted for the GE in AA) kcal/d for the two treatments, respectively. Pigs fed the AA supplemented diet retained more N ($P < 0.05$) than those fed the basal diet (17.84 vs. 13.30 g/d; 68.2 vs. 56.4% of N intake; 79.4 vs. 66.8% of N absorbed). The DE and ME of the high-oil corn (DM basis) following adjustment for the energy provided by the AA were 4,062 and 4,138 kcal DE/kg and 3,995 and 4,075 kcal ME/kg for the two treatments, respectively, with estimates tending to be slightly higher for the AA supplemented diets ($P < 0.09$). When adjusted to 89% DM and averaged across treatments, the DE of the high-oil corn was $3,646 \pm 17$ and the ME was $3,588 \pm 18$ kcal/kg. These energy values are 3.4 and 4.9% higher, respectively, than the DE and ME of normal corn at 89% DM (3,525 and 3,420 kcal/kg) listed in the current NRC *Nutrient Requirements of Swine*.

Key Words: Pigs, High-Oil Corn, Metabolizable Energy

W118 Effects of heat processing of corn and rice on faecal digestibility of nutrients and adipose tissue fatty acid composition in young pigs. D. Menoyo, M. P. Serrano, D. G. Valencia, R. Lázaro, and G. G. Mateos*, *Universidad Politécnica de Madrid, Spain*.

Heat processing (HP) of cereals gelatinizes the starch portion of the grain, which may result in improved nutrient utilization. A 24-d trial was conducted to evaluate the effect of the main cereal of the diet (corn or rice) and heat processing of the cereal (HP) on coefficients of apparent total tract digestibility (CATTD) of nutrients in young pigs. Also, diet effect on fatty acid (FA) composition of the adipose tissue was assessed. The experimental design was completely randomized with four treatments and nine replicates (one pig) per treatment. Piglets were fed their respective experimental complex diets with 52% of corn or rice either raw or cooked from 23 to 48 d of age. Pigs were slaughtered at 49 d of age and samples (5g) of subcutaneous fat were analyzed for FA composition. The CATTD of GE, OM, EE, and CP was higher for piglets fed rice than for piglets fed corn ($P \leq 0.01$). Heat processing of the cereal improved GE, OM, EE, and CP digestibility ($P \leq 0.001$). Also, the improvement of CATTD of nutrients with HP was higher in the corn- than in the rice-diets (7.4 vs. 0.8% for GE, 5.9 vs. 0.5% for OM, 9.4 vs. 2.7% for EE, and 5.9 vs. 0.6% for CP; $P \leq 0.01$). The

proportion of saturated FA (SFA) in the adipose tissue of the pigs was higher with rice than with corn (35.4 vs. 33.6%; $P \leq 0.05$), but HP did not affect SFA content. Both cereal type and HP of the cereal affected 18:2n-6 concentration ($P \leq 0.01$). Also, 18:2n-6 concentration was decreased with HP of corn but was increased with HP of rice ($P \leq 0.01$ for the interaction). In conclusion, feeding rice instead of corn and HP of the cereal portion of the diet increases nutrient digestibility in piglets. A more saturated fat with lower 18:2n-6 concentration was obtained in pigs fed rice than in pigs fed corn, especially when rice was HP. This effect might have important implications on meat quality of pigs when HP cereals are fed at the end of the growth period.

Key Words: Piglets, Cereal, Heat Processing

W119 Evaluation of a dynamic in vitro model to simulate the porcine ileal digestion of diets differing in the carbohydrate composition. J. P. Meunier^{*1}, E. Manzanilla², M. Anguita², S. Denis³, J. F. Pérez², J. Gasa², J. P. Cardot³, F. Garcia², and M. Alric³, ¹*Pancosma Research, Geneva, Switzerland*, ²*Universitat Autònoma de Barcelona, Spain*, ³*University of Auvergne, France*.

The aim of the study was to assess the ability of a dynamic in vitro model to determine the digestibility of OM, CP, and starch as compared to in vivo ileal digestibility obtained from growing pigs fitted with a T-cannula. Five experimental diets with different carbohydrate types and level were assessed: a standard corn-based diet (ST) or the same diet with coarse ground corn (CC), 8% sugar-beet pulp (BP), 10% wheat bran (WB), or 8% sugar beet pulp and 10% wheat bran (HF). In the in vivo experiment, diets CC and HF reduced ileum digestibility of OM when compared to ST diet (65.0 and 65.1 vs. 70.8%, $P = 0.015$, respectively). The inclusion of sugar-beet pulp reduced (65.9 vs. 76.6%, $P = 0.049$) ileal CP digestibility in the BP diet. This reduction was not statistically significant when sugar beet pulp was combined with the wheat bran in the HF diet. No differences were found in the in vivo starch digestibility among diets. The dynamic in vitro model yielded OM and CP digestibility coefficients comparable to those obtained in vivo for the ST and CC diets. However, values were considerably affected by the incorporation of the fibrous ingredients. Diets BP, WB, and HF had lower OM digestibility (33.3 vs. 74.9, $P = 0.009$, 48.5 vs. 74.9%, $P = 0.058$, and 24.0 vs. 74.9%, $P = 0.004$, respectively) compared with ST diet. Protein digestibility was also lower (43.0 vs. 81.8%, $P < 0.001$, 64.9 vs. 81.9%, $P = 0.019$ and 56.0 vs. 81.8%, $P = 0.003$, respectively) with the BP, WB, and HF diets than with the ST diet. However, digestibility was reduced to a greater extent in the BP diet than in the WB and HF diets, both containing wheat bran. The R-square between the dynamic model and in vivo results for CP digestibility was 0.99 when CC diet was not considered. No differences were found in starch digestibility among the diets with the dynamic in vitro model.

Key Words: In Vitro Model, Pig, Digestibility

W120 Performance of weanling piglets offered low, medium or high lactose diets supplemented with a seaweed extract from *Laminaria* spp. D. A. Gahan¹, M. B. Lynch¹, J. J. Callan¹, J. T. O'Sullivan², and J. V. O'Doherty^{*1}, ¹*University College Dublin, Ireland*, ²*Bioatlantis Ltd, Ireland*.

A 3 × 4 factorial experiment was conducted to investigate the interaction between different levels of lactose (60 (low) vs. 150 (medium) vs. 250 (high) g/kg) and seaweed extract (0 vs. 1 vs. 2 vs. 4 g/kg) on growth performance and nutrient digestibility of weanling pigs. The seaweed extract contained only laminarin and fucoidan. Three hundred and eighty four piglets (24 days of age, 7.5 kgs live weight) (96 pens containing 4 piglets) were blocked on the basis of live weight and were assigned to one of 12 dietary treatments (n=8). The pigs were offered the diets ad libitum for 21 days post weaning. There was a significant lactose × seaweed extract interaction (P<0.05) in average daily gain (ADG) and food conversion ratio (FCR) from day 0 to 21. At the low and medium level of lactose there was an increase in ADG as the level of seaweed extract increased to 2 g/kg (P<0.05). However, at the high level of lactose there was no further response in ADG as the level of seaweed extract increased above 1 g/kg (P<0.05). At the low level of lactose there was a significant improvement in FCR as the levels of seaweed extract increased to 4 g/kg (P<0.01). At the medium level of lactose there was a significant improvement in FCR as seaweed extract increased to 2 g/kg. However, there was no significant effect of seaweed extract on FCR at the high levels of lactose. There was a linear increase in average daily feed intake from day 0-21 (488 \hat{I} / \hat{s} . 514 \hat{I} / \hat{s} . 541 \hat{I} / \hat{s} . 518 g/day s.e 14.8; P<0.05) as levels of seaweed extract increased. There was a quadratic decrease (P<0.01) in nitrogen (84.41 \hat{I} / \hat{s} . 80.48 \hat{I} / \hat{s} . 79.78. s.e 0.469) and neutral-detergent fibre (36.01 \hat{I} / \hat{s} . 23.34 \hat{I} / \hat{s} . 25.89. s.e 1.883) digestibility as the levels of lactose increased. In conclusion, pigs responded differently to the inclusion levels of seaweed extract at each level of lactose supplementation. The inclusion of a laminarin-fucoidan extract in piglet diets may alleviate the use for high lactose diets and would also alleviate some of the common problems that occur post weaning.

Key Words: Lactose, Seaweed Extract, Pigs

W121 Development of feeding program for gestating gilts and its effects on reproductive performance and progeny. L. G. Piao*, H. F. Long, W. S. Ju, J. H. Lee, H. K. Oh, and Y. Y. Kim, *Seoul National University, Seoul, South Korea.*

Numerous feeding programs for gestating sows was introduced because high producing sows are reared in swine farm. This study was conducted to compare the effect of four different feeding programs for gestating gilts on reproductive performance and progeny. A total of 41 F1 gilts (Yorkshire×Landrace) were assigned to four treatments in a complete randomized design. For treatments, gestating period of gilts was divided for three trimesters (0~35, 36~90 and 91~farrowing) and treatments were Flat, Down-Up-Down, Up-Down-Up and Down-Up-Up feeding program. Gestating gilts body weight gain from d 0 to 110 was affected by feeding program (50.8 kg, 73.3 kg, 72.6 kg and 75.7 kg for Flat, DUD, UDU and DUU, respectively; P<0.05). However gilts consumed constant feed ration (flat feeding), less body weight loss tended to be observed in lactating sows (-0.9 kg, -6.7 kg, -9.2 kg and -7.8 kg for Flat, DUD, UDU and DUU, respectively, P=0.17) and desirable backfat thickness (average 19.5mm) can be acquired at 110 days of gestation. Feed intake of lactating sows tended to be higher (4.22 kg/d, 3.60 kg/d, 3.97 kg/d and 4.13 kg/d, P>0.05) when gilts had low backfat thickness during gestation. Low feed intake of lactating sows resulted in increasing weaning to estrus interval after weaning which may affect on reproductive performance of sows in next parity. When gilts were fed higher feed during midtrimester, higher stillborn (1.4 piglet/litter, P<0.05) and mummies (0.8 piglet/litter P=0.25) were observed compared to other treatments.

Various and complex feeding programs for gestating gilts had no effect on litter weight gain and individual pig weight during nursing period. These results suggested that changing of feed intake for gestating gilts resulted in detrimental effects on body condition and reproductive performance of sows. And flat feeding program for gestating gilts showed better reproductive performance and less body fat loss in lactating period because sows consumed more feed at this time.

Key Words: Feeding Program, Reproductive Performance, Gilts

W122 Dietary energy levels of gestating gilts on gestation parameters and reproductive performance. H. F. Long*, L. G. Piao, W. S. Ju, C. S. Chang, H. K. Oh, and Y. Y. Kim, *Seoul National University, Seoul, South Korea.*

This study was conducted to determine the effects of different energy intake for gestating gilts on gestation parameters and reproductive performance of sows. A total of 40 F1 gilts (Large White × Landrace) were allotted to 4 treatments in a completely randomized design (CRD). Dietary energy levels for gestating gilts were 3165, 3265, 3365 and 3465 kcal ME/kg and 2 kg of experimental diet was provided daily during gestating period. After farrowing, lactating sows were fed lactation diet ad libitum approximately 5 days post-farrowing. During the whole gestation period, body weight gain and backfat thickness gain of gilts were increased in proportion to dietary energy level (P<0.01). Fat mass gain was also increased when gilts were fed 3465Kcal ME/kg diet (P<0.01). But estimated protein mass gain of sows was not significantly affected by dietary energy level (P>0.27). At farrowing, litter size did not show any significant differences among all treatments (P>0.11). Litter weight at birth was improved as higher energy diet was provided (P=0.06), but litter weight gain during 21 day lactating period was not affected by dietary energy treatments (P>0.23). 3465Kcal ME/kg for gestating gilts didn't show positive responses on reproductive performance of sows. Lower feed consumption during lactating period was observed when higher dietary energy was provided during gestating period of gilts. These results demonstrated that higher dietary energy level were not required for high producing gilts and NRC requirement of energy (3265 kcal ME/kg) were adequate for gestating gilts when 2 kg of diet was provided daily.

Key Words: Energy Level, Body Weight, Gilt

W123 The effect of dietary starch sources on the performance, nutrients digestibility and blood biochemical parameters in growing pigs. Q. Z. Dai², Y. Yin^{*1}, R. Huang¹, and T. Li¹, ¹*Laboratory of Animal Nutrition and Health and Key Laboratory of Subtropical Agro-ecology, Institute of Subtropical Agriculture, Changsha, Hunan, P. R. China,* ²*Hunan Institute of Animal Science, Changsha, Hunan, P. R. China.*

A feeding trial covered 30ds and a 5 × 5 Latin square design metabolism experiment using 45 20 ± 0.642kg Duroc × Landrace × Yorkshire cross breed pigs were conducted to study the effect of dietary starch sources on the performance and nitrogen metabolism. 4 iso-nitrogen, iso-energy and iso-starch diet were formulated using Maize, Brown rice, Stick rice and Resistant starch (Hi-maize-1043) as starch sources, as well as an nitrogen free diet was also formulated to determinate the endogenous nitrogen losses. The results showed that the body weight

gain of Maize group was 719.52g per day which was 14.69%, 11.92% and 3.03% higher than Resistant starch, Stick rice and Brown rice group respectively. While the feed conversion (feed consumption/ body weight gain) was 1.64%, 12.46 ($p < 0.05$) and 0.5% lower than Resistant starch, Stick rice and Brown rice group correspondingly. The lowest fecal crude protein apparent and true digestibility were found in Resistant starch group, which were 10.23%, 12.76%, 12.42% and 9.64%, 12.11%, 11.73% ($p < 0.05$) lower than Maize, Stick rice and Brown rice group, and also the digestibility of energy and dry matter of Resistant group were lower than other groups. When compared with other groups, Resistant starch group excreted the most fecal nitrogen ($p < 0.05$), while Stick rice had the highest urinary nitrogen excretion ($p < 0.05$), but the largest whole body nitrogen retention was found in Maize group. The results of blood biochemical parameters analysis indicated that, the change of post-prandial blood glucose, insulin concentration and insulin/ glucose in Resistant starch was stable, while other groups had larger fluctuation, 1h after the meal which reached the pinnacle, among them Stick rice group had the highest blood glucose, insulin concentration and insulin/ glucose in post-prandial 1h, they were 1.21mg/ml, 52.35(μ U/ml) and 43.27(μ U/ml) respectively, and were significantly higher than other groups ($p < 0.05$).

Key Words: Pig, Metabolism, Starch

W124 The effect of dietary starch sources on amino acids portal flux and balance in growing pigs. W. Wang, Y. Yin*, R. Huang, and T. Li, *Institute of Subtropical Agriculture, Changsha, Hunan, P. R. China.*

Four Duroc \times Landrace \times Yorkshire cross breed male pigs fitted with permanent catheters in the portal vein, mesenteric vein and in the carotid artery were used in a 4×4 Latin square to measure the different effect of dietary starch sources on net portal absorption of blood glucose, volatile fatty acids (VFA), amino acids and lactate in growing pigs. When calculated as per 100g feed intake, 8h post-prandial maize group portal vein net absorbed 27.52g glucose, which was 54.26%, 7.88% and 1.55% higher than resistant starch, stick rice and brown rice respectively. Stick rice group absorbed 2.52g lactate and it was significantly higher than other groups ($P < 0.05$). In resistant starch group the portal vein absorbed blood ammonia was (5.36g) lower than other groups ($P < 0.05$), while the absorbed VFA (403.87mmol) was significantly higher than maize, brown rice and stick rice group. Portal vein net absorbed total amino acids of resistant starch, maize, brown rice and stick rice group were 5.93g, 8.89g, 8.77g and 7.83g, the lowest net portal vein absorption was found in resistant group. The proportion of net absorbed total amino acids in ileum apparent and true digested amino acids were 52.70% and 48.39%, which were lower than 67.66%, 65.83%, 63.62% and 63.76%, 61.80%, 59.18% of maize, brown rice and stick rice group ($P < 0.05$). The proportion of essential amino acids in absorbed total amino acids of resistant starch group was 50.0% it was also lower than 57.43%, 56.64%, 57.74% of maize, brown rice and stick rice respectively. Portal vein net absorbed Glu, Ser, His, Arg, Ala, Tyr, Meth, Val, Phe, Ile, Leu and Lys of resistant starch group and His, Arg, Tyr, Val, Meth, Lys and Leu of stick rice were lower than maize and brown rice group ($P < 0.05$). There are no significant difference between maize and brown rice group for most net absorbed amino acids, but His, Lys and Leu in maize group were higher ($P < 0.05$), while Arg was lower than brown rice group ($P < 0.05$). The balance pattern of portal vein net absorbed amino acids of maize group was better than other groups.

Key Words: Portal Flux, Amino Acid, Pig

W125 Intravenous glucose tolerance test in Ningxiang pigs. X. F. Kong¹, M. J. Bo¹, X. Y. Song¹, Y. L. Yin*¹, B. E. Tan¹, Z. Q. Liu¹, H. J. Xu¹, W. J. Tang¹, F. G. Yin¹, and G. Y. Wu^{1,2}, ¹*The Chinese Academy of Sciences, Changsha, Hunan, P. R. China,* ²*Texas A&M University, College Station.*

Intravenous glucose tolerance test was conducted with the Ningxiang pig (a Chinese swine breed), which has a relatively slow rate of growth and small body size. Four Ningxiang barrows (approximately 60 kg) with indwelling catheters in the hepatic vein and carotid artery were fasted for 12 h before use for the experiment. On d 1, at 10 min before saline infusion, as well as at 0, 5, 10, 20, 30, 60, 120, 180, and 240 min after saline infusion, blood samples (5 ml per barrow) were taken from the carotid artery into tubes containing sodium heparin. Meanwhile, urine samples from each of the animals were collected for glucose analysis. On d 2 and 3, saline and a 50% glucose solution were infused into the hepatic vein, respectively. Blood and urine samples were obtained as described above. Plasma was analyzed for glucose, insulin and glucagon. The insulin/glucose ratio was calculated for each sampling time. Results indicate that plasma concentrations of glucose at 5-10 min and those of insulin at 5-30 min post glucose infusion were greater ($P < 0.05$) than the values obtained after saline infusion. Intravenous glucose infusion increased ($P < 0.05$) the insulin/glucose ratio at 10-60 min but reduced ($P < 0.05$) plasma concentrations of glucagon at 30-60 min, when compared with saline infusion. Glucose was detected in urine beginning at 30 min after glucose infusion. These findings suggest that Ningxiang barrows may exhibit insulin resistance, which explains in part their relatively slow growth rate.

Key Words: Intravenous Glucose Tolerance Test, Indwelling Catheters, Ningxiang Barrows

W126 Evaluation of nutrient equivalency values of natuzyme for broiler chickens. M. Majdeddin*, M. Zaghari, and H. Moravej, *Tehran University, Karaj, Tehran, Iran.*

The experiment was conducted to determine the nutrient equivalency values of commercial multi enzyme (natuzyme) for broiler chickens. 480 day-old male commercial broiler chickens (Ross 308) were used from 1 to 28 days of age. The experimental design was completely randomized and the experimental units (pens) were allotted randomly to 8 treatments, each in 4 replicates. The dietary treatments 1 to 4 formulated without enzyme and contained graded levels of ME, CP and non-phytate phosphorus. The dietary treatments 5 to 8 have graded levels of multi enzyme 0.1 to 0.4 gr/kg diets respectively. Performance of chicks fed dietary treatments 1 to 4 and 5 to 8 compared with each other and calculated the total nutrient equivalency values of enzyme. Body weight, group feed consumption and viability was recorded weekly. Toe ash Ca, P and Ca, P and protein content of excreta were measured at day 28. Data was analyzed using the general Liner and non-liner model procedure of SAS software. Final body weight for treatments 1 to 4 was increased ($p < 0.05$). Addition of enzyme increased final body weight ($p < 0.05$). Liner relationship between ME, CP, non- phytate phosphorus, enzyme and body weight in 28 day-old was observed ($p < 0.05$). The result showed that added enzyme (0.4 gr/Kg diets), increased availability of energy, crude protein and phosphorus, 2.8, 3.1 and 19.8 % respectively. The effect of age on nutrient equivalency was not significant.

Key Words: Equivalency, Broiler, Natuzyme

W127 In vitro fermentation of diets incorporating different levels of carob pulp by rabbit cecal fluid. G.-B. Aziza^{*1}, B. Ridha¹, K. Abdelhamid², M.-L. Maria-Rosa³, and K. Abdeljabbar¹, ¹INAT, Tunis, Tunisia, ²INGREF, Institut National des Recherches en Génie Rural, Eaux et Forêts, Tunis, Tunisia, ³Escuela Polytechnica Superior, Universidad de Santiago de Compostela, Lugo, Spain.

Fermentation characteristics of diets incorporating 0% (D1), 10% (D2), 20% (D3) and 100% (D4) dry matter (DM) of carob pulp were determined in an in vitro experiment using cecal contents collected from 4 rabbits. Samples of diets were incubated in glass syringe for 72 h and various fermentation variables were determined. Diets varied in their crude protein and fermentable carbohydrates. Potential gas production ranged from 123 (D3) to 179 (carob pulp) ml/g DM and was similar ($P > 0.05$) for D1, D2 and D3. Low value of pH after 72 h fermentation was observed in D4 (carob pulp: 6.47), and the highest was in diet incorporating 10% of carob pulp (6.66). Of all diets, carob pulp was fermented the most rapidly and had higher ($P < 0.05$) organic matter digestibility (64.3%) than D1 (62%), D2 (60.3%) and D3 (58.6%). In vivo studies will be conducted to validate the in vitro results.

Key Words: Carob Pulp, Rabbit, Gas Production

W128 Dietary fiber decreases fecal nutrient digestibility and ammonia emission in growing swine, but increases odor emission and odor intensity in air. W. Zhang¹, E. van Heugten^{*1}, T. van Kempen², V. Fellner¹, and P. Kai³, ¹North Carolina State University, Raleigh, ²Provimi RIC, St. Stevens Woluwe, Belgium, ³University of Aarhus, Horsens, Denmark.

This study was designed to determine the effects of dietary fiber on nutrient digestibility and emission of ammonia and odor compounds in air. Diets consisted of a low fiber diet (degermed, dehulled corn and soy protein isolate), a semi-low fiber diet (corn and soy protein isolate), a typical commercial diet (corn and SBM), and a high fiber diet (corn and SBM with 10% soy hulls), containing 2.8, 8.9, 7.6, and 13.6% NDF, respectively. The study consisted of 4 replicates. For each replicate, 40 pigs (BW=20.3±0.98 kg) were allotted by weight into 4 groups of 10 pigs and were adjusted to the diets for 14 days. Pigs were then transferred into one of 4 identical air-flow controlled (316 m³ per h) odor chambers (3.0 × 2.4 × 2.0 m) with fully slatted floors and pit recharge. Pigs remained in the chambers for 6 days prior to measurements. Total reduced sulfur (TRS) in exhaust air was measured using a Jerome meter and ammonia was measured by trapping in sulfuric acid. Air samples were collected in 10 L Tedlar bags for odor detection threshold evaluation by 8 panelists. Odor compounds were adsorbed using SPME fibers and analyzed by GC/MS. Fecal digestibility of CP, ADF, NDF, and GE was reduced ($P < 0.05$) with increasing fiber. Ammonia emission decreased with increasing dietary fiber (1.35a, 0.63bc, 0.78b, 0.49c ppm; means without a common letter denote differences at $P < 0.05$). Peak area for acetic acid (6.42a, 6.61a, 6.78ab, 7.26b), propionic acid (6.49a, 6.85a, 7.23b, 7.39b), butyric acid (6.74a, 6.89a, 7.54b, 7.69b), phenol (5.78a, 5.96a, 6.14ab, 6.65b), concentration of TRS (4.21a, 4.88ab, 7.92c, 8.50cd ppb), and odor intensity (144a, 174ab, 208ab, 251b) increased ($P < 0.05$) with increasing dietary fiber, but p-cresol, indole, and skatole were not affected. In conclusion, increasing dietary fiber reduced nutrient digestibility, increased odorous compounds and odor intensity of air, but it reduced ammonia emission.

Key Words: Ammonia, Fiber, Odor

W129 Effects of different fiber level diets on normal microbiological floras in goose intestines. M. A. Zhang, B. W. Wang^{*}, B. Yue, F. Y. Long, X. P. Wu, and X. H. Jia, Qingdao Nongye University, Qingdao, Shandong Province, China.

Different levels (5% and 9%) of *Leymus Chinesis* were appended in the diets to study normal microflora in the intestine of adult geese. The quantitative method of diluted inoculability was used to study the effect of different proportion of *Leymus Chinesis* on normal microbiological flora in four parts (duodenum, jejunum, ileum and caecum) of goose intestines. The results showed that the number of dominant bacterial flora was relatively large, when the content of CF was 9% in the diet, pH of intestine chyme in CF 9% group was lower than CF 5% group ($P < 0.01$). It indicated that increasing the content of *Leymus Chinesis* power in the diets could decrease intestine pH, thus the acid environment was good for the fermentation of intestine microorganisms. It made sure that the dominant bacterial floras were *Bifidobacterium* (8.21±0.8cfu/g), *Clostridium* (7.98±0.4cfu/g) and *Lactobacillus* (7.33±0.4cfu/g). The isolation efficiency of *Staphylococcus* and *Bacteroides* was the lowest. The number of cecum bacteria was significantly larger than the other intestine bacteria ($P < 0.01$). The total number of intestine bacteria in crude fiber (CF) 9% group was larger than in CF 5% group ($P < 0.01$), and that of ganders was larger than that of geese ($P < 0.05$). In this trial, the number of bacteria in intestine secretion of geese was 10⁶ cfu/g~10⁸cfu/g. The results also showed that in the intestine of geese, fungi had the best ability to decompose crude fiber, the following was actinomycetes and the worst was bacterium ($P < 0.01$).

Key Words: Goose, Intestines, Cellulose

W130 Stabilized rice bran improves weaning pig growth performance when feed in an antibiotic-free diet. T. Herfel, S. Jacobi, X. Lin, and J. Odle^{*}, North Carolina State University, Raleigh.

Stabilized rice bran (SRB) is classified as a functional food because of its prebiotic characteristics. With increasing corn prices and the possible removal of antibiotics from swine diets due to concern over antibiotic resistance, SRB was investigated as a replacement for corn with and without the addition of antibiotics (ANT). Two hundred pigs were weaned at ~21 days of age, blocked by weight, and allotted to diets containing 0 or 10% SRB and (-) or (+) ANT according to a 2 × 2 factorial design. Five animals were housed per pen throughout a 28 day growth period. At the end of the trial, one pig from each pen was euthanized for measurement of intestinal parameters. Antibiotic supplementation improved average daily gain by 6.3% from day 14 to 28 ($P < 0.05$). Gain:feed improved by 22% in pigs fed the ANT-free + 10% SRB diet compared to pigs fed the ANT-free + 0% SRB diet ($P < 0.05$), but was similar to pigs fed diets containing antibiotics. Cumulatively, pigs fed the ANT-free + 10% SRB diet improved gain:feed by an average of 14% compared to all other treatments ($P < 0.05$). Ileal histology revealed a 28% decrease in crypt depth for pigs fed the ANT-free + 10% SRB and ANT + 0% SRB diets compared to the ANT + 10% SRB diet ($P < 0.05$). Villi length: crypt depth (V:C) decreased due to SRB (23%) and ANT (22%) supplementation ($P < 0.05$). Differences in ileal and cecal digesta short chain fatty acid concentrations were not detected. In conclusion, SRB appears to improve the efficiency of nutrient utilization with only modest alterations in ileal mucosal morphology. Further research is warranted to elucidate the underlying mechanism by which SRB effects are mediated.

Key Words: Stabilized Rice Bran, Antibiotics, Gastrointestinal

W131 Linseed oil addition alters swine adipose fatty acid composition. A. A. AbuGhazaleh*, G. Apgar, and W. Brown, *Southern Illinois University, Carbondale.*

Previous studies have shown that including linseed oil (LSO) in swine diets increase the omega-3 fatty acids (FA) content in adipose tissues. The objective of this study was to determine the effect of the duration of LSO supplementation on omega-3 FA content in adipose tissues. Ninety six pigs (48 barrows and 48 gilts) with an average weight of 30 kg ± 3.7 were used in this study. Pigs were allotted to four dietary treatments (4 barrows and 4 gilts per pen with 3 pens per treatment) on the basis of body weight using a randomized complete block design. The four dietary treatments were: 1) conventional corn-soybean meal diet + 3% saturated fatty acid source (DM basis; CONT), 2) conventional corn-soybean meal diet + LSO at 3% (LS), 3) CONT diet fed until pigs reached a target weight of 60 kg ± 2.5 then switched to the LSO diet (LSO1) and 4) CONT diet fed until pigs reached a target weight of 80 kg ± 2.5 then switched to the LSO diet (LSO2). Pigs feed intake and growth performance were measured every 2 weeks. Pigs were slaughtered once they reached a target weight of 100 ± 5 kg. Samples of adipose tissues were dissected at the 10th rib and analyzed for the concentration of FA. Treatment diets had no effects ($P > 0.10$) on weight gain, back fat, marbling or color. Pigs on the LS diet tended ($P < 0.13$) to have lower feed intake (2.26 kg/d) when compared with other treatment diets (2.61, 2.49, and 2.72 kg/d for the CONT, LSO1 and LSO2 diets, respectively). The concentrations of C16:0 and C18:0 were higher ($P < 0.10$) while the concentration of C18:2n6 was lower ($P < 0.10$) with the CONT and LSO2 diets when compared with the LS and LSO1 diets. The concentrations of C18:3n3 were higher ($P < 0.10$) with the LS (8.73% of total FA) and LSO1 (8.49%) diets when compared with the CONT (3.13%) and LSO2 (4.57%) diets. The n6/n3 FA ratios were lowered ($P < 0.10$) with the LSO supplementations averaging 3.68, 2.78, 1.76 and 1.63 with the CONT, LSO2, LSO1 and LS diets, respectively. In conclusion, LSO supplementation altered the FA profiles of adipose tissues without compromising pigs performance and such alteration is affected by the duration of LSO consumption.

Key Words: Linseed Oil, Fatty Acids

W132 Influence of glycerol and added fat on finishing pig performance. A. W. Duttlinger*, M. D. Tokach, S. S. Dritz, J. M. DeRouchey, J. L. Nelssen, and R. D. Goodband, *Kansas State University, Manhattan.*

A study was conducted to determine the effects of dietary glycerol and fat on finishing pig performance. The experiment was conducted at a commercial swine research facility in southwest MN in August, 2007. Glycerol was procured and stored in the feed mill for approximately 60 d before diets were mixed. A total of 1,093 pigs (PIC, initially 77.7 kg) were used in a 28-d study. Pigs were blocked by initial weight and randomly allotted to 1 of 6 dietary treatments with 7 replications per treatment. Pigs were fed corn-soybean meal-based diets arranged in a 2 × 3 factorial with main effects of glycerol (0, 2.5, or 5%) and added fat (0 or 6%). Overall (d 0 to 28), there was a fat × glycerol interaction ($P < 0.04$) for ADFI. As added glycerol increased, ADFI was not influenced in diets containing added fat; however, ADFI was reduced when increasing levels of glycerol were added to diets without fat. Pigs fed diets with added fat had improved ($P < 0.01$) ADG and G:F compared

with pigs fed diets with no added fat. Increasing glycerol decreased ADG (linear, $P < 0.02$) and ADFI (linear, $P < 0.04$) and tended (linear, $P < 0.11$) to decrease G:F which was due to the negative impact when added to diets without fat. In conclusion, 6% added fat improved ADG and G:F, but the glycerol used in this study decreased ADG and ADFI when added to diets without added fat. The storage of glycerol before use may have contributed to the negative impact on performance in this experiment.

Table 1.

Item	Added Fat, %:						SE
	0	0	0	6	6	6	
	Glycerol, %:						
	0	2.5	5	0	2.5	5	
ADG, kg	0.84	0.81	0.76	0.92	0.90	0.91	0.02
ADFI, kg	2.90	2.92	2.74	2.87	2.82	2.85	0.04
G:F	0.29	0.28	0.28	0.32	0.32	0.32	0.01

Key Words: Fat, Glycerol, Pigs

W133 Conjugated linoleic acid and tryptophan supplementation improve immune response of weaned piglets. J. Morales¹, R. Gatnau², and C. Pineiro*¹, ¹*PigCHAMP Pro Europa, SA, Segovia, Spain,* ²*Molimen, Barcelona, Spain.*

Conjugated linoleic acid (CLA) is a natural product that enhances immune function while decreasing the negative effects of inflammatory responses. This effect is especially interesting at weaning, when piglets are highly susceptible to enteric diseases. On the other hand, aminoacidic profile of proteins affecting the immune system is different than muscle proteins, especially higher Trp: Lys ratio. The aim of this study was to assess the effect of CLA in combination with two different Trp:Lys ratios in weaned piglets in a low-health status nursery unit. Therefore, there were four treatments arranged factorially with 2 CLA dietary contents (0 vs 1%) and 2 Trp:Lys dietary ratios (0.15 vs 0.22). For the experiment, 336 piglets were used (7.6 ± 1.78 kg BW) and allotted in 48 pens. Average daily gain (ADG), feed intake and feed efficiency were controlled. Fecal consistency was assessed at 56 d of age (scale 0-normal, 1-soft, 3-diarrhea). During the trial period an acute outbreak of diarrhea occurred but, under these special circumstances, CLA supplementation improved ADG 80% ($P = 0.0001$) and FGR 44% ($P < 0.001$). Consequently, CLA supplemented piglets reached significantly higher final BW (13.5 vs 10.9 kg; $P < 0.001$) than control piglets. Higher dietary Trp: Lys ratio allowed expressing CLA improvements in performance (P interaction < 0.10 in ADG). On the other hand, Trp also improved ADG (170 vs 155 g/d; $P = 0.02$). Mortality rate was not significantly affected, but in the total nursery period the highest risk group (0% CLA & low Trp content) showed the highest % of mortality (10.7%; $P = 0.02$). Fecal consistency was only affected by CLA supplementation, which reduced the signs of diarrhea (0.9 vs 1.8; $P = 0.001$). We conclude that 1 % of CLA supplementation improved ADG, clinical symptoms and decreased the number of animals that needed to be treated during an acute outbreak of diarrhea in the nursery period. Furthermore, higher dietary Trp content facilitates the expression of the CLA effect, demonstrating compatibility and certain synergy between both (CLA and Trp).

Key Words: Conjugated Linoleic Acid, Tryptophan, Piglet

W134 Effect of conjugated linoleic acid on immune function and nutrition composition of duck. B. W. Wang*, Y. C. Wang, M. A. Zhang, B. Yue, L. Z. Jing, X. X. Wei, and G. L. Liu, *Qingdao Nongye University, Qingdao, Shandong Province, China.*

The experiment was conducted to study the effects of different grades of dietary Conjugated linoleic acid (CLA) on immune function and nutrition composition of duck. Two hundred and forty healthy Cherry Valley Ducks of one day old with the similar body weight were selected ($P > 0.05$), and divided into four treatment groups according to one-factor completely random design, with six replications each group and ten ducks each replication. The proportion of CLA in the basal diets was 0%, 1%, 2% and 3% respectively. The whole trial period was 56 days. Sterile blood collecting from each 12 ducks in every group, centrifuging, separate loading, to determine the Cellular Immunity Index, the antibody titer of Avian influenza and the content of Cytokines IL-2. Then slaughter the animal to determine indexes of immune organs on the day of 14, 28, 42 and 56. On the day of 42 and 56 the nutrition related index was carried on. The results showed that 1% and 2% CLA diets increased the indexes of the thymus and Fabricius's gland in different period ($P < 0.05$); 2% CLA diets increased the antibody titer of Avian influenza significantly at the 6th weekend ($P < 0.05$), 1% and 2% CLA diets increased the rate of lymphocyte transformation and the number of E-rosette ring; increased the content of IL-2 significantly after 4 weeks ($P < 0.05$). CLA reduced the percentage of abdominal fat and Subcutaneous fat percentage ($P < 0.05$ or $P < 0.01$), and 2% CLA diets increased the breast muscle percentage significantly at the 6th weekend ($P < 0.05$); 1% and 2% CLA diets increased the content of fat and saturated fatty acids in fatty acids of CLA diets was increased significantly in breast muscle ($P < 0.05$), and reduced significantly that of unsaturated fatty acids ($P < 0.05$). The results indicate that, CLA did promotion on the development of immune organs, increased the function of Humoral immunity and Cellular Immunity, regulate the immunity of meat duck effectively; and CLA did definite function of nutrition redistribution. The proper percent of CLA in diets was 2%.

Key Words: CLA, Meat Duck, Immune Function

W135 Efficiency of retention and conversion of α -linolenic acid (ALA) to other n-3 fatty acids (FA) in the whole body of growing gilts is reduced over time. H. R. Martínez-Ramírez* and C. F. M. de Lange, *University of Guelph, Guelph, ON, Canada.*

Fifteen gilts were used in a serial slaughter study to determine the rate of ALA retention; ALA conversion to other n-3 FA, including eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic (DHA); and ALA disappearance. A corn-barley-soybean meal based diet with 10% flaxseed, containing 2.0% ALA, was fed for 30 d to pigs between 27.7 ± 1.9 and 45.7 ± 2.2 kg BW. Feed intake was fixed at 70% of ad libitum intake according to NRC (1998). Body composition was determined at initial, intermediate (d 15; 39.2 ± 1.4 kg) and final BW in 4, 6 and 5 pigs, respectively. At slaughter on d 15 and 30 digesta was sampled for measurement of apparent ileal fat digestibility, which was used as an estimate of ALA availability. Disappearance of ALA was calculated as the difference between available ALA intake and the sum of ALA retention and ALA conversion to other n-3 FA. At the initial BW (2516 g of body fat), the content of ALA, C18:4n-3, C20:3n-3, C20:4n-3, EPA, DPA and DHA was 0.79, 0.09, 0.10, 0.02,

0.04, 0.09 and 0.14% of body fat, respectively. Whole body content of individual n-3 FA increased linearly from d 0 to 30 ($P < 0.01$), except for DHA. Expressed as a portion of ALA intake, ALA retention declined numerically from 64% (day 0 to 15) to 49.8% (day 15 to 30; $P = 0.11$). Similarly, conversion of ALA to C20:3n-3 (7.06 vs. 4.29%), C20:4n-3 (0.60 vs. 0.34%), and DHA (1.07 vs. 0.33%) was reduced over time ($P < 0.05$), while disappearance of ALA tended to increase over time (3.07 vs. 22.02%; $P = 0.074$). Conversion of ALA to EPA (1.14 vs. 1.51%) and DPA (2.36 vs. 2.04%) did not change over time ($P > 0.10$). The rate of conversion of ALA to C20:3n-3 was much higher in this experiment than reported in other animals and humans and should be explored further. The rate of whole body n-3 FA catabolism appears to increase over time. Based on this study, feeding ALA to pigs only leads to modest increases in contents of EPA, DPA and DHA in the pig's body.

Key Words: Omega 3 Fatty Acid, Elongation, Growing Pigs

W136 Effects of betaine, conjugated linoleic acid or both on nutrient digestibility of growing Iberian gilts. I. Fernandez-Figares*, L. Gonzalez Valero, J. M. Rodriguez-Lopez, R. Nieto, L. Manuel, and J. F. Aguilera, *CSIC (Spanish National Research Council), Granada, Spain.*

We have demonstrated that betaine and CLA show a synergistic effect on growth rate and protein deposition in growing Iberian gilts (Fernandez-Figares et al., 2008). No difference on protein digestibility was encountered between treatments but no information on amino acid digestibility was available. The aim of the present study was to assess if betaine or CLA had an effect on apparent faecal amino acid digestibility of Iberian gilts. Twenty gilts (20 kg BW) were individually penned and fed barley-soybean meal based diets (12% CP, 0.81% lysine and 14.8 MJ ME / kg DM) containing either no added betaine or CLA (control), 0.5% betaine, 1% CLA, or 0.5% betaine + 1% CLA, at 95% *ad libitum* energy intake. At 30 kg BW, a balance experiment was conducted where animals were individually housed in metabolic cages placed in a controlled environment room to allow for separate collection of faeces and urine. Pigs were moved to the cages 3 d before starting excreta collection and fit with a self-retaining urethral catheter for urine collection. Total collection of faeces and urine was performed daily for 4 d. Aliquot samples of faeces and urine representative of total daily faecal output and of total urine were stored at -20°C and was then freeze-dried and finely ground for further analysis. Total nitrogen was determined by the Kjeldahl procedure. Dry matter content and total ash were carried out by standard procedures. Gross energy determination was measured in an adiabatic bomb calorimeter. Amino acids were determined after protein hydrolysis in 6 M HCl plus 1% phenol in sealed tubes at 110°C for 24 h, by HPLC according to the Waters Pico Tag method. The treatment effect was assessed by ANOVA and treatment means were compared by Duncan's procedure. Significance was set at $P < 0.05$. Digestibilities of DM, OM, GE, total nitrogen, total amino acids and ME (0.819, 0.836, 0.808, 0.771, 0.809 and 0.793, average values, respectively) were not affected by dietary treatments ($P = 0.27$ to 0.51). The synergistic effect of betaine and CLA on protein deposition must be exerted at tissue level and not at digestive level.

Key Words: Betaine and CLA, Pig, Amino Acid Digestibility

W137 Effects of dietary coconut fat powder supplementation on performance, nutrient digestibility and blood and milk characteristics in lactating sow. W. T. Kim^{*1}, H. J. Kim¹, J. H. Cho¹, Y. J. Chen¹, J. S. Yoo¹, S. O. Shin¹, Y. Haung¹, J. D. Hancock², C. Y. Lee³, and I. H. Kim¹, ¹Dankook University, Cheonan, Chungnam, Korea, ²Kansas State University, Manhattan, ³Jinju National University, Gyeongnam, Korea.

A total of thirty sows (Landrace×Yorkshire) were used to determine the effects of dietary coconut fat powder supplementation on performance, nutrients digestibility and blood and milk characteristics. A feeding trial was conducted for 21 days from parturition to weaning. Experimental diets were supplied for 1 week before the parturition day and throughout the experimental period. Dietary treatments included: 1) CON (basal diet), 2) CFP (basal diet added 0.5% coconut fat powder) and 3) CFH (basal diet added 0.5% coconut fat powder containing husk). Average daily feed intake was significantly improved ($P < 0.05$) in CFP and CFH treatments compared with CON treatment. Backfat loss was significantly lower ($P < 0.05$) in CFP and CFH treatments than CON treatment. Compared with CON treatment, final body weight, weight gain and average daily gain in piglet were significantly increased ($P < 0.05$) in CFP and CFH treatments. Red blood cell was significantly increased ($P < 0.05$) in CFH treatment compared with others. White blood cell at the final period and lymphocyte at the final period were significantly increased ($P < 0.05$) in sows fed coconut fat powder diet. At the final period, milk fat concentration was significantly improved ($P < 0.05$) in CFP and CFH treatments compared with CON treatment. Milk protein concentration was significantly higher ($P < 0.05$) in CFP treatment than CFH treatment at the initial period and was significantly lower ($P < 0.05$) in CFP and CFH treatments than CON treatment at the final period. Milk lactose concentration at the initial period was significantly increased ($P < 0.05$) in CFH treatment compared with CON and CFP treatments. On diarrhea rate in piglet, three piglets presented diarrhea in CON treatment from 0 to 5 days. Explanation should be the intestines of newborn piglets were not developed yet. However, none diarrhea occurred in all treatment from 5 to 20 days. In conclusion, dietary fat source from coconut supplementation improved feed intake, backfat loss, RBC, WBC and lymphocyte in sow and weight gain in piglet.

Key Words: Coconut, Nutrient Digestibility, Sow

W138 Use of glycerol for glucose, glycogen and non-essential amino acid synthesis by embryos from small and large chicken eggs. N. E. Sunny, J. Moorefield, S. L. Owens, and B. J. Bequette^{*}, *University of Maryland, College Park.*

The objective was to determine the contribution of glycerol to glucose, glycogen and non-essential amino acid (NEAA) synthesis by d 14 and d 19 chicken embryos derived from small (56.6 ± 0.88 g) and large eggs (71.7 ± 1.09 g). After setting the eggs, small and large eggs were each divided into 2 groups (d 14 and d 19, $n = 7$ per group), after which [¹³C₃]glycerol (14 mg in 75 μ L H₂O) was administered into the chorio-allantoic fluid for 4 consecutive days prior to tissue and blood collection on d 14 and 19 embryonic. Blood and tissues were analyzed by GC-MS for ¹³C-mass isotopomer enrichments in blood glycerol, glucose, and NEAA, and liver and muscle glycogen. At both embryonic ages, [¹³C₃] glycerol administration led to the synthesis of [M+1], [M+2] and [M+3] isotopomers in blood glucose and liver and muscle glycogen. In d 14 embryos, ¹³C-isotopomer enrichments (moles ¹³C-isotopomer/100 moles ¹²C-isotopomer) were higher ($P < 0.05$) in small vs. large egg embryos

for blood glucose ([M+1]; 3.6 vs. 2.1, [M+2]; 3.7 vs. 2.2, [M+3]; 2.6 vs. 1.4) with a similar trend for liver and muscle glycogen. Compared to d 14 embryos, blood glucose ¹³C-isotopomer enrichments from d 19 embryos were 2-fold higher ($P < 0.05$), suggesting a greater reliance on glycerol for gluconeogenesis. There was also synthesis of [M+1], [M+2] and [M+3] isotopomers of alanine, aspartate and glutamate, the latter two of which were more highly enriched ($P < 0.05$) in liver. This study provides unequivocal evidence that glycerol is a major precursor for glucose synthesis by chicken embryos and that the indirect pathway of glycogen synthesis is a major metabolic route in the liver and the muscle for glycogen synthesis.

Key Words: Embryo, Chicken, Metabolism

W139 The effect of feeding omega-3 fatty acids during the grower and early finisher phases on intramuscular fatty acid composition at market weight in pigs. S. A. Meers^{*}, C. R. Dove, T. D. Pringle, and M. J. Azain, *University of Georgia, Athens.*

The objective of this study was to determine the effects of feeding a diet containing omega-3 fatty acids during the grower and/or early finish phases on intramuscular fat content and fatty acid composition of loin muscle. The study was designed as a 2 × 2 factorial arrangement, with main effects of fat (Control, C or Omega-3, O) and diet phase (Grower, G d0-35, or Early Finisher, EF d35-70). All pigs were fed a common Late Finisher (LF, d70-98) diet. Diets were corn-SBM based: G (17.9% CP, 1.0% lys), EF (17.0% CP, 0.9% lys), & LF (15.9% CP, 0.8% lys). Omega-3 fatty acids were supplemented by adding 2% fish oil (Virginia Prime Gold, Omega Protein, Houston, TX) to the G and EF diets. Soybean oil (2%) was used as the control in G, EF, and common LF diets. Pigs ($n=92$, initial BW 29.3 kg) were allotted by gender and weight to pens where C or O diet treatments were assigned at random. There were no effects of diet on overall growth performance. There was a trend for 19% greater lipid content in loin from pigs fed the O diet relative to the C diet (5.03 vs 4.23%, $P < 0.10$). Pigs fed the O diet had lower loin concentrations of linolenic acid (0.32%, $P < 0.01$) and greater concentrations of EPA (1.03%, $P < 0.0001$), DPA (0.62%, $P < 0.006$), and DHA (0.91%, $P < 0.0001$) when compared to C fed pigs (0.44%, 0.16%, 0.38%, and 0.05% respectively). The addition of fish oil to the diet decreased the n-6/n-3 ratio in loin muscle (C 17.7 vs O 3.4, $P < 0.0001$). A 100-g loin sample from pigs fed the O diet in G and EF contained greater amounts of total n-3 fatty acids (112 vs 31 mg, $P < 0.0001$) and greater EPA & DHA (64 vs 5.6 mg, $P < 0.0001$) relative to that found in loin from C fed pigs. It should also be noted that despite dietary differences, there were no diet effects on the percent of saturated fatty acids ($37.7\% \pm 1.11\%$) or the iodine value (77.86 ± 3.35) in the loin muscle. These results demonstrate that feeding diets with 2% fish oil during the G & EF phases, followed by a withdrawal period, results in an increase in the omega-3 content and a trend for greater intramuscular fat in loin muscle.

Key Words: Fish Oil, Omega-3 Fatty Acids, EPA

W140 Effect of different dietary protein levels on lipid metabolism of subcutaneous adipose tissue in lean-type and fat-type fattening pigs. W. T. Gu¹, T. L. Liu², P. W. Xu¹, M. J. Bo¹, H. J. Xu¹, Y. L. Yin^{*1}, X. F. Kong¹, T. J. Li¹, Z. Q. Liu¹, W. J. Tang¹, and R. L. Huang¹,

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Thirty six Duroc × Landrace × Yorkshire hybrid (lean-type) and twenty seven Ninxiang breed (fat-type) fattening pig were individually housed in metabolic cages and randomly allocated into three groups, fed each of three diets for 46-day periods. The corn and soybean meal-based diets included 10%,13% and16% protein levels for Ninxiang breed, and 13%,16% and 19% protein levels for hybrid, respectively, and each diet were identical in calories as fat. The effects of those diets on serum lipoprotein, cholesterol, triglyceride and leptin levels, and subcutaneous adipose tissue lipogenesis and lipolytic gene mRNA expression in two breed pigs were detected. With the increasing protein levels, serum triglyceride and leptin levels in hybrid breed were increased (quadratic; $p < 0.05$), while in Ninxiang breed, 16% group (493.00 ± 37 pg/mL) had higher serum leptin levels than 10% group (117.00 ± 46 pg/mL) ($p < 0.05$), but serum triglyceride levels was not significantly effected. The abundance of Acetyl-CoA carboxylase (ACC) mRNA in subcutaneous adipose tissue of hybrid breed was increased (linear; $p < 0.05$) but was not significantly changed in Ninxiang breed with the increasing of protein levels. The subcutaneous adipose tissue leptin mRNA abundance of Ninxiang breed was reduced (quadratic; $p < 0.05$), and the expression of leptin mRNA was positive correlated with the abundance of liver × receptor LXR in both breed ($p < 0.05$). The abundance of sterol regulatory element-binding protein (SREBP-1) mRNA of two breed tend to increase. Our findings suggest that different dietary protein levels alters the energy homeostasis of fattening pig, thereby effect the expression of key enzymes and related genes of lipid metabolism (mainly ACC and leptin) in order to regulate the lipid synthesis and secretion in subcutaneous adipose tissue. Furthermore, different dietary protein may act on nuclear transcription factors LXR/SREBP-1 directly or indirectly via leptin signaling.

Key Words: Lipid Secretary Function, Fattening Pig, Dietary Protein

W141 Cloning and characterization of porcine adipose triglyceride lipase (pATGL) gene. T. Shan, Y. Wang*, T. Wu, J. Guo, G. Yao, J. Feng, and Z. Xu, Zhejiang University, Hangzhou, P. R.China.

Adipose triglyceride lipase was recently identified as a major novel triglyceride lipase in animals. In this study, we aimed to study the tissue- and development- specific expression of porcine adipose triglyceride lipase (pATGL) in pigs, and the effect of resveratrol on expression of pATGL in vitro. The full-length cDNA sequences of pATGL was 1958 bp (accession no: EF583921), with an Open Reading Frame (ORF) of 1458 bp encoding 486 amino acids protein (the predicated molecular mass of 53.2 kDa, accession no. ABS58651). Comparison of the deduced amino acid sequence with the bovine, mouse, rat, dog and human adipose triglyceride lipase showed 87%, 84%, 83%, 81% and 80% similarity, respectively. Furthermore, The pATGL was highly expressed in porcine adipose tissue, to a lesser degree in kidney, heart, and muscle, and lowest but detectable in brain. In subcutaneous adipose tissue, the pATGL mRNA was very low at birth (1 kg body weight), and kept increasing postnatal, reaching a maximal value ($P < 0.01$) at 20 kg body weight (about 7 weeks old). Similarly, in peritoneal and omental adipose tissue, the highest expression of pATGL was observed at 40 kg body weight (about 14 weeks postnatal). Finally, administration of 40 μ M resveratrol and 80 μ M resveratrol for 24 h increased ($P < 0.05$) the mRNA levels of pATGL in cultured adipocytes by 95.3% (mean value = 1.95) and 146.8% (mean value = 2.47), respectively. Accordingly, lipid accumulation was decreased ($P < 0.05$) by 25.7% (mean value = 0.051) and 60.8% (mean value = 0.027), respectively. When treated with resveratrol for 48 h, the mRNA levels of pATGL were increased ($P < 0.05$) by 104.1% (mean value = 2.04) and 163.1% (mean value = 2.63), respectively. And 80 μ M resveratrol treatment decreased ($P < 0.05$) the lipid accumulation by 29.0% (mean value = 0.055). These data would be helpful for manipulating fat deposition via controlling adipose triglyceride lipase expression, thus improving meat quality.

Key Words: Gene Expression, Porcine Adipose Triglyceride Lipase (pATGL), Resveratrol