NONRUMINANT NUTRITION: FAT, FIBER, FERMENTATION, AND RESIDUAL FEED INTAKE

0463 Changing the dietary omega-6 to omega-3 fatty acid ratio impacts nursery pig performance more than increasing omega-3 intake alone.
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The objective of this experiment was to determine if either increasing the intake of omega (ω)-3 fatty acids or the amount relative to ω-6 fatty acids (ω-6:ω-3 ratio) would impact nursery pig performance. A total of 300 newly weaned pigs (26 ± 2 d of age), blocked by gender, were housed in groups of 5/pen. Pens were assigned to 1 of 5 diets (n = 12 pens/diet) consisting of a control (Con; 10:1 ω-6:ω-3 ratio, 3.5% total fat, tallow based), 3 diets with 3.5% fat (plant based) and ω-6:ω-3 ratios of 10:1, 5:1, and 1:1 (3.5/10, 3.5/5, and 3.5/1 respectively), and a plant-based 10:1 ratio diet with 5% total fat (5/10). This design allowed us to examine the effects of increasing ω-3 intake at a constant ratio (10:1 ratio; 3.5 vs. 5% fat) and the effect of reducing the ω-6 to ω-3 ratio at a constant amount (3.5% fat; 10:1, 5:1, and 1:1 ratios). Pigs were weighed weekly for 4 wks. On d 0 and d 29, 6 pigs and 6 pigs/diet respectively, were slaughtered, allowing the calculation of whole body N, fat, and water deposition. The ADFI was higher for pigs consuming the 3.5/1 diet during d 21 to 28 (1.13 vs. 0.96 kg/d; P = 0.01) when compared with pigs fed all other diets. Increasing ω-3 amount (constant 10:1 ratio) did not affect ADFI or ADG (P > 0.10); but when the ω-6:ω-3 ratio decreased (constant total fat), ADFI was highest for pigs consuming the 3.5/1 diet relative to those consuming the 3.5/5 or 3.5/10 diets during d 21 to 28 postweaning (1.13 vs. 0.97 vs. 0.93 kg/d; P = 0.02). Pigs consuming the 3.5/5 diet had increased protein (82.5 vs. 71.1 vs. 74.2 g/d; P = 0.07) and water (342.1 vs. 301.0 vs. 313.0 g/d; P = 0.06) deposition rates relative to those consuming the 3.5/10 or 3.5/1 diets. Lipid deposition was unaffected by treatment (P > 0.10). Increasing the amount of dietary ω-3 fatty acids while keeping the ω-6:ω-3 ratio constant did not affect ADG, ADFI, or carcass composition; however, when total fat was held constant, a 5:1 ratio led to improved ADFI in older nursery pigs, as well as increased protein deposition without altering lipid deposition.

Key Words: swine, omega-3, performance

0464 The dietary omega-6 to omega-3 fatty acid ratio impacts the inflammatory response in nursery pigs more than increasing omega-3 intake.
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The objective of this experiment was to determine if the intake of ω-3 fatty acids affects the inflammatory response of nursery pigs postweaning, and if this response depends on the ratio with ω-6 fatty acids. Individually housed, newly weaned pigs (26 ± 2 d of age; n = 100) were assigned to 1 of 5 diets and 1 of 2 inflammatory challenge groups arranged as a 5 × 2 factorial with repeated measures. Diets consisted of a control (Con; 10:1 ω-6:ω-3, 3.5% total fat, tallow based), 3 diets with 3.5% fat (plant based) and ω-6:ω-3 ratios of 10:1, 5:1, or 1:1 (3.5/10, 3.5/5, and 3.5/1 respectively), and a 10:1 ratio diet with 5% total fat (5/10). This allowed for the comparison of increasing ω-3 intake at a constant ratio (10:1 ratio; 3.5 vs. 5% fat) and decreasing ratio at a constant ω-3 intake (3.5% fat; 10:1, 5:1, and 1:1 ratios). Challenge groups consisted of a saline or lipopolysaccharide (LPS; 15 μg/kg BW *Escherichia coli* lipopolysaccharide) injection. Pigs were fed their assigned diets for 22 d before the 24-h inflammatory challenge on d 23. Rectal temperatures were measured hourly for the first 6 h, then at 12 and 24 h postinjection. Blood samples were collected at 0, 2, 6, and 12 h postinjection. The ADG and ADFI from d 0 to 22 or during the challenge period were unaffected by diet (P > 0.05). During the challenge, LPS pigs had lower (P < 0.01) ADFI (0.93 vs. 0.40 kg, saline vs. LPS) and ADG (+0.44 kg vs. -0.52 kg, saline vs. LPS). Rectal temperature, blood urea N, IL-1β, IL-6, and TNFα were unaffected by diet (P > 0.05), but were increased by LPS (P < 0.01). Serum IL-8 concentration was reduced with decreasing ω-6:ω-3 ratio (16.79 vs. 11.14 pg/mL, 10:1 vs. 1:1; P = 0.03) but was unaffected by dietary ω-3 amount at a constant ratio (P > 0.05). Pigs consuming the 3.5/1 diet had lower IL-8 responses relative to those consuming the 3.5/10 and 3.5/5 diets (diet × challenge P = 0.03). Additionally, the IL-8 response of pigs fed the 1:1 diet and challenged with LPS was similar to the saline injected pigs fed the 10:1, 5:1, or 1:1 diets (P > 0.05), indicating that reducing the dietary ω-6:ω-3 ratio impacts a piglets inflammatory response postweaning.

Key Words: swine, omega-3, inflammatory response

0465 Effect of fiber and fat on calculated values for standardized total tract digestibility of calcium in fish meal.
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The objectives of the experiment were to determine the effect of fiber and fat on the standardized total tract digestibility (STTD) of Ca in fish meal and to evaluate the effect of type

of diet (cornstarch-based diet vs. corn-based diet) and digestibility procedure (direct procedure vs. difference procedure) on calculated values for STTD of Ca in fish meal. Seventy growing pigs (BW: 19.4 ± 1.0 kg) were randomly allotted to 7 diets with 10 pigs per treatment. Two diets were formulated to determine the effect of fiber on STTD of Ca in fish meal: (1) cornstarch-based diet + fish meal and (2) cornstarch-based diet + fish meal + Solka floc. Two additional diets were formulated to determine the effect of fat on STTD of Ca: (3) corn-based diet + fish meal + 1% fat and 4) corn-based diet + fish meal + 7% fat. To evaluate the effect of type of diet on the STTD of Ca in fish meal, diets 1 and 3 were compared. The STTD of Ca in fish meal was also determined using the difference procedure with a corn-soybean meal diet (0.33% Ca) and a corn-soybean meal-fish meal diet (0.89% Ca). A Ca-free diet was used to determine basal endogenous losses of Ca. Results indicated that fiber increased ($P < 0.001$) the STTD of Ca, but the STTD of Ca was not affected by inclusion of fat in the diet. The STTD of Ca (88.99%) in the corn-based diet was greater ($P < 0.05$) than in the cornstarch-based diet (45.79%). When comparing the direct and the difference procedure, the greatest ($P < 0.05$) values for the STTD of Ca in fish meal were obtained in pigs fed the corn-based diet using the direct method, followed by values calculated by difference procedure (77.66%; $P < 0.05$), and the least ($P < 0.05$) values were obtained in pigs fed the cornstarch-based diet using the direct method. In conclusion, fiber increased the STTD of Ca, but inclusion of fat did not affect the STTD of Ca. Values for the STTD of Ca were influenced by the type of diet and by the digestibility procedure used. These data indicate that values for the ATTD or the STTD of Ca obtained in synthetic diets may not always be representative for the ATTD and the STTD of Ca in practical corn-soybean meal diets.

Key Words: calcium digestibility, fish meal, pigs

0466 Response of pigs in ileal endogenous amino acid losses to different dietary fiber types determined using the regression method. S. A. Adedokun* and O. Adeola, *Purdue University, West Lafayette, IN.*

Dietary fiber, especially fiber with high water holding capacity, is theorized to increase ileal endogenous amino acid (EAA) losses in nonruminant animals. It is not known whether dietary fiber types have different effects on ileal EAA. Increase in EAA losses would decrease apparent ileal AA digestibility and increase N excretion into the environment. Information on basal ileal EAA losses in pigs will advance diet formulation on standardized ileal AA digestibility basis. The objective of this study was to evaluate the effect of 2 fiber sources, corn fiber or pectin, on ileal EAA losses in pigs. Total AA, crude protein, and crude fiber contents of corn fiber or pectin used in this study were 9.8, 10.8, and 10.0% or 1.1, 10.8, and 0.2%, respectively. For each fiber type, 3 semipurified diets were formulated to contain 3 levels of casein (40, 80, and 120 g/kg diet) and 100 g of fiber/kg diet. All fiber within a diet was supplied by either corn fiber or pectin. The experiment consisted of 3 periods of 7 d, each with ileal digesta collection on d 6 and 7. Within each period, there were 3 pigs on 3 levels of casein (40, 80, or 120 g/kg diet) in each of 3 blocks per fiber type; and each block served as the experimental unit. There were 18 cannulated pigs with average initial BW of 30, 31, and 30 kg for Periods 1, 2, and 3, respectively. Each pig received 3.5% of the starting BW of the smallest pig within each block in 2 equal portions at 0700 and 1800 h. Basal ileal EAA losses were determined from the ordinate intercept, at 0 AA intake, of the regression of ileal digesta AA concentration in mg/kg DMI against dietary AA intake in mg/kg DM. Corn fiber resulted in higher ($P < 0.05$) ileal endogenous His, Leu, and Tyr losses. Isoleucine, Phe, Thr, and Cys showed a tendency ($P < 0.1$) for higher endogenous loss in pigs fed diets containing corn fiber. In general, the effect of highly-fibrous but low-viscosity corn fiber on ileal endogenous N and AA losses is similar to that of low-fiber but highly-viscous pectin.

Key Words: corn fiber, endogenous AA, pectin

0467 Starch and fiber characteristics of barley influence site of energy digestion in ileal-cannulated grower pigs. J. M. Fouhse*[1], S. Moehn[1], J. Gao[1], T. Vasanthan[1], M. Izydorczyk[2], A. D. Beattie[3], and R. T. Zijlstra[1], *[1]University of Alberta, Edmonton, Canada, [2]Canadian Grain Commission, Winnipeg, MB, Canada, [3]University of Saskatchewan, Saskatoon, Canada.*

Chemical components of cereal grains such as amylose, β-glucan (BG), and total dietary fiber (TDF) may influence energy digestion in the gut. The objective was to determine the association between composition of barley and wheat and the site of energy digestion in pigs. Seven ileal-cannulated barrows were allotted to a 6 (periods) × 7 (diets) Youden square. Five cereal grain diets included (% amylose, β-glucan, and TDF): 3 hulless-barley cultivars: Diet 1, CDC Fibar (0, 10, 22); Diet 2, CDC Hilose (13, 7, 18); Diet 3, CDC McGwire (11, 5, 15); 1 hulled barley, Diet 4, Xena (12, 4, 17); and 1 hard red spring wheat, Diet 5, Utmost (12, 1, 14). Two reference diets, an N-free and a protein-energy mix, were included to calculate ingredient digestibility. Test diets included 80% cereal grain and were fed at 2.5 × maintenance. Feces and ileal digesta were sampled after a 5-d adaptation. The AID of GE, DM, and starch was lowest ($P < 0.05$) for Fibar (43, 42, 73%) and Hilose (48, 47, 69%) vs. McGwire (68, 67, 84%), Xena (65, 64, 92%), and Utmost (78, 80, 93%). In contrast, hindgut fermentation of GE, DM, and starch was greatest ($P < 0.05$) for Fibar (45, 46, 26%) and Hilose (48, 41, 30%) vs. McGwire (23, 23, 16%), Xena (17, 16, 8%), and Utmost (11, 14, 7%). Thus, Fibar and Hilose did not differ ($P > 0.05$) in ATTD of DM and GE from Utmost. McGwire had the greatest ($P < 0.05$) ATTD of DM and had a greater ($P < 0.05$) ATTD of GE

than Fibar, Hilose, and Xena but equal to that of Utmost ($P < 0.05$). Specifically, ATTD of DM was 90 vs. 87, 88, 81, and 88% and ATTD of GE was 91 vs. 88, 88, 83, and 89%, respectively, for McGwire vs. Fibar, Hilose, Xena, and Utmost. Starch ATTD did not differ among cereal grains ($P > 0.05$). Hulled barley, Xena, had an ATTD of GE and DM lower ($P < 0.05$) than all other cereal grains. Thus, the DE was lower ($P < 0.05$) in Xena than all other cereal grains, which did not vary ($P > 0.05$). In conclusion, a greater content of amylose, BG, and TDF in cereal grains decreased energy digestion in the small intestine and increased hindgut fermentation of energy, which may support maintaining pig gut health.

Key Words: grain, starch, fiber

0468 Effects of three types of dietary microalgal inclusions on n-3 and n-6 fatty acid profiles in egg yolks of laying hens. J. Kim, A. Magnuson, and X. Lei*, *Cornell University, Ithaca, NY.*

Two experiments were conducted to determine if including microalgal biomass into layer diets containing 0, 3, and 5% flaxseed oil (FO) affected fatty acid profiles in their egg yolk. In Experiment I, 90 Shaver-laying hens (20-wk old) were allotted into 9 groups ($n = 10$) and fed diets containing 3 levels of FO (0, 3, and 5%) and 3 levels of full-fat *Staurosira* spp. (SS) (0, 7.5, and 10%, Cellana, Kailua-Kona, HI) for 4 wk. In Experiment II, 50 Shaver-laying hens (28-wk old) were divided into 5 groups ($n = 10$) and fed control diet (without FO and MAB) or the diets containing 3% FO with SS at 7.5%, defatted *desmodesmus* spp. (DS) at 7.5%, or defatted *Nannochloropsis ocreanica* (NO) at 7.5 or 15% for 4 wk. Body weights, feed intakes, and egg quality (albumen, egg yolk, and egg shell weight) were measured weekly, and fatty acid contents of egg yolk were determined biweekly. In Experiment I, neither FO nor SS affected feed intakes, egg production, or egg quality. While body weights were decreased ($P < 0.05$) by 5% FO, the decrease was prevented by the inclusion of SS. At wk 2, the FO inclusion increased n-3 fatty acid ($P < 0.05$), and decreased n-6 fatty acid concentrations in the yolk. The SS inclusion affected ($P < 0.05$) yolk n-6 fatty acid concentrations. At wk 4, there were interactions ($P < 0.05$) between SS and FO on the yolk n-3 fatty acid concentrations or changes over time. The yolk concentrations of n-6 fatty acids were increased by FO, but decreased by SS. In Experiment II, egg production, egg component weights, body weights, and feed intakes were not affected by the 5 dietary treatments. While the combinations of 3% FO and 3 types of microalgal biomass elevated ($P < 0.05$) the yolk n-3 fatty acid contents, the 2 doses of NO (7.5 vs. 15%) showed no difference. In conclusion, inclusions of 3 types of microalgal biomass exerted moderate effects on n-3 and n-6 fatty acid profiles and concentrations in comparison with the much stronger effects of 3 or 5% FO. However, the microalgal biomass inclusion seemed to help offset the negative effects of 5% FO on the body weights of laying hens. *Supported in part by USDA/DOE Biomass R&D Initiative Grant.*

Key Words: Microalgal biomass, omega-3 fatty acid, laying hens

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0469 Dose-dependent effect of a defatted green microalgal biomass on enriching omega-3 fatty acids in broiler chicken. S. K. Gatrell*, J. Kim, T. J. Derksen, E. V. O'Neil, and X. G. Lei, *Cornell University, Ithaca, NY.*

The objective of this experiment was to determine the feasibility of creating an omega-3 (n-3) enriched chicken product using defatted green microalgae (*Nannochloropsis oceanica*), a byproduct of the biofuel production research. A total of 180 hatching Ross broiler chicks were divided into 5 groups ($n = 6$) fed a corn-soybean meal diet containing 0 (control), 2, 4, 8, or 16% algal biomass (Cellana, Kailua-Kona, HI) for 6 wk. Plasma, breast muscle (pectoralis major) and liver were collected at wk 6. Plasma n-3 fatty acid concentrations showed dose-dependent increases with the microalgal inclusion levels, and the concentration in the birds fed the 16% microalgae diet was 15-fold higher ($P < 0.001$) than that of the control. Meanwhile, liver eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were increased 8- to 22-fold ($P < 0.001$) and 2- to threefold ($P < 0.01$), respectively, by feeding the microalgal biomass compared with the control. Percentage of n-3 fatty acids, but not total fatty acid content, in the breast muscle was enhanced ($P < 0.0001$) by the microalgae inclusion in a dose-dependent fashion. Breast muscle EPA and DHA contents were elevated ($P < 0.0001$) by 38- and 60-fold, respectively, in the chicks fed the 8 and 16% microalgae diets compared with those fed the control diet. In conclusion, the defatted marine microalgal biomass tested in the present study was very effective in enriching n-3 fatty acids, in particular DHA and EPA, in broiler chicken tissues. Supported in part by USDA/DOE Biomass R&D Initiative Grant.

Key Words: biofuel, nutrition, health

0470 In vitro digestion and fermentation characteristics and in vivo digestibility of canola co-products in the pigs. T. A. Woyengo*[1], R. Jha[1,2], E. Beltranena[1], and R. T. Zijlstra[1], *[1]University of Alberta, Edmonton, Canada, [2]Univerisity of Hawaii at Manoa, Honolulu.*

Canola coproducts serve as source of dietary AA and energy to pigs. However, fermentation characteristics of solvent-extracted canola meal (CM) in the pig intestine are unknown. Thus, we determined in vitro degradation and fermentation characteristics of *Brassica juncea* CM (JCM) and *Brassica napus* CM (NCM) in comparison to soybean meal (SBM). Samples were first hydrolyzed using pepsin and pancreatin. Subsequently, residues were incubated in a buffer with fresh pig feces as inocula in a randomized complete block design providing 12 replicates

per feedstuff per run for 2 runs. Accumulated gas production was measured for 72 h and modeled to estimate kinetics of gas production. Concentration of VFA per unit weight of feedstuff was measured in fermented solutions. In previous studies, ileal and hindgut GE digestibility values for feedstuffs were obtained (by difference method) from ileal-cannulated barrows (~50 kg BW) fed cornstarch-based diets containing 50% feedstuffs for 5 d. On DM basis, SBM, JCM, and NCM contained 50.6, 44.0, and 38.1% CP; and 8.5, 22.3, and 30.6% NDF, respectively. The in vitro DM digestibility for SBM (82.3%) was greater ($P < 0.05$) than the in vitro DM digestibility for JCM (68.5%), which was greater ($P < 0.05$) than that of NCM (63.4%). Ileal GE digestibility was greatest ($P < 0.05$) for SBM followed by JCM and then NCM. Total gas production for SBM was greater ($P < 0.05$) than that of JCM, which was greater ($P < 0.05$) than that for NCM. Total VFA production was lower ($P < 0.05$) for SBM (0.73 mmol/g DM) than for NCM (1.05 mmol/g DM), which was lower ($P < 0.05$) than that of JCM (1.37 mmol/g DM). A similar trend was observed for hindgut GE digestibility (as percentage) for feedstuffs; 15, 21.4, and 24.4% for SBM, NCM, and JCM, respectively. In conclusion, in vitro fermentation characteristics of SBM, and canola meals simulated their digestion in the pig hindgut ($r^2 = 0.979$). The NCM or JCM can contribute more energy to the pig via hindgut fermentation than the SBM, whereas JCM can contribute more energy to the pig via hindgut fermentation than the NCM.

Key Words: canola meal, in vitro fermentation, pig

0471 In vitro pig cecal fermentation with different inoculum source with diets containing *Acrocomia aculeata*.

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The aim of this study was to determine the potential of different inoculum sources on in vitro gas production technique. Three different types of inoculum were used for fermentation in gas production analysis: fistulated bovine ruminal liquor grazing *Brachiaria brizantha* (RL); extract from slaughtered pig cecum raised in a conventional confined system (CS) and extract from slaughtered pig cecum raised in a free range system (CF), both collected directly from the cecum. The substratum used was 3 diets containing replacement of *Acrocomia aculeata* (AA) pulp being 100% (0% AA), 90% (10% AA), and 80% (20% AA) of a basal diet with soybean meals and corn grains to meet pig growth requirements, as well as *Braquiaria brizantha* grass. The accumulated volume of gas was measured at 0, 3, 6, 9, 12, 16, 24, 48, 72, and 96 h after incubation. The mathematical model used was France et al. (1993). A completely randomized design with factorial arrangement was used. All used inocula produced gases with the studied substrates (Table 0471). The pig cecum extract (CF) showed higher gas production ($P < 0.05$) with *Braquiaria brizantha*and 20%AA as substratum than CS. However, there was no statistical difference when compared with RL. The gas production was superior ($P < 0.05$) when basal diet (0%AA) was used with LR and CS inocula. There were no significant differences in gas production when 10% AA was used as a substrate. The pig cecum extract from slaughtered pigs raised in confined and free range systems produced gas as well as bovine ruminal liquor, and can be used for further gas production evaluation, mainly to study fiber usage in pork production. The pig cecum extract from pigs raised in free range (CF) pork production showed more important gas production potential ($P < 0.05$) than CS when the substrate had high fiber level, probably due to the increase of fiber intake in livestock breeding.

Key Words: gas production, fiber fermentation, alternative feed

Table 0471. Inocula gas production (mL) with distinct substrates after 96 h of incubation

Inocula	*Braquiaria brizantha*	0% AA	10% AA	20% AA
Bovine ruminal liquor	52.81[ab]†	112.14[a]	107.85	108.52[ab]
Pig cecum extract, standard	47.84[b]	98.47[a]	115.15	102.46[b]
Pig cecum extract, free range	60.14[a]	72.21[b]	83.54	110.4[a]
MSE	5.85	9.44	17.72	3.37
CV, %	10.92	10.02	17.34	3.14

† Means followed by different letters are significantly different by the Tukey Test 5%.

0472 Residual feed intake in pigs is associated with organ weight, nutrient digestibility, and intestinal nutrient transporter gene expression.

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Increases in nutrient digestibility mediated by changes in intestinal nutrient transporter gene expression could possibly explain the differences in efficiency between animals differing in residual feed intake (RFI). The objective of this study was to examine the effect of divergent selection for RFI on organ weights, nutrient digestibility and intestinal nutrient transporter gene expression in pigs. Male pigs ($n = 75$; initial BW 22.4 kg were fed a standard finishing diet (8.3 g/kg lysine and 16.4 MJ/kg gross energy) for 43 d to evaluate feed intake and growth for the purpose of calculating RFI. Phenotypic RFI was calculated as the residuals from a regression model regressing DMI on ADG and midtest $BW^{0.75}$(MWT). Data was analysed using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC). On d 43, 16 animals (average weight 85 kg sem 2.84 kg), designated as 8 high RFI (HRFI) and 8 low RFI (LRFI) were slaughtered and digesta from the ileum

and rectum were collected for the purpose of calculating the coefficient of apparent ileal (CAID) and total tract nutrient digestibility (CATTD). Tissue was collected from the jejunum, duodenum, and ileum for the purpose of examining intestinal nutrient transporter gene expression. As expected, LRFI pigs had lower ADFI (2.44kg vs. 1.87kg, sem 0.07) and improved feed conversion ratio (1.96 vs. 2.48) than HRFI pigs ($P < 0.001$) with no difference in ADG or MWT. When comparing weights of organs between RFI groups, HRFI pigs had increased weight of heart and visceral organs ($P < 0.05$) compared with the LRFI. There was a linear positive correlation between RFI and weight of large intestine ($r = 0.57$; $P < 0.05$). For the digestibility parameters measured, RFI was negatively correlated with CATTD of N ($r = -0.46$; $P < 0.05$) and GE ($r = -0.51$; $P < 0.05$). The RFI was negatively correlated with the intestinal glucose transporters SGLT1 ($r = -0.56$; $P < 0.05$) and GLUT2 ($r = -0.44$; $P = 0.09$). LRFI pigs had increased CAID of gross energy (GE) than HRFI pigs ($P < 0.05$). Similarly, LRFI pigs had improved CATTD of GE, while also having improved digestibility of N and dry matter (DM). LRFI pigs had higher gene expression of the fatty acid transporter FABP2 ($P < 0.01$) and glucose transporters SGLT1 ($P < 0.05$) and GLUT2. In conclusion differences in nutrient digestibility, intestinal nutrient transporter gene expression and differential organ weight are possibly some of the biological processes responsible for differences in feed efficiency in pigs.

Key Words: residual feed intake, nutrient transporter gene expression, pigs

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0473 Effect of divergent selection for residual feed intake on cytokine gene expression in pigs following an ex vivo liposaccharide challenge.

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Pathogenic microbes influence pig performance by stimulating an inflammatory immune response and disrupting metabolism. To date, little research has been undertaken to examine the effect of divergent selection for residual feed intake (RFI) on the immune system. The objective of this study was to examine the effect of divergent selection for RFI on colonic inflammatory cytokine gene expression following an ex vivo lipopolysaccharide (LPS) challenge. Male pigs ($n = 75$; initial BW 22.42kg [SD = 2.03]) were fed a standard finishing diet (12.5 g/kg lysine and 14.5 MJ/kg DE) for 43 d to evaluate feed intake and growth for the purpose of calculating RFI. Phenotypic RFI was calculated as the residuals from a regression model regressing DMI on ADG and midtest $BW^{0.75}$ (MWT). On d 43, 16 animals (average weight 85 kg, Std 2.84 kg), designated 8 high RFI (HRFI) and 8 low RFI (LRFI) were slaughtered. Colonic tissue was collected and stimulated for 3 h ex vivo with LPS. QPCR was performed to analyse the expression of *IL-1, IL-6 IL-8, IL-10, Il-17, TNF-α* and *IFN-γ*. As expected, LRFI pigs had lower ($P < 0.001$) ADFI (2.44kg vs. 1.87kg sem 0.04) and improved feed conversion ratio (1.96 vs. 2.48, sem 0.01) than HRFI pigs with no difference in ADG or MWT. Stimulation of the colonic tissue with LPS increased expression of *IL-8* ($P < 0.05$), *TNF-α* ($P < 0.0001$), *IL-10* ($P < 0.05$), *IL-1* ($P < 0.001$), *IFN-γ (P < 0.05)* and *IL-6* ($P < 0.001$) in both HRFI and LRFI pigs. There was an interaction between RFI and LPS challenge for the expression of *IL-8* ($P < 0.05$) and *IL-1* ($P < 0.01$) and *IFN-γ (P < 0.05)*. Following the LPS challenge there was an increase in the expression of *IL-1* ($P < 0.01$) and *IL-8* ($P < 0.05$) and *IFN-γ (P < 0.05)* in the HRFI pigs, with no change in the LRFI pigs. There was no difference between RFI groups for *IL-10* and *IL-17*. The upregulation of pro-inflammatory cytokines has an adverse effect on the gut mucosa and the reduced expression of the pro-inflammatory cytokines in this study could partly explain the increased efficiency in LRFI pigs.

Key Words: residual feed intake, cytokine, pigs