T389 Genistein decreases LPS-stimulated production of TNF-α in porcine peripheral blood mononuclear cells. L. Seefeldt* and J. Clapper, *South Dakota State University, Brookings.*

Endotoxemia is often manifested by an overproduction of circulating pro-inflammatory cytokines, such as tumor necrosis factor-α (TNF) in response to lipopolysaccharide (LPS). Genistein, a non-steroidal tyrosine kinase inhibitor, has been shown to decrease the release of TNF from circulating peripheral blood mononuclear cells (PBMC) in response to LPS in several species. To further examine if genistein could be used to reduce LPS stimulated TNF release in the pig the following experiment was performed. Blood (20 mL) was collected by jugular venipuncture from 5 mo old barrows and the isolated leukocyte rich plasma was layered over Histopaque 1077 and centrifuged to obtain an enriched PBMC population. PBMC were washed twice in sterile DPBS, counted, diluted and added to 24-well culture plates (5×10^5 cells/well) and incubated at 37°C in 5% CO_2 for 2 h to allow cells to adhere. Non-adherent cells were decanted and adherent cells covered with RPMI 1640 plus 1% FBS and 0, 10 μM, 20 μM and 40 μM genistein with and without 10 ng/mL LPS (*E. coli* O111:B4). Cells were incubated for 10 h at 37°C in 5% CO_2 after which the media was collected and frozen at −80°C until assayed for TNF by ELISA. Triplicate wells were prepared for each genistein-LPS combination. Optimal cell number and LPS concentration were determined by a previous dose response experiment. Differences in media concentrations of TNF were determined by ANOVA. LPS treatment increased media concentrations of TNF 7 fold over controls ($P < 0.01$). Genistein dose dependently decreased ($P < 0.01$) media concentrations of TNF. The 40 μM dose of genistein decreased ($P < 0.01$) media concentrations of TNF to a greater extent than 10 and 20 μM, however, all doses of genistein decreased ($P < 0.01$) media concentrations of TNF compared with LPS stimulated controls. Additionally, 20 and 40μM genistein decreased ($P < 0.01$) media concentrations of TNF in non-LPS-stimulated cells but no difference ($P > 0.05$) was detected between the 2 doses. These preliminary data suggest genistein may be useful in ameliorating LPS stimulated TNF production in the pig.

Key Words: pig, LPS, genistein

T390 Effort on an oral endotoxin challenge in pigs. S. Schaumberger* and G. Schatzmayr, *Biomin Research Center, Tulln, Austria.*

The effect of endotoxin (lipopolysaccharide - LPS) of *E. coli* O55:B5 was tested in vivo in weaners. The aim of the study was, to develop an oral endotoxin challenge model to better understand the mechanism of endodoxic shock. In the first trial, 3 groups with 3 pigs in each were conducted: group I received 200 μg LPS per kg body weight intravenously. Pigs in group II were administered 20 mg LPS per kg body weight orally. Group III served as a negative control which was orally given 40 mL physiological saline. The trial lasted for 14 h where blood samples were drawn hourly. At the end, all pigs were euthanized and necropsy was performed. Blood samples were analyzed for LPS, tumor-necrosis-factor-α (TNF- α) and interleukin-6 (IL-6). Pigs of group I showed severe clinical signs (hyperventilate, cyanosis, vomiting) starting 15 to 20 min after administration and one pig had to be euthanized within the first hour due to muscle spasms. Five hours after administration, a second pig died. The third pig recovered. The 3 pigs of group II did not show severe clinical signs. They laid down most of the time as did the animals in the negative control. An increase of LPS values as well as IL-6- and TNF- α-values were observed within blood samples in group I, compared with the other groups. As this trial did not reveal a positive oral endotoxin challenge in another attempt, 9 piglets were weaned at 3 weeks of age and were fed a diet with a higher protein source for one week, to trigger permeability of the intestinal wall and to ensure that, orally administered LPS can enter the circulation. Pigs were divided into 3 groups: group I orally received 20 mg of LPS per kg body weight. Pigs in group II were orally administered 20 mg LPS diluted in sun flower oil per kg body weight, as fatty acids should promote the resorption of LPS from the intestine. Group III served as negative control group which was orally given physiological saline. This trial was elongated to 22 h and again hourly blood sampling and necropsy were performed. After this challenge, no clinical signs were observed during the whole 22 h. No severe macroscopic or histological lesions were observed in the intestine. Blood samples of all 9 animals were inconspicuous. Further approaches have to be investigated for the development of an oral endotoxin challenge model.

Key Words: pigs, endotoxin, challenge

T391 Effect of Actigen supplementation in gestation and lactation on sow and piglet performance, colostrum Ig level and milk composition. R. S. Samuel* and K. M. Brennan, *Alltech Center for Animal Nutrigenomics and Applied Animal Nutrition, Nicholasville, KY.*

Actigen (Alltech Inc.) is a second-generation yeast-cell-wall (YCW) product containing mannanoligosaccharides that have been shown to increase sow body weight gain and reduce piglet mortality. Our aim was to assess whether inclusion of YCW sow diets changes milk composition and improves sow and piglet performance. Sows were fed non-medicated gestation (n = 657) and lactation (n = 633; parity 1–8) diets without or with YCW (900 ppm). Feed from d 3–100 of gestation was provided as per body condition. Additional feed (909 g/d) was fed after d 100. Sows were offered lactation feed ad libitum after d4 post-farrowing. Piglets (including stillborns) were weighed after farrowing. Cross-fostering within treatment was completed within 24 h post-farrowing and post-foster litter weights recorded. Sow BW was recorded pre- and post-farrowing. Milk samples (120 per treatment) were analyzed for immunoglobulin and nutritional content. Conception rate tended to be greater ($P \leq 0.09$) among sows fed YCW compared with controls. Sows fed YCW had lower ($P \leq 0.05$) post-farrow net BW and lost less BW ($P \leq 0.001$) during lactation (3.2 vs. 11.3 kg; SEM 2.6) than controls. Litter birth weight; piglets born alive and dead per sow; adjusted litter gain; sow ADFI; post-weaning BW; pre- and post-farrowing backfat thickness; and milk fat, lactose, milk energy, somatic cell count, milk urea N, and total solids did not differ between treatments. Protein (%; $P \leq 0.01$) and total solids less fat (%; $P \leq 0.03$) were greater in milk from YCW-fed sows compared with controls. Milk IgG concentrations from parities 1, 3 and 6 were greater ($P \leq 0.05$) with YCW. Number of piglets weaned per sow was greater ($P \leq 0.02$) for parity 4 sows fed YCW. Feeding YCW to sows during gestation and lactation significantly reduced lactating sow BW loss without affecting weaning weight or the number of piglets weaned per sow.

Key Words: mannan oligosaccharides, piglet, sow

T392 Effect of maternal Actigen supplementation during gestation and lactation on piglet gut development and gene expression. K. M. Brennan* and D. E. Graugnard, *Alltech Center for Animal Nutrigenomics and Applied Animal Nutrition, Nicholasville, KY.*

Our aim was to determine the effect of adding a yeast-cell-wall-based product (Actigen, Alltech Inc., Nicholasville, KY) to maternal gestation and lactation diets on piglet intestinal gene expression and morphology. Sows (parity 1–8) were housed in farrowing crates at a commercial production research facility and randomly assigned to 1 of 2 treatments: commercial gestation and lactation diets without (control, CON) or with 0.90 kg/t of Actigen (ACT). On d 10 post-farrowing, 1 piglet per sow (n = 15 per treatment) was randomly selected and euthanized. Jejunum samples were flash-frozen for microarray analysis and fixed in buffered formalin for histologic analysis. Intestinal morphology was evaluated using H-E staining of the jejunum (n = 6 per treatment). No differences in goblet cell count, goblet cell area or villus height were observed. Intestinal gene expression was evaluated using the Affymetrix Porcine Genome Array. Of the 15,000 transcripts, 659 genes were affected (262 upregulated, 397 downregulated) by maternal ACT ($P \leq 0.05$, FC $\geq$1.2). Genes significantly affected by ACT were classified by biologic function: growth and proliferation, metabolic process, immune system process, response to stimulus, cell cycle, cell communication, or organ development. Different functions showed evidence of positive regulation due to ACT (z-score $\geq$1.5) including cellular growth and proliferation, cell signaling and post-translational modification. Negative regulation was observed (z-score $\leq$ 1.5) in cellular movement and organismal injury and abnormalities. Multiple pathways were activated in piglets from ACT sows including cholecytokinin/gastrin-mediated signaling, ephrin receptor signaling and gonadotropin signaling. Gastrin is a potent cell-growth factor that has been implicated in a variety of biologic processes including maintenance of the gastric mucosa, proliferation of enterochromaffin-like cells, and neoplastic transformation. Ephrin is fundamental for the cell to cell signaling in different pathways related to cell migration and angiogenesis. Gonadotropins are known to play different roles in growth and reproduction. Although performance and intestinal morphology did not differ between treatments, transcriptional changes d10 post-farrowing implies long-term ACT gut health, growth and development benefits.

Key Words: mannan oligosaccharide, gene expression, piglet

T393 Effect of social ranks on oxidative stress status, reproductive performance, and immune status of sows housed in groups during gestation. Y. Zhao,* W. L. Flowers, and S. W. Kim, *North Carolina State University, Raleigh.*

This study was to determine if social ranks of gestating sows housed in group would affect their oxidative stress status, reproductive performance, and immune status. On d 35 of gestation, 72 multiparous sows were checked for pregnancy and randomly assigned to 24 gestational pens with 3 sows per pen. The social rank of sows within a pen was determined by observing their aggressive behavior for a 4-d period after allotment and classified into high-, middle-, and low-ranking groups (HR, MR, and LR) according to their percentage of winning interactions. On d 109 of gestation, sows were moved to individual farrowing crates. Litter size and piglet weight were recorded during lactation and blood samples from sows were taken during gestation and lactation. Plasma malondialdehyde, protein carbonyl, and 8-hydroxy-deoxyguanosine (8-OHdG) were analyzed. Immunoglobulin G and IgM in sow plasma and colostrum were measured. Sows in HR showed higher ($P < 0.05$) BW than sows in MR and LR. Sows in HR had greater ($P < 0.05$) number of born dead (2.6) than sows in MR (1.2) and LR (1.4). On d 18 of lactation, litter size was greater ($P < 0.05$) in LR (9.6) than in HR (7.2) and MR (8.2). Sows from LR tended to have greater ($P = 0.067$) litter weight (51.8 kg) than sows from HR (43.1 kg). Piglet from LR tended to have smaller ($P = 0.094$) ADG (207 g) compared with HR (233 g). Plasma 8-OHdG in LR (0.61 ng/mL) was greater ($P < 0.05$) than HR (0.36 ng/mL) and MR (0.43 ng/mL). The concentration of protein carbonyl was shown to be negatively correlated ($P < 0.05$) with litter performance in MR and LR. Plasma 8-OHdG was shown to be negatively correlated ($P < 0.05$) with reproductive performance of sows in HR and LR. Sows in HR tended to have greater ($P = 0.068$) IgG (163.8 mg/mL) in colostrums compared with sows in MR (127.5 mg/mL). In conclusion, for all ranks, it was shown that the reproductive performance was related to oxidative stress status of sows. Sows in HR had similar litter size, litter weight, and piglet ADG at wean compared with sows in MR. The farrowing rate of sows in LR was lower compared with HR and MR, which could be caused by higher DNA damage during late gestation and lactation.

Key Words: oxidative stress, social rank, sow

T394 Novel strategies to stimulate GLP-2 secretion and intestinal adaptation in weanling piglets. I. R. Ipharraguerre*[1], D. G. Burrin[2], G. Tedó[1], D. Menoyo[3], J. J. Holst[4], and A. Mereu[1], *[1]Feed Additives Division, Lucta S.A., Montornés del Vallés, Spain, [2]USDA/ARS Children's Nutrition Research Center, Department of Pedriatics, Baylor College of Medicine, Houston, Texas, [3]Departamento de Producción Animal, Universidad Politécnica de Madrid, ETS Ingenieros Agrónomos, Madrid, Spain, [4]Department of Biomedical Sciences, University of Copenhagen, Copenhagen, Denmark.*

Weaning-induced intestinal atrophy is partly related to reduced secretion of glucagon-like peptide 2 (GLP-2). Recent studies showed that stimulating GLP-2 secretion in total-parentally-fed piglets promotes gut growth. We conducted 2 infusion trials (IT) and 1 feeding trial (FT) to investigate the hypothesis that stimulating GLP-2 secretion immediately after weaning may improve intestinal integrity in piglets. In each trial, 36 piglets weaned on average at 21 d of age and 6.1 kg of BW were individually housed and fed ad libitum. In the IT (n = 12), treatment solutions were chenodeoxycholic acid [60 mg/kg BW, (CDC)] and β-sitoesterol [100 mg/kg BW, (BSE)] in IT1; and CDC (120 mg/kg BW) and zein protein hydrolyzate (1.4 g/kg BW) in IT2. Until d 6 postweaning, all piglets were intragastrically infused once daily with 50 mL of either water (control) or treatment solutions; on d 5, serial plasma samples were obtained from 6 pigs/treatment. In the FT (n = 18), a prestarter diet without (control) or with CDC (60 mg/ kg BW) was fed from 0 to 14 d postweaning; afterward, pigs were fed a starter diet until d 35. In all studies, 6 pigs/treatment were sacrificed and their intestines were collected for later analyses. Data were analyzed as a mixed-effect model with pig treated as random variable. Compared with control, infusing CDC at 60 mg/kg BW increased ($P < 0.05$) mean plasma GLP-2 by 77%, small intestine length, intraepithelial lymphocytes and cleaved caspase in the ileum; tended to increase ileum weight and length ($P < 0.08$) and mean plasma GLP-1 ($P < 0.13$) without affecting intake and final BW. At 120 mg/kg BW, infusing CDC also increased ($P < 0.05$) GLP-1 and GLP-2, but reduced intake, BW, and ileal crypt depth. Other treatments did not affect measured parameters, except that BSE tended to depress GLP-1 (27%) and GLP-2 (42%) compared with control. In the FT, CDC did not affect intestinal weight and piglet performance compared with control. In conclusion, oral CDC treatment potently enhanced GLP-2 secretion in weanling piglets, but the mitigation of weaning-induced intestinal atrophy was apparently counterbalanced by increased inflammation and reduced feed intake.

Key Words: GLP-2, bile acids, pigs