

Swine Species

W281 Effect of wheat bran and zinc oxide on the microbiota of weanling pigs. F. Molist*, A. Gómez de Segura, J. Gasa, R. G. Hermes, and J. F. Pérez, *Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain.*

This experiment was conducted to evaluate the effects of an antimicrobial agent such as zinc oxide (ZnO) and an insoluble fiber source like wheat bran (WB), and its interaction (WB-ZnO) on the gastrointestinal ecosystem in newly weaned piglets. A total of 64 piglets (24±0.77 days) were assigned randomly to 1 of 4 experimental groups. The dietary treatments consisted on a basal diet (STD) based on corn, barley and soybean meal which was supplemented with 4% WB (WB), 0.3% ZnO (ZnO) or 4% WB and 0.3% ZnO (WB-ZnO). On day 3, 6, 9 and 12 after beginning the dietary treatments, animal weight and feed intake were controlled and feces samples were taken for quantifying enterococci and *E.coli* population in agar plates and lactobacilli counts by real time PCR. As compared to the STD diet, dietary supplementation with ZnO increased ($p<0.05$) body weight (7157.2, 7261.5, 7509.5, 7385.4 g for the STD, WB, ZnO, WB-ZnO, respectively) and feed intake (2121.6, 2219.4, 2783.5, 2381.1 g/animal for the STD, WB, ZnO, WB-ZnO, respectively, $p=0.08$). The inclusion of WB and ZnO in the diet diminished ($p<0.05$) *E.coli* counts (5.7, 4.8, 4.6, 5.6 log cfu/ g FM for STD, WB, ZnO, WB-ZnO, respectively) in the feces compared to the STD diet and to the WB-ZnO combination. Diet containing ZnO decreased also lactobacilli loads (11.9, 11.7, 11.1, 11.5 log 16S rDNA gene copies/ g FM for STD, WB, ZnO, WB-ZnO, respectively, $p<0.05$). However, these effects were not observed when WB and ZnO were included in the same diet. No significant differences were observed in the enterococci population. It can be concluded that ZnO increased feed intake and productive performance associated with a reduction on the major groups of bacteria, including lactobacilli. On the other hand, WB inhibited *E.coli* and promoted the stability of beneficial bacteria namely lactobacilli.

Key Words: Piglets, Wheat Bran, Zinc Oxide

W282 Effects of wheat bran level and particle size on the intestinal microbiota composition and activity of early weaned piglets. F. Molist*, A. Gómez de Segura, J. Gasa, R. G. Hermes, and J. F. Pérez, *Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain.*

The incorporation of insoluble fiber in the piglet diets during the early weaning period was evaluated as a strategy to promote feed intake and digestive adaptation of the intestinal microbiota. Two different studies were conducted. In Exp 1, 90 early-weaned (24±0.77 days) pigs were allocated to three dietary treatments: a STD diet based on corn, barley and soybean protein, and two fibrous enriched diets including 4 and 8% of wheat bran (WB-4 and WB-8). Animals and feed were weighed and feces sampled on d 3, 6, 9, 12 and 15 for the microbial activity and composition analyses. Results indicated that WB-4 showed the highest feed intake ($p=0.02$), averaging 211.6, 226.7 and 189.6 g/animal and

day for the STD, WB-4 and WB-8, respectively. The same diet tended to decrease enterococci (6.1, 5.3, 6.1 log cfu/g FM; $p=0.06$) and coliforms (6.9, 6.3, 6.7 log cfu/g FM; $p=0.08$ for STD, WB-4 and WB-8, respectively). The inclusion of WB in the diet increased ($p=0.02$) the fecal SCFA concentration on day 15 (93.6, 145.5, 141.1 $\mu\text{mol/g}$ FM, respectively). In the Exp 2, it was studied the likely influence of the WB particle size on the above referred effects. A total of 48 early-weaned (22±0.66 days) pigs were fed with the STD diet and diets containing 4% of WB, either as coarse particle size (WBc, 1135 μm) or finely milled (WBf, 406 μm). WB increased the BW of pigs compared to the STD diet (7156.6, 7360.9, 7463.1 g; $p=0.02$ for STD, WBc, WBf, respectively). Diet containing WBc decreased ($p=0.05$) *E.coli* counts in feces, averaging 5.7, 4.8, 5.2 log cfu/g FM for the STD, WBc and WBf, respectively. Results suggest that WB included at 4% in the diet increases the microbial activity and improves the microbial composition of early weaned piglets. This effect was independent of the particle size.

Key Words: Piglets, Wheat Bran, Microbial Population

W283 Effect of supplemental mixed *Saccharomyces cerevisiae* and *Lactobacillus acidophilus* 30SC on the growth performance of weaned pigs. J. P. Kim*¹, K. H. Kim¹, K. G. Kim², S. J. Oh¹, S. H. Kim², and K. Y. Whang², ¹*Chonnam National University, Gwangju, Korea,* ²*Korea University, Seoul, Korea.*

The objective of this study was to examine the effect of supplemental mixed *S. cerevisiae* and *L. acidophilus* 30SC (MSL) on the growth performance of weaned pigs. Forty-eight weaned barrows weighing about 10.78 kg were allotted to four dietary treatments with four replications. Experimental period was consisted of Phase I (14 days) and Phase II (14 days). The Phase I diet contained 3600 kcal/kg ME, 22.6 % CP, 1.56 % Lys, 0.54% Met, 0.82% Ca, and 0.75% P. The Phase II diet contained 3430 kcal/kg ME, 19.5 % CP, 1.30 % Lys, 0.47% Met, 0.80% Ca, and 0.55% P. Each diet was formulated to meet the NRC (1998) requirements. Dietary treatments were; 1) Basal diet (B, no antibiotics), 2) B + 0.2% antibiotics (AB), 3) B + 0.2% MSL, 4) B + 0.4% MSL. Pigs consumed feed and water *ad libitum*. Body weights and feed intakes of pig were measured at the end of each Phase, and average daily gain was calculated. The ADG of pigs was slightly increased by MSL supplementation, however, pigs in AB tended to grow slower than pigs in other treatments in Phase I. In Phase II, ADG was not affected by supplementation of MSL or antibiotics. The ADG of pigs tended to be higher in 0.2% and 0.4% MSL treatments at the end of experiment. Feed intake was not different among treatments through the experiment, but, slightly increased feed intake was found in 0.2% MSL treatment. AB and MSL were not effective to increase FE in whole experimental period, however, FE of basal diet and 0.4% MSL fed groups showed increased FE compared to that of AB fed group at Phase I. The results of this study indicated that supplementation of MSL could improve the growth and feed efficiency of weaned pigs in early phase; however, these beneficial effects of MSL were diminished as the pigs grew.

Table 1. The growth performance of pig fed the experimental diet

AB	0%	0.2%	0%	0%	SEM
MSL	0%	0%	0.2%	0.4%	
ADG, g/d					
Day 1-14	620 ^{ab}	582 ^b	633 ^{ab}	655 ^a	11
Day 15-28	650	669	656	642	13
Day 1-28	635	625	644	649	12
ADFI, g/d					
Day 1-14	727	724	764	763	8
Day 15-28	1096	1094	1133	1090	12
Day 1-28	912	909	949	926	11
Fe, g/kg					
Day 1-14	860 ^a	810 ^b	832 ^{ab}	869 ^a	14
Day 15-28	892	611	578	590	11
Day 1-28	696	687	678	700	12

a,b:p<.05

Key Words: Mixed Probiotics, Growth Performance, Weaned Pig

W284 Effect of supplemental mixed *Saccharomyces cerevisiae* and *Lactobacillus acidophilus* 30SC on the energy, nitrogen, Ca, and P digestibility of weaned pigs. K. H. Kim^{*1}, J. P. Kim¹, J. G. Kim², S. J. Oh¹, S. H. Kim², and K. Y. Whang², ¹Chonnam National University, Gwangju, Korea, ²Korea University, Seoul, Korea.

The effects of supplemental mixed *S. cerevisiae* and *L. acidophilus* 30SC (MSL) on the energy, nitrogen, Ca, and P digestibility were determined by using forty-eight weaned barrows (about 10.78 kg). The pigs were allotted to four dietary treatments with four replications. Experimental period was divided into Phase I (14 days) and Phase II (14 days). The Phase I diet contained 3600 kcal/kg ME, 22.6 % CP, 1.56 % Lys, 0.54% Met, 0.82% Ca, and 0.75% P. The Phase II diet contained 3430 kcal/kg ME, 19.5 % CP, 1.30 % Lys, 0.47% Met, 0.80% Ca, and 0.55% P. Each diet was formulated to meet the NRC (1998) requirements. Dietary treatments were; 1) Basal diet (B, no antibiotics), 2) B + 0.2% antibiotics (AB), 3) B + 0.2% MSL, 4) B + 0.4% MSL. Pigs consumed feed and water *ad libitum*. Cr₂O₃ (0.2%) included diets were supplied from day 12 and day 26 to day 14 and day 28, and feces was collected at the end of each Phase (day 14 and 28). Energy digestibility at day 14 was significantly increased by supplement of 0.4% MSL (p<.05), and AB supplementation had no effects on energy digestibility. There was no difference among treatments at day 28. Nitrogen digestibility at day 14 was increased by 0.4% MSL supplementation, but 0.2% supplementation was not effective to increase nitrogen digestibility. Nitrogen digestibility at day 28 was not changed by supplementation of MSL either AB. Ca and P digestibility was not affected by MSL or AB supplementation, however, MSL supplementation slightly increased Ca and P digestibility. The results of this study suggested that supplementation of MSL could improve the energy and nitrogen digestibility weaned pigs in early phase, however, these beneficial effects of MSL were diminished as the pigs grew

Table 1. Nutrient digestibility of pigs fed experimental diets

AB	0%	0.2%	0%	0%	SEM
MSL	0%	0%	0.2%	0.4%	
Energy, %					
Day 14	87.2 ^b	86.8 ^b	88.2 ^b	88.7 ^a	0.2
Day 28	85.7	85.7	85.4	85.5	0.3
Nitrogen, %					
Day 14	92.8 ^b	92.8 ^b	92.9 ^b	93.8 ^a	0.3
Day 28	88.4	87.9	87.9	88.3	0.2
Ca, %					
Day 14	62.3	63.2	34.3	64.8	0.7
Day 28	55.8	54.8	56.2	56.3	0.9
P, %					
Day 14	52.3	53.2	54.1	54.5	0.6
Day 28	48.3	48.9	48.1	49.3	0.8

a,b: p<.05

Key Words: Mixed Probiotics, Nutrient Digestibility, Weaned Pig

W285 Effect of supplemental mixed *Saccharomyces cerevisiae* and *Lactobacillus acidophilus* 30SC on the immunoglobulin G production of weaned pigs. S. J. Oh^{*1}, J. P. Kim¹, K. H. Kim¹, J. G. Kim², S. H. Kim², and K. Y. Whang², ¹Chonnam National University, Gwangju, Korea, ²Korea University, Seoul, Korea.

This study was done to investigate the effect of supplemental mixed *S. cerevisiae* and *L. acidophilus* 30SC (MSL) on the Ig G production of weaned barrows by vaccination. Forty-eight weaned pigs (about 10.78 kg) were used for a 28 days trial, and allotted to four dietary treatments with four replications. Experimental period was consisted of Phase I (14 days) and Phase II (14 days). The Phase I diet contained 3600 kcal/kg ME, 22.6 % CP, 1.56 % Lys, 0.54% Met, 0.82% Ca, and 0.75% P. The Phase II diet contained 3430 kcal/kg ME, 19.5 % CP, 1.30 % Lys, 0.47% Met, 0.80% Ca, and 0.55% P. Each diet was formulated to meet the NRC (1998) requirements. Dietary treatments were; 1) Basal diet (B, no antibiotics), 2) B + 0.2% antibiotics (AB), 3) B + 0.2% MSL, 4) B + 0.4% MSL. Pigs consumed feed and water *ad libitum*. Swine cholera vaccine was injected at day 7, and serum samples were taken from all individual pigs at the end of each Phase (day 14 and 28). ELISA was used to determine the total Ig G and cholera specific Ig G. AB supplementation reduced total Ig G production compared to no-AB fed groups at both day 14 and 28. Total Ig G of pigs fed 0.4% MSL was higher than other groups at both day 14 and 28 (p<.05), and supplementation of 0.2% MSL also increased total Ig G production, however, these effects was reduced at day 28. Cholera specific Ig G production was increased by MSL supplementation, and decreased by AB supplementation. At day 14, the cholera specific Ig G of 0.2% MSL fed group was similar to that of no-AB fed groups, but at day 28, 0.2% MSL fed group showed higher cholera specific Ig G than no-AB fed group (p<.05). These results indicated that supplementation of MSL could increase total Ig G and specific Ig G production, and this increased immune response might be helpful to increase the preventive effects of vaccination on specific disease.

Table 1. Serum Ig G concentration of pigs fed experimental diets

AB	0%	0.2%	0%	0%	SEM
MSL	0%	0%	0.2%	0.4%	
Total Ig G, mg/mL					
Day 14	8.2 ^{ab}	7.8 ^b	8.4 ^a	8.6 ^a	0.2
Day 28	10.3 ^{ab}	9.8 ^b	10.5 ^{ab}	11.2 ^a	0.3
Specific Ig G, mg/mL					
Day 14	2.1 ^b	1.8 ^c	2.3 ^{ab}	2.5 ^a	0.1
Day 28	1.6 ^b	1.5 ^b	1.9 ^a	2.0 ^a	0.1

a,b: p<0.05

Key Words: Mixed Probiotics, Immune Response, Weaned Pig

W286 The effects of seaweed extract inclusion on gut microflora and immune status of the weaned pig. P. Reilly¹, T. Sweeney¹, K. M. Pierce^{*1}, J. J. Callan¹, A. Julka², and J. V. O'Doherty¹, ¹University College Dublin, Ireland, ²Bioatlantis Ltd, Ireland.

An experiment (complete randomised design) was conducted to investigate the effects of *Laminaria hyperborea* (LH) and *Laminaria digitata* (LD) seaweed extract inclusion on gastrointestinal health and immune status of the weaned pig. Twenty eight piglets (24 days of age, 6.5± 1.4 kg live weight) were assigned to one of four dietary treatments for 7 days and then sacrificed: T1) basal diet (control); T2) basal diet and 1.5kg /tonne LH; T3) basal diet and 1.5kg /tonne LD and T4) basal diet and 1.5kg /tonne of a combination of LH and LD. The SE contained both laminarin and fucoidan. Digesta samples were taken from the caecum and colon to measure the Enterobacteria, Bifidobacteria, and Lactobacilli populations. Blood samples were taken to determine the cytokine gene expression profile and to measure the phagocytotic capacity of the blood cells. Data was analysed by GLM procedure (SAS). A contrast statement was used to compare T1 vs. T2, T1 vs. T3 and T1 vs. T4. Pigs offered diets containing LH had a lower population of Bifidobacteria in the colon (P<0.05) and Lactobacilli in the caecum (P<0.05) and colon (P<0.001). The inclusion of LD resulted in lower populations of Enterobacteria in the caecum and colon (P<0.01), Bifidobacteria in the caecum (P<0.05), and Lactobacilli in the caecum (P<0.05) and colon (P<0.001). Pigs offered the combination of LH and LD had a reduction in Enterobacteria (P<0.05) and Lactobacilli (P<0.01) in the caecum and colon. An increase in the expression of Interleukin-8 (IL-8) mRNA was observed on day six with the supplementation of the combination of LH and LD (P<0.05). The inclusion of LH resulted in an increase in total monocyte number (P<0.05). In conclusion, the supplementation of LH and LD seaweed extract alone and in combination acted as a powerful antimicrobial in reducing the Enterobacteria, Bifidobacteria, and Lactobacilli populations in the caecum and colon, while only marginal effects on the immune response was observed.

Key Words: *Laminaria hyperborea*, *Laminaria digitata*, Pig

W287 Yam on fermentation characteristics and immune function in pigs. M. J. Bo, Y. I. Yin*, X. F. Kong, Y. Z. Zhang, G. Y. Wu, and B. E. Tan, *Laboratory of Animal Nutrition and Human Health and Key Laboratory of Agro-ecology, Changsha, Hunan, P. R. China.*

The present study was conducted to determine in vitro fermentation characteristics and in vivo immune enhancement of the Chinese Yam

(CY) with the goal of developing a novel dietary additive for pigs. The terminal ileum digesta collected from fistula in Duroc × Landrace × Yorkshire barrows fed the corn- and soybean meal-based diet was used as inoculums, and CY served as a substrate for in vitro fermentation. The slurry was fermented for 48 h in an in vitro anaerobic system. Fermentation products were determined. The maximum volume of gas production in the CY-containing medium was higher (P < 0.05) compared with the non-supplemented and glucose-supplemented media. The rate of gas production in the CY-supplemented medium was lower (P < 0.05) than that in the glucose-supplemented medium but higher (P < 0.05) than the value for the non-supplemented medium. The pH and NH₃ concentration were higher (P < 0.05) in the CY-supplemented medium, compared with the glucose-supplemented medium but lower (P < 0.05) compared with the non-supplemented medium. Concentrations of acetate, propionate, and butyrate in the CY-supplemented medium were higher (P < 0.05) than those in compared with the glucose- and non-supplemented media. For the feeding trial, 4 barrows were fed the basal diet, supplemented with 0.1% CY powder for 8 d. On days 0, 4 and 8 after initiation of the treatment, total and differential counts of leucocytes, lymphocyte proliferating activity, and serum levels of antibodies were measured. Dietary supplementation with CY increased (P < 0.05) the numbers of leukocyte, lymphocytes, monocytes, and neutrophils in plasma on day 8 compared with days 0 and 4, as well as lymphocyte proliferation. In summary, CY may be a good source of carbon and energy for intestinal microbial metabolism, therefore contributing to enhancement of immune function in barrows.

Key Words: Fermentation Characteristics, Chinese Yam, Immune Function

W288 Effect of Chinese herbal ultra-fine powder as a dietary additive on digestion and absorption of amino acids in early-weaned piglets. X. F. Kong¹, Q. H. He¹, F. G. Yin¹, Y. L. Yin^{*1}, G. Y. Wu^{1,2}, B. E. Tan¹, and R. L. Huang¹, ¹Laboratory of Animal Nutrition and Human Health and Key Laboratory of Agro-ecology, Changsha, Hunan, P. R. China, ²Texas A&M University, College Station.

To study the effects of Chinese herbal ultra-fine powder (CHUP) as a dietary additive on digestion and absorption of amino acids, sixty piglets weaned at 21 days of age were randomly assigned to 3 treatment groups, representing supplementation with 0 or 2 g/kg of CHUP, or 0.2 g/kg of colistin to corn- and soybean meal-based diets (n = 20 per group). Blood samples were collected from 5 piglets per treatment group on days 7, 14 and 28 to determine serum concentrations of amino acids. Digesta at terminal ileum was collected to determine amino acids after piglets were sacrificed under anesthesia with intraperitoneal administration of sodium pentobarbital. The results showed that plasma concentrations of total amino acids in CHUP-supplemented pigs were higher (P < 0.05), compared with the control group on days 14 and 28. Concentrations of total amino acids at terminal ileum were lower (P < 0.05) in CHUP-supplemented pigs, when compared with the other two groups of pigs on day 28. These findings indicate that the Chinese herbal product could enhance digestion and absorption of protein or amino acids in early-weaned piglets.

Key Words: Dietary Additive, Herbal Product, Amino Acids

W289 Effects of dietary supplemental Chinese herbal formula on immune responses in weaned piglets. X. F. Kong, B. E. Tan, Y. L. Yin*, H. J. Liu, F. G. Yin, and M. J. Bo, *Laboratory of Animal Nutrition and Human Health and Key Laboratory of Agro-ecology, Changsha, Hunan, P.R. China.*

The study was conducted to evaluate the effects of dietary supplemental Chinese herbal formula (CHF) on immune responses in piglets. A total of 60 three-way crossbred piglets weaned at 21 days of age were randomly assigned to three treatments which were replicated twenty times with one piglet. Corn-soybean meal based diet was used in the control group, while CHF and colistin were used at 0.2 and 0.02 percent of the total diets in the other two groups to substitute for equal cornstarch, respectively. On days 7, 14 and 28 after initiation of the addition, the total and differential counts of leucocytes, and lymphocyte proliferation conversion efficiency, and serum concentrations of immunoglobulin and cytokines, as well as immune organ index, were determined. The results showed that dietary supplementation with the formula increased ($P < 0.05$) the ratio of middle cell to leukocyte and concentrations of serum IL-2 and IL-6 compared with the control groups after 7 days trial, and the concentrations of serum IL-2 was higher ($P < 0.05$) while of IL-6 and TNF were lower ($P < 0.05$) in the formula-supplemented piglets than those of the colistin groups. On day 14, the index of spleen and groin lymphonodues, and number of middle cell in piglets of the formula groups were higher ($P < 0.05$) compared with the control groups and leukocyte number was higher than that of the colistin group, and the concentration of serum IL-6 decreased ($P < 0.05$) compared with the other two groups. Dietary supplementation with the formula for 28 days decreased ($P < 0.05$) the numbers of the middle cell and granulocyte, while increased ($P < 0.05$) the ratio of lymphocleukocyte to leukocyte compared with the control groups. The concentrations of serum IgG and IgM in the CHF piglets increased ($P < 0.05$) compared with the others. The higher ($P < 0.05$) proliferation conversion efficiencies of peripheral lymphocytes in the CHF piglets were observed on days 14 and 28 compared with the other two groups. Collectively, these findings indicated that the CHF as dietary additive could be beneficial to immune responses in the weaned piglets.

Key Words: Chinese Herbal Formula, Weaned Piglet, Immune Responses

W290 Level of management affects finisher growth and pig composition. J. S. Fix* and M. T. See, *North Carolina State University, Raleigh.*

Differences in finisher growth and composition of pigs from three sire lines in a high management research facility (SES) compared to a commercial facility (COM) were evaluated. Pigs were farrowed over 2 wk at COM sow farm. At weaning 400 pigs were randomly selected across sire lines (B, G, R) and sex and placed in SES. Remaining pigs were transferred to COM nurseries. At 66 d of age SES pigs ($n = 336$) and COM pigs ($n = 538$) began finish phase. Pigs were randomly assigned within sire line and sex to pens of 4 pigs at SES and 20-22 at COM. Body wt, fat depth (BF) and loin muscle area (LMA), measured using real-time ultrasound, collected at 20 kg, 50 kg, 75 kg, 100 kg and 115 kg (178 d of age) on all SES pigs and 10 pigs from each COM pen. Feed allotment was recorded daily. Feed weigh back (SES) and feed estimate (COM) was done at BW measurement. Pigs raised at SES were heavier entering the finisher (21.0 vs. 19.2 kg; $P < 0.01$) and at off-test

(118.9 vs. 95.8 kg; $P < 0.01$). Sire line x management interaction was observed for G:F ($P < 0.05$) where pigs at COM did not differ between sire lines (0.418, 0.409, 0.401 ± 0.006) but SES pigs from sire line R had the poorest G:F (0.432, 0.427, 0.392 ± 0.004). This is supported by a sire line x management interaction ($P = 0.06$) for ADFI where SES pigs consumed more feed (2.16, 2.08, $2.36 \text{ kg/d} \pm 0.03$) than COM pigs (1.68, 1.73, 1.82 ± 0.05). Pigs raised at SES had greater ADG (0.87 vs. 0.68 kg/d; $P < 0.01$), ADFI (2.2 vs. 1.7 kg/d; $P < 0.01$), G:F (0.42 vs. 0.41; $P < 0.05$) and lean ADG (0.35 vs. 0.28 kg/d; $P < 0.01$) Pigs raised at SES had less ($P < 0.01$) BF depth and greater ($P < 0.01$) LMA at 20 kg (0.65 vs. 0.73 cm; 11.14 vs. 10.02 cm²), 50 kg (0.99 vs. 1.06 cm; 23.55 vs. 21.90 cm²) and 75 kg (1.33 vs. 1.47 cm; 33.08 vs. 31.39 cm²). At 100 and 115 kg BW SES pigs had greater ($P < 0.01$) LMA (43.26 vs. 36.93 cm²; 48.31 vs. 45.33 cm²). However, at 100 kg COM pigs had less BF (1.59 vs. 1.76 cm; $P < 0.01$) and did not differ at 115 kg. Raising pigs in a high management vs. commercial facility resulted in increased LMA, ADFI, ADG and G:F. However, higher management resulted in increased ADFI resulting in decreased efficiency for one sire line.

Key Words: Pigs, Growth, Management

W291 *In vivo* antioxidant activity of peptide fractions from porcine plasma albumin in rats. J. Z. Wang*^{1,2}, H. Zhang¹, S. S. Zeng², and F. Z. Ren¹, ¹*College of Food Science & Nutritional Engineering, China Agricultural University, Beijing, China,* ²*American Institute for Goat Research, Langston University, Langston, OK.*

Our previous research showed that porcine plasma peptide fractions (A5, MW < 3 KDa) had antioxidant effect *in vitro*. In the present study, the effect of A5 on antioxidant activity, lipid peroxidation, and total antioxidant capacity (TAOC) in rats was investigated *in vivo*. Thirty five male Sprague Dawley rats (3 month old, BW 366 ± 24 g) were randomly divided into five groups. The five feeding treatments were control, 100, 200, 400 mg of A5/kg BW, and 10 mg of vitamin E/kg BW (as positive control). Blood samples and organ tissues (liver, heart, spleen, thymus, and lung) were collected one month after daily treatments were started. TAOC, activities of superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px), and level of malondialdehyde (MDA) in serum and organ tissues were determined. ANOVA was treated by GLM procedure using SAS software. $p < 0.05$ was considered as significant. The results showed that A5 treatments increased TAOC and the activities of SOD and GSH-Px ($p < 0.05$), and decreased the level of MDA in all the organ tissues tested ($p < 0.05$). It is concluded that the peptide fractions A5 can enhance the TAOC and antioxidant activities, reducing the risks of lipid peroxidation in rats.

Key Words: Porcine Plasma Peptide Fractions, Rats, Lipid Peroxidation

W292 Influence of weaning age and number of weaning per week on productive performance of sows and piglets. N. Simal¹, A. Fuentetaja², M. Nieto², M. P. Serrano¹, and G. G. Mateos*¹, ¹*Universidad Politécnic de Madrid, Spain,* ²*Copese, Segovia, Spain.*

A total of 320 crossbred sows (LW x LR) between the second and seventh lactation were used to study the influence of weaning age (21 vs. 28 d) and number of weanings per week (1 vs. 2) on productive performance

of sows and piglets. The 4 treatments arranged factorially and each treatment was replicated five times. The experimental unit was a room with 16 lactating sows. Number of weaning per week did not affect any of the productive traits studied. Age at weaning had little effect on productive performance of piglets during lactation. Sows weaned at 28 d tended to lose more weight (27.1 vs. 24.8 kg; $P \leq 0.10$) and lost more fat thickness (2.85 vs. 2.44 mm) during lactation than sows weaned at 21 d but daily BW losses were smaller ($P \leq 0.05$). Piglets weaned at 28 d were heavier (8.3 vs. 6.4 kg; $P \leq 0.05$) than piglets weaned at 21 d but the uniformity of the litters decreased with increases in weaning age. A positive relation was observed between fat thickness at farrowing and loss of fat during lactation. For sows with a fat thickness lower than 15 mm backfat, fat loss was less than for sows with a fat thickness higher than 18 mm (1.89 and 3.47 mm; $P \leq 0.05$). Also, piglet growth was higher in sows with a fat thickness lower than 20 mm at farrowing than in sows with fat thickness higher than 20 mm ($P \leq 0.05$). Sows with heavier litters at weaning lost more weight during lactation than sows with lighter litters ($P \leq 0.05$). In the next gestation, weaning to oestrus interval tended to be reduced (6.8 vs. 8.0 d) in those sows weaned at 28 d. Number of piglets born alive tended to increase (12.5 vs. 11.3; $P \leq 0.10$) in sows that were weaned at 21 d. It is concluded that weaning at 28 d had a positive effect on sow productivity but that number of weanings per week did not have any effect.

Key Words: Weaning Age, Weaning Number, Sow Productivity

W293 Sow parity and number born alive influence piglet birth weight along with subsequent growth, composition, mortality and endpoint value. J. S. Fix* and M. T. See, *North Carolina State University, Raleigh.*

Piglets ($n = 1472$) were weighed and identified within 24 h of birth to determine effect of parity and number born alive (NBA) on piglet birth weight (BWT), within litter variation, along with growth, composition, mortality and endpoint value. Sows ($n = 217$) were mated via AI with pooled semen from 3 sire lines, resulting in 163 litters. The commercial sow farm experienced a clinical PRRS outbreak during the trial and used a high level of cross fostering which may have contributed to the severity. Individual BWT along with mean litter BWT, BWT SD, and BWT CV were evaluated. At 18 d of age pigs were weaned and 421 were transported to the NCSU Swine Evaluation Station (SES) and BW was measured; remaining pigs were placed in 3 commercial nurseries. At approximately 66 d of age pigs at SES were placed in pens of 4 and pigs in commercial nurseries were placed in pens of 20-22 at a commercial finisher. Body weight, at placement and off-test, along with fat depth (BF) and loin muscle area (LMA), using real-time ultrasound at off-test, were collected on all pigs at SES and 10 pigs from each pen at commercial finisher. At time of final BW a value was given to all pigs (2 = dead; 1 = $BW < [\text{mean BW} - \text{one SD}]$; 0 = $BW > [\text{mean BW} - \text{one SD}]$). This was done to simulate levels where price discounts based on wt occur at local packing plants. A range 0.45 to 2.45 kg, with a mean of 1.28 kg was observed for BWT. Individual and mean litter BWT increased quadratically with increasing parity ($P = 0.07$, $P < 0.01$) to parity 5 and increasing NBA ($P < 0.01$) to 9 pigs. Pig wean wt decreased quadratically with increasing NBA ($P < 0.05$) to 6-7 pigs born alive. Increasing parity also had a quadratic effect on LMA ($P < 0.01$) and BF ($P = 0.07$) both reaching a minimum at parity 4. As NBA increased pigs had 1.09 ($P < 0.01$) and 1.12 ($P < 0.05$) times greater odds of being alive vs. dead at placement and full value vs. non-full value or dead at harvest. As parity increased pigs had 1.10 ($P < 0.01$) times greater odds

of being alive vs. dead at placement. These findings indicate parity and NBA affect birth weight, growth, composition and survival.

Key Words: Parity, NBA, Pigs

W294 Influence of a live yeast on the faecal microflora of gestating and lactating sows. N. Walker*¹, M. Cintora¹, H. Durand², and Y. le Treut², ¹Lallemand Animal Nutrition, Montreal, Canada, ²Lallemand Animal Nutrition, Toulouse, France.

Live yeast products have been shown to have significant effects on the health and performance of production farm animals, both ruminants and monogastrics. They may have this effect by stabilizing the beneficial gut microflora, particularly during periods of stress, leading to the competitive exclusion of opportunistic pathogens and reducing incidences of diarrhea. The use of *Saccharomyces cerevisiae* type *boulardii* (CNMC I-1079) as a feed additive for improving performance and health of animals has been well documented. The aim of the current work was to determine whether the inclusion of CNMC I-1079 in two different diets had any effect upon the faecal microflora and whether a stress event like farrowing altered the structure and composition of the gut microbial community. Faecal samples were collected from 80 animals which had been randomly assigned to 4 different treatment groups on d-21, d-3 and d+7 in relation to farrowing. Treatment 1, high corn-soy, no yeast; treatment 2, high corn-soy plus yeast; treatment 3, high fibre, no yeast; and treatment 4, high fibre plus yeast. Total DNA was extracted and PCR-TTGE was used to generate a DNA fingerprint of the faecal bacterial community for each treatment group. GelComparII with the DICE similarity indice and UPMGA was used to generate the dendrogram and determine the relatedness of each profile. Not surprisingly, 2 distinct clusters due to diet were observed, indicating an effect of diet on the microbial community. Within each diet, in the days before farrowing, control and yeast treated groups clustered together, indicating an effect of yeast on the composition of the microbial population. Farrowing caused a dramatic change in the fingerprint profile for each treatment indicating that this stress event had a direct effect on the microbial community. It should be noted however that the yeast treated animals tended to have a population which was more closely related to the original microflora, indicating a degree of stabilization. To conclude, several different factors eg diet, inclusion of yeast and stress events may influence the composition of the gut microflora and yeast may help to stabilize the normal microflora.

Key Words: Yeast, PCR-TTGE, Microflora

W295 Effect of lactation length of on herd-level performance of breeding sows. S. S. Anil*, L. Anil, and J. Deen, *University of Minnesota, Saint Paul.*

Reducing lactation length in sows results in an improvement in the number of litters farrowed per year. However, early weaning has been suggested to influence the subsequent reproductive performance of the sow along with the performance of its litter. At the herd level, the crucial point is to maintain a lactation length that does not reduce the reproductive performance of sows while enabling maximum utilization of farrowing facilities. However, most of the studies on this aspect have focused on sow-level performance. The present study evaluates the

effect of lactation length on the overall performance at the herd level. Data pertaining to the performance in 2006 of 493 US swine herds were collected from the Pigchamp datashare database. Based on the average lactation length (19.02 days), these herds were divided into 2 groups and compared in terms of performance and longevity variables (proc MEANS, SAS V 9.1). The average number of piglets per litter, average number of piglets born alive per litter and average litter weaning weight were higher ($P \leq 0.05$ for all) in the herds with average lactation length ≥ 19.02 days. However, these farms also had higher average stillborn piglets per litter and preweaning piglet mortality ($P \leq 0.05$ for both). The groups were similar in terms of farrowing rate, pigs weaned per mated female per year, culling and death rates. The results indicate that farrowing and post-partum management should be improved to make full benefit of an increased lactation length on herd performance.

Key Words: Sow, Lactation Length, Herd Performance

W296 Association between claw lesions and farrowing performance of sows. S. S. Anil*, L. Anil, and J. Deen, *University of Minnesota, St. Paul.*

Lameness is a major reason for reduced sow longevity in swine breeding herds. Claw lesions, especially severe white line and side wall lesions are reported to lead to lameness. Claw lesions are very common in pigs. Despite a high prevalence, studies focusing on claw lesions and their adverse effects on sow performance are scanty in the US. At present, it is less clear whether claw lesions are linked to sow performance. The objective of the present study conducted at the University of Minnesota was to analyze the associations between claw lesions and performance variables such as number of piglets born alive (≤ 10 or greater), mummies, stillborn and preweaning piglet mortality (present or absent) and wean to service interval (≤ 5 or greater), along with parity (≤ 3 or greater). Claws of 257 sows were examined for lesions while the sows were in the farrowing crates prior to farrowing. Lesions included erosions, cracks, and overgrowths. Areas on the claw were categorized as side wall, heel, overgrown heel, sole, heel-sole junction and white line. The number of lesions in these areas was counted. The associations between number of lesions in different claw areas with performance variables and parity were analyzed using logistic regression analysis (Proc logistic, SAS V 9.1). Results indicated a positive association ($P \leq 0.05$) between piglets born alive and white line and side wall lesions (Odds ratios, OR 1.29 and 1.60 respectively). Heel-sole lesions were negatively associated ($P \leq 0.05$) with mummies (OR 0.62). White line lesions were negatively ($P \leq 0.05$) associated with stillbirth and preweaning piglet mortality (OR 0.74 and 0.79 respectively). Parity was positively associated ($P \leq 0.05$) with heel and heel-sole lesions (OR 1.26 and 1.40 respectively) and negatively ($P \leq 0.05$) associated with white line lesions (OR 0.72). The positive association between lesions and production performance may be indicative that high producing sows are more susceptible to lesions especially white line and side wall lesions.

Key Words: Sow, Claw Lesions, Performance

W297 Evaluation of welfare of gestating sows in conventional gestation stalls and in gestation stalls with widths defined by the sow height. L. Anil*, S. S. Anil, and J. Deen, *University of Minnesota, St. Paul.*

Sow welfare guidelines have indicated that pregnant sow in gestation stalls should have at least the minimum space to lie down without its teats extending into the adjacent stalls and its hind quarters not in contact with the back of the stall. Increasing the stall dimensions in relation to sow dimensions will increase the dynamic space available to the sow to make movements, thus minimizing injuries. A study was conducted to evaluate welfare of pregnant sows housed in conventional gestation stalls (control $n = 46$) and in stalls with width of the stall at least 75% of the height of the sow in it (treatment $n = 40$). Body measurements (length and height) of sows were taken before weaning and sows were allotted after weaning to either control or treatment group. Injury scores of all sows and behavior of focal sows (24 in control and 27 in treatment) were recorded on day 6 post-breeding and on days 70 and 105 of the gestation. Farrowing performances were also recorded. Data were analyzed using repeated measures ANOVA, two sample proportion tests and two sample test for means. Width of stalls had no significant effect on various postural behaviors studied except on the average duration of getting up (from either lying or from sitting posture) which showed a trend ($p = 0.061$) towards lower duration in the treatment group. Higher % of time lying in lateral recumbency and standing and lower % of sitting were noticed at day 105 than at other time periods. The groups did not differ significantly in terms of injuries. Farrowing performances were also similar among the treatments. The results indicate that ensuring the width of the stall at least 75% of the height of the sow may not be sufficient to improve welfare in terms of behavior and injury scores when compared to the existing conventional stalls.

Key Words: Sow, Welfare, Gestation Stall

W298 The relationship between distance of pig farms to roads and its seroprevalence to Aujeszky's disease. G. Rocha-Chavez¹, O. D. Montañez-Valadez¹, R. Santibañez-Escobar¹, J. G. Michel-Parra¹, and M. A. Pinto-Jacobo^{*2,3}, ¹CUSUR, Univ de Guadalajara, Cd Guzman, Jalisco. Mexico, ²Private practice, Zapotiltic, Jalisco. Mexico, ³URPJ, El Salto, Jalisco Mexico.

Aujeszky's disease is a viral infection of pigs transmitted through aerosols. Western Mexico is still struggling with this disease and there are a lot of small improvised farms rising up to 30% of pigs in that area. It is hypothesized that the closer the farms are to a busy road, the greater the possibility of acquiring this disease. The purpose of this study was to determine the relationship between the distance from the farm to an interstate highway and its level of prevalence of Aujeszky's disease. A total of 15919 blood samples from 297 small sow farms (20-100 sows) were analyzed for this disease. Farms were divided according to their location into four groups: (a) 35 farms located from 0 to 300 meters of a road; (b) 108 farms 300-1000 meters away; (c) 70 farms between 1 and 3 kilometers and (d) 83 farms with more than 3 km away from a road. Serology was done with the ELISA method and the prevalence was expressed as a percentage of positive sera of those sent for analysis. Pearson's correlation was used to compare distance and prevalence and Chi squared was used for comparison between means. Prevalence of 3.4 ± 5.9 , 7.21 ± 6.7 , 3.42 ± 2.29 and 8.4 ± 6.2 were found for Groups A, B, C, and D respectively with no significant difference between groups ($p > 0.05$). The correlation between distance and seropositivity was 0.07 indicating that there is no interaction between the two parameters studied. Contrary to what we were expecting, it was observed that under the conditions of this study, the distance from the farm to an interstate highway has no influence on their likelihood of acquiring this disease.

Key Words: Aujeszky's Disease, Interstate Roads, Prevalence

W299 Expression of Dicer and Ago-2 in Porcine Ovarian Tissue. H. M. Barton* and S. L. Pratt, *Clemson University, Clemson, SC.*

MicroRNA (miRNA) is hypothesized to have fundamental roles in mammalian embryonic development. miRNAs are short, non-coding RNA, processed by a ribonuclease enzyme known as Dicer and then loaded into the RNA-induced silencing complex (RISC), to be guided to its target. The argonaute gene family has been identified as key proteins in RISC, and Argonaute-2 (Ago-2) has been identified as the only member of this family possessing endonuclease activity. The nucleotide sequence for Dicer and Ago-2 has yet to be identified in pigs. Our objective is to identify the cDNA sequence for porcine Dicer and Ago-2, and verify their expression in reproductive tissue. Total cellular RNA was isolated from bovine and porcine ovaries using mirVana miRNA isolation kit (Ambion, Austin, TX). RNA was then subjected to endpoint RT-PCR using SuperScript™ III First-Strand Synthesis Super Mix for qRT-PCR (Invitrogen, Carlsbad, CA). The first strand reaction was utilized for PCR with GoTaq (Promega, Madison, WI). To generate PCR primers, the cDNA sequences for bovine, human and rodent Dicer (accession numbers XR027590, NM177438, and NM148948, respectively), and Ago-2 (BC151491, NM012154, and BC096465, respectively) were aligned. Primers were generated from highly conserved regions for each respective cDNA by using the Vector NTI program (Invitrogen, Carlsbad, CA). Reactions were subjected to non-denaturing slab gel electrophoresis and visualized using EtBr staining and UV-light exposure. PCR products were subcloned into pDrive Cloning Vector using Qiagen PCR Cloning Kit (Qiagen, Valencia, CA), transformed into *E. coli*, plasmid propagated, purified and subjected to dideoxy-sequencing at the Clemson University Genomics Institute. A 489 bp product and a 346 bp product were visible in both bovine and porcine samples. Sequencing verified the porcine products as Dicer and Ago-2, respectively, showing a 97.6% and 93.9% sequence identity to bovine Dicer and Ago-2, respectively. These data show that Dicer and Ago-2 are present in porcine ovary and that the sequences are highly similar to those reported for other species.

Key Words: Pigs, Argonaute, Dicer

W300 Association of gene markers affecting the principal components of skeletal design and feet and leg soundness in pigs. B. Fan, S. Onteru, B. Mote, T. Serenius, M. Nikkilä, K.J. Stalder, and M.F. Rothschild*, *Iowa State University, Ames.*

Identifying and culling the replacement gilts with poor skeletal and leg and feet conformation is helpful to reduce replacement and mortality rates in breeding stock. Recent replacement and mortality rates have averaged around 50% and 10% respectively in US commercial swine herds in 2007 according to PigCHAMP reports. Due to the low to moderate heritability of conformation and soundness traits, molecular markers would be useful selection aids. In our recent candidate genes studies, several promising significant associations between SNPs and 6 body conformation traits and 10 leg structure traits and overall leg action were observed. However, it was difficult to determine which SNPs were overall associated with total structural soundness. Using the PRINCOMP procedure of SAS, 6 body conformation traits could be primarily combined into two principal factors, each explaining greater than 20% of the total variation, and which accounted for body volume and side-view, respectively. The other 11 feet and leg traits were summarized into three principal factors, which generally described leg movement, leg defects and uneven toes, respectively. The subsequent

association analyses between the SNPs and the principal factors were implemented using the MIXED procedure of SAS. The raw P values were further adjusted using the false discovery rate (FDR) method from the MULTTEST package of the R program. SNPs in the following genes COL9A1, hDBP, APOE, DK, PPARGP and PAPP were associated with body volume ($P < 0.05$). SNPs in COL1A2, CALCR, FBN1 and OXTR were associated with side-view. Leg movement was significantly associated with SNPs in COL1A2, CALCR, BMP8, OPG, PTHR and OXTR. Leg defects were significantly associated with SNPs in ALOX15, ALOX5, COL9A2 and WNT16. It appears that, genes involving cartilage development and fatness seem to function in skeletal structure, and genes relevant to cartilage and bone formation are likely to play important role for feet and leg soundness in pigs.

Key Words: Body Conformation, Feet and Leg Structure, Candidate Gene

W301 Effects of the sex and the halothane genotype on carcass and meat quality characteristics in Duroc and Landrace crossbred pigs. L. L. Lo*¹, C. C. Tsai¹, M. C. Huang², R. S. Lin³, and T. H. Huang⁴, ¹*Chinese Culture University, Taipei, Taiwan, ROC*, ²*National Chung-Hsing University, TaiChung, Taiwan, ROC*, ³*National ILan University, ILan, Taiwan, ROC*, ⁴*Taiwan Farm Industry Co., Ltd., Pingtung, Taiwan, ROC.*

Two hundred and thirty crossbred Duroc×Landrace pigs of two halothane genotypes (NN=185, Nn=45) of 107 kg live weight were slaughtered to detect the effects of sex (barrows=116, gilts=114) and halothane genotype on carcass and meat quality characteristics. All data were analysed using a linear model that included fixed effects of year, farm, sex, halothane genotype, and the important two way interactions ($P < 0.20$). Carcass weight was used as a covariable. Sex and halothane genotype were important sources of variation for most carcass and meat quality traits. Compared with barrows, gilts had larger 10th rib longissimus muscle area (LMA, $P < 0.01$), but lower marbling score ($P < 0.05$), higher protein percentage ($P < 0.01$), and lighter Hunter value ($P < 0.05$). For eating quality, LM from barrows had higher scores on juiciness, flavour, tenderness and overall acceptability ($P < 0.01$). Halothane genotype significantly affected the dressing percentage, carcass length, 10th rib backfat thickness, and the 10th rib LMA. Carcasses from Nn pigs had a higher dressing percentage ($P < 0.05$); longer carcass ($P < 0.01$); and larger LMA at the 10th rib ($P < 0.001$) than that of the NN pigs. Fat thickness and the lean percentage; however had no differences between the two halothane genotypes ($P > 0.10$). LM of Nn halothane genotype had lower ultimate pH ($P < 0.001$), higher drip loss ($P < 0.001$), and lighter Hunter L value ($P < 0.05$). As for sensory evaluation, LM from Nn genotype had lower scores on juiciness ($P < 0.01$) and tenderness ($P < 0.05$). These results suggest that LM from barrows had better meat quality and pigs from Nn halothane genotype had better carcass characteristics but poor quality with regard to ultimate pH, drip loss, reflectance values, and the eating quality of juiciness and tenderness.

Key Words: Halothane Genotype, Meat Quality, Crossbred Pigs

W302 Identification and quantification of miRNA expression in porcine sperm cells. E. Curry* and S. L. Pratt, *Clemson University, Clemson, SC.*

MicroRNAs (miRNA) are short, non-coding, single-stranded, ribonucleic acids which are transcribed by RNA polymerase and down-regulate or prevent RNA translation. miRNAs have been shown to play roles in diverse biological processes such as insulin secretion, regulation of adipocyte differentiation, B-cell development, and tumorigenesis. More importantly, it is theorized that miRNAs are important for embryonic development, but little information is known as to the identity of miRNA in porcine gametes or their potential involvement in reproductive failure. Previous investigations have demonstrated that sperm messenger RNA (mRNA) are introduced into the oocyte during fertilization and may play a role in early embryonic development, but the presence and/or identity of miRNA in porcine sperm cells has not been thoroughly investigated. The objective of this study was to determine the presence and identity of miRNA in porcine sperm cells. In this experiment, RNA was isolated from porcine sperm cells using TRIzol[®] Reagent (Invitrogen; Carlsbad, CA) and was used to hybridize to commercially available arrays (LC

Sciences, LLC; Houston, TX) to identify the known miRNA present. The arrays were constructed from 1260 known miRNA sequences from 19 different species and, because many miRNAs are highly conserved among species, allowed for efficient hybridization. Of the miRNAs probed, results showed that 73.7% (n= 929) were non-detectable, 12.4% (n= 154) had low detection, and 12.2% were moderately (7.4%; n= 93) to highly expressed (4.8%; n= 60) in porcine sperm cells. In particular, the majority of the let-7 family, a highly conserved group of heterochronic miRNAs shown to play critical roles in developmental timing in non-mammalian species, was present and highly expressed in porcine sperm cells. Results of this study suggest that sperm miRNAs may play a fundamental role in spermiogenesis. In addition, if delivered along with mRNA to the oocyte at fertilization, miRNAs may have a function in early embryonic development.

Key Words: microRNA, Sperm, Swine