M212 Effects of β-glucan and probiotics (*Bacillus subtilis* and Kefir) supplementation on growth performance, blood profile, relative organ weight and meat quality in broiler chickens. J. H. Jang*, L. Yan, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to determine β-glucan and probiotics (*Bacillus subtilis* and Kefir) on growth performance, blood profile, relative organ weight and meat quality in broilers. A total of 315 Ross 308 broilers with an initial BW of 46 ± 5 g were allotted into 1 of 7 treatments (15 broilers per pen and 3 replicate pens per treatment). Dietary treatments included: 1) NC, basal diet (antibiotics-free diet); 2) PC, NC + 40 mg/kg avilamycin; 3) B, NC + 0.1% β-glucan; 4) P, NC + 0.1% *Bacillus subtilis*; 5) K, NC + 0.1% Kefir; 6) BP, NC + 0.1% β-glucan + 0.1% *Bacillus subtilis*; and 7) BK, NC + 0.1% β-glucan + 0.1% Kefir. The experiment lasted for 35 d. Data were subjected to the GLM procedures of SAS and Duncan's multiple range test was used to compare the means of the treatments. On d 21, broilers in PC, B, P, K, BP and BK treatment had a higher ($P < 0.05$) ADG than broilers in NC treatment group. On d 35, broilers fed BP had a higher ($P < 0.05$) ADG than those fed NC diet. Overall, ADG in PC, B, P, K, BP and BK treatments was higher ($P < 0.05$) than that in NC treatment. G:F was higher ($P < 0.05$) in PC treatment group compared with NC treatment group. The BP treatment increased ($P < 0.05$) relative liver weight. Broilers in BK treatment group had a higher ($P < 0.05$) relative breast meat and gizzard weight than those in NC treatment group. Broilers fed PC, B, BP and BK diets had a higher ($P < 0.05$) redness than those fed NC diet. Furthermore, the yellowness was higher ($P < 0.05$) in BP treatment than in K treatment. On d 5 and 7, drip loss was decreased ($P < 0.05$) by dietary supplementation of 0.1% β-glucan + 0.1% Kefir. Cooking loss was lower ($P < 0.05$) in BP and BK treatment groups than that in NC treatment. In conclusion, dietary supplementation of β-glucan and/or probiotics could increase the growth performance of broilers and 0.1% β-glucan along with 0.1% Kefir could improve broiler′s relative organ weight and meat quality.

Key words: β-glucan, probiotics, broiler

M213 Effects of caprylic acid and *Yucca schidigera* extract supplementation on growth performance, nutrient digestibility, fecal microflora and blood profiles in growing pigs. B. U. Yang*, S. Zhang, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to evaluate the effects of caprylic acid and *Yucca schidigera* extract supplementation on growth performance, nutrient digestibility, excreta microflora and blood profiles in growing pigs. A total of 120 [(Landrace × Yorkshire) × Duroc] pigs with a initial body weight (BW) of 23.3 ± 1.74kg was used in a 6–wk experiment. Pigs were randomly allotted to 1 of 6 treatments with 5 replicate pens per treatment and 4 pigs per pen. Dietary treatments included: 1) NC (Antibiotic free diet), 2) PC (NC + 0.01% Apramycin), 3) B1 (NC + 0.05% Caprylic acid + 0.05% Yucca extract), 4) B2 (NC + 0.1% Caprylic acid + 0.1% Yucca extract), 5) B3 (NC + 0.15% Caprylic acid + 0.15% Yucca extract) and 6) B4 (NC + 0.2% Caprylic acid + 0.2% Yucca extract).Overall the experiment, pigs fed the B2 had a greater ADG and G:F but lower ADFI than those fed the NC diet ($P < 0.05$). The ATTD of DM and N was higher in B2, B3, B4 and C1 treatments than that the NC treatment ($P < 0.05$). and ATTD of energy was higher in B4, C1, B3, PC, B2 and B1 groups than that in NC group ($P < 0.05$). The number of *Lactobacillus* was greater in B2 treatment than that in NC, PC and B4 treatments ($P < 0.05$). NC had a higher *E. coli* number compared with other treatments ($P < 0.05$), further more PC and B3 treatments had a lower *E. coli* concentration than B1, B2 and C1 treatments ($P < 0.05$). The total protein concentration in the blood was increased in B1 treatment ($P < 0.05$). Moreover, the IgG concentration was increased in both B1 and C1 treatments compared with the NC treatment ($P < 0.05$). NC treatment had a higher HDL-cholesterol concentration than B3 and C1 treatments ($P < 0.05$), furthermore LDL-cholesterol concentration was higher in B3, B1 and PC treatments compared with the other treatments ($P < 0.05$). It is concluded that caprylic acid and *Yucca schidigera* extract at level of 0.1 or 0.2% can improve growth performance, nutrient digestibility, fecal microflora and blood profiles in growing pigs.

Key words: caprylic acid, growing pigs, yucca extract

M214 Effect of fructooligosaccharide and levan on growth performance, nutrient digestibility, blood characteristic and diarrhea in growing pigs. L. Yan*, X. Y. Guo, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

A total of 100 commercial cross-bred pigs [(Duroc × Yorkshire) × Landrace, weaned at 21 d, BW = 5.97 ± 0.46 kg] were allocated to 1 of 5 treatments [4 replicates with 5 pigs per pen (3 barrows and 2 gilts)] to determine the effects of fructooligosaccharide (FOS) and levan (LV) on growth performance, nutrient digestibility, blood characteristic and diarrhea in weaning pigs. The experiment lasted for 6 wk. The experimental treatments were: 1.NC, basal diet; 2.PC, NC + 0.01% apramycin; 3. LV, NC + 0.1% levan; 4. BM, NC + 0.1% FOS and 5. LB, NC + 0.05% levan + 0.05% FOS. Data were subjected to the GLM procedures and Duncan multiple range test was used to compare the means of the treatments. Pigs fed PC, BM and LB diets led to a higher (410, 399, 394 vs. 306 g; $P < 0.05$) ADG than the NC diet during 0–14 d. Dietary supplementation of 0.1% FOS increased (402 vs. 327 g; $P < 0.05$) the ADG compared with the NC treatment through the entire period. No difference ($P > 0.05$) was observed on the ADFI and G:F among treatments in the present study. Administration of PC, BM and LB led to higher (84.38, 85.82, 85.42 vs. 78.71; 81.33, 82.73, 83.69 vs. 77.27; 83.43, 86.14, 86.27 vs. 78.91%; $P < 0.05$) DM, N and energy digestibility compared with the NC treatment at the end of 14 d. A lower diarrhea score was detected for the BM treatment compared with the NC treatment during 0–7 d ($P < 0.05$). No difference was observed on the ($P > 0.05$) blood characteristic in the current study. In conclusion, the inclusion of levan or fructooligosaccharide could benefit the growth performance and nutrient digestibility during 0–14 d. Administration of fructooligosaccharide decreased the diarrhea scores and increased the growth performance when the entire period was evaluated.

Key words: fructooligosaccharide, growth performance, levan

M215 Effects of dietary sodium stearoyl-2-lactylate supplementation on growth performance, nutrient digestibility, and blood profiles in growing pigs. B. U. Yang*, H. Y. Baek, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to evaluate the effects of dietary sodium stearoyl-2-lactylate (SSL) supplementation on growth performance,

nutrient digestibility, and blood profiles in growing pigs. A total of 144 [(Landrace × Yorkshire) × Duroc] pigs with an initial BW of 24.62 ± 1.32 kg were used in a 6-wk experiment. Pigs were randomly allotted to 1 of 6 treatments. Dietary treatments included: 1) PC (basal diet), 2) PCS (basal diet + 0.05% SSL), 3) P50 (50 kcal/kg down spec design (−50 kcal/kg comapred with basal diet)), 4) P50S (P50 + 0.05% SSL), 5) P100 (100kcal/kg down spec design (−100 kcal/kg comapred with basal diet)) and 6) P100S (P100 + 0.05% SSL). There were 6 replicates per treatment with 4 pigs per pens (2 barrows and 2 gilt). Throughout the experimental period, pigs fed the PC, PCS and P50S treatments had greater ADG than those fed the P100 diets (647, 680, 671 vs. 671 g; $P < 0.05$). Average daily gain was decreased as SSL level increased (680, 671 vs. 658 g; $P = 0.025$). Pigs fed P100S diet had greater blood glucose concentration than those fed the PC and PCS diets (90.8 vs. 77.2, 79.3 mg/dL; $P < 0.05$). The blood glucose concentration was increased as energy source decreased (78.3, 83.0 vs. 88.65 mg/dL; $P = 0.018$). However, the triglyceride concentration was decreased as SSL level increased (46.8, 46.0 vs. 45.8mg/dL; $P = 0.022$). In conclusion, SSL at level of 0.05% can improve growth performance and blood profiles in growing pigs.

Key words: blood profile, growing pigs, growth performance

M216 Effect of dietary zootechnical feed additive supplementation on sow and litter performance. D. Solà-Oriol*[1], P. S. Agostini[1], S. L. Vinokurovas[1], B. T. Lund[2], and J. Gasa[1], *[1]Universitat Autònoma de Barcelona, Bellaterra, Spain, [2]Chr. Hansen, Hørsholm, Denmark.*

The aim of the present study was to evaluate the effect of Bioplus 2B supplementation of sows' diet on sows and litter performance. Bioplus 2B is a zootechnical additive containing *B. licheniformis* and *B. subtilis* in a 1:1 ratio. A total of 72 crossbred sows were fed one of 2 experimental treatments from matting to 21 d of lactation. Treatments were: control diet (CTL, n = 35) and CTL + 0.4 ppm of Bioplus 2B (B2B, n = 37). Cereal and soybean meal based diets were formulated to contain 12.2 MJ/kg ME and 6.23 g/kg Lys during gestation and 13.1 MJ/kg ME and 8.93 g/kg Lys during the lactation. At matting, sows were distributed into 2 experimental treatments according to parity number, BW, BCS and backfat (BFP2). Sow BW, BCS and BFP2 were individually monitored at 0, 35 and 110 d of gestation and at 21 d post-farrowing. Feed intake was individually adjusted according to BCS (every 3 wk during gestation) and an ad libitum feeding program was used during lactation. Total feed intake (TFI) of sows was individually recorded during gestation and lactation. Sow and litter performance was controlled until 21 d of age. Litters were standardized in number and weight by cross fostering within each treatment. No difference in BCS or BFP2 was observed between treatments during gestation and lactation periods ($P > 0.10$). Lower and higher TFI was observed for sows fed B2B than those fed CTL diets for the gestation (320 vs. 336 kg; $P < 0.05$) and lactation (129 vs. 121 kg $P < 0.05$), respectively. The total piglets born and piglets born alive was not afected ($P > 0.10$) by the treatments used. A reduction of stillbirth piglets and piglets dead during the suckling period was observed for the sows fed the B2B diet than those fed the CTL diet (1.27 vs.. 2.05 and 1.32 vs.. 2.09; $P < 0.01$, respectively). Total mortality rate during lactation tended to be reduced for the B2B supplemented sows (9.6 vs.. 14.6%; $P = 0.105$). No differences were observed on the number of piglets weaned, litter weight at weaning, or weaning to oestrus interval ($P > 0.10$). It is concluded that B2B may improve sow farrowing performance by reducing piglet mortality at farrowing.

Key words: feed additive, sow, stillborn

M217 Effect of a wheat dextrin and a fructooligosaccharide as prebiotics on nursery pig performance. V. G. Perez*, H. Yang, T. R. Radke, and D. P. Holzgraefe, *ADM Alliance Nutrition Inc., Quincy, IL.*

The wheat dextrin (PMD) and fructooligosaccharide (FOS) selected for this experiment were used as prebiotics to promote pig growth. Both PMD and FOS were added in nursery diets at the dose recommended by their vendors to determine whether or not they have additive effects on promoting pig performance. The experiment was a randomized complete block design; blocks were 3 categories of initial BW. Treatments had a 2 (0 vs.. 0.2% PMD) × 2 (0 vs.. 0.1% FOS) factorial arrangement. Each treatment was replicated with 12 pens of 4 pigs per pen. Pigs were weaned (about 21 d of age) and fed the experimental diets for 28 d, using a 3-phase feeding program (7, 7, and 14 d for feeding phases 1, 2, and 3, respectively). All diets were formulated to provide same amount of nutrients within feeding phase. Carbadox was added at 55 mg/kg of diet to all treatments. The PMD and FOS interacted on the ADG ($P < 0.05$) and G:F ($P < 0.01$). During the first 7 d, PMD increased ADG by 35 g/d in the absence of FOS, but decreased it by 25 g/d in the presence of FOS. Overall, PMD increased ADG by 37 g/d in the absence of FOS, but decreased it by 10 g/d in the presence of FOS. The same pattern of response was observed for G:F in both periods, but no effect was detected for ADFI (Table 1). No main effects of PMD or FOS were detected. These results were consistent with previous dose-response company studies, in which the inclusion of up to 0.2% of prebiotic in nursery diets improved pig performance, but then reduced performance with larger doses of prebiotic. In summary, the inclusion of PMD at 0.2% of the diet improved pig performance only in the absence of FOS.

Table 1. Effect of wheat dextrin (PMD) and fructooligosaccharide (FOS) on pig performance

Item	None	PMD	FOS	PMD+FOS	SEM
Initial BW, kg	5.84	5.85	5.86	5.88	0.02
Days 1-7					
ADG, g/d[a]	189	224	203	178	14
ADFI, g/d	173	198	179	182	12
G:F, g/kg[b]	1,091	1,134	1,129	969	35
Days 1-28					
ADG, g/d[a]	373	410	392	382	11
ADFI, g/d	457	490	474	477	13
G:F, g/kg[b]	817	836	829	802	8

[a]PMD × FOS interaction, $P < 0.05$; [b]PMD × FOS interaction, $P < 0.01$.

Key words: wheat dextrin, fructooligosaccharide, prebiotic

M218 Effects of ractopamine feeding duration on performance and carcass traits of finishing pigs. V. V. Almeida*[1], A. J. C. Nuñez[2], C. Andrade[1], J. C. C. Balieiro[2], and V. S. Miyada[1], *[1]USP/ESALQ, Piracicaba, SP, Brazil, [2]USP/FZEA, Pirassununga, SP, Brazil.*

The β adrenergic agonist ractopamine is increasingly used in the swine industry due to its ability to improve performance and carcass leanness by directing nutrients from adipose tissue toward skeletal muscle. However, the response may vary as a function of ractopamine treatment duration. Therefore, 80 barrows weighing 69.23 ± 7.74 kg BW were used to determine the effects of ractopamine feeding duration on performance and carcass traits of finishing pigs. A randomized complete block design experiment was carried out to evaluate 5 treatments with 8 replications per treatment and 2 pigs per experimental unit

(pen). Dietary treatments included control (without ractopamine for 28 d) and 10 ppm of ractopamine fed for 7, 14, 21 or 28 d before slaughter. Diets were based on corn-soybean meal, formulated to contain 0.88% of digestible lysine and 3.23 Mcal/kg ME. Feed intake and live body weight were recorded weekly to determine ADG, ADFI, and G:F. After 28 d on test, pigs were slaughtered at 101.94 ± 9.06 kg BW and carcass measurements made at 24 h postmortem. Treatment effects were assessed by ANOVA and regression analysis using the GLM procedure of SAS. G:F was quadratically improved (0.331, 0.352, 0.369, 0.377, and 0.367 ± 0.03; $P < 0.05$) as the duration of ractopamine feeding increased from 0 to 28 d; however, ADG and ADFI were not affected ($P > 0.05$) by treatments. Increasing ractopamine feeding duration from 0 to 28 d before slaughter resulted in linear increases on loin eye area (40.28, 42.24, 43.37, 45.03, and 48.86 ± 5.79 cm^2; $P < 0.01$) and loin depth (62.69, 63.69, 66.06, 65.69, and 70.19 ± 6.21 mm; $P < 0.01$). Ractopamine feeding duration did not affect ($P > 0.05$) carcass weight, carcass length, dressing percentage, backfat thickness and lean percentage. These results suggest that the maximum improvement in performance of finishing pigs is achieved within 21 d of ractopamine feeding, while the magnitude of carcass response seems to be directly dependent on ractopamine feeding duration.

Key words: beta-adrenergic agonist, carcass leanness, swine

M219 Effect of zilpaterol hydrochloride supplementation on growth performance in male Japanese Quails. M. Mohammadi*, A. Towhidi, H. Moravej, and A. Z. Shahneh, *Department of Animal Science, university of Tehran, Karj, Karaj, Alborz, Iran.*

Zilpaterol hydrochloride is a β-adrenergic agonist that has been shown to increase lean muscle and decrease fat deposition. In this study, 128 birds at 33 d of age were randomly assigned to 4 treatments. Each treatment consisted of 4 replicates of 8 birds. Diets were formulated based on corn and soybean meal for finishing period (24% CP and 2.9 Mcal/kg of ME) that were supplemented with 0, 0.2, 0.225, or 0.25 mg/kg of live weight d^{-1} of zilpaterol. Quails were fed the diets until d 47 and then slaughtered on d 50. Data were analyzed with using the GLM procedure of SAS. Results showed that during d 33–47, zilpaterol supplementation improved G:F ($P < 0.04$), and live weight gain in group 0.2 and 0.225 compared with control, but did not affect feed intake (Table 1). Birds fed zilpaterol had lower abdominal and subcutaneous fat percentage ($P < 0.05$). Dietary zilpaterol did not affect carcass, thigh, breast and liver weight. It was concluded that zilpaterol hydrochloride supplementation in japans quail improved growth performance and the optimal level of this β-agonist was 0.225 mg/kg of live weight d^{-1}.

Table 1. Effect of zilpaterol supplementation on growth responses in Japanese Quails

Item	T_1 0	T_2 0.2	T_3 0 .225	T_4 0 .25	SEM	*P*-value
Total weight gain(g)	64.31[a]	71.71[b]	75.28[b]	69.87[ab]	2.23	0.03
Feed intake(g)	363.34	369.4	372.87	357.06	6.77	0.4
gain:feed	0.176[a]	0.194[b]	0.202[b]	0.195[b]	0.005	0.041

[ab]Means in each row without a common superscript letter differ ($P < 0.05$).

$T_{1, 2, 3, 4}$: 0, 0.2, 0.225, 0.25 mg/kg of LW^{-1} d^{-1} zilpaterol, respectively.

Key words: zilpaterol hydrochloride, Japanese quail, growth performance

M220 Safety and efficacy of *Moringa oleifera* powder for growing poultry. J. O. Ashong* and D. L. Brown, *Cornell University, Ithaca, NY.*

Leaves from *Moringa oleifera* have been reported to have a remarkable range of qualities from superior nutritional composition, therapeutic applications and prophylactic uses for both humans and animals. Most of these claims are based on anecdotes or uncontrolled observations. The objective of the present study was to evaluate the safety and nutritional efficacy of *Moringa oleifera* leaf meal. At 7 d of age, 60 White-leghorn type chicks were randomly assigned to 4 isocaloric and isonitrogenous experimental diets formulated to contain 0% (control group), 10%, 20% and 30% moringa leaf powder. There were 5 chickens per cage with 3 replicates per diet. Daily feed intake and weekly BW were recorded for the duration of the 5 wk study. Chicks were observed for any signs of abnormal behavior and/or toxicity. Post-trial postmortem examination conducted included weighing of kidney, liver and heart and biochemical analyses such as, cholesterol, uric acid, thyroxine (T4), total protein and iron. There were no signs of abnormal behavior and/or toxicity and mortality during the entire period of the experiment. The control group had a higher feed intake ($P < 0.05$) with a corresponding higher weight gain ($P < 0.0001$) compared with the other treatment groups. Chicks fed with 10% moringa leaf meal, had the lowest feed intake although it did not correspond to the lowest weight gain. Heart, liver and kidney weights were heaviest in the control group even though the kidney weight was not significantly ($P > 0.05$) different from the kidney weights of chicks on the treatment diets. The heart weight decreased with increasing percentage of moringa leaf powder in the meal. The control group had significantly higher levels of cholesterol; triglyceride and uric acid. These results suggest that although incorporation of moringa leaf meal may reduce intake and rate of gain, this ingredient otherwise is not toxic to growing poultry and has some effects on blood lipids profiles that may be of interest to human nutritionists.

Key words: *Moringa oleifera*, safety, poultry

M221 Singular consumption of either *Lactobacillus plantarum* or inulin reduces manure odor from finishing pigs; however, this is negated when offered in combination. C. J. O'Shea, T. Sweeney, B. Bahar, M. Ryan, and J. V. O'Doherty*, *University College Dublin, Dublin, Ireland.*

A 2 × 2 factorial experiment was conducted to investigate the effects of inulin (0 vs. 12.5 g/kg) and/or *Lactobacillus plantarum* (LP) inclusion (0 vs. 0.5 g/kg) on nutrient digestibility, nitrogen excretion, distal gastrointestinal tract (dGIT) fermentation and manure ammonia and odor emissions from finishing pigs. Consumption of diets containing LP and inulin had no influence on apparent total tract nutrient digestibility when offered either singularly or in combination ($P > 0.05$). In the colon, pigs offered diets containing LP decreased concentrations of propionic acid ($P = 0.048$) and valeric acid ($P = 0.007$) when compared with unsupplemented diets. Consumption of inulin-supplemented diets decreased concentrations of isobutyric acid ($P = 0.050$) in the colon when compared with unsupplemented diets. Consumption of diets containing LP increased the *Lactobacillus* spp.:*Enterobacteriaceae* ratio (2.12 vs. 1.66; sem 0.14; $P = 0.034$) when compared with unsupplemented diets. Pigs offered diets containing inulin had decreased numbers of *Enterobacteriaceae* (5.85 vs. 6.66; sem 0.256; $P = 0.035$) compared with unsupplemented diets. There was an interaction between dietary inulin and LP supplementation on fecal *Clostridia* ($P = 0.004$). Singular consumption of either

inulin or LP had no effect on fecal *Clostridia*, however when offered in combination fecal *Clostridia* were increased when compared with the C diet. There was an interaction between dietary inulin and LP supplementation on manure odor at 72h. Consumption of diets supplemented with LP reduced manure odor ($P = 0.007$) when compared with the C diet, however there was no effect of LP when offered in combination with inulin on manure odor emissions. In summary, consumption of a LP-supplemented diet modified the distal gastrointestinal contents and increased the ratio of *Lactobacillus* spp. to *Enterobacteriaceae* in fecal matter. Consumption of LP singularly reduced manure odor, however when offered in combination with inulin this beneficial event was negated.

Key words: pig, odor, microbes

M222 Standardized total tract digestibility of P in Dried Fermentation Biomass, Peptone 50, and P.E.P. 2 Plus fed to weanling pigs. J. K. Mathai*[1], R. C. Sulabo[1], J. L. Usry[2], B. W. Ratliff[3], D. M. McKilligan[3], and H. H. Stein[1], *[1]University of Illinois, Urbana, [2]Ajinomoto Heartland, LLC, Chicago, IL, [3]TechMix, LLC, Stewart, MN.*

Forty barrows (BW: 12.4 ± 1.3 kg) were used to measure the apparent (ATTD) and standardized total tract digestibility (STTD) of P in Dried Fermentation Biomass (DFB), Peptone 50 (PEP50), and P.E.P. Two Plus (PEP2+) fed to weanling pigs and to compare these values to those in fish meal. The DFB product (Ajinomoto Heartland LLC) is a co-product from AA production and PEP50 and PEP2+ (TechMix LLC) are produced from hydrolyzed pig intestines. Pigs were housed individually in metabolism cages and were randomly allotted to 5 diets with 8 replicate pigs per diet. Four diets were formulated with DFB, PEP50, PEP2+, or fish meal as the sole source of P in the diet. A P-free diet was used to measure basal endogenous P losses (EPL). Feces were collected for 5 d based on the marker to marker approach after a 5-d adaptation period. Analyzed total P in DFB, PEP50, PEP2+, and fish meal were 0.88, 0.74, 0.80, and 3.25%, respectively. Daily P intake of pigs fed DFB, PEP50, and PEP2+ were less (0.80, 0.82, 0.96 g/d; $P < 0.01$) than in pigs fed fish meal (1.77 g/d). Fecal P concentration (0.41, 0.57, 1.12, 2.56%) and daily P output (0.08, 0.09, 0.27, 0.62 g/d) were less ($P < 0.01$) in pigs fed DFB and PEP2+ than in pigs fed PEP50 and fish meal. The amount of P absorbed was different ($P < 0.01$) between all treatments (0.56, 0.72, 0.87, and 1.15 g/d in PEP50, DFB, PEP2+, and fish meal, respectively). The ATTD of P was greater ($P < 0.01$; SEM = 1.8) in DFB (90.4%) and PEP2+ (90.6%) than in PEP50 and fish meal (68.0 and 65.5%, respectively). The basal EPL was measured at 148 ± 63 mg/kg DMI in pigs fed the P-free diet. The STTD of P in DFB (96.9%) and PEP2+ (97.6%) were greater ($P < 0.01$; SEM = 2.2) than in PEP50 and fish meal (76.2 and 68.5%, respectively). Likewise, PEP50 had greater ($P < 0.01$) STTD of P than in fish meal. Therefore, DFB, PEP50, and PEP2+ had greater STTD of P, but lower concentration of P, than fish meal.

Key words: alternative feedstuffs, phosphorus, pigs

M223 Digestibility of green banana flour (*Musa cavendishi*) in roosters. E. Toledo*[1], F. Martínez–Bustos[2], and A. G. Borbolla[1], *[1]Department of Swine Medicine and Production, School of Veterinary Medicine, Universidad Nacional Autónoma de México, Mexico City, Mexico, [2]CINVESTAV, IPN, Unidad Queretarétaro, Querétaro, Qro. Mexico.*

Banana flour can be used in swine and poultry, as an alternative energy source, when the fruit is locally available and cheaper than the cereals regularly fed to these species. The aim of this study was to evaluate the fecal digestibility of banana flour in roosters (Ross, 308). Green bananas were chopped in pieces (1cm thickness/10cm length), and heat dried in a convection oven (Yakomoto 900, YKN), at 55, 70, 80 and 90°C, for 48 h. The trial was conducted in 12 roosters, which were randomly assigned to 4 groups (3 roosters/group). Each treatment (temperature of dehydration), was changed every wk using a Latin Square Model. Digestibility of the flour was evaluated using the methodology described by Douglas et al. (1997), where each bird received 32 g of banana flour in one shot daily. Feces were collected after 48 h and dehydrated in a convection oven at 60°C for 48 h. The percentage of digestibility was determined using the following formula: {[(feed, g – feces, g) / feed, g] * 100}.The resulting data was analyzed using the statistical package SPSS 17.0. The amount of feces collected was higher ($P < 0.05$), for those animals that consumed the flour dehydrated at 80°C (19.97 g ± 2.05), than the other 3 treatments (55°C = 12.88 g ± 1.73; 70°C = 11.38 g ± 1.62 and 90°C = 13.83 g ± 1.37). Therefore, the digestibility of the flour dried at 80°C was lower ($P < 0.05$), than the values observed for the other drying temperatures (36.63% ± 6.41 vs.. 59.12% ± 5.32; 63.88% ± 5.02 and 56.14% ± 4.27; for 80, 55, 70 and 90°C, respectively). Banana flour dehydrated at 55 and 70°C showed the highest digestibility and the lowest amount of feces produced by roosters. According to these results, it can be concluded that roosters had a better use of the nutrients of the banana flour, when it is dried at low temperature (55 and 70°C). Banana flour might be considered a good source of energy for monogastric species such as swine and poultry.

Key words: banana flour, digestibility, rooster

M224 Effects of increasing levels of dietary turmeric on growth performance and immune response of nursery pigs. M. R. Bible*[1], S. D. Carter[1], H. J. Kim[1], T. M. Walraven[1], C. Houchen[2], S. Anant[3], and R. Ramanujum[4,5], *[1]Oklahoma State University, Stillwater, [2]University of Oklahoma Health Sciences Center, Oklahoma City, [3]University of Kansas Medical Center, Kansas City, KS, [4]Swaath Inc., Oklahoma City, OK, [5]ADNA Inc., Dublin, OH.*

Turmeric is a common dietary spice used in India and Southeast Asia that contains the active ingredient curcumin, a potent polyphenolic phytochemical. Curcumin and curcuminoids in turmeric are known to have anti-inflammatory and anti-microbial activities. Therefore, 32 crossbred (D x (L x Y)) barrows (7.5 kg; 20 d of age) were weaned and used to determine the effects of dietary turmeric on performance and immune response. Pigs were blocked by BW and ancestry, and allotted randomly to 4 dietary treatments in a randomized complete block design. Pigs were housed individually in metabolism crates in an environmentally-controlled building (8 pigs/trt). During a 3-d adjustment period to the crates, barrows consumed a standard, phase 1, nursery diet. After the adjustment period, the experimental diets were fed for 21 d. A corn-soybean meal-based diet (1.44% SID Lys) containing no antibiotics served as the control. The experimental diets contained increasing levels of turmeric at 2, 4, and 8 g/kg of diet, respectively. ADG, ADFI, and G:F were calculated weekly. Turmeric consumption per day (linear, $P < 0.0001$) was 0, 89, 181, and 354 mg/kg BW, respectively. Turmeric increased (quad, $P < 0.03$) final BW (14.8, 15.8, 16.3, 15.5 kg), ADG (350, 389, 417, 382 g), ADFI (458, 487, 508, 459 g), and G:F (0.762, 0.798, 0.820, 0.826; linear, $P < 0.03$). On d 20 of the experiment, a lipopolysaccharide (LPS) challenge was performed. Pigs were administered intraperitoneally saline-based *E. coli* O111:B4 LPS (25 μg/kg of BW). Rectal temperature was measured and blood was collected for the analysis of tumor necrosis factor-α (TNF-α) at 0

h, and 3, 6, 12, and 24 h post-injection. Turmeric decreased (quad, $P < 0.05$) rectal temperature at h 3 (41.0, 40.6, 40.8, 40.7°C) with a corresponding numerical decrease (quad, $P = 0.12$) in blood serum TNF-α (2509, 805, 1300, 1585 pg/mL). In general, there were no differences observed for TNF-α concentrations or rectal temperature at any other hour post-LPS. In conclusion, dietary turmeric increased performance and lowered the inflammatory cytokine, TNF-α, during an *E. coli* LPS challenge in weanling pigs.

Key words: pig, turmeric, performance

M225 Evaluation the effect of inositol monophosphate supplementation on growth performance, blood profiles and nutrient digestibility in weaning pigs. H. Y. Baek*, H. W. Cho, and I. H Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to evaluate the effect of inositol monophosphate (IMP) supplementation on growth performance, blood profiles and nutrient digestibility in weaning pigs. A total of 200 weaning pigs [(Yorkshire × Landrace) × Duroc] with an initial BW 6.21 ± 0.90 kg were randomly assigned to 5 dietary treatments as follows: 1) CON (basal diet), 2) IMP02 (basal diet + 0.2% IMP), 3) IMP04 (basal diet + 0.4% IMP), 4) IMP06 (basal diet + 0.6% IMP) and 5) IMP10 (basal diet + 1.0% IMP). There were 8 replicate pens per treatment and 5 pigs per pen. Average daily gain (ADG) was higher ($P < 0.05$) in IMP04 treatment than that in IMP10 treatment during the overall experiment. Dry matter digestibility was higher ($P < 0.05$) in IMP06 treatment compared with that in CON, IMP02 and IMP10 treatments and CON treatment was lower ($P < 0.05$) than that in IMP04 and IMP06 treatments on d14. Nitrogen digestibility was higher ($P < 0.05$) in IMP04 treatment than that in CON treatment. Also, energy digestibility was higher ($P < 0.05$) in IMP04 treatment compared with that in CON, IMP02 and IMP10 treatments. On d28, nitrogen digestibility was higher ($P < 0.05$) in IMP04 treatment compared with that in CON and IMP10 treatments. IgG concentration was higher ($P < 0.05$) in IMP04 treatment than that in CON, IMP02 and IMP06 treatment on 28d. However, total cholesterol, Red blood cell (RBC), White blood cell (WBC) and lymphocyte were not affected by dietary treatments during this experiment ($P > 0.05$). Jejunum crypt depth was lower ($P < 0.05$) in IMP04 treatment compared with that in CON treatment ($P > 0.05$). In conclusion, growth performance was enhanced by supplementation of 0.4% IMP, and nutrient digestibility was increased by 0.4 and 0.6% IMP, and IgG concentration was improved by the supplementation of 0.4 and 1.0% IMP, and villi and crypt statue of small intestine was improved by the supplementation of 0.4 and 1.0% IMP.

Key words: growth performance, pigs, nutrient digestibility

M226 Effects of probiotics and probiotics mix on growth performance and blood characteristics. J. M. Lee*, S. M. Hong, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

A total of 150 weaned pigs with an average BW of 6.42 ± 0.91 kg were used in a 4 wk study to investigate the effects of *Bacillus subtilis* and *Bacillus licheniformi* mix (BBM) (1:1) and *Bacillus subtilis* (BS) on growth performance, blood characteristics and nutrient digestibility. Pigs were allocated to 1 of 6 dietary treatments with 5 replicate pens per treatment and 5 pigs per pen. Dietary treatments included: 1) NC (no antibiotics), 2) PC (antibiotics), 3) NBP (NC + 0.04% BBM), 4) PBP (PC + 0.04% BBM), 5) NCP (NC + 0.05% BS) and 6) PCP (PC + 0.05% BS). Data were subjected to the GLM procedures of SAS and Duncan multiple range test was used to compare the means of the treatments. On d 14, pigs fed NBP, PBP and PCP diets showed a higher ADG than pigs fed NC diet (286, 282, 282 vs. 228 g; $P < 0.05$). The ADFI was greater in NBP treatment than that in NCP treatment (345 vs. 271 g; $P < 0.05$). On d 28, pigs fed NBP and PCP diets showed a higher ADG than NC diet (604, 641 vs. 490 g; $P < 0.05$). The ADFI was greater in PC, NBP, BPB and PCP treatments than that in NCP treatment (779, 795, 792, 812 vs. 713 g; $P < 0.05$). G:F was greater in NCP treatments than NC treatment (0.812 vs. 0.652; $P < 0.05$). Overall the experiment, NBP, PBP and PCP diets had a higher ADG than NC diet (445, 435, 462 vs. 359 g; $P < 0.05$) and ADFI was greater in NBP and PCP treatments than NC and NCP treatments (570, 575 vs. 522, 492; $P < 0.05$). G:F was greater in NCP treatment than NC treatment (0.831 vs. 0.688; $P < 0.05$). On d 28, IgG was higher in PC and NCP treatments than that in NC, PBP and PCP treatments (434, 428 vs. 348, 357 mg/dl; $P < 0.05$). Dry matter digestibility was greater in PC treatment than that of NC treatment (82.18 vs. 78.39%; $P < 0.05$). Nitrogen digestibility was higher in PC treatment than that of NC and PCP treatments (74.18 va 67.85, 69.85%; $P < 0.05$). Energy digestibility was higher in PC, PBP and NCP treatments than that of NC and PCP treatments (81.51, 80.30, 80.46 vs. 77.65, 78.22%; $P < 0.05$). In conclusion, dietary supplementation of *Bacillus subtilis* and *Bacillus licheniformi* mix and *Bacillus subtilis* can be considered as an alternative to antibiotics.

Key words: growth performance, probiotics, weaned pig