M198 Effect of dietary gamma-aminobutyric acid on egg production, egg quality, blood profiles, cecal microbial populations and excreta gas emission in layers. J. H. Park*[1], B. Balasubramanian[1], S. Kathannan[1], J. H. Cho[2], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea, [2]Department of Animal Science, Chungbuk National University, Cheongju, Chungbuk, South Korea.*

Thirty-two-week-old Hy-line brown commercial layers were used to investigate the additive effect of gamma-aminobutyric acid (GABA) derived from *E. coli* strains, on the productivity, egg quality, blood profile, cecal population and excreta noxious gas emission. Two hundred eighty-eight birds (46 ± 0.5 g) were fed 4 different levels of GABA (0, 25, 50 and 100 ppm), in a basal diet based on corn-soybean meal, for 5 wks. Daily egg production was expressed on a hen-day basis, and egg quality and blood profiles were determined using an egg multi tester and an automatic blood analyzer, respectively. The *Lactobacillus* and *E. coli* medium agar plates were incubated for 24 h at 37°C, under anaerobic and aerobic conditions, respectively. A Gastec gas sampling pump was used for noxious gas detection. Polynomial contrasts were conducted to measure the linear and quadratic effects for increasing GABA levels on all measurements. As a result of the current study, egg production (93.5 vs. 95.2, 95.4, 97.1), egg weight (62.2 vs. 64.3, 65.9, 66.8), and egg mass (58.2 vs. 61.2, 62.9, 64.9) during 32–36 wks showed significant improvement, as dietary GABA increased from 0 to 100 ppm (linear, $P < 0.05$). In addition, GABA supplementation was associated with increased eggshell breaking strength (4.28 vs. 4.48, 4.46, 4.44; quadratic, $P < 0.05$) and albumen height (8.16 vs. 8.58, 8.62, 8.78; linear, $P < 0.05$). Blood parameters, such as white blood cells, red blood cells, lymphocyte, cortisol, epinephrine and norepinephrine concentrations, were not influenced by GABA added into the diet; however, the haptoglobin concentration (15.0 vs. 12.3, 11.0, 10.8) was significantly decreased linearly, and IgG concentration (48.8 vs. 54.0, 54.3, 68.3) was increased quadratically in GABA-fed groups ($P < 0.05$). *Lactobacillus* populations (7.46 vs. 7.48, 7.58, 7.90) in the cecum were significantly increased, as dietary GABA supplementation increased (linear, $P < 0.05$). The ammonia (70 vs. 62, 59, 54) and hydrogen sulfide (12.0 vs. 9.7, 9.3, 7.7) gas emissions in the excreta were significantly decreased (linear, $P < 0.05$). These results suggest that diets containing GABA may beneficially affect productivity, egg quality, serum haptoglobin and IgG concentration, and excreta noxious gas emission. Besides, GABA may also improve the intestinal environment, by increasing the *Lactobacillus* population of layers.

Key Words: blood profile, egg production, gamma-aminobutyric acid

M199 Egg production, egg quality, blood profiles, cecal microflora, and excreta noxious gas emission in layer hens fed with fenugreek (*Trigonella foenum-graecum* L.) seed powder. J. H. Park*[1], P. Y. Zhao[1], H. L. Li[1], J. H. Cho[2], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Choongnam, South Korea, [2]Department of Animal Science, Chungbuk National University, Cheongju, Chungbuk, South Korea.*

The objective of this study was to investigate the effects of dietary fenugreek seed powder (FSP) supplementation in layers. A total of 288 layers (26 weeks old, Hyline-brown) were divided into 3 groups fed a corn-soybean meal diet (corn 50.4%, soybean meal 18.7%) containing 0 [control (CON)], 0.05 or 0.1% FSP for 5 weeks. Data were statistically analyzed via ANOVA using the GLM procedure of SAS for a completely randomized design, replicated 8 times with 12 layers per replication. Egg production was recorded daily on a hen-day basis, and egg quality and blood profiles were analyzed using an egg multi tester and an automatic biochemistry blood analyzer, respectively. For the measurement of cecal *Lactobacillus* and *E. coli*, cecal digesta was serially diluted in 0.1% peptone water, and incubated onto agar plates at 37°C for 24 h, under anaerobic and aerobic conditions, respectively. A Gastec gas sampling pump was used to detect gases in layer excreta. The inclusion of FSP in the layer diet did not affect egg production, feed intake and feed conversion among treatments. However, egg weight (CON = 63.1 vs. 0.1% FSP = 66.4 g), eggshell breaking strength (CON = 4.39 vs. 0.1% FSP = 4.66 kg/cm^2), eggshell thickness (CON = 35.4 vs. 0.1% FSP = 36.7 mm^{-2}) and yolk color (CON = 7.0 vs. 0.1% FSP = 7.8) was increased in FSP-fed groups ($P < 0.05$). Supplemental FSP decreased serum total cholesterol concentration (CON = 222 vs. 0.05% FSP = 172, 0.1% FSP = 184 mg/dL), whereas the HDL-cholesterol (CON = 33 vs. 0.1% = FSP 44 mg/dL) and IgG concentration (CON = 446 vs. 0.1% FSP = 469 mg/dL) was increased in the FSP fed-groups ($P < 0.05$). The inclusion of FSP led to an increase in cecal *Lactobacillus* number (CON = 6.98 vs. 0.1% FSP = 7.42 cfu/g; $P < 0.05$) and a decrease in *E. coli* number (CON = 6.57 vs. 0.05% FSP = 6.14 cfu/g; $P < 0.05$) and excreta ammonia gas emission (CON = 48 vs. 0.1% FSP = 30 ppm; $P < 0.05$). These results suggest that the addition of FSP does not increase egg production, but may affect egg quality, serum total- and HDL-cholesterol, IgG concentration and cecal microflora. The inclusion of FSP also decreased ammonia gas emission in layer excreta.

Key Words: blood profile, egg quality, fenugreek

M200 Effect of astaxanthin produced by *Phaffia rhodozyma* on growth performance, meat quality, and fecal noxious gas emission in broilers. M. M. Hossain*, M. Begum, H. Y. Shin, J. S. Jeong, M. Mohammadi, and I. H. Kim, *Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea.*

Phaffia rhodozyma is a species of yeast that produces the carotenoid pigment astaxanthin (AST), which exhibits a wide variety of biological activities in animals. A total of 432 1-d-old male broilers (Arbor Acres) was used in a 4-wk trial. Birds were allotted to 1 of 3 corn-soybean meal-based diets supplemented with 0 mg (CON, basal diet), 1,000 mg (CON + AST production 0.1%) or 2,000 mg (CON + AST production 0.2%) *P. rhodozyma* yeast per kg feed. There were 9 replicate cages per treatment, with 16 broilers per pen. Nine broilers were randomly selected from each treatment (1 bird per cage) for sampling on d 28. Statistical analysis was performed using the mixed models analysis procedures in SAS, with AST treatment and pen serving as the fixed and random effect model terms, respectively. In addition, orthogonal comparison was conducted using polynomial regression to measure the linear and quadratic effect of increasing dietary concentrations of supplemental AST production. Alpha level of significance was set at $P < 0.05$. The inclusion of yeast-AST in feed improved body weight gain in a linear fashion with increasing AST concentration (969, 989, 1024 g) in the finisher period and the overall experimental period (1377, 1401, 1439 g). Furthermore, yeast supplementation reduced feed conversion ratio (1.650, 1.603, 1.562) in the finisher period, and tended ($P < 0.10$) to reduce feed conversion ratio for the overall experimental period (1.588, 1.554, 1.525). The yeast-AST supplemental diet had no effect on breast

muscle color or pH, and water holding capacity values. Treatments with yeast-AST reduced ammonia emission in a linear fashion (17.98, 14.42, 14.32 ppm). This study demonstrated that yeast producing AST supplementation has a positive effect on BWG and FCR in the finisher period and the overall experimental period. It is possible that yeast-AST might maintain and promote the growth of a beneficial microbial population in fast-growing broilers. Moreover, there was an effective reduction in the fecal ammonia in response to treatment with yeast-AST. Ammonia is considered the most harmful gas to livestock, and can reduce daily weight gains and feed utilization.

Key Words: astaxanthin, growth performance, noxious gas emission

M201 Effect of protected organic acid blends on growth performance, nutrient digestibility and fecal micro flora in growing pigs. Y. H. Liu*[1], J. K. Kim[1], P. Y. Zhao[1], K. Y. Lee[2], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea, [2]Morningbio Co., LTD, Cheonan, Chungnam, South Korea.*

Protected organic acids are suggested to more effectively deliver acids to the distal ileum, cecum, and colon of piglets. The objective of this study was to evaluate the effects of dietary supplementation of protected organic acid blends (17% fumaric acid, 13% citric acid, 10% malic acid, 1.2% medium chain fatty acid) and carrier on growth performance, nutrient digestibility and fecal micro flora in growing pigs. A total of 100 crossed [(Landrace × Yorkshire) × Duroc] with an average initial BW of 23.4 kg was used in a 6-wk trial. Pigs were randomly allocated into 1 of 4 treatments (5 replications with 5 pigs per pen) in a randomized complete block design based on their BW. Treatments consisted of a control diet (CON) and the control plus 0.1, 0.2, and 0.4% of organic acid blends. Body weight and feed intake were measured initially and at the end of 6 wk to determine average daily gain (ADG), average daily feed intake (ADFI) and gain/feed. The digestibility of nutrients and fecal micro flora was also assessed at the end of the experiment. Data were analyzed using contrast statements to test the linear and quadratic effect of organic acid concentration in the diet. Linear effects ($P < 0.05$) were observed for ADG (713 g, 724 g, 745 g, and 737g) as well as G:F (0.450, 0.456, 0.471, and 0.464) with the increase in the level of organic acid blends. Dietary supplementation with 0.1%, 0.2% and 0.4% protected organic acid did not affect DM, N and energy digestibility. Supplementation of organic acid blends in the diet linearly increased ($P < 0.01$) fecal *Lactobacillus* population counts (7.26, 7.31, 7.47, and 7.38 $\log_{10}$ cfu/g) with the increase in the dose of organic acid blends. Our result suggests that protected organic acid has the potential to enhance growth performance and improve microbial population in growing pigs.

Key Words: growth performance, microflora, protected organic acids

M202 Effect of phytogenics on egg production, egg quality, excreta microbiota, noxious gas emission and nutrient digestibility in laying hens fed with different density diets. A. Hosseindoust*, H. L. Li, P. Y. Zhao, J. S. Jeong, and I. H. Kim, *Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea.*

This study was conducted to evaluate effects of dietary supplementation with phytogenics on production performance, feed intake, egg quality, excreta microbiota, noxious gas emission, and nutrient digestibility in laying hens. Total of 240 Hy-line Brown 50-week-old laying hens were randomly assigned to 1 of 4 treatments. The dietary treatments included (1) T1, basal diet (ingredients included Ca: 4.92%; protein: 16.9%, phosphorus: 0.64% and energy: 3920 kcal/kg); (2) T2 = T1 + 150 ppm phytogenics (quillaja 30%, anise 20% and thyme 17%); (3) T3 = T1 + 150 ppm phytogenics w/matrix (reduction in Ca −0.072% and P −0.068% only; (4) T4 = T1 + 150 ppm phytogenics w/matrix (reduction in Ca −0.072%, P −0.068%, protein −0.5%, energy −32 kcal/kg and amino acids). Variability in the data was expressed as the pooled standard error (SE) and probability level of $P < 0.05$ was considered to be significant. Egg weight was improved ($P < 0.05$) by the T2 (62.95), T3(63.54) and T4 (61.02) treatments compared with the T1 treatment during wk 15–20. The feed intake was higher ($P < 0.05$) in the T3 (112) and T4 (115) treatments than the T1 and T2 treatments. The yolk height in the T4 treatment (8.38) was higher ($P < 0.05$) than that in the T1 treatment at wk 20. T2 (8.95) and the T4 (9.00) treatments had higher ($P < 0.05$) yolk color compared with that in the T3 treatment at wk 15. *E. coli* and *lactobacillus* counts were not affected by dietary treatments. Laying hens in T3 (14.2) and T4 (16.4) treatments excreted significantly less ($P < 0.05$) ammonia than that in the T1 and T2 treatments at wk 20. At wk 15, the T1 (59.25) treatment had the greater ($P < 0.05$) ATTD (apparent total-tract digestibility) of Ca compared with the T3 treatment. Meanwhile, the T2 (47.59) and T4 (48.53) treatments had greater ($P < 0.05$) ATTD of P compared with the T1 and T3 treatments. At wk 20, the T3 (48.90) group had the highest ($P < 0.05$) ATTD of P when compared with the T2 and T4 groups. Thus the dietary supplementation with phytogenics has some influence on performance, feed intake, egg quality, excreta microbiota, noxious gas emission, and nutrient digestibility in laying hens.

Key Words: phytogenics, performance, egg quality

M203 Effects of gel based phytogenic feed supplement on growth performance, nutrient digestibility, blood characteristics, and intestinal morphology in weanling pigs. P. Y. Zhao*[1], H. M. Yun[1], H. L. Li[1], J. D. Hancock[2], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea, [2]Department of Animal Science & Industry, Kansas State University, Manhattan, Kansas.*

Gel based phytogenic feed supplement (GBP) is designed to facilitate the transition from a liquid diet (sow milk) to dry ration. It contains both feed component and water component thereby influencing feed consumption and intestinal health. In the current study, 120 weanling pigs [(Landrace × Yorkshire) × Duroc] with an average body weight of 6.71 kg were used in a 42-d feeding trial divided into 3 phases; d 1 to d 7 (Phase 1), d 8 to 21 (Phase 2) and d 22 to d 42 (Phase 3) to evaluate effects of GBP containing essential oil from caraway seed on growth performance, nutrient digestibility, blood chemistry and intestinal morphology. Pigs were randomly distributed on the basis of body weight and sex with 5 pigs per pen and 8 pens per treatment. Dietary treatments were: CON (basal diet), CON + 50 g GBP per pig a day, (F50) and CON + 100 g GBP per pig a day, (F100). The GBP was mixed with powdered feed just before feeding and fed during phase 1 post weaning and thereafter all pigs were fed only basal diet without GBP. All experimental data were analyzed as a randomized complete block design using the GLM procedures (SAS) with pen as the experimental unit and blocks based on initial BW. The digestibility of nutrients and measurement of villi of small intestine was done on d 10. Orthogonal contrasts were used to test the effect of treatments. During phase 3, feeding GBP linearly increased ($P < 0.05$) ADG (544 g, 553 g, 562 g) and G:F (0.644, 0.657, 0.674). Overall, linear increase were shown ($P < 0.05$) in ADG (462 g, 470 g, 477 g) and G:F (0.679, 0.694, 0.707). However, ADFI was neither improved nor reduced in piglets fed GBP. The digestibility of DM (78.2%, 81.8%, 82.5%) and GE (78.2%, 82.2%, 81.9%) increased

linearly ($P < 0.05$). The villi length of jejunum (540, 695, 755μm) and ileum (556, 713, 774μm) was improved linearly ($P < 0.05$) with the increase in the level of GBP. In conclusion, phytogenic feed supplement did not influence feed intake but increased ADG, improved G:F through enhancement of dry matter and energy digestibility as well as improved jejunum and ileum villi length.

Key Words: gel-based phytogenic feed supplement, growth performance, phytogenic

M204 Effect of medium chain fatty acids and probiotic (*Enterococcus faecium*) supplementation on the growth performance, nutrient digestibility, fecal score, fecal microflora, and fecal noxious gas emission in weanling pigs. P. Y. Zhao*, B. Balasubramanian, M. Begum, M. Mohammadi, and I. H. Kim, *Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea.*

The objective of the present study was to evaluate the effects of medium-chain fatty acids (MCFA) and probiotic (*Enterococcus faecium* DSM 7134) supplementation in weanling pigs. A total of 140 weanling pigs [(Yorkshire × Landrace) × Duroc] were allotted to 4 treatments, 7 replicates/treatment and 5 pigs/replicate. Diets include: CON, basal diet; TRT 1, CON + MCFA 0.2%; TRT 2, CON + probiotic 0.01%; TRT 3, CON + MCFA 0.2% + probiotic 0.01%. Titanium oxide was added to the feed at 0.2% dosage (2 kg/t of feed) and for a duration of 5 d as an indigestible marker for digestibility determination. Fresh fecal grab samples collected from 2 pigs per pen were mixed and pooled, and a representative sample was stored in a freezer at –20°C until analysis. Data were analyzed as 2 × 2 factorial arrangement by using the GLM Procedure of SAS. During wk 0–2, probiotics supplementation increased ($P < 0.05$) ADG (393 vs. 352) and G:F (0.831 vs. 0.741). During the overall period (wk 0–6), increased ($P < 0.05$) ADG (454 vs. 424) and G:F (0.709 vs. 0.660) were detected in probiotic treatments. The ATTD of DM, N, and energy were increased ($P < 0.05$) by probiotic (80.07% vs. 77.67%; 80.06% vs. 77.09%; 80.28% vs. 78.10%), MCFA (80.22% vs. 77.52%; 79.86% vs. 77.29%; 80.46% vs. 77.92%) and their combination (80.96% vs. 75.86%; 81.17% vs. 75.63%; 81.12% vs. 76.40%). There was no significant difference in fecal score, microflora (*Lactobacillus* and *E. coli*) and noxious gas emission (ammonia, hydrogen sulfide, total mercaptans, and acetic acid) in all the treatments. In conclusion, dietary probiotic supplementation have beneficial effect on growth performance, additionally, MCFA, probiotic and their combination can improve nutrient digestibility in weanling pigs.

Key Words: medium-chain fatty acids, weanling pig, growth performance

M205 Effect of dietary protected organic acids on growth performance, nutrient digestibility, blood profiles, microflora, and gas emission in weanling pigs. P. Y. Zhao*[1], M. Mohammadi[1], K. Y. Lee[2], M. Begum[1], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea, [2]Morningbio Co. Ltd., Cheonan, Chungnam, South Korea.*

The protected organic acids consist of medium chain fatty acid (MCFA) for animal nutrition and metabolism made by technology of Joint Matrix coating (JMT). The objective of the present study was to evaluate the effect of protected organic acid supplementation in piglets particularly at the weaning. A total of 112 weanling pigs with an average BW of 6.70 ± 1.31 kg were allotted to 4 experimental diets as: CON (basal diet); OA1 (CON + unprotected organic acid 0.2%); OA2, (CON + protected organic acid 0.1%) and OA3 (CON + protected organic acid 0.2%). There are 7 replications/treatment and 4 pigs/replication. The organic acid such as 17% fumaric acid, 13% citric acid, and 1.2% medium chain fatty acid (capric and caprilic acid) were used in the present experiment. Effects of treatments (Control, OA1, OA2, OA3) were analyzed by ANOVA as a randomized complete block design. Results are presented as least squares means and the variability in data was expressed as standard error (SE). The probability values less than 0.05 were considered as significant. Average daily gain (ADG), average daily feed intake (ADFI), gain to feed ratio (G:F), apparent total-tract digestibility (ATTD) were determined along with WBC, RBC, lymphocytes, IgG, *Lactobacillus* and *Escherichia coli* (*E. coli*). Average daily gain (ADG) at 0–2 wks were increased linearly (CON:307 g, OA1: 311 g, OA2: 319 g, OA3: 324 g) ADFI at 2–6 weeks (CON:762 g, OA1:757 g, OA2:755 g, OA3:750 g) and the overall ADFI was increased. A linear increasing effect was shown in the ATTD of dry matter (DM) (CON: 80.40%; OA1: 80.24%; OA2: 82.87%; OA3: 83.11%) with OA2 and OA3 treatments, the serum IgG in OA2 (235 mg/dL) and OA3 (245 mg/dL) treatments and the lymphocyte in OA3 treatments (50.9%) and in supplementation coated protected organic acid of *Lactobacillus*. However, a linearly reduced effect was observed in the population of *E. coli* (CON: 5.70, OA1: 5.65, OA2: 5.60, OA3: 5.49). In conclusion, dietary protected organic acids improve health status and performance in weanling pigs.

Key Words: protected organic acid, weaning pig, growth performance

M206 Effects of dietary fiber and benzoic acid on growth performance, nutrient digestibility, reduction of harmful gases, and lipid profiles in growing pigs. H. Y. Shin*[1], T. S. Li[1], J. Y. Cheong[2], C. M. Nyachoti[3], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Choongnam, South Korea, [2]Daehan Feed Co. Ltd., Incheon, South Korea, [3]Department of Animal Science, University of Manitoba, Winnipeg, Manitoba, Canada.*

We assessed the possible synergistic effects of fiber from sugar beet pulp and benzoic acid in growing-finishing pigs. In total, 96 growing pigs ([Landrace × Yorkshire] × Duroc) with an average initial BW of 22.8 kg were selected and provided the dietary supplements based on their BW in a 2 × 2 factorial experiment, with the respective factors being fiber (low vs. high; 140 g/kg, 160 g/kg NSP, respectively) and BA (0, 5 g/kg benzoic acid) in 6 replicate pens consisting of 4 pigs per pen. Sugar beet pulp was used as a DF sources, at 50 g/kg of the diet. All diets were formulated to contain 14.44 ME MJ/kg and 190 g/kg CP. This experiment was conducted to evaluate the growth performance, nutrient digestibility, and reduction of harmful gases and serum metabolites. The pen was considered as the experimental unit for growth performance and each pig was considered the experimental unit for gas emission and serum metabolites. The final model included the main effects of DF level and BA as well as the interaction between DF and BA. Data are reported as means ± standard error (SE). Differences were considered statistically significant when $P < 0.05$. There was no significant difference in feed intake (1.428). No difference was found in weight during treatments. Fiber levels affect the dry matter digestibility: it was higher in the high fiber group (79.91) than the low fiber group (78.80) ($P < 0.05$). Addition of BA also improved the energy digestibility ($P < 0.05$). No interaction was found between fiber level and benzoic acid treatment. There was no difference in NH_3, but RSH (25.0, 26.1) and H_2S (20.2, 25.5) gases emissions shows significant reduction with fiber and benzoic acid treatment. Additionally, serum metabolites, including lipoprotein (LDL: 56.25, HDL: 36.25) and cholesterol (93.25), were also appar-

ently unaffected by these treatments. Thus, the addition of 50 g sugar beet pulp per kg of growing feed as a DF source and the addition of BA had no significant effect on the growth performance of pigs during the growth period. We now consider that 50 g of sugar beet pulp per kg of diet may have been insufficient to reduce serum cholesterol in grower pigs. The findings of this study also
suggests that the metabolism of benzoic acid may differ from that of niacin.

Key Words: fiber, benzoic acid, growing pig

M207 Ileal digestibility of nutrients and amino acids in conventional hulled (44% CP) and dehulled (48% CP) soybean meal treated with β-mannanase for growing pigs. S. Shanmugam*[1], J. K. Kim[1], H. M. Yun[1], J. H. Cho[2], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea, [2]Department of Animal Science, Chungbuk National University, Cheongju, Chungbuk, South Korea.*

This experiment was conducted to determine the efficacy of β-mannanase supplementation to corn SBM based diet on ileal digestibility of nutrients and amino acids in growing pigs. Twenty barrows [(Landrace × Yorkshire) × Duroc] with an average body weight of 25 kg were fasted for 16 h and T-cannulas were surgically attached 15 cm proximal to ileo-cecal junction upon induction of anesthesia. The experimental diet consisted of corn based hulled or de-hulled SBM supplemented with or without 400U β-mannanase/kg. Cannulated pigs were allotted to one of 4 dietary treatments plus a nitrogen-free diet in a completely randomized design with 4 pigs per treatment. A nitrogen-free diet was used to determine basal endogenous losses of CP and amino acids. Data were analyzed as a completely randomized design with 2 × 2 factorial arrangement using GLM procedures of SAS. The main effect included dietary SBM (hulled vs dehulled) and with or without β-mannanase supplementation as well as the interaction between β-mannanase and types of SBM. Each experimental period consisted of 7 d of diet adaptation followed by total feces and ileal digesta collection. The supplementation of β-mannanase improved ($P < 0.05$) apparent ileal digestibility (AID) of DM compared with non-supplemented in hulled SBM (80.9% vs. 77.2%) and in de-hulled SBM (83% vs. 79.5%) but it did not influence N and GE digestibility. The AID of Thr and Pro was higher ($P < 0.05$) in dehulled SBM (81.3%, 82.6%) than hulled SBM (77.3%, 78.0%). Likewise, the SID (standardized ileal digestibility) of Thr and Pro was higher ($P < 0.05$) in dehulled (87.3%, 83.9%) than hulled SBM (83.9%, 80.3%). The supplementation of mannanase led to higher ($P < 0.05$) AID of amino acids such as Arg (78.2, 79.6% vs. 74.0, 75.5%), His (82.2, 83.2% vs. 79.0, 81.5%), Lys (84.6, 86.9% vs. 79.4, 80.1%), Val (78.2, 80.2% vs. 74.3, 76.7%) and Gly (81.2, 82.9% vs. 77.1, 80.3%) in hulled and dehulled SBM than non-supplemented diet and higher ($P < 0.05$) SID of Lys (89.0, 89.8% vs. 84.2, 87.0%) in hulled and dehulled SBM than non-supplemented diet. In conclusion the supplementation of enzyme increased the AID of Arg, His, Lys, Val and Gly and SID of Lys.

Key Words: mannanase, soybean meal, growing pig

M208 Effect of flavor and sweetener on growth performance, nutrient digestibility, blood profile, and diarrhea score in weaning pigs. Y. Lei*[1], P. Y. Zhao[1], H. L. Li[1], C. M. Nyachoti[2], and I. H. Kim[1], *[1]Department of Animal Resource & Science, Dankook University, Cheonan, Chungnam, South Korea, [2]Department of Animal Science, University of Manitoba, Winnipeg, Manitoba, Canada.*

A total of 120 weaning pigs [(Landrace × Yorkshire) × Duroc; BW = 8.95 ± 0.88 kg] were allotted to 4 treatments (6 pens/treatment, 5 pigs/pen) to evaluate the effect of anise flavor (F), sweetener (ST), and compound of them in weaning pigs. Treatments were as follows: 1) control, 2) control + 500 ppm F, 3) control + 150 ppm ST, 4) control + 500 ppm F + 150 ppm ST. Individual pig BW and pen feed intake were recorded on d 1, 14 and 42 (phase 1: d 1–14, phase 2: d 15–42) to calculate ADG, ADFI, and G:F. Cr_2O_3 (0.2%) was added to the diets from d 7 to 14 and d 35 to 42 as indigestible marker to determine apparent total-tract digestibility (ATTD) of DM, N, and GE. Blood samples were collected from the cervical vein of 2 pigs in each pen at 24, 48, and 72 h after weaning. Subjective diarrhea scores were recorded daily from d 1 to 7 and d 8 to 14. Data were analyzed as 2 × 2 factorial arrangement by using the GLM Procedure of SAS. During d 1 to 14, ADFI (-F vs. +F = 412 vs. 447.5 g; -ST vs. +ST = 407.5 vs. 452 g) and ADG (-F vs. +F = 323 vs. 355 g; -ST vs. +ST = 317.5 vs. 360.5 g) respectively improved by F ($P < 0.01$) and ST ($P < 0.01$) supplementation. During d 1 to 42, ST increased ADFI (-ST vs. +ST = 689.5 vs. 732 g; $P < 0.01$) and ADG (-ST vs. +ST = 461 vs. 508 g; $P < 0.05$). Digestibility of N was improved (-ST vs. +ST = 83.5 vs. 86.1%; $P < 0.05$) in ST treatments on d 14. The epinephrine level at 48 h after weaning was decreased (-ST vs. +ST = 154 vs. 148.5 pg/mL; $P < 0.05$) by supplementation of ST. Diarrhea score (scoring system from 1 to 5) was decreased ($P < 0.05$) by F (-F vs. +F = 4.04 vs. 3.93) and ST (-ST vs. +ST = 4.05 vs. 3.92) during d 1 to 7. No interaction effect was observed in our experiment. In conclusion, sweetener improved growth performance and nutrient digestibility, decreased serum norepinephrine concentration, epinephrine concentration and diarrhea score. Anise flavor could improve growth performance, decreased norepinephrine concentration and diarrhea score after weaning. It implies the benefit of anise flavor and sweetener might be more effective in the first week after weaning, and the effect sweetener seems better than anise flavor.

Key Words: flavor, sweetener, weaning pig