

(no azidiol added), Azidiol liquid (130 μ L/40mL), Azidiol tablet not sterilized, azidiol tablet sterilized by gamma radiation in the levels of 10, 15 and 20 kGy, and azidiol tablet sterilized by ethylene oxide. The results and variance analysis were compared using Duncan's Test. It is concluded that the treatments did not show any statistical difference ($p \geq 0.05$) in the several ranges of bacteria counting tested, concluding that azidiol liquid can safely be replaced by the tablet. The steriliza-

tion using gamma radiation is more feasible with lower levels, such as 10kGy, to reduce exposition of the tablets to high doses of radiation, which could result in the fusion of the crystal components, and less solubility. The tablet sterilization for ethylene oxide is also viable. *Acknowledgements: FUNDEP/UFMG; FAPEMIG; CNPq; CAPES.*

Key Words: azidiol, milk quality, bacteria counting

Nonruminant Nutrition: Feed Additives II

W144 Effect of dietary medicinal plants or an organic acid on ileal nutrient digestibility of Ross broiler chickens. H. Ziaei^{*1}, M. Bashtani², M. A. Karimi Torshizi³, H. Farhangfar², H. Naeemipour², and A. Zeinali², ¹*Agricultural Research Center, Birjand, Iran*, ²*Birjand University, Birjand, Iran*, ³*Tarbiat Modares University, Tehran, Iran*.

An experiment was conducted using 240 one-day old male Ross broiler chickens to evaluate the effect of dietary medicinal plants or an organic acid on ileal nutrient digestibility of Ross broiler chickens. Chicks were allocated to a randomized complete block design with 4 replicate pens (15 birds per pen). The experimental treatments were: T1= control, T2= control + 15 ppm of Virginiamycin, T3= control + 450 mg medicinal plants (digestrom) per kg diet and T4= control diet + 400 mg organic acid (Formycine) per kg diet. At age 21 and 42 d, ileal digestibility of nutrients was measured by Titanium oxide marker. Data was statistically analyzed using the GLM models of SAS. Duncan's multiple range test was used for pair-wise comparisons of treatment means. The results showed that supplemental diets significantly ($P < 0.05$) improved bioavailability of energy and ileal digestibility of protein. At 21 days of age, broiler fed with treatments 3 and 4 had lower bioavailability of energy and ileal digestibility of protein as compared to treatment 2, but their differences were not significant at 42 d of age. The experimental diets had no effect on ileal digestibility of fat. In conclusion, using medicinal plants or an organic acid in broiler diets could improve nutrient digestibility indicating that these compounds may be an alternative to antibiotics.

Key Words: Ross broiler, medicinal plants, organic acid

W145 Effect of a dietary herbal medicine and an organic acid on bone characteristics of Ross broiler chickens. H. Ziaie^{*1}, M. Bashtani², M. A. Karimi Torshizi³, A. Zeinali², H. Naeemipour², and H. Farhangfar², ¹*South Khorasan Agricultural and Natural Resources Researches Center, Birjand, Khorasan, Iran*, ²*Birjand University, Birjand, Khorasan, Iran*, ³*Tarbiat Modares University, Tehran, Iran*.

An experiment was conducted on 240 one-day old male Ross broiler chickens to evaluate the effect of dietary herbal medicine and or an organic acid on bone characteristic of Ross broiler chickens. Chicks were fed in a completely randomized block design with 4 replicate pens (15 birds per pen) for 42 days. Experimental treatments were: (T1= control, T2= control + 15 ppm of Virginiamycin, T3= control + 450 mg herbal medicine Digestrom /kg diet and T4= control diet + 400 mg organic acid Formycine /kg diet). At the end of the experiment, two birds from each replicate were randomly selected and sacrificed to determine the bone characteristics (modulus of elasticity, yield stress and percentage of ash, calcium and phosphorous). The results of our experiment showed that all parameters increased in supplemental diets ($P < 0.05$). The differences between the antibiotic diet and treatments 3 and 4 were not significant ($P > 0.05$). Therefore, supplementation of broiler diets with

antibiotics and their alternatives such as a herbal medicine or an organic acid resulted in increased resistance of broiler bones.

Key Words: organic acid, herbal medicine, bone characteristic

W146 The effect of ractopamine and ileal digestible lysine levels on growth performance and carcass characteristics of finishing pigs. D. Fontes^{*2}, E. C. Almeida¹, E. T. Fialho¹, M. A Zangeronimo¹, N. O. Amaral¹, L. M. Pereira, Jr.¹, and P. B. Rodrigues¹, ¹*University Federal of Lavras, Lavras, MG, Brazil*, ²*University Federal Minas Gerais, Belo-Horizonte, Brazil*.

A total of 50 hybrid barrows and 50 gilts (TOPIGS; initial and final weight of 90.2 \pm 0.90 and 117.8 \pm 1.2 kg) were used to evaluate the effects of ractopamine (Paylean[®], PAY) and ileal digestible lysine (IDL) levels on late finishing pig performance and carcass characteristics. Pigs were blocked by weight and sex and randomly allotted to one of ten dietary treatments in a 28d experiment. There were two pigs (one barrow and one gilt) per pen and five pens per treatment. Pigs were fed corn and soybean meal based diets formulated to meet the NRC (1998) requirements, with the exception of ileal digestible lysine, methionine and threonine which were adjusted to satisfy the ideal relationship to lysine. Treatments were arranged as a 2 \times 5 factorial with main effects of PAY (0 or 5 ppm) and ileal digestible lysine (0.68, 0.78, 0.88, 0.98, and 1.08%). There were no PAY \times ileal digestible lysine interactions ($P > 0.36$) observed. For the overall study, ADG and final weight were increased ($P < 0.05$) for pigs fed Paylean[®]. For the carcass measurements, the results showed that barrows fed PAY had better carcass yield ($P < 0.05$) than gilts. Pigs fed PAY had increased ($P < 0.05$) hot carcass weight (HCW), yield and longissimus muscle area at the 10th rib than those fed diets not supplemented with PAY. Average backfat thickness decreased ($P < 0.05$) for pigs fed PAY. Increasing ileal digestible lysine level did not affect ($P > 0.05$) the growth performance or carcass characteristics. In conclusion, pigs fed 5 ppm PAY had improved growth performance and carcass characteristics. The diet containing 0.68% ileal digestible lysine (30 g/day) was enough to meet the requirement for finishing pigs weighing 90 to 117 kg.

Key Words: B-adrenergic, metabolism Assay, performance

W147 Influence of ractopamine on carcass characteristics and economic viability of finishing pigs fed ad libitum or restricted feeding system. E. T. Fialho^{*}, V. S. Cantarelli, E. C. Almeida, M. G. Zangeronimo, N. O. Amaral, and L. V. C. Girão, *University Federal of Lavras, Lavras, MG, Brazil*.

A total of 30 barrows (TOPIGS; initial weight - 107.2 \pm 4.2kg) were used to evaluate the influence of ractopamine (Paylean[®]) and feeding system (restricted vs ad libitum) on late finishing pig carcass characteristics

and economic viability. Pigs were blocked by weight and randomly allotted to one of five dietary treatments in a 28d experiment. There was one barrow per pen and six pens per treatment. Pigs were fed corn and soybean meal based diets with 1.04% total lysine. Treatments were arranged as a 2 x 2 factorial (main effects of Paylean® [0 or 5.0 ppm] and feeding system [ad libitum vs restricted by 15%]) plus a control diet with 0.80% total lysine and no Paylean® in an ad libitum system. There were no Paylean® and feeding system interactions ($P>0.38$) observed. The economic viability was determined based on diets and pig production costs, as well as considering carcass quality. Throughout the study, pigs which were fed Paylean® had increased ($P<0.05$) hot carcass weight, carcass yield, longissimus muscle area at the 10th rib, and standardized fat:free lean. Average backfat thickness decreased ($P<0.05$) for pigs fed Paylean®. Tenth-rib backfat was also reduced ($P<0.05$) in pigs fed diets with Paylean® in a restricted feeding system. In conclusion, pigs fed 5 ppm Paylean® associated with the restricted feeding system had improved carcass characteristics and prove to be more economically viable for the production of finishing pigs from 107 to 120Kg.

Key Words: β -adrenergic, metabolism assay, carcass

W148 Effects of probiotics in lactating sow diets on litter growth performance. M. L. F. Silva, J. A. F. Lima, E. T. Fialho*, N. O. Amaral, V. S. Cantarelli, P. F. A. Souza, and C. H. T. Barbosa, *University Federal of Lavras, Lavras, MG, Brazil.*

The experiment was designed to evaluate the effects of antibiotics and probiotics during late gestation and lactation periods on litter growth performance during lactation through 14 and 28 days post-weaning. A total of 42 sows and 120 piglets were used. Early-weaned pigs ($n = 120$; 6.2 ± 0.72 kg of BW) were randomly distributed into 24 pens. Each pen was assigned one of three dietary treatments. The experimental diets were: two sow diets (with or without probiotics) fed 14 days before parturition until 21 days of lactation, and three piglets diets (1. with antibiotics, 2, with probiotics, or 3. both). The diets were formulated to meet the requirements of gestating and lactating sows and weaning piglets (NRC,1998) based on corn and soybean meal. Sows were fed the diets starting on day 100 of gestation through 21 days of lactation. There were no differences in ADG, and gain:feed ratio (G:F) among treatments ($P > 0.05$) in both the 14 and 28 day periods. At 28 d post weaning, feed intake (FI) was higher ($P<0.05$) for piglets fed diet 2 from sows fed diets with no probiotics. At 28 d postweaning, FI was higher ($P<0.05$) for piglets fed diets 2 and 3 from sows fed probiotics. F:G was higher for piglets fed diet 3 from sows fed probiotics. In conclusion, the combination of both antibiotics and probiotics used to supplement sow diets (during gestation and lactation) and young piglets diets during 14 and 28 days post-weaning resulted in positive effects on piglet growth performance.

Key Words: additive, sows, piglets

W149 Effects of ginger root powder on growth performance and antioxidant status of broiler chickens. G. F. Zhang¹, Z. B. Yang*¹, Y. Wang², W. R. Yang¹, X. Y. Zhao³, and S. Z. Jiang¹, ¹Shandong Agricultural University, Tai-an, Shandong, China, ²Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB, Canada, ³Tsinghua University, Beijing, China.

A study using 144 of day-old AA broilers was conducted to assess the effects of dried ginger root (*Zingiber officinale*) that was processed to

particle sizes of 8.4, 37, 74, 149 or 300 μm on growth performance, antioxidant status and serum metabolites of broiler chicks. The birds were housed in 24 wire cages in an environmentally controlled room with continuous overhead lighting, and were fed starter rations from d1 to 21 and finish rations from d22 to 42. Dietary treatments were non-ginger supplementation (Control) and ginger root processed to 5 particle sizes supplemented at the level of 0.5% (DM basis). Broilers were fed for *ad libitum* intake and had free access to water. Body weight and feed intake of chicks of each cage were measured weekly for determination of average daily gain (ADG), average daily feed intake (ADFI), and feed conversion rate (FCR). Blood samples were taken on d21 and 42 to determine the antioxidant status and serum metabolites. All broilers had similar ADG, DMI or FCR in each period or over the entire experimental period. However, supplementation of ginger powder increased ($P<0.001$) activities of total superoxide dismutase (TSOD) and glutathione peroxidase (GSHPx), but reduced ($P<0.01$) concentrations of malondialdehyde (MDA) and cholesterol in the serum of broilers at 21 and 42-day of ages. Concentration of total protein (TP) in the serum of ginger supplemented broilers tended ($P=0.09$) to be higher at 21-d and was higher ($P<0.01$) at 42-d of age compared to that of control broilers at the same ages. Reducing particle size of ginger powder linearly reduced ($P<0.05$) cholesterol (d21), linearly increased ($P<0.05$) GSHPx (d21), TSOD (d42) and TP (d21 & d42), but had no effect on MDA in the serum of ginger supplemented chickens. Supplementation of ginger at 0.5% level did not affect growth performance, but improved antioxidant status of broilers and the efficacy was enhanced as the particle sizes reducing from 300 to 8.4 μm .

Key Words: ginger root, broilers, antioxidant status

W150 Effects of long term dietary supplementation of betaine, CLA or both to mice on growth and viscera weight. L. González-Valero, J. M. Rodríguez-López, M. Lachica, and I. Fernández-Fígares*, *Spanish Research Council, CSIC, Granada, Spain.*

Betaine (BET) and CLA have the potential to alter growth and body composition in different animal models. Previous results in pigs have shown that BET and CLA have a synergistic effect on growth and carcass composition leading to leaner carcasses (Fernandez-Figares *et al.*, 2008), although increased liver weight was found in BET+CLA fed pigs. The aim of the present study was to gain further insight on the possible adverse effects of BET or CLA using mice as a model in a sub-chronic study. Male ICR (CD-1) mice, weighing 14-18 g, were group housed (5 mice per cage, 4 cages per treatment) and *ad libitum* fed Teklad global 14% protein rodent diet containing either no added BET or CLA (control), 0.5% BET, 1% CLA, or 0.5% BET + 1% CLA for 90 days. Mice were slaughtered and viscera was removed and weighed. Feed intake was significantly higher in BET+CLA fed mice ($P<0.001$) compared to the other treatments. No differences in BW gain and gain:feed were found among treatments ($P>0.05$). Carcass weight of CLA fed mice was higher ($P<0.05$) than mice fed the control diet with no further benefit when BET was added to the same diet. Gastrointestinal tract weight of mice fed BET+CLA diet was lighter ($P<0.05$) than control mice. Furthermore, gastrointestinal tract weight relative to body weight was lighter ($P<0.05$) in mice fed BET and/or CLA supplemented diets relative to control mice. Spleen weight and spleen weight relative to body weight were higher (44 and 42%, respectively; $P<0.05$) in BET+CLA fed mice than in control mice. No changes ($P>0.05$) in liver, kidneys, cecum and total viscera weight or relative to body weight were observed. Splenomegaly observed when mice were fed BET+CLA diets deserves

further investigation. Fernandez-Figares, Conde-Aguilera, Nieto, Lachica, Aguilera. (2008). *J. Anim. Sci.* 86: 102-111.

Key Words: betaine and CLA, mice, growth viscera

W151 The effect of dietary laminarin and fucoidan in the diet of the weanling piglet on performance, selected faecal microbial populations and volatile fatty acid concentrations. P. McDonnell and J. V. O'Doherty*, *Lyons Research Farm, University College Dublin, Newcastle, Co Dublin, Ireland.*

A 2x2 factorial experiment (n = 12 replicates/treatment, 4 pigs/replicate) was performed to investigate the effects of laminarin and fucoidan, independently or in combination on post weaning piglet performance and selected microbial populations. At weaning the piglets (24 days of age, 6.4 kgs live weight) were assigned to one of four dietary treatments: (T1) basal diet, (T2) basal diet with 300 ppm laminarin, (T3) basal diet with 236 ppm fucoidan, (T4) basal diet with 300 ppm laminarin and 235 ppm fucoidan. Pigs offered diets supplemented with laminarin had an increased daily gain ($P < 0.01$) and gain to feed ratio ($P < 0.05$) compared to unsupplemented laminarin diets during the experimental period (d 0-21). Pigs offered laminarin supplemented diets had an increased faecal dry matter and reduced diarrhoea ($P < 0.05$) during the critical d 7-14 period. Pigs offered diets containing laminarin had reduced faecal *E. coli* populations. There was a significant interaction ($P < 0.01$) on faecal *Lactobacilli* populations between laminarin and fucoidan. Pigs offered the fucoidan diet had an increased *Lactobacilli* population compared to pigs offered the basal diet. However, there was no effect of fucoidan on faecal *Lactobacilli* populations when included with laminarin. Overall, the reduction in *E. coli* population and the increase in daily gain suggest that laminarin may provide a dietary means to improve gut health post weaning.

Key Words: piglets, laminarin, fucoidan

W152 *Acanthopanax senticosus* extract improved growth performance and antioxidative capacity in weaned piglets. X. Wu¹, F. Y. Yan¹, Y. L. Yin^{*1}, X. F. Kong¹, T. J. Li¹, R. L. Huang¹, and L. X. Chen², ¹*The Chinese Academy of Sciences, Changsha, China*, ²*Guang An Biological Technique Company, China.*

This study was conducted to investigate the effect of *Acanthopanax senticosus* extract (ASE) on the growth performance and antioxidant capacity of weaned piglets. Dried AS herb was decocted in boiling distilled water (200 g/L) for 2 h. The decoction products were filtered and lyophilized. The yield of extract was about 25% (w/w), with total polysaccharides, flavone and organic acids 2.94, 0.19 and 1.04%, respectively. Ninety-six Duroc×Landrace×Yorkshire piglets weaned at 21 days of age (BW=5.64±0.48 kg) were randomly assigned to one of 3 treatments with 4 replicates each and fed a basal diet (BD), BD+ASE (1 g/kg), and BD+antibiotics (10% bacitracin zinc 400 mg+15% carbadox 300 mg) for 14 days. Blood samples were collected on d 7 and 14. ADG in the ASE group (216.80 g/d) and antibiotics group (231.38 g/d) were 16.81 and 24.66% higher than the control group ($P < 0.01$), and gain-feed ratio was improved by 18.18 and 21.39% ($P < 0.05$), respectively. However, there was no difference in growth performance between the ASE and antibiotic group ($P > 0.05$). Compared to the control group, both ASE and antibiotics increased Cu-Zn superoxide dismutase (SOD) activity on d 7 and 14 ($P < 0.05$). SOD activity decreased from 147.96±15.88 to 125.68±14.26 in the antibiotics group ($P < 0.05$), while it increased in the

ASE group (from 132.37±7.64 to 135.44±12.68). Malondialdehyde in the ASE group significantly decreased by 20.00 and 30.46% ($P < 0.01$) on d 7 and 14, respectively. Glutathione also had an increasing trend in the ASE group on d 7 and 14 ($P = 0.235$ and 0.211 , respectively). In addition, ASE influenced serum IgG on d 14 ($P < 0.05$). These findings indicated that ASE could alleviate weaning stress by improving antioxidant enzymatic system effectively in piglets.

Key Words: *Acanthopanax senticosus* extract, antioxidative capacity, weaned piglets

W153 Weaned piglet responses to Escherichia coli K88+ oral challenge when receiving yeast fermentation products: growth performance and gastrointestinal measurements. E. Kiarie^{*1}, S. Bhandari¹, M. Scott², D. O. Krause¹, and C. M. Nyachoti¹, ¹*University of Manitoba, Winnipeg, MB, Canada*, ²*Diamond V, Cedar Rapids, IA.*

Ninety weaned piglets (17 d of age; 5.2 ± 0.31 kg BW) were used to investigate the effects of in-feed and in-water yeast fermentation products (YFP) on the growth performance and gastrointestinal measurements upon *E. coli* K88+ oral challenge. Pigs were randomly allotted to one of six diets with five replicate pens/diet and 3 pigs/pen. Treatments consisted of a negative control (NC, no in-feed or in-water additive), positive control (PC, 0.0055% carbadox), yeast culture (YC, in-feed, 0.2% Diamond V XPC Yeast Culture), and a yeast fermentation-based prototype (YFBP, in-water, 0.5, 1 or 2 g/head/d). Pigs were acclimatized to treatments for a 7-d period prior to oral challenge and BW and feed intake were measured. Pigs were orally inoculated with a 6 ml dose of 2×10^9 cfu/ml of *E. coli* K88+. On d 3 and 7 post challenge, performance measures were recorded and GIT digesta and tissues were obtained. The BW, ADG, or G:F of NC pigs did not differ from those receiving additive treatments (PC, YC, YFBP) pre- or post-challenge. Pigs receiving additives (PC, YC, YFBP) had higher ADFI compared to NC pigs during the pre-challenge ($P = 0.06$) and post-challenge ($P = 0.01$) periods. PC pigs had a higher ($P < 0.05$) ADFI compared to YFP pigs (576 vs. 506 g/d) d 4 to 7 post challenge. Less digesta ammonia was observed in the ileum (2.4 vs. 3.1 mg/dL, $P = 0.05$) and colon (5.4 vs. 6.5 mg/dL, $P = 0.04$) of pigs receiving additives relative to NC pigs. Pigs fed YC had lower ($P = 0.01$) colonic ammonia compared to PC pigs (4.1 vs. 7.0 mg/dL) while pigs fed YFBP tended ($P = 0.07$) to show a linear reduction as the level increased (5.6, 5.9, and 4.4 mg/dL for 0.5 g, 1.0 g, and 2.0 g, respectively). In conclusion, pigs receiving YFP (YC, YFBP) had a healthier colonic environment during 7 d post-challenge period as suggested by reduce ammonia concentration.

Key Words: *E. coli* K88+, piglet performance, yeast culture

W154 Effect of multi-microbe probiotic product processed by high drying temperature and antibiotic on performance, nutrient digestibility, fecal and intestinal microflora and intestinal morphology of weanling pigs. J. Y. Choi¹, P. L. Shinde¹, Y. X. Yang¹, I. K. Kwon¹, C. S. Ra¹, W.-T. Cho², and B. J. Chae^{*1}, ¹*Kangwon National University, Chuncheon, Republic of Korea*, ²*Genebiotech Co. Ltd., Seoul, Republic of Korea.*

In this study effect of multi-microbe probiotic product subjected to high temperature drying was investigated. The probiotic product was prepared by solid substrate fermentation and dried at 70 °C for 36 h. The product comprised of *L. acidophilus*, *B. subtilis*, *S. cerevisiae* and *A. oryzae* and the count of each microbe was less than 10^5 cfu/g. Weanling pigs

(n = 360, initial BW 5.84 ± 0.18 kg and 21 ± 2 d age) were randomly allotted to 5 treatments (4 replicates per treatment with 18 pigs in each) on the basis of BW. Effects of probiotic level (low, 0.3 or high, 0.6%), and antibiotic (chlortetracycline, 0 or 0.1%) on growth performance, nutrient digestibility, small intestinal morphology, fecal and intestinal microflora were investigated in a 2×2 factorial arrangement with a negative control diet (NC, diet without antibiotic and probiotics). Pigs fed high probiotic diet had greater ADG (342 vs 333 g, $P < 0.05$) and nutrient digestibility, lesser coliforms and *Clostridium* and more *Lactobacillus* in intestine and feces (d 14) than pigs fed low probiotic diet. Inclusion of antibiotic improved ADG (344 vs 331 g, $P < 0.01$), ADFI (521 vs 510 g, $P < 0.05$) and DM digestibility (d 14). Also, higher fecal *Lactobacillus* (d 28), greater villus height at jejunum and ileum were noticed in pigs fed high probiotic ($P < 0.05$) and antibiotic ($P < 0.01$) diets. Pigs fed NC diet showed the poorest ($P < 0.05$) performance and nutrient digestibility than pigs fed probiotic diets with or without added antibiotic. In addition, higher ($P < 0.05$) fecal and intestinal coliforms and *Clostridium* and less ($P < 0.05$) *Lactobacillus* were noted in pigs fed NC diets when compared with other treatment diets. These results suggest that the probiotic product was more effective at higher inclusion levels, while the addition of an antibiotic to high and low probiotic diets improved weanling pig performance; however, no interaction (probiotic level \times antibiotic) effect was noticed on any of the measured parameters.

Key Words: piglet performance, intestinal morphology, multi-microbe probiotic product and antibiotic

W155 Effects of dietary supplementaion of talc on growth performance and meat quality in finishing pigs. H. D. Jang^{*1}, J. H. Lee¹, J. H. Jung¹, H. J. Jung², I. B. Chung², and I. H. Kim¹, ¹Dankook University, Cheonan, Choongnam, Korea, ²National Institute of Animal Science, RDA, Cheonan, Choongnam, Korea.

This study was conducted to evaluate the effects of dietary supplementation of talc on growth performance and meat quality in finishing pigs. Fifty-six pigs (Landrace \times Yorkshire \times Duroc, $94.20 \text{ kg} \pm 1.28$ kg average initial BW) were used in a 30 d growth assay. Dietary treatments included 1) CON (basal diet) and 2) Talc (basal diet + Talc 0.3%). The pigs were allotted into 4 pigs per pen with 7 replicate pens per treatment using a completely randomized design. There were no differences in final weight, ADG, ADFI and gain/feed during the whole period. All pigs were killed at the end of experiment, and the loin muscle were obtained for further meat quality evaluation. For meat color, redness was significantly increased in the talc treatment compared to CON treatment ($P < 0.05$). However, yellowness was greater in CON treatment than talc treatment ($P < 0.05$). There were no significant differences in other meat quality parameters (TBARS, water holding capacity, drip loss and pH) among treatments. For the sensory characteristics of meat, talc treatment significantly increased palatability compared to CON treatment ($P < 0.05$). In conclusion, inclusion of talc in the diet can increase meat redness and palatability in finishing pigs.

Key Words: talc, finishing pigs, meat quality

W156 Effects of dietary wild-ginseng adventitious root meal on growth performance, blood characteristics and meat quality in broiler chicks. H. D. Jang^{*1}, E. J. Han², W. K. Jeon³, K. Y. Paek², S. D. Lee⁴, J. C. Park⁴, and I. H. Kim¹, ¹Dankook University, Cheonan, Choongnam, Korea, ²Chungbuk University, Cheongju, Chungbuk,

Korea, ³Korea Institute of Oriental Medicine, Daejeon, Korea, ⁴National Institute of Animal Science, RDA, Cheonan, Choongnam, Korea.

This study was conducted to evaluate the effects of dietary wild-ginseng adventitious root meal on growth performance, blood characteristics, and meat quality characteristics in broiler chicks. Five hundred fifty two broilers (Arbor Acre broiler) with average initial body weight of 42.82 ± 0.38 g were used in a 35d growth trial. Dietary treatments included 1) CON (Basal diet), 2) WGR1 (Basal diet + 0.1% wild-ginseng adventitious root meal), 3) WGR2 (Basal diet + 0.2% wild-ginseng adventitious root meal) and 4) WGR3 (Basal diet + 0.3% wild-ginseng adventitious root meal). The broilers were allotted to four dietary treatments with 6 replicate pens and 26 broilers per pen in a completely randomized design. For the whole period, weight gain and feed intake were increased in the WGR1 treatment compared to the CON treatment ($P < 0.05$). Total blood cholesterol concentration was higher in both WGR2 and WGR3 treatments compared to the CON treatment ($P < 0.05$). CON treatment resulted in a higher IgG than WGR1, WGR2 and WGR3 treatments ($P < 0.05$). On d35, chicks were slaughtered and carcass samples were obtained. All carcass parameters were not affected by treatment with the exception of meat pH. A higher pH value was found in CON and WGR3 treatments ($P < 0.05$). TBARS was significantly increased in CON, WGR2 and WGR3 treatments compared to the WGR1 treatment ($P < 0.05$). In conclusion, the 0.2% WGR treatment increased weight gain and feed intake in broilers.

Key Words: wild ginseng adventitious root meal, blood characteristics, broilers

W157 Effects of the Chinese herb extract supplementation on growth performance, blood characteristics and meat quality in growing-finishing pigs. T. X. Zhou^{*}, J. S. Yoo, J. P. Wang, L. Yan, and I. H. Kim, Dankook University, Cheonan, Choongnam, Korea.

The effects of the Chinese herb extract (Taraxacum, Chinese Coptis, Forsythia and Glycyrrhiza) supplementation on growth performance, blood characteristics and meat quality in grow-finishing pigs were investigated in a 18-week feed trial. A total of 32 [(Landrace \times Yorkshire) \times Duroc] pigs with an initial body weight of 20 ± 2.6 kg were randomly assigned to four dietary treatments with 4 replications per treatment and 2 pigs per pen. A corn-soybean meal-based diet was formulated as a control diet and other treatment diets were supplemented with 0.5, 1 and 1.5 g/kg Chinese herb extract, respectively. After the feeding period, meat samples were collected from those pigs, which reached market body weight. During the feeding periods, grow performance was improved (Linear, $P < 0.05$) by the supplementation of the herb extract. Immunoglobulin (IgG) was increased (Linear, $P < 0.05$) by the herb extract addition at the end of the experiment. Pigs fed the herb extract at level of 1.5 g/kg had better ($P < 0.05$) meat color, pH value and water holding capacity (WHC). In conclusion, the supplementation of the Chinese herb can improve the growth performance, IgG concentration and meat quality in growing-finishing pigs.

Key Words: herb extract, blood characteristics, growing-finishing pigs

W158 Effects of anion emission rock powder supplementation on growth performance, nutrient digestibility, blood characteristic and fecal gas emission of weaning pigs. J. H. Lee*, J. S. Yoo, H. D. Jang, and I. H. Kim, *Dankook University, Cheonan, Choongnam, Korea.*

A total of 96 weaning pigs (6.73 ± 0.52 kg, 21 d of age) were blocked by BW and then divided into one of four dietary treatments for five weeks to evaluate the effects of anion emission rock powder supplementation. Dietary treatments included 1) NC (corn-SBM diet), 2) PC (Phase I : NC + avilamycin 40ppm + apramycin 100ppm; Phase II : NC + BMD 25ppm + avilamycin 40ppm + tylosin 100ppm; Phase III : NC + BMD 25ppm + tylosin 100ppm), 3) AP1 (NC + 1/2 antibiotics + anion emission rock powder 0.3%) and 4) AP2 (NC + anion emission rock powder 0.6%). During the overall experimental period, ADG and G:F ratio were significantly lower in NC treatment than other treatments ($P < 0.05$), and ADFI was higher in NC and AP2 treatments than PC treatment ($P < 0.05$). DM digestibility was higher in the PC treatment than that of NC and AP2 treatments ($P < 0.05$) at d 7, while at 21d, PC, AP1 and AP2 treatments were higher than the NC treatment ($P < 0.05$). Nitrogen digestibility was increased by PC treatment at 7d, compared to NC and AP2 treatments ($P < 0.05$). At 21d, NC treatment had the lowest nitrogen digestibility ($P < 0.05$). There was no difference in blood IgG and lymphocyte concentration at 0, 7, 21 and 35d among the treatments. However, RBC concentration of PC treatment was higher than that of the NC treatment at 7d ($P < 0.05$), and WBC of NC and PC treatments was higher than AP2 treatment at 35d ($P < 0.05$). For the fecal total mercaptan concentration at 10d, NC treatment was higher than other treatments ($P < 0.05$), and at 15d, AP1 and AP2 treatments was lower than NC and PC treatments ($P < 0.05$). In conclusion, supplementation of anion emission rock powder in weaning pig diet can reduce fecal odor gas emission without negative effects on growth performance.

Key Words: anion emission rock powder, odor gas emission, weaning pig

W159 Effects of delta-aminolevulinic acid and antibiotics on the growth performance, nutrient digestibility, hematological status, and immune responses of weaning pigs. J. P. Wang*¹, J. S. Yoo¹, J. H. Lee¹, R. Noble², S. H. Oh², and I. H. Kim¹, ¹*Dankook University, Cheonan, Choongnam, Korea,* ²*North Carolina A&T State University, Greensboro.*

Delta-aminolevulinic acid (ALA) is a non-protein amino acid that plays a rate limiting role in the process of heme biosynthesis. In this study, the effects of supplementation of the diet with ALA and antibiotics on growth performance, nutrient digestibility, hematological status, and immune responses in early weaning pigs were evaluated. A total of 144 weaned castrated male pigs (6.37 ± 0.52 kg, 21 d of age) were blocked by BW and litter and then divided into one of four dietary treatments. The treatments were arranged as a 2×2 factorial design with the inclusion of 2 levels of ALA (0 or 10 mg/kg) and antibiotics (0 or 40 mg/kg of apramycin and 100 mg/kg oxytetracycline). Supplementation of the diet with antibiotics resulted in a significant increase ($P < 0.05$) in ADG during phase 2. In addition, an interactive effect between ALA and antibiotics was found to increase ADFI ($P < 0.05$), whereas ADG and G:F were not affected by treatments in the overall phase. ALA significantly decreased the digestibility of DM and nitrogen (N) on d 21 ($P < 0.05$) and DM digestibility on d 35 ($P < 0.05$). The serum hemoglobin (Hb) and hematocrit (HCT) values increased significantly in response to ALA supplementation ($P < 0.05$). Despite this, the CD-8, B cell, and MHC-I were increased by the interactions between ALA and antibiotics ($P < 0.01$). ALA was found to elevate the numbers of CD-2,

CD-8, B-cell, MHC-I and MHC-II ($P < 0.05$, $P < 0.05$, $P < 0.01$, $P < 0.01$ and $P < 0.01$, respectively). Furthermore, an interaction effect between ALA and antibiotics resulted in an increase of CD-8, B-cell, and MHC-I and -II cells ($P < 0.01$). Overall, the results of this study indicate that dietary supplementation with ALA had no effect on the growth performance of weaning pigs, but that it did reduce the DM and N digestibility. Furthermore, supplementation with ALA resulted in improved iron status and had beneficial effects on the immune responses.

Key Words: delta-aminolevulinic acid, immune status, weaning pig

W160 Utilization of delta-aminolevulinic acid for livestock: Blood characteristics and immune organ weights in broilers. L. Yan*, Y. J. Chen, H. J. Kim, J. P. Wang, and I. H. Kim, *Dankook University, Cheonan, Choongnam, Korea.*

A study was conducted to evaluate the effects of delta-aminolevulinic acid (ALA) on blood characteristics and immune organ weights in broilers. A total of 480, one-day-old broiler chicks were randomly assigned to one of four dietary treatments with six replicates of 20 chicks each. Treatments were a basal diet supplemented with 0, 5, 10 and 15 mg/kg ALA. The two-phase experimental diets were formulated to meet the NRC requirements for chicks and fed for 5 weeks. Growth performance was not affected by supplementation of ALA during any of the experimental periods. Blood cell counts (WBC, RBC and lymphocyte), serum total protein, albumin, iron concentrations, and total iron binding capacity (TIBC) were also not influenced by dietary treatments. Hemoglobin concentration (8.85, 9.17, 9.49 and 9.67 g/dL) tended to increase with increased ALA supplementation levels (linear effect; $P < 0.10$). Dietary ALA addition did not influence liver weight. However, spleen (0.097, 0.122, 0.138 and 0.122 g/100g BW) and bursa of fabricius (0.190, 0.227, 0.270 and 0.294 g/100g BW) weights were increased with the increased ALA supplementation levels (linear effect; $P < 0.05$). The current data indicate that supplementation of ALA in commercial broiler diets could partly improve hemoglobin concentrations and immune organ weights, without influencing growth performance and other blood characteristics of broilers.

Key Words: delta-aminolevulinic acid, blood characteristics, immunity

W161 Effects of supplementation with a combination of delta-aminolevulinic acid and chito-oligosaccharide supplementation on the growth performance, nutrient digestibility, blood parameters and appearance of diarrhea in weaning pigs. T. X. Zhou*¹, Y. J. Chen¹, J. H. Lee¹, C. Y. Lee², B. C. Park³, and I. H. Kim¹, ¹*Dankook University, Cheonan, Choongnam, Korea,* ²*Regional Animal Industry Center, Jinju National University, Jinju, Gyeongnam, Korea,* ³*CJ Feed Inc., Incheon, Gyeonggi, Korea.*

This study was conducted to investigate the effects of supplementation with a combination of delta-aminolevulinic acid and chito-oligosaccharide (ACO) supplementation on the growth performance, nutrient digestibility, blood parameters and appearance of diarrhea in weaning pigs. A total of 144 pigs [(Landrace×Yorkshire)×Duroc] with an average initial body weight (BW) of 7.10 ± 0.48 were randomly allotted into four dietary treatments, with 6 pens per treatment and five pigs per pen. A corn-soybean meal-based diet was formulated as a control diet and then supplemented with antibiotics (phase 1, 40 ppm avilamycin and 100 ppm OTC; phase 2, 40 ppm chlortetracycline), or with 1 or 2 g/kg

ACO, respectively. The experiment lasted 42 days and was divided into 3 phases, including phase 1 (d 0 to d 7), phase 2 (d 8 to d 21) and phase 3 (d 22 to d 42). Growth performance in the ACO group was improved in phase 2, 3 and for the overall period ($P < 0.05$). ACO improved feed intake ($P < 0.05$) and total tract apparent digestibilities (TTAD) for DM and N ($P < 0.05$). However, lymphocyte concentration and appearance of diarrhea decreased ($P < 0.05$) in response to supplementation of ACO. Taken together, the results of the current study indicated that dietary supplementation with ACO enhanced growth performance by increasing the apparent digestibility of nutrients and decreasing the incidence of diarrhea.

Key Words: delta-aminolevulinic acid, chito-oligosaccharide, blood parameters

W162 Effects of AROMEX-ME supplementation in high and low nutrient density diets on growth performance, nutrient digestibility, blood characteristic, carcass trait and fecal malodor emission in growing-finishing pigs. H. J. Kim^{*1}, J. P. Wang¹, L. Yan¹, H. J. Jung², I. B. Chung², and I. H. Kim¹, ¹Dankook University, Cheonan, Choongnam, Korea, ²National Institute of Animal Science, RDA, Cheonan, Choongnam, Korea.

This study was conducted to investigate the effects of AROMEX-ME supplementation in high and low nutrient density diets on growth performance, nutrient digestibility, blood characteristic and carcass trait in growing-finishing pigs. A total of 96 pigs (23.89 kg, average initial body weight) were used during 112 days. Dietary treatments included: 1) HNDD (high nutrient density diet), 2) HNAR (high nutrient density diet + 0.01% AROMEX-ME), 3) LNDD (low nutrient density diet) and 4) LNAR (low nutrient density diet + 0.01% AROMEX-ME). Each treatment had 6 replicates of 4 pigs per pen in a randomized complete block design. During 12 to 16 weeks, average daily gain and G/F ratio were higher ($P < 0.05$) in HNAR group than others. Average daily feed intake was higher ($P < 0.05$) in LNAR group than others. Dry matter, nitrogen and energy digestibility at 6 week were highest ($P < 0.05$) in LNAR group than others. At 16 week, energy digestibility was lower ($P < 0.05$) in HNAR group than others. White blood cell concentration was higher ($P < 0.05$) in LNDD group than HNDD group at 6 week and was higher ($P < 0.05$) in HNDD group than LNAR group at 18 weeks. Lymphocyte concentration of blood was higher ($P < 0.05$) in HNDD group than HNAR group at 6 weeks. In sensory evaluation, marbling score was improved ($P < 0.05$) in low nutrient density diet group than high nutrient density diet group. In meat color, yellowness (b^*) was higher ($P < 0.05$) in HNDD group than AROMEX group and drip loss at day 1 was higher ($P < 0.05$) in HNDD group than LNDD group. Loin muscle area was highest ($P < 0.05$) in HNAR group. Fecal malodor emission was reduced in LNDD and LNAR treatments ($P < 0.05$). In conclusion, AROMEX supplementation in high nutrient density diet maximizes growth performance in pigs and AROMEX supplementation in low nutrient density diet improves growth performance, nutrient digestibility, marbling score and reduces fecal malodor emission.

Key Words: AROMEX, malodor, pigs

W163 Effects of complex probiotics supplementation on growth performance, fecal gas emission and meat quality in finishing pigs. J. H. Jung^{*1}, H. J. Kim¹, S. M. Hong¹, C. Y. Lee², and B. C. Park³, ¹Dankook

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This study was conducted to evaluate the effects of complex probiotics (*Bacillus subtilis* 1×10^7 cfu/g and *Lactobacillus acidophilus* 1×10^6 cfu/g) on growth performance, fecal gas emission and meat quality in finishing pigs. A total of sixty pigs [(Landrace \times Yorkshire) \times Duroc] (initial body weight 69.3kg) were used for a 56 day feeding trial. Dietary treatments included 1) CON (corn-soybean meal diet), 2) CM01 (CON + probiotics 0.1%) and 3) CM02 (CON + probiotics 0.2%). There were three dietary treatments with five replicate pens per treatment and four pigs per pen. From 0 to 28 days, gain:feed was higher in CM01 treatment than CON treatment ($P < 0.05$). There were no significant differences in ADG and ADFI among the treatments ($P > 0.05$). L^* value (lightness) in CM01 and CM02 treatment was lower than CON treatment ($P < 0.05$). Compared with CM02 treatment, a^* value (redness) was lower than in CM01 and CON treatments ($P < 0.05$). The b^* value (yellowness) was lower in CM01 and CM02 treatments than CON treatment ($P < 0.05$). There were no significant differences in sensory evaluation, drip loss, cooking loss, pH, TBARS and loin muscle area among the treatments ($P > 0.05$). During 0 day of this experiment, ammonia gas emission in CM01 and CM02 treatments was lower than CON treatment ($P < 0.05$). By 10 days of the experiment, fecal total mercaptan had decreased in CM01 and CM02 treatments compared to CON treatment ($P < 0.05$). At 5 days of this experiment, there were no significant differences in fecal hydrogen sulfide, ammonia and total mercaptan ($P > 0.05$). In conclusion, dietary complex probiotics increased meat color and decreased fecal noxious gas emission.

Key Words: probiotics, noxious gas emission, finishing pigs

W164 Effects of essential oils supplementation and difference stocking density on performance of growing-finishing pigs. J. H. Lee^{*1}, J. S. Yoo², H. D. Jang¹, J. C. Park², S. D. Lee², and I. H. Kim¹, ¹Dankook University, Cheonan, Choongnam, Korea, ²National Institute of Animal Science, RDA, Cheonan, Choongnam, Korea.

A 2 \times 3 factorial (CON vs. Essential oils, three regimens of stocking densities; 1.08, 0.81 and 0.65 m²/pig) arrangement was used with 96 pigs (45.64 kg). The diets were supplemented with 0.02% essential oils. The essential oils used in the experiment included thyme (23.0%), rosemary (12.0%), oregano (8.0%) extract, and carrier (57.0%). The experiment lasted for 84 days. Overall, ADG (0.793, 0.762, 0.655 kg) of pigs was decreased linearly with increased stocking density ($P = 0.042$). ADG (0.703 kg) and ADFI (2.204 kg) were significantly improved by essential oil supplementation ($P < 0.05$), as compared to the CON treatment (0.761, 2.173 kg, respectively). Both DM (71.38 vs. 74.37%) and N (70.55 vs. 73.27%) digestibilities were significantly increased by essential oil supplementation ($P = 0.01$, $P = 0.03$, respectively). Moreover, a significant linear decrease of increasing stocking density was found on DM (74.70, 72.51, 71.40%) and N (73.52, 72.45, 69.77%) digestibilities ($P = 0.01$, 0.02, respectively). Blood sample were collected at the initial and final day, and the differences were calculated. WBC counts (Difference -7.55, -4.94, -0.23 10^3 /mm³) were linearly decreased by high stocking density ($P = 0.02$). Cortisol concentration (Difference 0.53, 0.68, 1.35 μ g/dl) were linearly increased by high stocking density ($P = 0.05$). IgG concentration (Difference 177, 198, 307 mg/dl) responded quadratically to increasing stocking density ($P = 0.02$). Difference of Lymphocyte percentage (Difference 3.09 vs. -4.08%), IgG (Difference 202.00 vs. 252.93 mg/dl) and norepinephrine (Difference -199.49 vs. 141.85 pg/mL) were increased ($P < 0.05$) in the essential oil treatment compared to non supplemented treatment. However, cortisol (Difference 1.19 vs.

0.52 µg/dl) was decreased ($P<0.05$) in essential oils treatment compared to non supplemented treatment. In conclusion, the data suggests that high stocking density exerted negative effects on growth performance, digestibility and blood characteristics which could be corrected by supplementation of essential oils.

Key Words: stocking density, essential oils, growing-finishing pigs

W165 Effects of yucca and *Bacillus subtilis* on nutrient digestibility, fecal noxious gas content and meat quality in finishing pigs. J. H. Lee*¹, H. J. Kim¹, S. M. Hong¹, S. H. Oh², R. Noble², and I. H. Kim¹, ¹Dankook University, Cheonan, Choongnam, Korea., ²North Carolina A&T State University, Greensboro.

This study was conducted to evaluate the effects of yucca and *Bacillus subtilis* on growth performance, apparent total tract digestibility (ATTD) of DM and N, fecal noxious gas content and meat quality in finishing pigs. Twenty pigs (81.54±1.33kg average initial body weight) were used in a 49d growth assay. Dietary treatments were: 1) CON (basal diet), 2) P1 (CON + protein coated *Bacillus subtilis* 0.3%), 3) P2 (CON + protein coated probiotics complex 0.3%), 4) Y1 (CON + (yucca extract + *Bacillus subtilis* 0.3%)) and 5) Y2 (CON + (yucca extract + protein coated probiotics complex 0.3%)). The pigs were allotted into one pig per pen using a completely randomized design. Through the whole experimental period, CON treatment showed the lowest dry matter digestibility among treatments ($P<0.05$). However, nitrogen digestibility was not significantly affected by treatments. For lean percent, P2 treatment was higher than CON treatment ($P<0.05$). L*-value of *M. longissimus dorsi* in CON treatment showed the lowest among treatments ($P<0.05$). The b*-value of *M. longissimus dorsi* muscle were decreased in P2, Y1 and Y2 treatments compared to CON treatment ($P<0.05$). Marbling score of sensory evaluation in P1 and P2 treatments were significantly higher than Y1, Y2 and CON treatments ($P<0.05$). Cooking loss of CON treatment was the lowest among treatments ($P<0.05$). Water holding capacity was higher in P2 and Y2 treatments than Y1 and CON treatments ($P<0.05$). Ammonia, acetic acid and total mercaptans concentration were not affected by dietary treatments ($P<0.05$). In conclusion, this experiment suggested that yucca and *Bacillus subtilis* supplementation could improve dry matter digestibility and meat quality in finishing pigs.

Key Words: probiotics complex, meat quality, ammonia

W166 Effect of Siberian Ginseng (*Acanthopanax senticosus*) and *Eucommia ulmoides* on growth performance and immune functions in broiler chickens. S. Y. Kang, Y. H. Ko, S. H. Sohn, Y. S. Moon, C. Y. Lee, and I. Jang*, Jinju National University, Jinju, Gyeongnam, Korea.

The objective of this study was to investigate the effect of dietary inclusion of Siberian Ginseng (*Acanthopanax senticosus*) and *Eucommia ulmoides* in a broiler chicken diet on growth performance and immune functions. A total of two hundred 3-d old male broiler chickens (Ross 308) were assigned to five dietary treatments: (1) control diet (corn, wheat and soybean meal based), (2) control diet supplemented with Siberian Ginseng at 0.5% (low level; LSG), (3) control diet supplemented with Siberian Ginseng at 1.0% (high level; HSG), (4) control diet supplemented with *Eucommia ulmoides* at 0.5% (low level; LEU) and (5) control diet supplemented with *Eucommia ulmoides* at 1.0% (high level; HEU). The birds fed the diet supplemented with 1.0% Siberian Ginseng showed a significantly lower ($P<0.05$) feed conver-

sion ratio than those fed control diet, whereas weight gain and feed intake were unaffected by dietary treatments. The organ weight of the bursa of Fabricius was significantly ($P<0.05$) higher in birds fed the diet supplemented with 1.0% *Eucommia ulmoides* (HEU) without change in weights of other organs such as the liver, spleen and thymus. In cytokine expressions, there was no significant dietary effect on the expression of interleukin-4 (IL-4), interleukin-6 (IL-6), interferon- γ (IFN- γ) and inducible nitric oxide synthases (iNOS) in the lymphocytes and bursa of Fabricius. In the thymus, however, the expression of IFN- γ and iNOS was higher ($P<0.05$) in birds fed the diets supplemented with Siberian Ginseng (LSG and HSG groups) compared with those fed the control diet, whereas gene expression was not changed by dietary inclusion of *Eucommia ulmoides*. Thymic IL-4 known as an anti-inflammatory gene was significantly ($P<0.05$) higher in birds fed the diet supplemented with *Eucommia ulmoides* (LEU and HEU groups). In conclusion, dietary inclusion of *Eucommia ulmoides* had a beneficial effect on the expression of anti-inflammatory cytokine without affecting growth performance of birds.

Key Words: broiler chickens, immune functions, cytokines

W167 Effects of dietary supplementation of Biacton™ on growth performance of pigs from weaning through finishing phases. K. Bregendahl and M. Z. Fan*, University of Guelph, Guelph, Ontario, Canada.

Biacton™, a probiotic product of highly concentrated live microbial culture of the beneficent bacterium *Lactobacilli farciminis*. *L. farciminis*, is manufactured in France as an alternative probiotic growth promoting product. The objective of this study was to examine and compare the efficacy of dietary supplementation (0.1-0.2%) of Biacton™ and a sub-therapeutical level of antibiotics, i.e., Lincomix-44 for weanling pigs and Tylan-10 for growing-finishing pigs, in improving growth performance, and carcass quality. A total of 180 purebred Yorkshire pigs, with an average BW of 5.6±0.1 kg were weaned at 16±2 d of age in five periods, each consisting of 36 pigs, were used. Dietary supplementation (0.2%) of Biacton™ was only effective ($P<0.05$) for improving growth rate and feed intake in weaning phase (5-10 kg) equivalent to the efficacy of a sub-therapeutical level of the antibiotics. Biacton™ supplementation had no effects ($P>0.05$) on growth performance, including growth rate, feed intake and feed utilization in post-weaned (10-20 kg), growing (20-50 kg) and finishing (50-110 kg) phases. Whereas the growth-promoting effects of a sub-therapeutical level of antibiotics were consistently observed ($P<0.05$) over these phases. Dietary supplementation of both Biacton™ and a sub-therapeutical level of antibiotics had no effects ($P>0.05$) on major carcass quality parameters such as hot carcass weight, dressing percentage, backfat thickness and carcass lean in pigs. Dietary supplementation (0.2%) of Biacton™ may improve growth performance for weanling pigs in the absence of antibiotics.

Key Words: antibiotics, probiotics, pigs

W168 Effects of dehydrated chicory root powder on growth, nutrient utilization and manure odor in weanling pigs. M. Z. Fan*, T. Archbold, Y. Shen, C. Yang, and T. C. Rideout, University of Guelph, Guelph, Ontario, Canada.

The objectives of this study were to determine the effect of dietary supplementation of dehydrated chicory root powder on growth performance, efficiency of dietary nutrient utilization and fecal excretion of

volatile sulfides in the weanling pig fed a corn and SBM-based diet. Six corn and SBM-based diets were formulated to contain six levels of dehydrated chicory root powder (diet 1, 0; diet 2, 0.20; diet 3, 0.40; diet 4, 0.60; diet 5, 0.80; and diet 6, 1.00%). A total of 36 weanling Yorkshire barrows (10-14 kg BW) were randomly assigned to the six experimental diets and fed according to a completely randomized block design. Orthogonal polynomial contrasts were conducted to examine treatment effects and Dunnett's tests were used to compare a treatment group with the control diet 1. Dietary supplementation of the chicory root powder had a quintic effect ($P < 0.05$) on the average daily gain with the best responses in diets 2, 3 and 5. Supplementation of the chicory powder had a negative linear effect ($P < 0.05$) on the apparent fecal dry matter digestibility with the lowest value observed in diet 5. Supplementation of the chicory powder had a negative linear effect ($P < 0.05$) on the apparent fecal CP digestibility and efficiency of the apparent CP retention with the lowest values observed in diets 4 and 6. Supplementation of the chicory powder had a quartic effect ($P < 0.05$) on the apparent fecal Ca digestibility and efficiency of apparent Ca retention and a quintic effect ($P < 0.05$) on urinary Ca excretion with the highest retention efficiency in diet 2. Furthermore, supplementation of chicory root powder had a quartic effect ($P < 0.05$) on efficiency of apparent P retention with the highest retention efficiency in diets 2 and 5. Chicory root powder supplementation did not change ($P > 0.05$) the fecal content of total volatile sulfides. Taking together, dietary supplementation of dried chicory root powder within 0.20% improved efficiency of dietary Ca and P utilization without adversely affecting growth performance and efficiency of whole body N utilization in weanling pigs fed corn and SBM-based diets.

Key Words: chicory inulin, nutrient utilization, weanling pigs

W169 Different enzymatic activities of sixty-two isolated lactic acid bacteria of chicken digestive tract. H. R. Taheri*¹, H. Moravej¹, F. Tabandeh², M. Zaghari¹, and M. Shivazad¹, ¹University of Tehran, Karaj, Tehran, Iran, ²National Institute of Genetic Engineering and Biotechnology, Tehran, Iran.

Lactic acid bacteria are used as a source of probiotics and one major reason for using probiotics is their enzymatic activities, but there is no data about different enzymatic activities of chicken origin bacterial strains. A total of 62 lactic acid bacteria were isolated from the digestive tract of broilers varying in age. These isolated bacteria were selected based on different aggregation times. The aggregation was a test that shows the adherence ability of lactic acid bacteria to mucosa. The aggregation time of bacterial strains was 15, 30, 45, 60, 75, 90, 115 and 120 min. They were then studied for amylase, protease, lipase and phytase activities. The medium culture used for detecting the amylase, lipase and phytase activities contained starch, olive oil and calcium phytate, respectively. The bacteria were spot-inoculated and then incubated for 48 h at 37°C. For examination of protease activity, the supernatant of an overnight culture of lactic acid bacteria were poured on discs that were placed on plates containing skim milk. Clear zone was measured with a caliper. The results were analyzed using the GLM procedure of SAS. No lipase activity was detected, but all of them showed almost similar proteolytic activities. However, they had different amylase and phytase activities (Table 1). The results of this study showed that there are only noticeable differences among the bacterial strains for amylase and phytase activities. Also it indicates that lipase and protease activities should not be used as a major screening test for probiotics.

Table1. Different enzymatic activities of 62 selected lactic acid bacteria

Halo zone (mm)	+++ ¹	+	nd
Amylase	4	40	18
Phytase	5	52	5
Halo zone (mm)	14-16	12-14	10-12
Protease	21	35	6

+++¹, Halo zone was more than 3 mm that was noticeable compared to other strains; +, halo zone was just detected as less than one mm; nd = Not Detected

Key Words: enzymatic activity, lactic acid bacteria, probiotic

W170 Effects of sanguinarine on growth performance, serum biochemical indices and HSP70 of weaned piglets. X. H. Zhou, X. Wu, K. Yao, D. Zhou, R. L. Huang, and Y. L. Yin*, Chinese Academy of Sciences, Changsha, China.

This study was conducted to investigate the effects of *Sanguinarine* (SA) on the growth performance, serum biochemical indices, HSP70 and TNF- α in weaned piglets. One hundred and twenty Landrace \times Yorkshire piglets weaned at 28 d with initial average weight 8.30 \pm 0.29 kg were randomly allotted to 3 treatments with 4 replicates each. Piglets were fed the following diets for 14 days: 1) NC (control diet without antibiotics), 2) PC (NC+100 ppm aureomycin), and 3) SA (NC+SA \geq 1.5%, 30 ppm). Six piglets from each treatment were selected randomly for serum samples for biochemical indices. Serum heat shock protein 70 (HSP70) and TNF- α was analyzed by ELISA. The results showed that ADFI and ADG of SA Group were significantly improved ($P < 0.05$) compared to the NC. However, no difference was observed in ADFI, ADG and F/G between the PC and SA group ($P > 0.05$). Compared to the NC, dietary supplementation with SA increased GLU level in serum significantly ($P < 0.05$), but had no significant effects on levels of ALP, TP, LDH, ALT, AST and BU ($P > 0.05$). Serum HSP70 significantly decreased in the PC and SA groups ($P < 0.05$), which indicated that both antibiotics and SA alleviated weaning stress. Serum TNF- α tended to be high in the SA and antibiotics groups ($P = 0.118$). In conclusion, SA improved growth performance and alleviated weaning stress, and didn't affect any serum biochemical parameters in weaning piglets. This study demonstrates the potential use of SA as a feed additive instead of antibiotics in weaned piglets.

Key Words: *Sanguinarine*, growth performance, weaned piglet

W171 Effects of low doses of encapsulated cinnamaldehyde on the performance and antioxidant status of weaned piglets. C. Moynat, C. Ionescu*, and D. Bravo, Pancosma, Geneva, Switzerland.

Animal studies have demonstrated that at high levels (> 500 ppm), cinnamaldehyde (CIN) exhibits antioxidant properties, but the effect of low levels of CIN on performance and antioxidant status of animals is poorly described. The intent of the present study was to investigate the effect of low dietary supply of encapsulated CIN on piglets performance and antioxidant status. Ninety six weaned piglets (BW = 7.69 \pm 0.80 kg) at 26 days of age were moved to pens for a period of 14 days. The animals were allotted based on sex and initial BW to 16 pens of 6 animals and to one of the 4 dietary treatments (4 pens per treatment): no additive (NC), 9, 18 and 35 ppm of encapsulated CIN (CIN9, CIN18, CIN35 respectively). CIN was encapsulated in modified starch using fluidized

bed technology. Animals had *ad libitum* access to water and feed. FI and ADG were measured at days 7 and 14. At day 7, blood samples of 8 piglets in each group were collected and analyzed on blood glutathione peroxidase (GSH-Px). Data were analyzed using GLM procedure of SAS. FI was increased by CIN18 ($P = 0.09$) during week 2 (506.5 vs. 454.6 g/d) and for the whole period (354.8 and 330.8 g/d with $P = 0.18$) and decreased by CIN35 ($P < 0.01$) during week 1 (206.9 vs. 160.8 g/d) and for the whole period (306.3 vs. 330.8 g/d with $P = 0.18$). ADG was increased by CIN18 during week 1 (+7.0%, $P > 0.1$) and week 2 (435.6 vs. 367.8 g/d with $P = 0.02$). ADG was decreased ($P < 0.01$) by CIN35 during week 1 (144.1 vs. 200.9 g/d) and increased ($P = 0.04$) during week 2 (427.4 vs. 367.8 g/d). For the whole period, ADG was improved ($P = 0.03$) by CIN18 (326.9 vs. 280.1 g/d) but not by CIN35 (+1.1%, $P > 0.1$). GSH-Px was numerically increased by CIN18 (+7.4%, 15.15 UI/mL) and by CIN35 (+ 7.2%, 15.13 UI/mL). This study suggested that the dose of CIN was essential to the response of piglets. Eighteen ppm of CIN improved performance and antioxidant status whereas 35 ppm seemed to decrease feed palatability, while sustaining ADG and improving antioxidant status.

Key Words: piglet, essential oil, antioxidant status

W172 Efficacy of a combination of essential oils in weaned pigs.

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A total of 280 pigs were sorted according to litter origin and sex and then allocated to 28 pens in 2 weaner rooms. A randomized complete block design was applied using two experimental treatments: T1-Control and T2-Fresta[®] F Conc. at 250 g/T of feed (phytogenic feed additive containing a mixture of essential oils as main active substances); each treatment group equivalent in terms of pen weights, sex distribution, and litter origin. Pelleted feeds were available *ad libitum* with no added growth promoter or veterinary antibiotics. Prestarter feeds were fed from 28-42 days and starter feeds from 42-70 days of age. Criteria investigated included growth, body weight, feed intake, feed efficiency and body uniformity and were analyzed using the GLM procedure of SAS. Mortality was considered normal and was unaffected by treatment (2.86 vs 2.14%; $P = 0.660$). Pigs fed on the supplemented diet weighed 6.0% more than Controls at 70 days of age (22.9 vs 24.3 kg bodyweight; $P = 0.015$). During the prestarter period, no significant differences were observed for any of the parameters studied. During the starter period, pigs of the supplemented group had a significantly higher daily gain (431.4 vs 473.7 g/d; $P = 0.032$), and tended towards a better feed conversion rate (1.57 vs 1.46 g feed/g gain; $P = 0.069$) than Controls. For the overall period, pigs fed the phytogenic feed additive grew 9.4% more (343.1 vs 375.2 g/d; $P = 0.015$) and had 7.1% better feed conversion rate (1.54 vs 1.43 g feed/g gain; $P = 0.044$) than Controls. No significant differences were found for feed intake. Pig's body weight uniformity at the end of the trial was unaffected by treatment (85.9 vs 87.9%; $P = 0.122$), but this is not surprising as the pigs selected for the trial were very homogeneous at study start. We conclude that, under our experimental conditions, the dietary addition of a combination of essential oils (Fresta[®] F Conc.) at 250 g/T feed significantly improved growth and feed conversion rate in weaned pigs.

Key Words: essential oils, performance, weaned pigs

W173 Effects of yeast fermentation products on fecal consistency and gut microbial population in weaned piglets challenged with *Escherichia coli* K88⁺. S. K. Bhandari^{*1}, E. Kiarie¹, M. Scott², D. O. Krause¹, and C. M. Nyachoti¹, ¹University of Manitoba, Winnipeg, Manitoba, Canada, ²Diamond V, Cedar Rapids, IA.

One hundred and two weaned piglets (17 d of age; 5.2 ± 0.31 kg BW) were used to evaluate two yeast fermentation products (YFP) as potential alternatives to antibiotics for controlling post-weaning diarrhea. Twelve pigs were euthanized at 20 d of age to generate baseline data. The remaining 90 pigs were assigned to one of six diets in a randomized complete block design with 5 replicate pens/diet and 3 pigs/pen. Treatments were: negative control (NC, no in-feed or in-water additives), positive control (PC, in-feed, 0.0055% carbadox), yeast culture (YC, in-feed, 0.2% Diamond V XPC Yeast Culture), and a yeast fermentation-based prototype (YFBP, in-water, 0.5, 1 or 2 g/head/d). Diets were formulated to meet NRC (1998) recommendations. After a 7-d adaptation period, pigs were orally inoculated with a 6 mL dose of 2×10^9 cfu/mL of ciprofloxacin-resistant *E. coli* K88⁺(K88). Pigs were euthanized on d 3 (1 pig/pen) and d 7 (2 pigs/pen) post-challenge. Fecal consistency scores were determined daily. Microbial enumeration on ileal mucosa, digesta, and feces were performed on an EMB media with or without 0.05 μ g ciprofloxacin/mL. On d 2 post-challenge, fecal consistency score of pigs fed PC, YC, and YFBP tended ($P = 0.08$) to be lower compared to NC pigs (0.88 vs. 1.3) suggesting less severe diarrhea. Fecal score did not differ between the NC pigs and those receiving additives d 4 to 7 post-challenge. A lower ($P = 0.03$) number of K88 were found in the ileal mucosal scrapings of PC pigs (3.2) compared to YFP pigs (4.3) d 7 post-challenge. Pigs fed YFBP tended ($P = 0.14$) to have less K88 in the ileal mucosa compared to pigs fed YC (3.9 vs. 5.3). Results suggest that YC and YFBP may help to reduce severity of diarrhea in weaned pigs shortly after K88 challenge.

Key Words: *E. coli* K88⁺, weaned piglets, yeast fermentation

W174 Effects of *Pediococcus acidilactici* and *Saccharomyces cerevisiae boulardii* on the ileal microbiota of piglets two weeks after weaning. J.-P. Brousseau^{*1,2}, F. Beaudoin¹, D. Roy¹, and M. Lessard²,

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Weaning is a stressful period for piglets. The transition from milk to a solid diet causes major changes in the intestinal microbiota. In North America, to minimize effects of weaning, low doses of antibiotics (Atb) are added to the food. But this practice has increasingly become the focus of concern, with a rising number of resistant bacteria to Atb. A lot of research is now in progress to develop new and more natural approaches to replace the Atb use as a growth promoter. Among the alternatives, probiotics (Pbt) arouse great interest. We have evaluated the effects of two Pbt, *Pediococcus acidilactici* MA18/5M (Pa) and *Saccharomyces cerevisiae boulardii* CNCM I-1079 (Scb). Gestating sows (6 per treatment), 28 days before parturition, were divided into five groups that received: 1) Pa, 2) Scb, 3) Pa+Scb, 4) Control (no Pbt) (Ctrl) and 5) Ctrl+Atb. One day after their birth, piglets (12 per treatment) received the same treatment as their mother (Pbt at 1×10^9 CFU/day). After weaning, a dose of 2×10^9 CFU/day was added to the feed of the pigs. The Terminal Restriction Fragment Length Polymorphism (T-RFLP) technique was used to evaluate the composition of the ileal microflora, two weeks post-weaning. Traditional plating on selective medium was used to quantify: *E. coli*, Lactobacilli, total coliform and the two Pbt. A treatment effect was found when comparing the counts of *E. coli* for Pa+Scb and Ctrl+Atb ($P=0.034$). From the T-RFLP profiles obtained, diversity indices were calculated for each treatment and

significant results were obtained for the Evenness and Shannon indices, respectively, when comparing Ctrl to Ctrl+Atb ($P=0.006$; $P=0.008$) and Ctrl to Pa ($P=0.017$; $P=0.018$). A major terminal restriction fragment (177 bp), was significantly different when comparing treatment Ctrl to Ctrl+Atb ($P=0.006$) and Ctrl to Pa ($P=0.006$). In conclusion, the administrations of Pa diminished the microbial diversity of the ileum, two weeks after weaning, in a comparable manner to the addition of Atb; while co-administration of Pa and Scb attenuated the reducing effect of Pa on the microbial diversity.

Key Words: probiotics, piglets, ileal microbiota

W175 Effects of acidifiers on growth performance and intestine health in weanling piglets. P. Li^{1,2}, H. J. Zhang¹, Y. Miao³, S. G. Wu^{*1}, H. Y. Yue¹, and G. H. Qi¹, ¹Feed Research Institute of Chinese Academy of Agricultural Sciences, Beijing, China, ²Institute of Animal Husbandry and Veterinary Science, Tianjin Academy of Agricultural Sciences, China, ³Beijing General Station of Animal Husbandry and Veterinary, China.

This research was conducted to study the effects of phosphoric acid and lactic acid acidifiers on growth performance and gut health in weanling piglets. Two hundred weanling piglets were allotted into five groups randomly: control group without acidifier, four groups with phosphoric acid or lactic acid acidifier at 0.1% or 0.3%, respectively. Feed intake, average daily body weight gain, feed efficiency, and rate of diarrhea in each group were recorded. Three piglets from every group were randomly selected and sacrificed at 28 d of experiment to determine the pH of the digestive tract, digestive enzyme activities, intestine morphology and microflora, serum immune and biochemical indexes. Results showed that acidifiers significantly increased average feed intake, daily weight gain, remarkably improved feed efficiency and decreased the diarrhea rate compared to the control group ($P<0.05$). Lactic acid acidifier addition of 0.3% showed the best growth performance among treatments. Acidifiers significantly decreased the pH value in stomach and duodenum, increased the activities of pepsin, trypsin in duodenum, and increased the ileum villi height ($P<0.05$). E.coli and salmonella counts were decreased, lactobacillus and bifidobacteria counts were increased in the cecum ($P<0.05$). Acidifiers significantly increased the content of serum immunoglobulin (Ig) A and G ($P<0.05$). Serum IgM content and the ratio of CD4+/CD8+ were not affected by acidifiers. Addition of acidifiers at 0.3% concentration significantly decreased serum uric nitrogen content ($P<0.05$). In conclusion, acidifiers improved growth performance and ameliorated gut health in the weanling piglets. The appropriate addition level of acidifier was 0.3% in this study. The acidifier of the lactic acid type exhibited superior effects compared to that of the phosphoric acid type.

Key Words: acidifier, weanling piglet, gut health

W176 Plant active compounds or extracts can be effective as antioxidants in vitro. C. Ionescu^{*1}, J. Seppey², D. Bravo¹, M. Grogg², X. Simonnet², N. Marcon³, and A.-F. Grogg³, ¹Pancosma, Geneva, Switzerland, ²Médipland, Conthey, Switzerland, ³HESSO, Sion, Switzerland.

A selection of active compounds were investigated as free radical scavengers, antioxidants and phospholipase A2 (sPLA2) inhibitors. The free radical scavenging activity was checked by mean of DPPH test and the antioxidant activity by the Fe³⁺/Fe²⁺ antioxidant test (FRAP). Carvacrol (CAR), cinnamaldehyde (CIN), eugenol (EUG), anethol (ANE), capsicum oleoresin type 1 (CAP1), capsicum oleoresin type 2 (CAP2), coffee row extract (COF1), coffee refined extract (COF2), hazelnut row

extract (HAZ1), hazelnut refined extract (HAZ2), grape extract (GRA), olive extract (OLI) and sclareol (SCL) were screened. In DPPH test, EUG and GRA were the best products, with identical activities, based on the low concentrations needed to reach EC50 (4.2 and 4.7 µg/mL, $P > 0.1$). COF1, COF2, HAZ1 were less effective (respectively, 10.9, 19.1, 20.6, 27.1 µg/mL, $P > 0.05$). OLI, SCL and CAR (respectively, 48, 57 and 72 µg/mL) and CAP1, CAP2, CIN and ANE had poor activities (> 100 µg/mL). CIN and ANE had poor activities in FRAP ($> 1.1 \times 10^{11}$ µg/mL). EUG, the most efficient product, was not dose-dependent (0.004 µg/mL). GRA and HAZ2 had similar activities (3.1 and 4.8 µg/mL, $P > 0.1$), which were better than the activities of COF1, COF2 and HAZ1 (respectively, 11.4, 11.8, 20 µg/mL, $P > 0.05$). EUG was only different from CAP1, CAR and SCL (respectively, 307, 486 and 1455 µg/mL, $P < 0.05$). sPLA2 screening lead to IC50 values of 59, 140 and 456 µg/mL, for SCL, CAR and HAZ1, respectively. The other compounds inhibited sPLA2 with higher concentrations. EUG could be used in the digestive tract to reduce oxidation process because it has effective radical scavenging and antioxidant activities. sPLA2 inhibitors such as SCL could be used in different types of disease therapy aiming to reduce the oxidation process.

Key Words: essential oils, antioxidant, in vitro

W177 Effect of dietary acids on growth performance of weanling pigs-a cooperative study. J. E. Pettigrew^{*}, O. Adeola, M. J. Azain, S. D. Carter, G. L. Cromwell, G. M. Hill, D. C. Mahan, and P. S. Miller, NCCC-42 Committee on Swine Nutrition.

An experiment involving 854 crossbred pigs (20 replicate pens of 4 to 8 pigs per pen) was conducted at 8 stations (blocks) to determine the effects of acids in the diets of weanling pigs and their inclusion levels on growth performance using diets and weaning ages typical of those used in US commercial pork industry. Basal diets supplemented with various types and levels of acid and constant levels of ME and standardized ileal digestible lysine were fed to pigs in 3 phases of 1, 1, and 2 wk, respectively. Treatment diets included 0% acid as a control, 0.1% or 0.2% phosphoric acid, 1% or 2% organic acid, and 0.1% phosphoric acid plus 1% organic acid with or without antibiotic. The organic acid consisted of 50% citric acid and 50% fumaric acid by weight. All but the latter diet contained antibiotic. Addition of acids to diets did not affect pig performance during any phase or the overall period. In phase 2, pigs in the non-antibiotic group had decreased ADG and ADFI as compared to those in the other treatment groups ($P<0.01$). Overall, ADG of pigs fed the non-antibiotic diet was lower ($P<0.05$) than that of pigs fed the others. Pigs fed the combination of acids without antibiotic had similar G:F as those fed the control, phosphoric acid, and a combination of acids with antibiotic, but a lower G:F ($P<0.05$) than those fed the organic acid. In summary, acids added to nursery diets did not improve pig performance, but including antibiotic in the acid-supplemented diets increased ADG and ADFI.

Table 1. Effects of dietary acids on ADG, ADFI, and G:F of pigs from d 0 to 28 after weaning

	Phosphoric acid			Organic acid ^a		Combination ^b		SEM
	0%	0.1%	0.2%	1%	2%	0.1% + 1%		
Antibiotic	+	+	+	+	+	+		-
ADG, g*	359 ^c	350 ^c	358 ^c	352 ^c	348 ^c	349 ^c		320 ^d 8
ADFI, g*	539 ^c	522 ^c	527 ^c	528 ^c	508 ^{cd}	513 ^{cd}		481 ^d 12
G:F, g/kg*	669 ^{cd}	662 ^e	683 ^{cd}	687 ^c	685 ^c	683 ^{cd}		663 ^{de} 7

^aCitric:fumaric = 1:1 by weight, ^bphosphoric acid (0.1%) + organic acid (1%). *Means within a row with different superscripts differ ($P<0.05$).

Key Words: inorganic and organic acids, performance, nursery pigs

W178 Effects of feeding *Lathyrus sativus* on broiler performance. M. Eslami* and B. Ahmadi-pour, *Ramin Agricultur and Natural Resources University, Ahwaz, Khouzeestan, Iran.*

Lathyrus sativus is a legume grain with 28-30 percent crude protein, which can be a suitable substitute for soybean meal in broiler diets. However, the use of this feed in poultry nutrition involves some limitations due to anti-nutritive factors. It is necessary to evaluate the effects of different levels of *Lathyrus sativus* in comparison with soybean meal, on broiler performance, final weight, daily weight gain, feed consumption, feed conversion rate, carcass characteristics and abdominal fat. A total of 240 chicks (day-old) were allotted randomly to four dietary treatments each in four replicates of 15 birds per pen in a completely randomized design. The experiment lasted for 42 d and the birds were fed four different levels (0, 10, 20 and 30 percent) of *Lathyrus sativus* instead of soybean meal. The results revealed that using *Lathyrus sativus* even up to 30 percent in broiler diets does not indicate any significant difference in final weight, daily weight gain, feed conversion rate, and carcass characteristics ($P > 0.05$). At 30 percent usage of *Lathyrus sativus*, feed consumption was significantly reduced compared with the control diet ($P < 0.05$). Increasing *Lathyrus sativus* level significantly increased abdominal fat ($P < 0.05$). In conclusion, the present study demonstrated that *Lathyrus sativus* up to 30 percent could be used instead of soybean meal in broiler diets.

Key Words: *Lathyrus sativus*, broilers performance, feed conversion

W179 Effects of dietary Biomate (Artemisia, Acanthopanax and garlic) on performance in lactating sows. S.-M. Hong*¹, M.-J. Kim¹, M.-B. Cho¹, B.-U. Yang¹, M.-J. Kim¹, I.-H. Kim¹, and S.-H. Oh², ¹*Dankook University, Cheonan, Chungnam, South Korea*, ²*North Carolina A&T State University, Greensboro.*

The objective of this experiment is to investigate the effects of dietary Biomate (Artemisia, Acanthopanax and garlic) on the performance of lactating sows. Artemisia, Acanthopanax and garlic are known as natural growth promoters and stimulate the secretion of growth hormones. They also improve feed conversion, daily weight gain, and backfat in lactating sows. A total of 15 lactating sows were used in this experiment. There were three treatments, which were control (basal diet; CON), basal diet + Biomate 0.1% (BM1), and basal diet + Biomate 0.2% (BM2). Sows were fed ad libitum for three weeks after farrowing. The number of piglets was equalized in each group of treatments within 24 to 48 hours after birth. Each treatment had three replications, and it was assumed that there is no parity effect. Litter weights of piglets, changes in backfat thickness, ADFI and return to estrus in sows were measured and analyzed using Duncan multiple range test in SAS. Loss of backfat thickness (mm) from farrowing to weaning were 1.50, 0.84 and -0.33 in CON, BM1, and BM2, respectively. Average daily feed intakes (kg) and litter weight gain (kg) were 8.13, 6.33, 6.74, and 4.69, 5.48, 4.02 in CON, BM1, and BM2, respectively. There was no significant difference among treatments, but BM1 showed higher performance compared to other treatment groups. Further studies will be needed to compare blood profiles in treatments.

Key Words: artemisia, acanthopanax, lactating sow

W180 Effects of dietary probiotics of endospores and complex enzyme supplementation on growth performance in pigs. M.-J. Kim*¹, B.-U. Yang¹, M.-B. Cho¹, M.-J. Kim¹, S.-M. Hong¹, I.-H. Kim¹,

T. Barrios², and S.-H. Oh², ¹*Dankook University, Cheonan, Chungnam, South Korea*, ²*North Carolina A&T State University, Greensboro.*

The current study was conducted to investigate the effects of dietary probiotics of endospores and complex enzyme supplementation on growth performance, ADG, ADFI and gain/feed in growing pigs. A total of 96 pigs were used in this experiment. Pigs were grouped by weight with 16 pigs per pen and 6 pens per treatment. Dietary treatments included: 1) CON (basal diet), 2) basal diet + 0.1% dietary probiotics of endospores and complex enzyme supplementation (Spe 1) and 3) basal diet + 0.2% dietary probiotics of endospores and complex enzyme supplementation (Spe 2). Pigs were weighed three times at the beginning, 3 weeks, and 5 weeks. Pigs in each pen were assumed that they were fed equally. Average daily gain and feed efficiency were calculated using their feed intake and gain in total. Each treatment had weight gains and feed efficiency similar to those fed the control diet and there were no significant differences among treatments. Although significant differences were not found among treatments, feed efficiency (gain:feed) was significantly improved ($P < 0.05$) in the low weight group (0.42) compared to high weight group (0.39). Therefore, it may be suggested that dietary probiotics of endospores and complex enzyme supplementation would be more effective in lower weight pigs.

Key Words: endospore, growth, pig

W181 Comparison of Bio-Mos[®] and carbadox on growth performance during the early nursery phases of weanling pigs. J. L. Pierce*, R. F. Gilliam, and C. A. Moran, *Alltech, Inc., Nicholasville, KY.*

The three week period following weaning is one of the most challenging of a piglets life. Antibiotics have been used for many years during these production phases to help control disease and promote growth. However, alternatives to antibiotics continue to be examined for numerous reasons. Therefore an experiment was conducted in a Midwest commercial research barn to evaluate the effectiveness of Bio-Mos as a replacement for carbadox during the first three weeks following weaning. A total of 540 pigs were blocked by sex, initial weight, pen location, and nursery room and randomly allotted to one of three dietary treatments; negative control, 50 g/t carbadox, or 1 kg/t Bio-Mos. From days 1-7 pigs were fed a commercial nursery containing 25% dried whey, 5% lactose, 6.5% SDPP, 6.0% select menhaden fish meal. Phase 2 diets were fed from days 8-14 and contained 20% dried whey, 2.0% lactose, 2.5% SDPP, and 4.0% select menhaden fish meal. Phase 3 diets were fed from days 15-21 and were comprised of diets containing 57.4% corn, 34.2% SBM, and 3.9% tallow. No dried whey, lactose, fish meal, or SDPP were fed after day 14. There were 3 dietary treatments with pen as the experimental unit. There were eighteen replicate pens per treatment with 180 pigs per treatment. The 3 diets were commercial nursery diets with 1, No additive; 2: carbadox (50g/t) and 3, Bio-Mos 1 kg/t. Data were analyzed as a randomized block split-plot design with means separation performed by the pdiff option of LSMEANS in SAS. Overall, pigs fed 1kg/t of Bio-Mos had a 9% improvement in ADG compared with pigs fed the Control diet (410 vs. 373 g/d, $P < .02$). Pigs fed Bio-Mos had a tendency toward an improvement in ADG compared to pigs fed carbadox (410 vs. 393 g/d). Pigs fed 1 kg/t of BioMos grew 20% more efficiently (F:G) than the Control-fed pigs (1.39 vs. 1.21 $P < .01$) and 6% more efficient than pigs fed carbadox (1.39 vs 1.31 $P < .01$). Based on these results, Bio-Mos is a valuable alternative to carbadox and was more effective at improving feed efficiency in this study.

Key Words: pig, MOS, antibiotic

W182 The effect of ractopamine supplemented for 14 or 28 days on growth performance of finishing pigs. E. T. Fialho*, L. V. C. Girão, M. G. Zangeronimo, N. O. Amaral, V. S. Cantarelli, R. C. Wolp, and P. B. Rodrigues, *University Federal of Lavras, Lavras, MG, Brazil.*

A total of 30 hybrid barrows and 30 gilts (TOPIGS; initial and final weight of 93.8±1.8 kg and 130.6±1.6 Kg) were used to evaluate the effects of ractopamine (Paylean®) supplementation for 14 or 28 day periods on late finishing pig performance. Pigs were blocked by weight and sex and randomly allotted to one of six treatments. There were two pigs (one barrow and one gilt) per pen and five pens/treatment. Pigs were fed corn soybean meal based diets formulated to meet NRC (1998) requirements, with 0.68% ileal digestible lysine. Treatments were arranged as a 3 × 2 factorial with main effects of Paylean® (0, 5 and 10 ppm) and period length (14 and 28 days). There were no Paylean® period interactions (P>0.39) observed. For the overall study, ADG and final weight were higher (P<0.05) for pigs fed Paylean®. Barrows had better ADG and final weight than gilts. However, gilts had better F:G than barrows. The Paylean® inclusion (5 to 10 ppm) as well as the period length (14 to 28 days) did not improve growth performance. In conclusion, diets containing 5 ppm Paylean® and fed for 14 or 28 days improved the performance of finishing pigs from 93 to 130 kg of body weight

Key Words: B-agonist, additive, performance

W183 Effects of natural clay enterosorbent on vulva sizes and reproductive organ weights of postweaning female pigs fed zearalenone contaminated diets. Z. B. Yang*¹, S. Z. Jiang¹, W. R. Yang¹, H. Zao¹, C. C. Chen², and F. Chi³, ¹Shandong Agricultural University, Taian, Shandong, PRC, ²Chaoyang University Technology, Taichung, Taiwan, ROC, ³Amlan International, Chicago, IL.

A total of thirty-five postweaning gilts (L x Y x D) with an average of 12.36 ± 1.46 kg body weight were used in the study. The gilts were raised individually in metabolic cages and fed a corn-soybean meal-whey based diet with an addition of 0 or 1 ppm of zearalenone (ZEA, Fermentek, Israel) for 24 d with four levels of natural clay added in the feeds. The treatments were 1) control diet; 2) control + 0.25% clay; 3) control + 1 ppm ZEA; 4) control + 1 ppm ZEA + 0.125% clay; 5) control + 1 ppm ZEA + 0.25% clay; 6) control + 1 ppm ZEA + 0.5% clay; 7) control + 1 ppm ZEA + 1.0% clay. Pigs were weighed at the beginning and the end of trial. Feed intakes were recorded daily. Vulva length and width were measured at 3 days intervals. Vulva area was calculated as (L × W)/2. Pigs were killed at the end of trial, and reproductive organs were obtained and weighed. Pigs fed a diet with 1 ppm ZEA consumed more feed and gained more than pigs fed control feed (P<0.05) but showed no difference on feed efficiency (P>0.05). Overall gilts fed diets containing 1 ppm ZEA with or without natural clay had increased vulva size (length and width) and reproductive organ weights as compared to gilts fed control diets with or without natural clay (P<0.001); on the other hand, gilts fed natural clay in ZEA contaminated diets significantly reduced the vulva size (P<0.1) and reproductive organ weights (P<0.05). Treatment effects of ZEA and clay enterosorbent are shown in Table 1. Reproductive organ weights in pigs fed ZEA contaminated feeds were decreased linearly as dietary natural clay increased (P<0.05). However, reduction of vulva sizes was not correlated to dietary clay concentrations. In conclusion, ZEA clinical symptoms can be shown in postweaning gilts continuously fed a diet containing 1 ppm ZEA for 24 d, and feeding natural clay enterosorbent can significantly improve the clinical symptoms in the reproductive tract.

Table 1. Treatments effects on vulva size and reproductive organ weights

Treatment	Vulva Length, cm	Vulva Width, cm	Vulva Area, cm ²	Ovary + Uterus Wt., g
Control	2.10 ^a	1.61 ^a	1.69 ^a	14.25 ^a
Control + 0.25% clay	1.90 ^a	1.45 ^a	1.40 ^a	13.67 ^a
Control + 1 ppm ZEA (Test)	2.90 ^b	2.39 ^b	3.46 ^c	52.00 ^c
Test + 0.125% clay	2.30 ^a	1.92 ^a	2.25 ^b	45.00 ^{bc}
Test + 0.25% clay	2.58 ^{ab}	2.16 ^{ab}	2.80 ^{bc}	33.67 ^{bc}
Test + 0.5% clay	2.49 ^a	1.99 ^a	2.52 ^{bc}	25.00 ^b
Test + 1.0% clay	2.52 ^a	1.90 ^a	2.39 ^b	19.00 ^a

^{abc}significant difference between treatments (P<0.05)

Key Words: zearalenone, natural clay enterosorbent, postweaning female pig vulva size

W184 Effects of natural clay enterosorbent on nutrient digestibility of postweaning female pigs fed zearalenone contaminated diets. Z. B. Yang*¹, S. Z. Jiang¹, W. R. Yang¹, H. Zao¹, C. C. Chen², and F. Chi³, ¹Shandong Agricultural University, Taian, Shandong, PRC, ²Chaoyang University Technology, Taichung, Taiwan, ROC, ³Amlan International, Chicago, IL.

A total of twenty-one postweaning gilts (L × Y × D) with an average BW of 12.66±1.18 kg were used in the study. The gilts were raised individually in metabolic cages and fed a corn-soybean meal-whey based diet with an addition of 0 or 1 ppm of zearalenone (ZEA, Fermentek, Israel) for 21 d with various levels of natural clay added in the feeds. The treatments were 1) control diet; 2) control + 0.25% clay; 3) control + 1 ppm ZEA; 4) control + 1 ppm ZEA + 0.125% clay; 5) control + 1 ppm ZEA + 0.25% clay; 6) control + 1 ppm ZEA + 0.5% clay; 7) control + 1 ppm ZEA + 1.0% clay. Pigs were weighed at the beginning and the end of trial. Feed intakes were recorded daily. Total fecal and urine samples were collected daily and samples pooled weekly. Gross energy and nitrogen content were determined in the feed, fecal and urine samples; and digestible energy (DE), metabolizable energy (ME), digestible crude protein (DCP), and biological value (BV) were calculated. The BV was calculated as (RN/DN) × 100 where DN (digestible N) = ingested N - fecal N; RN (retained N) = DN - urinary N. Gilts fed the test diet (1 ppm ZEA without clay enterosorbent supplement) had significant reductions in DE and DCP as compared to the gilts fed the control diet. Dietary addition of natural clay enterosorbent in the test diet linearly improved the DE as the clay concentrations increased, and DCP followed a similar trend with higher clay inclusion having a better performance. Although treatment difference was observed in the ME value, the ME and BV were not different between gilts fed control (diet 1) and gilts fed the test diet (diet 3), suggesting little negative effects of dietary ZEA on ME and BV values. In conclusion, feeding low concentrations (1 mg/kg) of ZEA to young gilts for 21 days resulted in a reduction of DE and DCP, but the reduction was not found in ME and BV. Addition of clay enterosorbent could improve the reduced DE and DCP in young gilts.

Table 1. Treatment effects on digestible and metabolizable energy, digestible protein, and biological value

Treatment	DE, %	ME, %	DCP, %	BV, %
Control	83.69 ^a	77.59 ^{abc}	84.45 ^a	77.08
Control + 0.25% clay	83.79 ^a	77.80 ^{ab}	85.47 ^a	76.90
Control + 1 ppm ZEA (Test)	79.81 ^b	75.68 ^c	83.33 ^b	77.99
Test + 0.125% clay	81.13 ^{ab}	76.04 ^{bc}	83.06 ^b	78.03
Test + 0.25% clay	82.33 ^{ab}	75.51 ^c	82.98 ^b	77.69
Test + 0.5% clay	83.75 ^a	77.51 ^{abc}	84.23 ^{ab}	76.02
Test + 1.0% clay	84.02 ^a	78.27 ^a	84.33 ^{ab}	77.97

^{abc}Statistically different (P < 0.05)

Key Words: zearalenone, natural clay enterosorbent, nutrient availability

W185 Evaluation of the efficacy of a commercial purified phylosilicate to reduce the toxicity of zearalenone + deoxynivalenol in gilts. K. Bond¹, C. K. Maune¹, J. R. Stoltz¹, R. J. Malone¹, and D. Zaviezo^{*2}, ¹Trilogy Analytical Laboratory, Washington, MO, ²Special Nutrients, Miami, FL.

An experiment was conducted to study the efficacy of a very low inclusion commercial purified phylosilicate (Myco-Ad A-Z) in preventing the deleterious effects of natural zearalenone (ZEA) plus deoxynivalenol (DON) contaminated feed in prepubertal gilts. Eighteen 19-day old recently weaned Yorkshire Cross gilts were individually housed and randomly distributed into 3 dietary treatments with 6 replications each. Pigs were fed a corn-soy diet containing or exceeding NRC recommended nutrients levels for 21 days. Treatments were: (1) control diet; (2) control + 1.2 ppm ZEA + 6 ppm DON; and (3) control + 1.2 ppm ZEA + 6 ppm + 1.0 kg/mt Myco-Ad A-Z. Highly contaminated corn was used to provide the ZEA + DON in treatments 2 and 3. Performance, relative liver and internal reproductive organs weights were evaluated at the end of the experiment, and vulva measurements (height x width) recorded at day 7, 9, 12, 14, 16, 19 and 21. Results indicated that gilts fed the ZEA + DON contaminated diet presented significant lower body weight gain, poorer feed conversion, heavier internal reproductive organs (94%) and lighter livers (23%) than gilts fed the control diet. The addition of Myco-Ad A-Z to the contaminated diet resulted in gilts with a statistically significant higher body weight gain (2220 vs 1040 g), better feed efficiency (5.53 vs 12.82), lighter internal reproductive organs weight (17%) and heavier livers (8%) than those fed ZEA + DON. Starting on day 9 until the end of the experiment there was a significant increase in size of the vulva in gilts fed the contaminated diet compared to gilts fed the control and Myco-Ad A-Z diets (29.1 vs 16.5 and 18.6 at 21 days). These results indicate that Myco-Ad A-Z at 1.0 kg/mt was very effective in preventing both the toxic effects of DON and the estrogenic effects of ZEA in prepubertal gilts.

Key Words: Myco-Ad A-Z, zearalenone, deoxynivalenol

W186 Effects of dietary levels of tylosin on growth performance and efficiency of nutrient utilization in growing pigs. M. Z. Fan^{*1}, T. Archbold¹, K. Bregendahl¹, C. Yang¹, X. Yang¹, R. Bagg², G. Vessie², P. Dick², and D. Anderson², ¹University of Guelph, Guelph, Ontario, Canada, ²Elanco Animal Health Canada Inc., Guelph, Ontario, Canada.

The objectives of this study were to examine effects of graded dietary levels of tylosin on growth performance and efficiency of utilization

of dietary nutrients, including CP, calcium (Ca), and phosphorus (P) in growing pigs. Sixty Yorkshire barrows, with an average initial and final BW of 31 and 48 kg, were fed four diets for 15 blocks according to a randomized complete block design. The four diets were corn and SBM-based and formulated to contain four levels of tylosin at 0, 11, 22, and 44 ppm, respectively. Each experimental block consisted of a 12-d pre-adaptation to the control diet, 9-d adaptation and a 5-d collection of total urine excretion, and fecal samples. Orthogonal polynomial contrasts and Dunnett's tests were conducted to examine treatment effects. Tylosin supplementation improved ADG (P<0.05) at 11 ppm but not at the higher levels. Tylosin did not affect (P>0.05) feed intake and feed conversion efficiency. Tylosin supplementation did not affect (P>0.05) fecal content (mg H₂S/g DM) of total volatile sulfides. The apparent DM digestibility values in the diets were not affected (P>0.05) by tylosin. Tylosin improved (P<0.05) the apparent CP digestibility at 11 ppm, but not at higher levels, yet did not affect (P>0.05) the efficiency of CP retention at any of the tested levels. Efficiency of Ca utilization was not improved (P<0.05) by tylosin. Dietary supplementation of tylosin had cubic effects (P<0.05) on the efficiency of P utilization at the digestive and post-absorptive levels. In conclusion, dietary supplementation of tylosin at 11 ppm may improve growth and efficiency of P utilization in growing pigs.

Key Words: growing pigs, nutrient utilization, tylosin

W187 Effect of the combined use of ractopamine and chromium picolinate on growth performance and carcass traits of finishing pigs. E. Toledo^{*}, K. Gomezjurado, A. García-Rendón, G. Cárdenas, and A. Borbolla, *Departamento de Producción Animal: Cerdos, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México, Ciudad de México, Distrito Federal, México.*

An experiment was conducted to evaluate the dietary effects of ractopamine plus chromium picolinate on growth performance and carcass traits of finishing pigs. One hundred and twenty seven mixed-sex pigs (64 pigs/treatment/4 replicates/treatment) were randomly assigned to two dietary treatments. Control (R) group used a ractopamine-formulated diet containing 5 ppm 1000 Kg-1 of the β -agonist. Experimental group (R+Cr) used the same diet and level of ractopamine plus 200 ppb of chromium using chromium picolinate as the source. Diets were fed ad libitum for 21 days before slaughtering. Initial and final weight \pm SE, for R (84.16 \pm 10.8 and 105.12 \pm 12.7 Kg), and R+Cr (84.94 \pm 9.2 and 104.43 \pm 11.1) were not different (P > .05). However, growth data indicated that pigs fed the R-diet exhibited greater (P<0.05), ADG and decreased (P<0.05) FC than R+Cr pigs (1.00 vs. 0.93 Kg and 2.92 vs. 3.34, respectively). Meanwhile, ADFI was greater (P<0.05) in R+Cr (2.99 kg/d), than in R (2.88 Kg/d) pigs. At the end of the trial, 5 pigs per treatment were selected to evaluate dietary effects on carcass traits. Overall carcass traits (carcass weight, carcass length, 10th rib backfat) in R+Cr pigs differed (P>0.05), + 1.94%, + 1.4% and - 3.8%, respectively, when compared to the carcass of R pigs. Furthermore, the butcher in charge of quartering preferred the meat from R+Cr rather than R pigs. According to this study, there appeared to be a slight improvement when finishing pigs were supplemented with ractopamine and chromium.

Key Words: finishing pigs, ractopamine vs chromium, growth performance