156 Effects of modified yeast cell wall extract on growth performance and health status of pigs fed diets with low level mycotoxins. I. Park*, J. Guo, S. W. Kim, *North Carolina State University, Raleigh.*

This study was performed to determine the effect of modified yeast cell wall extract (YCWE) (Mycosorb A+, Alltech, Lexington, KY) on growth and health of pigs fed diets naturally contaminated with aflatoxin B1 and fumonisin under the FDA regulatory level. One hundred twenty pigs (60 barrows and 60 gilts at 55.69 ± 6.29 kg BW) were randomly allotted to 4 treatments (2 × 2 factorial arrangement) with 10 pens (3 pigs per pen) per treatment, and fed the experimental diets for 5 wk period. Factors were mycotoxin (0 or 150 ug/kg aflatoxin and 19 mg/kg fumonisin) and YCWE (0 or 2 g/kg diet). All diets were formulated to meet or exceed the NRC nutrient requirements. Feed intake and body weight were measured weekly. At the end of 5 wk, 32 pigs representing a median BW of 8 pens per treatment were selected to take blood samples and euthanized to obtain intestinal tissues. Blood samples were obtained to measure the numbers of blood cells, and to separate serum for liver function test, tumor necrosis factor-α (TNF-α), immunoglobulin G (lgG), malondialdehyde (MDA), and 8-hydroxy-2'-deoxyguanosine (8-OHdG). Mucosa from duodenum and jejunum were obtained to evaluate morphology and to measure TNF-α, MDA, and IgG. Data were analyzed using the Mixed procedure in SAS with pen as the experimental unit using treatments and sex as fixed effects and initial BW as a random effect. Mycotoxin decreased ($P < 0.05$) ADG (1.210 to 0.992 kg/d) at 1 wk, and tended to decreased ($P = 0.099$) BW (68.4 to 67.5 kg) at 2 wk, without affecting overall growth performance after 5 wk feeding. Mycotoxin decreased ($P < 0.05$) neutrophil counts (7.28 to 5.83 cell/mL) and serum cholesterol (86.7 to 77.1 mg/dL). The YCWE decreased ($P < 0.05$) serum 8-OHdG (1.48 to 0.60 ng/mL), and tended to decrease ($P = 0.051$) crypt depth (285 to 261 μm) in duodenum. TNF-α, MDA, and IgG in serum and intestinal mucosa were not affected by 2 treatment factors. There was no interaction between 2 treatment factors. Collectively, dietary mycotoxin under the FDA regulatory level had minor effects on growth performance and hematology, and supplemental YCWE reduced oxidative stress in pigs indicated by reduced serum 8-OHdG.

Key Words: 8-OHdG, growing pig, growth performance, mycotoxin, modified yeast cell wall extract

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157 Effects of dietary Cu, Zn, and ractopamine-HCl on finishing pig growth performance, carcass characteristics, and antimicrobial susceptibility of enteric bacteria. J. A. Feldpausch*[1], R. Amachawadi[1], M. D. Tokach[1], H. M. Scott[2], S. S. Dritz[1], T. G. Nagaraja[1], R. D. Goodband[1], J. C. Woodworth[1], J. M. DeRouchey[1], *[1]Kansas State University, Manhattan, [2]Texas A&M University, College Station.*

A total of 480 pigs (PIC 327 × 1050; initially 48.7 kg) were used to determine the interactive effects of supplemental Cu, Zn, and ractopamine HCl on finishing pig growth, carcass characteristics, and antimicrobial susceptibility of enteric bacteria. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of added copper ($CuSO_4$; 0 vs. 125 ppm Cu), added zinc (ZnO; 0 vs. 150 ppm Zn) and ractopamine HCl (0 vs. 10 ppm during the last 28 d before marketing; Paylean®; Elanco Animal Health, Greenfield, IN). All diets contained 11 ppm Cu and 73 ppm Zn from the trace mineral premix. Pens of pigs were balanced and blocked on initial BW then randomly allotted to 1 of the 4 mineral treatment diets. Twenty-eight d before marketing, pens within each block and mineral treatment were randomly assigned to receive either 0 or 10 ppm ractopamine in addition to the mineral treatment. Adding either Cu or Zn alone did not improve ADG or ADFI yet resulted in numerical improvements in overall G:F and caloric efficiencies but improvements were not additive (Cu × Zn, $P = 0.057$, 0.068 and 0.064 for G:F and caloric efficiency on a ME and NE basis, respectively). Ractopamine improved ($P < 0.001$) overall ADG, G:F, and caloric efficiency thereby increasing final BW by 3% with no change in ADFI. Ractopamine increased ($P < 0.001$) HCW, percent carcass yield, HCW G:F, loin depth, and percent fat-free lean and decreased ($P = 0.014$) backfat. An interaction existed whereby adding Zn or Cu alone to diets containing ractopamine numerically improved percent carcass yield and HCW G:F, but no improvement was observed when the Cu or Zn was added to the control diet or when Cu and Zn were fed in combination in the ractopamine diets (Cu × Zn × ractopamine, $P = 0.011$ and 0.018 for yield and HCW G:F, respectively). Fecal samples were collected on d 0 and at the conclusion of the finishing period (d 90) for bacterial isolation and antimicrobial susceptibility determinations according to minimal inhibitory concentration breakpoints. *Escherichia coli* and *Enterococcus* spp. isolates displayed varying levels of resistance to certain antibiotics before initiation of treatments on d 0. Resistance to most antibiotics decreased ($P < 0.05$) over time or was stable for those that had a low base-line percentage of resistance. Ractopamine and Zn did not adversely affect antimicrobial resistance but extended feeding of 125 ppm Cu throughout the finishing period appeared to antagonize any time-associated decrease in enterococcal resistance to

tetracycline, tylosin, and quinupristin/dalfopristin.

Key Words: finishing pig, mineral, antimicrobial resistance

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158 *Lactobacillus acidophilus* fermentation product modulates inflammatory activity by regulating the TLR4 and NFkB expression in porcine peripheral blood mononuclear cells after lipopolysaccharide challenge. S. I. Lee*[1], J. M. Koo[2], R. X. Lan[1], I. H. Kim[1], [1]*Department of Animal Resource & Science, Dankook University, Cheonan, South Korea,* [2]*Shinhan BioChem Co., Hwaseong, South Korea.*

A total of forty weaned pigs [(Landrace × Yorkshire) × Duroc] were used to evaluate the effects of *Lactobacillus acidophilus* fermentation product (LAFP; SynGenX®, Diamond V, Cedar Rapids, IA) on inflammatory activity after lipopolysaccharide (LPS) challenge. Experimental treatments were T1) control diet + saline challenge; T2) control diet with 0.1% LAFP + saline challenge; T3) control diet + LPS challenge; T4) control diet with 0.1% LAPF + LPS challenge. The BW of individual pig was recorded at the beginning and d-14 and feed consumption was recorded on an individual pig basis during the experiment to calculate ADG, ADFI and G/F. On d 14 of the trial, piglets were challenged with saline (T1 and T2) or LPS (T3 and T4). Blood samples were obtained at 0, 2, 4, 6, and 12h after challenged and analyzed cytokine production and gene expression pattern. Serum insulin-like growth factor 1 (IGF-1), cortisol, tumor necrosis factor α (TNF-α), and IL-6 were determined by ELISA. For peripheral blood mononuclear cells (PBMCs) isolation, the collected blood (with an equal volume of balanced salt solution) was mixed with a half volume of Histopaque solution, and was then centrifuged at 400 × *g* for 35 min at room temperature. The PBMCs were carefully aspirated from the Histopaque solution-plasma interface. The LAPF treatment increased BW, ADG, and ADFI compared to the control diet. With control diet, the LPS challenge (T3) increased immune cells and expression of TNF-α and IL-6 compared to saline challenge (T1). Whereas with saline challenge, LAPF treatment (T2) increased WBCs and $CD4^+$ compared to the control diet (T1). With LPS challenge, LAPF treatment (T4) decreased white blood cells, lymphocytes, $CD4^+$, $CD8^+$, and expression of TNF-α and IL-6 compared to the control diet (T3). LAPF treatment decreased expression of toll-like receptor 4 (*TRL4*) and nuclear factor kappa-light-chain-enhancer of activated B cells (*NFκB*) in PBMCs after LPS challenge, which leads to inhibition of *TNF-α,* interferon γ (*IFNγ*), *IL-6, IL-8,* and *IL1B1* and to induction of *IL-4* and *IL-10*. We suggested that LAPF improved ADG and ADFI and protected against LPS-induced inflammatory responses by regulating *TLR4* and *NFκB* expression in porcine PBMCs.

Key Words: *Lactobacillus acidophilus*, lipopolysaccharide, peripheral blood mononuclear cells

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159 Effects of copper source and level on growth performance and bone mineralization in pigs fed phytase-supplemented diets. R. Davin*[1], F. N. Almeida[2], J. Zhao[2], J. Escobar[2], M. Vázquez-Añón[2], [1]*University of Missouri, Columbia,* [2]*Novus International, Inc., St. Charles.*

It is well documented that high levels of trace minerals can inhibit phytase activity and that chelated trace minerals are highly stable, hence, less prone to interact with other dietary components. The objective of this trial was to study the effect of 2 Cu sources and levels in pig diets supplemented with phytase on growth performance and bone characteristics. A total of 144 pigs (initial BW: 42.9 ± 4.95 kg) were allocated (2 pigs/pen) to 6 treatments: 2 control diets with no supplemented Cu, without (NC) or with 500 FTU/kg of phytase (NC+Phy; CIBENZA® PHYTAVERSE®, Novus International, Inc., St Charles, MO), and 4 diets with 500 FTU/kg of phytase with Cu sulfate ($CuSO_4$) or Cu- Cu methionine hydroxyl analog chelate (Cu-MMHAC, MINTREX®, Novus International, Inc., St. Charles, MO) at 2 different levels (80 or 250 mg/kg). Diets were corn-soybean meal-based, P deficient (STTD P = 0.31%) and were fed for 21 d. A contrast statement was used to determine the main effect of phytase (NC vs. NC+Phy). Data was also analyzed as a 2 × 2 factorial with 2 Cu sources and 2 Cu levels supplemented to phytase containing diets (Table 159). Phytase inclusion increased (NC+Phy vs. NC; $P < 0.01$) final BW and ADG 0–21 d (62.3 vs. 60.2 kg, and 0.943 vs. 0.844 kg, respectively), and bone content of ash ($P < 0.01$; 2.94 vs. 2.38 g/bone), P ($P < 0.01$; 0.507 vs. 0.383 g/bone), and Ca ($P < 0.01$; 0.937 vs. 0.726 g/bone). Growth performance parameters were not different among Cu supplemented pigs. Copper source ($P = 0.033$) and Cu level ($P = 0.028$) impacted bone P content, without an interaction between Cu source and level ($P = 0.174$). Highest bone P content was obtained with Cu-MHAC-80 (0.55 g/bone) and low-

Table 159. Effects of Cu source and level on bone measurements (g/bone)

	Bone ash	Bone P	Bone Ca
Cu-MHAC80	3.00	0.55a	1.02a
Cu-MHAC250	2.83	0.51ab	0.93ab
$CuSO_4$ 80	3.00	0.52ab	0.96ab
$CuSO_4$ 250	2.70	0.42b	0.77b
SEM	0.13	0.03	0.05
		P-values	
Cu source	0.618	0.033	0.039
Cu level	0.150	0.028	0.023
Interaction	0.573	0.174	0.180