of feeding the blend on carcass measurements. The results of these studies suggest that feeding this blend of plant extracts and acidifiers during finishing improves feed efficiency and can improve growth rate.

Key Words: AmbitineFA, feed efficiency, pig
doi: 10.2527/asasmw.2017.12.177

178 Effects of zinc oxide and microbial phytase on standardized total tract digestibility of calcium in maize-based diets fed to growing pigs.

L. Blavi[1,2,*], D. Solà-Oriol[1], J. F. Pérez[1], H. H. Stein[2], *[1]Animal Nutrition and Welfare Service, Department of Animal and Food Sciences, Universitat Autònoma de Barcelona, Bellaterra, Spain, [2]University of Illinois at Urbana-Champaign, Urbana.*

It is common industry practice to use diets with pharmacological concentrations of zinc during the post-weaning period to prevent post-weaning diarrhea in pigs. However, Zn competes with Ca for absorption, and Ca and Zn may bind to phytate, which may also affect Ca absorption. Therefore, an experiment was conducted to test the hypothesis that inclusion of Zn at a therapeutic level in diets fed to pigs affects apparent total tract digestibility (ATTD) of Ca and P and standardized total tract digestibility (STTD) of Ca. The second hypothesis was that inclusion of microbial phytase increases the STTD of Ca regardless of the concentration of Zn in the diet. Fifty-six growing barrows (average BW: 15.4 ± 1.9 kg) were allotted to a randomized complete block design with 7 dietary treatments and 8 pigs per treatment. A basal diet containing corn, cornstarch, potato protein isolate, soybean oil, calcium carbonate, monosodium phosphate, vitamins, and minerals was formulated with either 0 or 2400 mg/kg Zn from ZnO and 0, 1000, or 3000 units of phytase (FTU) per kg. A Ca-free diet was used to determine basal endogenous losses of Ca. Feces were collected from the feed provided from d 6 to 11 using the marker-to-marker approach, and urine was also collected. Retention of Ca, ATTD of Ca, and STTD of Ca increased linearly ($P < 0.01$) as the concentration of phytase in the diet increased, but were less if ZnO was used than if no ZnO was added to the diet (interaction, $P < 0.01$). Retention of P and the ATTD of P increased linearly ($P < 0.01$) and quadratically ($P < 0.05$) as the concentration of phytase increased in the diet, but the increase was greater if ZnO was not added than if ZnO was added to the diet (interaction, $P < 0.05$). In conclusion, pharmacological levels of Zn reduced Ca and P digestibility and retention, but this effect was partly mitigated by the inclusion of high levels of phytase in the diets. Inclusion of microbial phytase increased the ATTD and STTD of Ca in diets and also the ATTD of P.

Key Words: minerals, phytase, pigs
doi: 10.2527/asasmw.2017.12.178

179 Effects of increasing copper from either $CuSO_4$ or combinations of $CuSO_4$ and a Cu-amino acid complex on growth performance and carcass characteristics of finishing pigs.

C. B. Carpenter[1,*], J. C. Woodworth[1], J. M. DeRouchey[1], M. D. Tokach[1], R. D. Goodband[1], S. S. Dritz[1], Z. J. Rambo[2], *[1]Kansas State University, Manhattan, [2]Zinpro Corporation, Eden Prairie, MN.*

A total of 1089 pigs (PIC 280 × 1050; initially 37.3 kg) were used in a 105-d growth study to determine the effects of increasing added Cu from either $CuSO_4$ (Prince Agri-Products, Quincy, IL) alone or a 50/50 blend of $CuSO_4$ and Cu-AA complex (Availa®-Cu, Zinpro Corporation, Eden Prairie, MN) on growth performance and carcass characteristics of finishing pigs. Treatments were fed in 5 phases (27 to 45, 45 to 61, 61 to 77, 77 to 104, and 104 to 127 kg BW) and consisted of a control diet with 17 ppm Cu from $CuSO_4$ from the trace mineral premix or the control plus added $CuSO_4$ to provide 70 and 130 ppm total Cu or a 50/50 blend of $CuSO_4$ and Cu-AA to provide 70, 100, and 130 ppm total Cu. There were 25 or 26 pigs/pen and 7 replicates/treatment. Overall, added Cu above 17 ppm did not influence ADG; however, pigs fed 70 and 130 ppm added Cu from the 50/50 blend of $CuSO_4$ and Cu-AA had decreased ($P = 0.045$) ADFI but G:F tended ($P = 0.051$) to be improved compared with those fed 70 and 130 ppm of added Cu from $CuSO_4$ only. Similar to the G:F response, pigs fed diets that contained $CuSO_4$ alone had poorer ($P = 0.033$) carcass G:F than those fed added Cu from the 50/50 blend of $CuSO_4$ and Cu-AA. Carcass characteristics were not influenced. In conclusion, these data suggest pigs fed diets that contained added Cu from $CuSO_4$ alone consume more feed but have poorer G:F on a live and carcass basis compared to those fed a 50/50 blend of $CuSO_4$and Cu-AA. Increasing Cu did not affect growth performance in this study.

Key Words: copper source, finishing pig, growth
doi: 10.2527/asasmw.2017.12.179

180 Phytate hydrolysis, intestinal microbiota, microbial metabolites, and innate immune cell numbers are changed in growing pigs fed diets with varying calcium-phosphorus levels and fermentable substrates.

C. M. E. Heyer[1,2,*], S. Schmucker[2], E. Weiss[2], M. Eklund[2], T. Aumiller[2], E. Graeter[2], T. Hofmann[2], M. Rodehutscord[2], L. E. Hoelzle[2], J. Seifert[2], R. T. Zijlstra[1], V. Stefanski[2], R. Mosenthin[2], *[1]University of Alberta, Department of Agricultural, Food and Nutritional Science, Edmonton, AB, Canada, [2]University of Hohenheim, Institute of Animal Science, Stuttgart, Germany.*

Effects of dietary calcium-phosphorus (CaP) on the swine immune system and intestinal microbiota are not fully elucidated. The present study assesses effects of diets containing varying