

Table 1: Growth performance, total tract energy and nutrient digestibility, bone ash and bone strength in pigs fed different phytases

	PC	NC	PhyG	PhyC	PhyH	PhyE	SEM	P-value
Body Weight, kg								
D0	9.796	9.728	9.773	9.853	9.784	9.742	0.346	0.987
D14	14.86ab	14.26b	15.36a	15.27a	14.90ab	14.73ab	0.224	0.0076
D28	21.58a	19.14b	21.82a	21.36a	21.06a	20.78a	0.374	<.0001
D42	30.65a	24.36b	30.74a	30.11a	30.02a	29.30a	0.486	<.0001
Avg Daily Gain, g								
d0-14	364.94ab	321.92b	400.26a	394.39a	367.91ab	355.39ab	16.002	0.0078
d14-28	469.71a	348.49b	461.39a	434.29a	439.89a	432.09a	15.884	<.0001
d28-42	647.65a	373.29b	637.24a	625.66a	639.69a	608.74a	17.957	<.0001
d0-42	497.53a	347.87b	499.63a	484.80a	482.50a	465.41a	11.560	<.0001
Avg Daily Feed Intake								
d0-14	507.43	489.65	510.31	520.93	499.57	494.85	16.128	0.7325
d14-28	662.05	600.88	659.47	657.54	646.02	635.27	20.986	0.2271
d28-42	952.22a	700.41b	946.46a	924.12a	961.86a	939.47a	27.052	<.0001
d0-42	707.23a	596.98b	705.41a	700.87a	702.48a	689.86a	16.974	<.0001
Feed Conversion Ratio								
d0-14	1.40ab	1.54a	1.28b	1.33b	1.37b	1.43ab	0.039	<.0001
d14-28	1.41b	1.73a	1.44b	1.52b	1.48b	1.48b	0.030	<.0001
d28-42	1.48b	1.87a	1.49a	1.48a	1.50a	1.55a	0.031	<.0001
d0-42	1.42bc	1.71a	1.41c	1.44bc	1.46bc	1.49b	0.016	<.0001
Bone ash, %								
	15.84a	10.70b	16.99a	15.75a	16.68a	15.71a	0.308	<.0001
Bone strength, Ultimate force, N								
	292.61c	140.01d	364.74a	322.84bc	333.24ab	309.66bc	9.627	<.0001
Apparent Total Tract Digestibility, %								
DM	84.87c	85.46bc	86.38ab	85.95ab	86.35ab	86.54a	0.225	<.0001
GE	85.07b	85.68ab	85.76 ab	85.37 ab	85.77 ab	86.20a	0.242	0.045
CP	82.31b	84.57a	85.28 a	84.92 a	85.26 a	85.31 a	0.390	<.0001
Ca	55.87b	56.68b	70.89a	69.95a	72.19a	68.82a	1.050	<.0001
P	45.17d	32.24e	71.57a	67.22b	69.54ab	60.39c	0.770	<.0001

Keywords: bone strength, digestibility, growth performance, phosphorus, phytases, piglets

100 The Impact of Dietary Analyzed Ca to P Ratios and Standardized Total Tract Digestible P to Net Energy Ratios on Growth Performance, Bone, and Carcass Characteristics of Pigs.

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Abstract: A total of 2,184 pigs (initially 12.4 kg) were used to evaluate effects of varying analyzed Ca:P ratios at 2 levels of standardized total tract digestible (STTD) P:NE. Pens of pigs (26 pigs/pen) were assigned to 6 dietary treatments in a randomized complete block design with 14 pens/treatment. Diets consisted of 2 levels of STTD P:NE: PIC recommendation (1.8, 1.62, 1.43, 1.25, 1.10, 0.99 g STTD P/Mcal NE from 11-22, 22-40, 40-58, 58-81, 81-104, 104-129 kg, respectively) or 75% of the PIC recommendation, and 3 analyzed Ca:P ratios: 0.90:1, 1.30:1, and 1.75:1. Diets were corn-soybean meal-based and contained phytase (Quantum Blue G, AB Vista, Marlborough, UK; 500 to 210 FTU/kg with release values from 0.13 to 0.07% STTD P). There was a Ca:P×STTD P:NE interaction ($P < 0.05$) observed for ADG, G:F and final BW. For ADG and final BW, when feeding 75% of PIC STTD P recommendation, increasing analyzed Ca:P ratio decreased ADG and final BW (linear, $P < 0.001$). But when feeding at PIC STTD P recommendation, increasing the analyzed Ca:P ratio tended to improve ADG and final BW (linear, $P < 0.10$). For G:F, when feeding 75% of PIC STTD P recommendation, increasing analyzed Ca:P ratio tended to decrease G:F (linear, $P < 0.10$), whereas in pigs fed diets that met PIC STTD P recommendations, increasing analyzed Ca:P ratio tended to improve G:F in a quadratic ($P < 0.10$) manner. Pigs fed at PIC STTD P recommendations had increased ADG, final BW, and G:F compared with pigs fed 75% of PIC STTD P recommendations ($P < 0.001$). In summary, pigs fed at PIC STTD P recommendations had improved overall ADG and G:F compared with pigs fed diets at 75% PIC STTD P recommendations. Additionally, increasing analyzed Ca:P ratio reduced ADG and G:F when STTD P was below PIC recommendations, but had marginal impacts when adequate STTD P was fed.

Table 1. The interactive effects of analyzed Ca:P ratio on current or 75% of PIC STTD P recommendations on growing-finishing pig performance

	Ca:P	75% of current PIC P			Current PIC P			SEM
		0.90	1.30	1.75	0.90	1.30	1.75	
Starting BW, kg		12.4	12.4	12.4	12.4	12.4	12.4	0.17
Ending BW, kg ¹		130.5	127.5	125.5	132.6	134.3	134.9	0.90
Overall								
ADG, kg ¹		0.87	0.85	0.84	0.89	0.89	0.90	0.006
ADFI, kg		2.04	1.99	2.00	2.06	2.03	2.07	0.014
G:F, g/kg ²		428	429	423	433	439	436	3.6

¹Ca:P × STTD P:NE, linear, $P < 0.05$. Within 75% of the current PIC P level, linear, $P < 0.05$. Within current PIC P level, linear, $P < 0.05$. Significant main effect for PIC P level, $P < 0.05$.
²Ca:P × STTD P:NE, linear, $P < 0.05$. Within 75% of the current PIC P level, linear, $P < 0.05$. Within 75% of the current PIC P level, linear, $P < 0.10$. Within current PIC P level, quadratic, $P < 0.10$. Significant main effect for PIC P level, $P < 0.05$.

Keywords: calcium, growth performance, phosphorus

264 Awardee Talk: A Systems Approach for Evaluating Productivity, Nutritional Efficiency, and Environmental Impacts of Feeding Programs for Growing-Finishing Pigs. Zhaohui Yang¹, Yuan-tai Hung¹, Jae C. Jang¹, Pedro E. Urriola¹, Lee J. Johnston¹, Gerald C. Shurson¹, ¹University of Minnesota

Abstract: Traditional evaluation of swine feeding programs have generally focused only on economically important performance and carcass measures but achieving sustainable pork production also requires formulating diets to reduce negative environmental impacts. Therefore, a systems approach is needed to evaluate swine feeding programs from multiple perspectives. The objectives of this study were to compare productivity, nutritional efficiency, and environmental outcomes of four different growing-finishing feeding programs consisting of diets containing corn and soybean meal (CSBM), low protein CSBM supplemented with crystalline amino acids (LP), CSBM with 30% distillers dried grains with solubles (DDGS), and DDGS supplemented with crystalline Ile, Val, and Trp (DDGS+IVT). In experiment 1, growth performance and carcass characteristics of pigs (n=288; initial BW=36.9±4.2 kg) were measured in a 12-wk feeding trial. There were no differences in ADG, ADFI, carcass yield, and carcass fat-free lean percentage observed among feeding programs but gain:feed was greater ($P < 0.05$) in pigs fed CSBM and DDGS+IVT than pigs fed LP. In experiment 2, nitrogen and phosphorus balance of pigs (n=32; initial BW=59.9±5.1 kg) were determined in a metabolism study. Pigs fed CSBM had greater N retained ($P < 0.05$) than those fed other diets, but pigs fed LP had greater ($P < 0.05$) protein efficiency ratio but lower ($P < 0.05$) P intake than pigs fed CSBM and DDGS. In experiment 3, data collected from the previous 2 experiments were used to calculate environmental impacts of the four feeding programs through life-cycle assessments using Opteinics™ (BASF, Lampertheim, Germany). Feeding CSBM had the least impact per 1,000 kg carcass weight on climate change and fossil resource use, while LP had the least impact on acidification, water use, and total environmental footprint. These results indicate that each feeding program has comparative advantages depending on the metrics, which requires using a holistic systems approach for decision-making to improve the sustainability of pork production.

Keywords: carcass characteristics, distillers dried grains with solubles, growth performance