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Effects of super-dosing phytase in diets with adequate phosphorus on finishing pig growth performance and carcass characteristics

Abstract

A total of 274 finishing pigs (PIC 1050 Ã— 327, initially 129 lb) were used in a 78-d study to compare the effects of adding high levels of three different sources of phytase (super-dosing) on growth performance and carcass characteristics of finishing pigs. Pigs were randomly allotted to pens with 7 or 8 pigs per pen and 9 replications per treatment. Dietary treatments included a corn-soybean mealâ€"based control diet that was formulated to meet the available P requirements of the pigs without any added phytase, or three diets that were formed by adding 2,000 FTU/kg of phytase from 1 of 3 different phytase sources to the basal diet. The three phytase sources were Quantum Blue 5 G (AB Vista, Chesterfield, MO), Ronozyme HiPhos (GT) 2500 (DSM Nutritional Products, Parsippany, NJ), or Optiphos 1000 (Enzyvia, Sheraton, IN). Overall, regardless of source, super-dosing phytase had no effect (P > 0.26) on ADG, ADFI, or F/G; furthermore, there were no effects (P > 0.36) on any of the carcass criteria measured. In conclusion, in this environment with nutritionally adequate diets, this study suggests that super-dosing phytase had no beneficial effects on finishing pig growth or carcass performance.; Swine Day, Manhattan, KS, November 21, 2013

Keywords

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Effects of Super-Dosing Phytase in Diets with Adequate Phosphorus on Finishing Pig Growth Performance and Carcass Characteristics

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Summary

A total of 274 finishing pigs (PIC 1050 × 327, initially 129 lb) were used in a 78-d study to compare the effects of adding high levels of three different sources of phytase (super-dosing) on growth performance and carcass characteristics of finishing pigs. Pigs were randomly allotted to pens with 7 or 8 pigs per pen and 9 replications per treatment. Dietary treatments included a corn-soybean meal–based control diet that was formulated to meet the available P requirements of the pigs without any added phytase, or three diets that were formed by adding 2,000 FTU/kg of phytase from 1 of 3 different phytase sources to the basal diet. The three phytase sources were Quantum Blue 5 G (AB Vista, Chesterfield, MO), Ronozyme HiPhos (GT) 2500 (DSM Nutritional Products, Parsippany, NJ), or Optiphos 1000 (Enzyvia, Sheraton, IN). Overall, regardless of source, super-dosing phytase had no effect ($P > 0.26$) on ADG, ADFI, or F/G; furthermore, there were no effects ($P > 0.36$) on any of the carcass criteria measured. In conclusion, in this environment with nutritionally adequate diets, this study suggests that super-dosing phytase had no beneficial effects on finishing pig growth or carcass performance.

Key words: phosphorous, phytase, finishing pig

Introduction

Phytase is routinely added to swine diets to improve phosphorus availability. "Super-dosing," or adding greater amounts of phytase to diets than that needed to meet the P requirement, has been suggested to elicit additional benefits above those attributed to the enhanced P availability. The hypothesis is that the phytase will improve digestibility and availability of other nutrients besides the P; however, previous research has not consistently demonstrated this benefit. Reasons for the inconsistency might be that different sources of phytase do not elicit the same response, differences in diet formulation (below or at the requirement), and differences in environment (university or commercial facilities). Therefore, the objective of this study was to determine the effects of superdosing phytase from three different phytase sources on finishing pig growth and carcass performance in university facilities.

Procedures

The protocol for this experiment was approved by the Kansas State University Institutional Animal Care and Use Committee. The study was conducted at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. The barn

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was tunnel-ventilated with completely slatted flooring and deep pits. Each pen was equipped with a 2-hole stainless steel feeder and bowl waterer for ad libitum access to feed and water. Feed was delivered to each individual pen by a robotic feeding system (FeedPro; Feedlogic Corp., Wilmar, MN).

A total of 274 finishing pigs (PIC 1050 × 327, initially 129 lb) were used in a 78-d study with 7 or 8 pigs per pen and 9 replications per treatment. Pigs were randomly allotted to pen by initial BW and pens were assigned to 1 of 4 dietary treatments that were fed in meal form. The dietary treatments included a corn-soybean meal–based control diet that was formulated to meet the available P requirements of the pigs without any added phytase, or three diets that were formed by adding 2,000 FTU/kg of phytase from 1 of 3 different phytase sources to the basal diet. The three phytase sources were Quantum Blue 5 G (AB Vista, Chesterfield, MO), Ronozyme HiPhos (GT) 2500 (DSM Nutritional Products, Parsippany, NJ), or Optiphos 1000 (JBS United, Sheraton, IN). Diets were fed in 3 phases during the study, with 0.27, 0.23, and 0.21% available P formulated for Phases 1, 2, and 3, respectively (Table 1). Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feed disappearance every 2 wk throughout the study.

On d 78, all pigs were weighed and transported approximately 2.5 h to a commercial packing plant (Triumph Foods LLC, St. Joseph, MO) for harvest under USDA inspection. Before transport to the plant, pigs were individually tattooed according to pen number to allow for carcass data collection at the packing plant and data retrieval by pen. Hot carcass weight was measured immediately after evisceration, and each carcass was evaluated for carcass yield, backfat depth, loin depth, and percentage lean. Carcass yield was calculated by dividing HCW at the plant by final live weight at the farm before transport to the plant. Fat depth and loin depth were measured with an optical probe inserted between the 3rd and 4th last ribs (counting from the ham end of the carcass) at a distance approximately 3 in. from the dorsal midline.

Data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Institute Inc., Cary, NC) with pen as the experimental unit. Differences between treatments were determined by using least squares means. Results were considered significant at $P \leq 0.05$ and considered a trend at $P \leq 0.10$.

Results and Discussion

Overall (d 0 to 78), no differences ($P > 0.26$) were observed between treatments for ADG, ADFI, or F/G (Table 2), and no differences ($P > 0.36$) were observed in HCW, carcass yield, backfat depth, loin depth, or percentage lean. When diets were formulated to meet the available P requirements of the pigs in this study, additional phytase from any of the sources did not benefit growth or carcass performance compared with the control. In conclusion, under the conditions of this study, superdosing phytase in diets formulated to be adequate in available P did not elicit additional benefits in pig performance.

Table 1. Diet composition (as-fed basis)[1]

Ingredient, %	Phase 1	Phase 2	Phase 3
Corn[2]	61.45	65.95	84.80
Soybean meal (46.5% CP)	15.85	11.60	12.55
Dried distillers grains with solubles	20.00	20.00	0.00
Monocalcium P (21% P)	0.60	0.45	0.75
Limestone	1.24	1.17	1.06
Salt	0.35	0.35	0.35
L-lysine HCl	0.26	0.23	0.20
L-threonine	0.00	0.00	0.04
Trace mineral premix	0.12	0.12	0.13
Vitamin premix	0.12	0.12	0.13
Total	100.00	100.00	100.00
Calculated analysis			
Standardized ileal digestible (SID) amino acids, %			
Lysine	0.85	0.72	0.65
Isoleucine:lysine	71	74	67
Methionine:lysine	33	36	31
Met & Cys:lysine	62	69	63
Threonine:lysine	62	65	65
Tryptophan:lysine	18	18	18
Valine:lysine	83	89	79
Total lysine, %	1.01	0.87	0.74
CP, %	18.4	16.7	13.2
ME, kcal/lb	1,496	1,501	1,498
SID lysine:ME, g/Mcal	2.58	2.18	1.95
Ca, %	0.63	0.57	0.57
P, %	0.52	0.47	0.47
Available P, %	0.27	0.23	0.21

[1] All diets were fed in meal from with Phase 1, 2, and 3 fed from d 0 to 20, 20 to 50, and 50 to 78, respectively.
[2] Phytase replaced corn in the basal diet with 2,000 phytase units (FTU)/kg added from either Quantum Blue 5 G (0.8 lb/ton; AB Vista, Chesterfield, MO), Ronozyme HiPhos (GT) 2500 (1.6 lb/ton; DSM Nutritional Products, Parsippany, NJ), or Optiphos 1000 (4.0 lb/ton; Enzyvia, Sheraton, IN) to form the experimental treatments.

Table 2. Influence of high levels of phytase from three different sources on finishing pig growth and carcass performance[1]

		Phytase source, 2,000 FTU/kg[2]				
Item	Control	Quantum Blue	Ronozyme HiPhos	Optiphos	SEM	Trt, *P* <
Wt, lb						
d 0	128.9	129.0	128.9	129.1	1.62	1.00
d 78	296.2	291.6	292.6	291.1	3.00	0.63
d 0 to 78						
ADG, lb	2.13	2.06	2.08	2.08	0.025	0.26
ADFI, lb	6.27	6.06	6.16	6.15	0.087	0.43
F/G	2.95	2.94	2.96	2.96	0.028	0.97
Carcass characteristics						
HCW, lb	212.8	209.9	210.4	208.2	2.49	0.61
Yield, %[3]	73.18	73.51	73.39	73.40	0.204	0.70
Back fat, in.[4]	0.80	0.81	0.80	0.81	0.018	0.98
Loin depth, in.[4]	2.40	2.48	2.45	2.44	0.031	0.36
Lean, %[4]	52.50	52.78	52.66	52.57	0.239	0.85

[1] A total of 274 finishing pigs (PIC 1050 × 327, initially 129 lb) were used in a 78-d study with 7 or 8 pigs per pen and 9 pens per treatment. Basal diets were formulated to adequately meet the pigs available P requirements.

[2] Phytase units per kilogram. Phytase replaced corn in the basal diet with 2,000 phytase units (FTU)/kg added from either Quantum Blue 5 G (0.8 lb/ton; AB Vista, Chesterfield, MO), Ronozyme HiPhos (GT) 2500 (1.6 lb/ton; DSM Nutritional Products, Parsippany, NJ), or Optiphos 1000 (4.0 lb/ton; Enzyvia, Sheraton, IN) to form the experimental treatments.

[3] Percentage yield was calculated by dividing HCW by live weight obtained at the farm before transport to the packing plant.

[4] Carcass characteristics were adjusted by using HCW as a covariate.