Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 901

2002

Effects of increasing CA:P ratio in diets containing phytase on growth performance of grow-finish pigs

S M. Hanni

M R. Barker

C N. Groesbeck

See next page for additional authors

Recommended Citation

Hanni, S M.; Barker, M R.; Groesbeck, C N.; Keegan, T P.; Lawrence, K R.; Young, M G.; James, B W.; Tokach, Michael D.; Nelssen, Jim L.; Goodband, Robert D.; and Dritz, Steven S. (2002) "Effects of increasing CA:P ratio in diets containing phytase on growth performance of grow-finish pigs," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6741

Effects of increasing CA:P ratio in diets containing phytase on growth performance of grow-finish pigs

Authors

S M. Hanni, M R. Barker, C N. Groesbeck, T P. Keegan, K R. Lawrence, M G. Young, B W. James, Michael D. Tokach, Jim L. Nelssen, Robert D. Goodband, and Steven S. Dritz

EFFECTS OF INCREASING CA:P RATIO IN DIETS CONTAINING PHYTASE ON GROWTH PERFORMANCE OF GROW-FINISH PIGS

S. M. Hanni, M. D. Tokach, J. L. Nelssen, R. D. Goodband, S. S. Dritz[1], M. R. Barker, C. N. Groesbeck, T. P. Keegan, K. R. Lawrence, M. G. Young, and B. W. James

Summary

We used 144 growing-finishing pigs (72 barrows and 72 gilts; initially 85 lb) to determine the effects of calcium to total phosphorus (Ca:P) ratio on growth performance. Pigs were housed in an environmentally regulated finishing building with two pigs per pen and nine pens per sex per treatment in a randomized complete block design. Pigs were blocked by initial weight and sex, and then allotted to one of four dietary treatments. The dietary treatments were corn-soybean meal-based diets fed in three phases. In each phase, diets consisted of a 1:1; 1.25:1; 1.5:1, and 2:1 Ca:P ratio. Diets were formulated to contain 0.44%, 0.39%, and 0.34% phosphorus from 70 to 130, 130 to 190, and 190 to 250 lb, respectively. All diets contained 0.05% phytase, providing 300 FTU/kg of feed. For the overall experiment, increasing Ca:P ratio decreased ADG (quadratic $P<0.03$) and ADFI (linear $P<0.05$). However, the greatest decrease in ADG and ADFI was observed when Ca:P increased from 1.5:1 to 2:1. Feed to gain was not affected by Ca:P ratio. These results suggest that in growing-finishing diets containing 300 FTU/kg phytase, a Ca:P ratio greater then 1.5:1 will decrease ADG and ADFI.

(Key Words: Calcium, Phosphorus, Phytase, Finishing Pigs.)

Introduction

Calcium and phosphorus are essential for proper skeletal development and maintenance. Phosphorus is organically bound in cereal grains to phytate and has poor availability to pigs. However, the bioavailability of phytate phosphorus from cereal grains is increased with the addition of phytase. This reduces the level of dietary phosphorus in a diet, which results in reduced amounts of phosphorus excreted. As the Ca:P ratio widens, there is a decrease in phosphorus absorption, which results in poorer growth performance. However, as we decrease the phosphorus level and maintain a narrow Ca:P ratio, calcium levels can fall below estimated requirements of NRC (1998). Therefore, the objective of this experiment was to determine the effect of increasing calcium to total phosphorus ratio in diets containing phytase on growth performance in growing finishing pigs.

Procedures

One hundred forty-four pigs (72 barrows and 72 gilts; PIC 327 × C22) averaging 85 lb were used in this experiment. Pigs were housed in an environmentally regulated finishing building with two pigs per pen and nine pens (5 × 5 ft) per sex per treatment (nine pens of barrows and nine pens of gilts) in a ran-

[1]Food Animal Health and Management Center.

domized complete block design. Pigs were blocked by initial weight and sex, and then randomly allotted to one of the four experimental treatments. Feed and water were provided ad libitum.

The four dietary treatments consisted of calcium to total phosphorus ratios of 1:1; 1.25:1; 1.5:1, and 2:1. Soybean meal, vitamin premixes, antibiotic, Natuphos 600, monocalcium phosphate, trace mineral premix, and limestone were analyzed for percentage calcium and phosphorus. These values were then used in diet formulation. Diets were fed in meal form in three phases; phase one and two were 28 days and phase 3 was 19 days. These corresponded to approximately 70 to 130 lb, 130 to 190 lb, and 190 to 250 lb, respectively. The same Ca:P ratios were used in each phase. Diets were formulated to contain 1.10%, 0.90%, and 0.75% total dietary lysine, and 0.45%, 0.40%, and 0.35% total available phosphorus for phase 1, 2, and 3, respectively. Natuphos was added to all of the diets to provide 300 FTU/kg in order to achieve available phosphorus equivalence values of 0.22%, 0.19%, and 0.15% for phase 1, 2, and 3, respectively.

Individual pig weights and feed disappearance were measured every 14 d to calculate ADG, ADFI, and F/G. At the end of the study, pigs were marked with an individual tattoo to allow for individual carcass data to be collected at marketing. All pigs were sent to Sioux Preme Packing Co, Sioux Center, IA for individual carcass data collection (i.e., carcass weight, fat and loin measurements). The experiment was conducted from May to August, 2002.

Results and Discussion

From d 0 to 28, increasing Ca:P ratio decreased ADG (linear $P<0.0006$) and worsened F/G (linear $P<0.008$), but did not affect ($P<0.18$) ADFI. Although responses were linear for both ADG and F/G, the greatest change in performance was observed when Ca:P ratios increased from 1.5:1 to 2:1. From d 28 to 57, increasing Ca:P ratio decreased ADG (quadratic $P<0.002$) and ADFI (linear $P<0.03$), but F/G was not affected ($P<0.76$). Again, as with phase I, the greatest change in performance was observed when Ca:P ratio increased from 1.5:1 to 2:1. From day 57 to 76, no differences in growth performance were observed; however, pigs fed the 2:1 Ca:P ratio had a numerically lower ADG.

For the overall experiment, increasing the Ca:P ratio decreased ADG (quadratic $P<0.03$) and ADFI (linear, $P<0.05$). Similar to the response in both phase 1 and 2, the greatest changes occurred when the Ca:P ratio increased from 1.5:1 to 2:1. Even though F/G was not affected ($P<0.21$), as the Ca:P ratio increased from 1.5:1 to 2:1, F/G was numerically reduced.

Increasing the Ca:P ratio decreased carcass weight (quadratic $P<0.03$). Once again the greatest changes taking place when the Ca:P ratio was increased from 1.5:1 to 2:1. There were no differences for carcass yield, backfat depth, loin eye area, and fat free lean index (FFLI).

In summary, these results suggest that calcium to total phosphorus should not be greater than a 1.5:1 ratio in a corn-soybean meal-based diet containing 300 FTU/kg phytase for growing finishing pigs to avoid limiting growth performance.

Table 1. Diet Composition for Phase 1, 2, and 3

Ingredient, %	Phase 1	Phase 2	Phase 3
Corn	70.65	78.20	83.90
Soybean meal 46.5%	26.45	19.15	13.70
Monocalcium phosphate, 21%P	0.40	0.25	0.10
Limestone	0.44 - 1.60	0.46 - 1.48	0.48 - 1.38
Salt	0.35	0.35	0.35
Vitamin premix	0.15	0.15	0.15
Trace mineral premix	0.15	0.15	0.15
Tylan 40	0.05	0.05	0.05
Sand	1.17 - 0.005	1.04 - 0.02	0.93 - 0.03
Lysine HCL	0.15	0.15	0.15
Natuphos 600	0.05	0.05	0.05
Calculated Analysis			
Lysine, %	1.10	0.90	0.75
Protein, %	18.30	15.50	13.50
Me, Kcal/lb	1497	1502	1508
Ca, %	0.44 - 0.88	0.39 – 0.77	0.34 - 0.68
P, %	0.44	0.39	0.34

Table 2. Influence of Ca:P Ratio on Growth Performance[d]

	Calcium : Phosphorus Ratio					Contrast *P*<	
Item	1:1	1.25:1	1.5:1	2:1	SED	Linear	Quadratic
Day 0 to 28							
ADG	2.23[a]	2.14[a]	2.20[a]	2.04[b]	0.05	<0.01	0.44
ADFI	5.08	4.91	5.00	4.92	0.10	0.18	0.56
Feed/gain	2.28[a]	2.29[a]	2.28[a]	2.40[b]	0.05	<0.01	0.15
Day 28 to 57							
ADG	1.93[a,c]	2.01[a,b]	2.03[b]	1.86[c]	0.05	0.76	<0.01
ADFI	5.81	5.79	5.81	5.51	0.15	0.03	0.27
Feed/gain	3.01	2.89	2.85	2.96	0.09	0.76	0.08
Day 57 to 76							
ADG	1.56	1.52	1.55	1.44	0.08	0.11	0.64
ADFI	5.65	5.66	5.86	5.46	0.21	0.40	0.15
Feed/gain	3.65	3.74	3.86	3.84	0.16	0.23	0.44
Overall							
ADG	1.95[a]	1.94[a]	1.97[a]	1.83[b]	0.04	0.01	0.03
ADFI	5.49[a]	5.43[ab]	5.52[a]	5.27[cb]	0.11	0.05	0.25
Feed/gain	2.81	2.80	2.80	2.89	0.07	0.21	0.34
Packing Plant Data							
Carcass wt.	169.40[a]	170.24[a]	172.25[a]	157.47[b]	4.25	<0.01	0.03
Yield, %	72.75	72.92	73.20	72.59	0.38	0.65	0.15
Backfat, in.	0.86	0.90	0.93	0.83	0.06	0.58	0.12
Loin eye area	7.37	7.55	7.53	7.11	0.28	0.26	0.18
FFLI, %	52.88	53.64	52.85	53.77	0.89	0.46	0.84