EFFECTS OF SOURCE AND LEVEL OF DIETARY LYSINE ON GROWTH PERFORMANCE OF PIGS FROM 24 TO 48 LB[1]

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Summary

Three hundred twenty, 24 lb nursery pigs were fed for 19 days to compare the effects of increasing dietary lysine from L-lysine HCl (L-Lys) or Peptide Plus™ (PP) on growth performance. Three dietary treatments (1.025, 1.15, and 1.275% lysine) were each formulated with L-Lys and PP. Negative and positive control corn-soybean meal-based diets were formulated to .90 and 1.275% lysine, respectively. Increasing dietary lysine to 1.275% from L-Lys or PP resulted in increased performance; however, pigs fed the positive control diet had the best overall performance.

(Key Words: Lysine, L-Lysine HCl, Peptide Plus, Pigs.)

Introduction

Numerous research trials have indicated that replacing intact protein sources with high levels of crystalline amino acids results in poorer feed efficiency and protein accretion. Recent research has shown that peptides may account for a large portion of dietary protein absorbed from the small intestine. Therefore, feeding a diet containing partially digested protein and peptides, compared with diets with intact proteins and/or free amino acids, may result in improved protein utilization and growth performance.

Peptide Plus™ (PP) is a chemically/ enzymatically hydrolyzed bovine muscle protein source manufactured by Darling International Inc. Research by Darling indicated that performance of weanling pigs was enhanced when diets were supplemented with PP. Therefore, the objective of this study was to determine the effects of source and level of dietary lysine on growth performance of 24 to 48 lb pigs.

Procedures

Three hundred-twenty PIC (C22 × 355) barrows and gilt nursery pigs (24 lb.) were blocked by weight and randomly allotted to one of eight dietary treatments with five pigs per pen and eight pens per treatment. Pigs were housed with ad-libitum access to feed and water in the two environmentally controlled nursery barns at Kansas State University. There were four replication of each treatment in each barn. All pigs were fed the standard KSU SEW, Transition, and Phase II diets for 1 week each prior to initiation of the trial. Pigs were weighed individually and pen feed disappearance was calculated on day 7, 14 and 19.

Eight dietary treatments were used in the experiment (Table 1). The positive (1.275% lysine) and negative (.90% lysine) control diets were corn and soybean meal-based and formulated with no synthetic amino acids with the exception of DL-methionine in the positive control diet to maintain an ideal

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minimum ratio to lysine. Three dietary treatments (1.025, 1.15, and 1.275% lysine) were each formulated with L-Lys and PP. Minimum ideal ratios of isoleucine, methionine, methionine plus cystiene, threonine, tryptophan, and valine relative to lysine were maintained at 55, 28, 57, 65, 22, and 69% in all diets with synthetic amino acid additions. All diets were formulated to contain minimums of .80% Ca, .42% available P, .32% Na, .49% Cl, .73% K, and 1,571 kcal ME/lb.

Data were analyzed as a randomized complete block design with seven single degree of freedom contrast comparisons: 1) positive vs negative control; 2) positive control vs other 1.275% lysine diets; 3) linear effect of L-Lys; 4) quadratic effect of L-Lys; 5) linear effect of PP; 6) quadratic effect of PP; and 7) L-Lys vs PP.

Results and Discussion

Least square means for the entire 19-day study are presented in Table 2. For all criteria evaluated, pigs fed the positive control diet had improved performance compared to pigs fed the negative control diet ($P<.01$). Regardless of lysine source, ADG increased with increasing dietary lysine ($P<.01$); however, those pigs fed diets containing L-Lys had higher ADG than those fed diets containing PP ($P<.05$). Average daily feed intake tended to decrease linearly ($P=.12$), although F/G improved linearly with increasing levels of PP ($P<.001$). Pigs fed the positive control diet had decreased ADFI ($P<.05$) and improved F/G ($P<.001$) compared to pigs fed 1.275% lysine diets containing L-Lys or PP. Feed efficiency improved linearly ($P<.001$) and quadratically ($P<.05$) for those pigs fed diets with increasing lysine from L-Lys and linearly ($P<.001$) for those pigs fed increasing lysine from PP. Similar to ADG, pigs fed diets containing L-Lys had improved F/G ($P<.001$) compared to those fed diets containing PP. Final weight increased linearly ($P<.01$) with increasing dietary lysine from either L-Lys or PP, although those pigs fed PP were lighter ($P<.05$) than those fed diets containing L-Lys.

These data indicate that PP is a less bioavailable form of amino acids than synthetic amino acids. Also, pigs will consume more feed but convert it less efficiently when fed diets formulated with high levels of synthetic amino acids or PP compared to pigs fed diets based on corn and soybean meal. Further research opportunities include verifying the amino acid digestibility of PP; establishing the metabolizable and net energy content of PP; and determining why pigs as light as 24 lb will overconsume a low-protein, amino acid-fortified diet. These data also indicate that pigs from 24 to 48 lb require a diet with at least 1.275% lysine (3.68 grams of lysine per Mcal of ME) formulated to ideal amino acid ratios with corn, soybean, fat, and synthetic amino acids on a least-cost basis.

Table 1. Percentage Compositions of Experimental Diets

	Negative Control	L-Lysine HCl			Peptide Plus™			Positive Control
Ingredient	.90%[a]	1.025%	1.15%	1.275%	1.025%	1.15%	1.275%	1.275%
Corn	59.200	59.200	59.200	59.200	59.200	59.200	59.200	52.750
Soybean meal, 46.5%	24.700	24.700	24.700	24.700	24.700	24.700	24.700	37.675
Choice white grease	3.950	4.050	4.100	4.300	3.500	3.150	2.750	4.850
Corn starch	7.275	6.887	6.454	5.755	5.788	4.193	2.03	
Monocalcium phosphate, 21%	1.725	1.725	1.725	1.725	1.300	.900	.500	1.625
Limestone	1.000	.950	.900	.8500	.925	.850	.800	.925
Salt	.750	.6925	.635	.5775	.500	.255	.010	.750
Vitamin premix	.250	.250	.250	.250	.250	.250	.250	.250
Trace mineral premix	.150	.150	.150	.150	.150	.150	.150	.150
Calcium chloride		.0675	.125	.195	.2875	.5625	.8375	
Sodium bicarbonate		.084	.168	.2525				
Mecadox 2.5g/ton	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
L-Lysine HCl		.1595	.3185	.475				
Peptide Plus™					2.390	4.775	7.160	
L-Isoleucine				.035				.01
DL-Methionine		.025	.100	.165				
L-Threonine		.035	.120	.200			.015	
L-Tryptophan		.025	.055	.080	.010	.015	.025	
L-Valine				.090				
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis, %								
Crude protein	16.5	16.8	17.2	17.7	18.2	19.9	21.6	22.0
Lysine	.90	1.025	1.15	1.275	1.025	1.15	1.275	1.275

[a]Calculated lysine level in the diet.

Table 2. Effects of Source and Level of Dietary Lysine on Growth Performance (d 0 to 19) from 24 to 48 lb

	Negative Control	L-Lysine HCl			Peptide Plus™			Positive Control	
Item	.90[a]	1.025	1.15	1.275	1.025	1.15	1.275	1.275	SEM
ADG, lb/d [bcde]	1.18	1.24	1.31	1.35	1.25	1.23	1.30	1.35	.022
ADFI, lb/d [bfgh]	2.13	2.11	2.02	2.10	2.12	2.06	2.07	1.97	.035
F/G [bcdefi]	1.80	1.70	1.54	1.55	1.70	1.68	1.58	1.46	.020
Final weight, lb [bcde]	46.51	47.55	48.95	49.70	47.71	47.36	48.78	49.62	.425

[a]Calculated lysine level in the diet.
[b]Positive vs negative control (P<.01).
[c]Linear effect of L-lysine HCl (P<.01).
[dh]Linear effect of Peptide Plus™ (P<.01 and .12, respectively).
[e]L-Lysine HCl vs Peptide Plus ™ (P<.05).
[f]Positive control vs other 1.275% lysine diets (P<.01).
[gi]Quadratic effect of L-lysine HCl (P<.15 and .02, respectively).