EFFECTS OF INCREASING DIETARY LYSINE IN TRANSITION DIETS ON NURSERY PIG GROWTH PERFORMANCE[1]

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Summary

A total of 1,400 weanling pigs (initially 13.6 lb) was used in a 9 d growth assay (d 4 to 13 postweaning) to determine the effects of increasing lysine in the transition diet on nursery pig growth performance. All pigs were fed a common SEW diet until d 4 after weaning. Pigs were then switched to experimental diets with total dietary lysine levels of 1.40, 1.50, 1.60, 1.70 or 1.80%. All diets were formulated to contain 20% soybean meal, with increasing amounts of synthetic amino acids to achieve desired amino acid concentrations in the diets. From d 4 to 9 postweaning, increasing lysine increased ADG (linear, $P<0.03$) and improved feed efficiency (linear, $P<0.001$), but ADFI was not affected. Overall (d 4 to 13 postweaning), pigs fed diets containing increasing dietary lysine had improved ADG (linear, $P<0.03$) and feed efficiency (linear, $P<0.001$), with no differences in ADFI. Although responses to increasing dietary lysine were linear, there was little improvement either ADG or F/G above 1.7% lysine. There was no difference in average pig weight at the end of the trial, probably because of the short duration of the study. In conclusion, increasing dietary lysine up to 1.7% in transition diets (13 to 19 lb) for nursery pigs maximized growth performance.

(Key Words: Nursery Pig, Transition Diet, Lysine Requirement, Growth)

Introduction

Nursery diets are routinely formulated to contain a small amount of soybean meal, yet not as much as to cause digestive complications. When maximum soybean meal levels are reached, other specialty protein products, such as spray-dried animal plasma, blood meal, fishmeal, and spray-dried whey are used to meet the amino acid requirements. However, as levels of these products increase in the diet, diet cost also increases. Another possible means of increasing dietary lysine without using excessive amounts of soybean meal or specialty protein source levels is through the use of crystalline amino acids. Historically, synthetic amino acid use was limited to lysine and methionine because of the high cost of other amino acids. However, recent increased production capabilities have decreased the cost of synthetic threonine, thus providing an economical method of increasing synthetic amino acids in nursery diets. Limited data are available to determine an upper threshold of synthetic amino acid inclusion in nursery diets. Therefore, our objective was to determine the impact of increasing the lysine level in the

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transition diet for nursery pigs through the use of synthetic amino acids (lysine, methionine, and threonine).

Procedures

A total of 1,440 barrows and gilts (initially 13.5 lb and 18 ± 2 d of age) was used in a 9-d growth assay. Pigs were housed in a commercial nursery located in southern Minnesota. At weaning, pigs were randomly sorted into one of 60 pens (30 pens of barrows and 30 pens of gilts) with 24 pigs per pen. Pens of pigs were then weighed and allotted so all pens within each block (six total) were initially the same weight. Two pens of each sex of pigs consumed feed from a single fence line feeder. Thus, the experimental unit was the combined data from the two pens.

All pigs were fed a common SEW diet until d 4 postweaning, then switched to one of five experimental diets with total lysine levels of 1.40, 1.50, 1.60, 1.70, or 1.80%. This period, d 4 to 13 after weaning, corresponds to approximately the same weight range as usage of a transition diet in commercial production. All diets were formulated to contain 20% soybean meal, with increasing amounts of synthetic amino acids to achieve desired experimental levels of amino acids. Experimental diets met or exceeded the nutrient requirements by the NRC (1998). As the dietary lysine level increased, the levels of synthetic methionine, threonine, tryptophan, isoleucine, and valine also increased as needed to maintain minimum ratios relative to lysine (Table 1).

The common SEW diets was formulated to contain 1.70% lysine, and contained 6.7% animal plasma, 5.8% fishmeal, and 1.65% blood meal. Pigs were weighed and feed disappearance determined on d 9 and 13 postweaning for calculation of ADG, ADFI, and F/G.

Data were analyzed using the MIXED procedures of SAS as a randomized complete block design with two pens consuming feed from a single feeder as the experimental unit. Linear and quadratic effects of increasing dietary lysine were determined.

Results and Discussion

From d 4 to 9 postweaning, increasing dietary lysine improved ADG (linear, $P<0.03$) and feed efficiency (linear, $P<0.001$;Table 2). There was no difference in ADFI. Overall (d 4 to 13 postweaning), increasing dietary lysine improved ADG (linear, $P<0.03$) and feed efficiency (linear, $P<0.001$), with no differences in ADFI. Although the responses to ADG and F/G were linear, pig performance was maximized at 1.70% lysine for both. Probably because of the short duration of the trial, the differences in ADG did not result in an overall increase in average pig weight on d 9 or 13.

These data indicate that dietary lysine and other limiting amino acids can be increased through the use of crystalline amino acids and have positive effects on pig growth performance in the transition phase. This may allow nutritionists to increase dietary amino acid levels without increasing the use of high cost specialty protein sources. It would appear that pigs from 13 to 19 lb require approximately 1.7% total lysine to maximize growth performance.

Table 1. Experimental Transition Diets (As-fed Basis)[a]

	Total Dietary Lysine, %				
Ingredient,%	1.40	1.50	1.60	1.70	1.80
Corn	37.80	37.80	37.80	37.80	37.80
Soybean meal, 46.5% CP	20.00	20.00	20.00	20.00	20.00
Spray dried whey	25.00	25.00	25.00	25.00	25.00
Select menhaden fishmeal	6.00	6.00	6.00	6.00	6.00
Spray-dried animal plasma	2.50	2.50	2.50	2.50	2.50
Choice white grease	5.00	5.00	5.00	5.00	5.00
Monocalcium phosphate, 21% P	0.40	0.40	0.40	0.40	0.40
Limestone	0.40	0.40	0.40	0.40	0.40
Salt	0.30	0.30	0.30	0.30	0.30
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15	0.15	0.15
Antibiotic[b]	0.125	0.125	0.125	0.125	0.125
L-Isoleucine	0.00	0.024	0.048	0.071	0.095
L-Valine	0.00	0.041	0.083	0.124	0.165
L-Tryptophan	0.00	0.02	0.03	0.05	0.06
L-Threonine	0.025	0.089	0.153	0.216	0.280
L-Lysine HCl	0.018	0.144	0.271	0.398	0.525
DL-Methionine	0.10	0.16	0.22	0.28	0.34
Zinc oxide	0.38	0.38	0.38	0.38	0.38
Acidifier	0.20	0.20	0.20	0.20	0.20
Corn starch	1.36	1.03	0.70	0.37	0.04
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
Total lysine, %	1.40	1.50	1.60	1.70	1.80
Isoleucine:lysine ratio, %	65	63	60	58	56
Leucine:lysine ratio, %	131	123	115	108	102
Methionine:lysine ratio, %	33	35	36	38	39
Met & Cys:lysine ratio, %	60	60	60	60	60
Threonine:lysine ratio, %	69	68	68	68	67
Tryptophan:lysine ratio, %	19	19	19	19	18
Valine:lysine ratio, %	75	73	71	69	68
ME, kcal/lb	1,599	1,598	1,597	1,596	1,595
Lysine:calorie ratio, g/mcal	3.97	4.26	4.55	4.83	5.12
Crude protein, %	21.3	21.3	21.3	21.3	21.3
Ca, %	0.81	0.81	0.81	0.81	0.81
P, %	0.73	0.73	0.73	0.73	0.73
Available P, %	0.52	0.52	0.52	0.52	0.52

[a]All pigs were fed a common SEW diet (1.7% lysine) from weaning to day 4, then fed the experimental diets from d 4 to 13 post-weaning.
[b]Provided Denegard (35 g/ton) and chlortetracycline (600 g/ton).

Table 2. Effects of Increasing Dietary Lysine in Transition Diets on Nursery Pig Growth Performance[a]

	Total dietary lysine, %						P<	
Item	1.40	1.50	1.60	1.70	1.80	SE	Linear	Quadratic
Day 4 to 9								
ADG, lb	0.42	0.40	0.47	0.47	0.45	0.03	0.03	0.43
ADFI, lb	0.40	0.37	0.39	0.38	0.37	0.02	0.31	0.99
F/G	0.94	0.93	0.84	0.82	0.82	0.04	0.001	0.34
Day 4 to 13								
ADG, lb	0.59	0.60	0.59	0.63	0.64	0.020	0.001	0.44
ADFI, lb	0.59	0.57	0.57	0.57	0.57	0.014	0.55	0.33
F/G	1.00	0.95	0.98	0.91	0.90	0.027	0.001	0.95
Pig weight, lb								
Day 4	13.6	13.6	13.6	13.6	13.6	0.26	0.94	0.93
Day 9	15.7	15.6	16.0	15.9	15.9	0.31	0.34	0.81
Day 13	18.9	18.9	18.9	19.3	19.3	0.37	0.15	0.66

[a]A total of 1,440 pigs (6 observations/treatment with 2 pens of 24 pigs and a single fenceline feeder per observation) was used in the experiment.