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Abstract

A 28-d growth study with a total of 1,500 pigs (7 d after weaning and 14.5 lb initial BW) was conducted to compare differences in pig performance when fed either fish meal, poultry meal, or synthetic amino acids in a phase 2 nursery-pig diet. In addition, pigs were fed either a negative-control diet (predominately soybean meal without specialty protein sources) or a positive-control diet containing both blood meal and fish meal. Spray-dried whey was added to all diets at 10% and fat was added at 3%. All diets were formulated to meet minimum amino acid ratios. From d 7 to 17, feeding pigs the positive-control diet or the diet high in synthetic amino acids resulted in improved ADG and F/G (P<0.01), compared with those of pigs fed the negativecontrol, fish-meal, or poultry-meal diets. Pigs fed the positive-control diet or the synthetic amino acid diet were heavier at d 17 (P<0.01) than were pigs fed the negative control or diets containing fish or poultry meal. There was no treatment effect on ADFI (P>0.34). When all pigs were fed a common diet from d 17 to 35, similar ADG and F/G were observed between all dietary treatments (P>0.17); but pigs fed the positive-control diet had increased ADFI (P<0.01) compared with that of the negative control or of diets containing fish meal, poultry meal, or synthetic amino acids. For the overall treatment period (d 7 to 35), pigs fed the positive-control diet had greater ADG (P<0.01) and were heavier (P<0.01) than were pigs fed the negative-control diet or fed diets containing fish meal or poultry meal; the performance pigs fed the diet containing high concentrations of synthetic amino acids was intermediate. Pigs fed the positive-control diet also had increased ADFI (P<0.01), compared with that of pigs fed the other dietary treatments. Pigs fed the diet containing high concentrations of synthetic amino acids or the positive-control diet tended to have improved F/G (P<0.07), compared with that of pigs fed the other dietary treatments. In summary, synthetic amino acids were an effective replacement for specialty protein sources, such as fish meal or poultry meal, in the phase 2 diet.; Swine Day, 2004, Kansas State University, Manhattan, KS, 2004

Keywords

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THE EFFECT OF REPLACING SPECIALTY PROTEIN SOURCES WITH SYNTHETIC AMINO ACIDS IN PHASE 2 NURSERY-PIG DIETS[1]

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Summary

A 28-d growth study with a total of 1,500 pigs (7 d after weaning and 14.5 lb initial BW) was conducted to compare differences in pig performance when fed either fish meal, poultry meal, or synthetic amino acids in a phase 2 nursery-pig diet. In addition, pigs were fed either a negative-control diet (predominately soybean meal without specialty protein sources) or a positive-control diet containing both blood meal and fish meal. Spray-dried whey was added to all diets at 10% and fat was added at 3%. All diets were formulated to meet minimum amino acid ratios. From d 7 to 17, feeding pigs the positive-control diet or the diet high in synthetic amino acids resulted in improved ADG and F/G (P<0.01), compared with those of pigs fed the negative-control, fish-meal, or poultry-meal diets. Pigs fed the positive-control diet or the synthetic amino acid diet were heavier at d 17 (P<0.01) than were pigs fed the negative control or diets containing fish or poultry meal. There was no treatment effect on ADFI (P>0.34). When all pigs were fed a common diet from d 17 to 35, similar ADG and F/G were observed between all dietary treatments (P>0.17); but pigs fed the positive-control diet had increased ADFI (P<0.01) compared with that of the negative control or of diets containing fish meal, poultry meal, or synthetic amino acids. For the overall treatment period (d 7 to 35), pigs fed the positive-control diet had greater ADG (P<0.01) and were heavier (P<0.01) than were pigs fed the negative-control diet or fed diets containing fish meal or poultry meal; the performance pigs fed the diet containing high concentrations of synthetic amino acids was intermediate. Pigs fed the positive-control diet also had increased ADFI (P<0.01), compared with that of pigs fed the other dietary treatments. Pigs fed the diet containing high concentrations of synthetic amino acids or the positive-control diet tended to have improved F/G (P<0.07), compared with that of pigs fed the other dietary treatments. In summary, synthetic amino acids were an effective replacement for specialty protein sources, such as fish meal or poultry meal, in the phase 2 diet.

(Key Words: Pigs, Protein Sources, Synthetic Amino Acids, Weanling Pigs.)

Introduction

Previous experiments at Kansas State University have demonstrated that adding synthetic L-lysine HCl in excess of the normal 3 lb per ton inclusion requires the addition of other essential amino acids to the diet. The use of high concentrations of synthetic amino acids in nursery diets may provide an effective alternative to specialty protein sources when the specialty ingredients are expensive. Specialty protein sources, such as fish meal or

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[2]Food Animal Health and Management Center.

blood meal, are used in nursery diets to improve feed intake and average daily gain. There has recently been some question as to whether the benefit in increased feed intake is due to the protein source itself or because adding the protein source reduces the amount of soybean meal in the diet. Poultry meal is another amino acid source that is currently being used to reduce cost in nursery diets. This study was conducted to evaluate the effectiveness of replacing protein sources, such as fish meal or poultry meal, with synthetic amino acids to improve nursery-pig performance.

Procedures

A total of 1,500 weaned pigs (PIC, initially 14.5 lb and 7 d after weaning) were blocked by weight in a 28-day growth study. Pigs were randomly allotted to one of five dietary treatments in a randomized complete-block design. Each pen contained 25 pigs per pen, and two pens shared a common fence-line feeder, resulting in six replicates (pens) per treatment, with two pens as the experimental unit. Pigs were housed at a commercial facility in southwestern Minnesota.

Pigs were fed one of five experimental diets consisting of a negative-control diet based on corn-soybean meal as the sole protein source, or a positive-control diet that contained both fish meal and blood meal. Either fish meal, poultry meal, or added synthetic amino acids (L-lysine, L-threonine, DL-methionine, Isoleucine, Valine, and Tryptophan) replaced the amino acids provided by the blood meal and fish meal in the positive-control diet. The objective of testing the diet having the increased synthetic amino acid content was to see if synthetic amino acid, at rates in excess of that currently used in diets today, could replace the specialty protein sources.

Experimental diets were based on corn-soybean meal with 10% added whey and 3% added fat. The experimental diets (1.55% total lysine) were fed from d 7 to 17 after weaning (Table 1), and a common diet was fed from d 17 to d 35. Diets did not contain growth-promoting amounts of zinc oxide. Pigs and feeders were weighed on d 7, 17, and 35 after weaning to determine ADG, ADFI, and F/G. Data were analyzed as a randomized complete-block design, with the experimental unit as two pens sharing a common fence-line feeder, by using the Mixed procedure of SAS.

Results and Discussion

From d 7 to 17, feeding pigs the positive-control diet or a diet high in synthetic amino acids resulted in improved ($P<0.01$) ADG and F/G, and resulted in heavier ($P<0.01$) weights compared with those of pigs fed the negative-control, fish-meal, or poultry-meal diets (Table 2). There was no treatment effect on ADFI ($P>0.34$).

When all pigs were fed a common diet from d 17 to 35, similar ADG and F/G were observed between all dietary treatments ($P>0.17$); but pigs fed the positive-control diet from d 7 to 17 had increased ADFI ($P<0.01$) from d 17 to 35, compared with that of pigs fed the negative control or diets containing fish meal or poultry meal, or a diet high in synthetic amino acids.

For the overall treatment period (d 7 to 35), pigs fed the positive-control diet from d 0 to 7 had greater ADG ($P<0.01$) and were heavier ($P<0.01$) on d 35 than were pigs fed the negative-control diet or fed diets containing fish or poultry meal; the performance of pigs fed the diet containing added synthetic amino acids was intermediate. In addition, pigs fed the positive-control diet had increased ADFI and weighed more ($P<0.01$), compared with pigs fed the other dietary treatments. Pigs fed the diet containing added synthetic amino acids or fed the positive-control diet tended to have improved F/G ($P<0.07$), compared with that of pigs fed the other dietary treatments.

Neither poultry meal nor fish meal improved pig performance from d 7 to 17 or for the overall trial, compared with that of the negative-control diet containing soybean meal. Feeding diets containing added synthetic amino acids improved pig performance from d 7 to 17, compared with feeding diets containing fish meal, poultry meal, or soybean meal; but overall performance was slightly lower than that of pigs fed the positive-control diet containing both fish meal and blood meal. Using synthetic amino acids to replace specialty protein sources, such as fish meal and poultry meal, may be a viable option in current phase 2 nursery diets.

Table 1. Diet Composition (As-fed Basis)[ab]

Ingredient, %	Negative Control	Positive Control	Fish	Poultry	Synthetic Amino Acids
Corn	43.00	50.74	46.90	46.00	52.60
Soybean meal, 46.5% CP	40.70	30.25	33.24	33.38	30.16
Spray-dried whey	10.00	10.00	10.00	10.00	10.00
Choice white grease	3.00	1.00	1.00	1.00	1.00
Monocalcium phosphate, 21% P	1.50	1.20	1.00	1.00	1.50
Fish meal	-	2.25	4.50	-	-
Blood meal		0.83			
Poultry meal	-	-	-	5.00	-
Limestone	0.95	0.55	0.68	0.88	0.93
Salt	0.30	0.30	0.30	0.30	0.30
Vitamins and trace minerals[b]	0.30	0.30	0.30	0.30	0.30
L-Lysine HCl	0.15	0.30	0.15	0.15	0.53
DL-Methionine	0.10	0.15	0.18	0.18	0.27
L-Threonine	-	0.14	-	-	0.25
L-Isoleucine	-	-	-	-	0.10
L-Valine	-	-	-	-	0.13
L-Tryptophan	-	-	-	-	0.03
Calculated Analysis					
Total lysine, %	1.55	1.55	1.55	1.55	1.55
True-ileal-digestible amino acids					
Lysine, %	1.40	1.40	1.40	1.40	1.40
Isoleucine:lysine ratio, %	68.0	65.0	66.0	61.0	58.0
Leucine:lysine ratio, %	130.0	123.0	128.0	130.0	110.0
Methionine:lysine ratio, %	31.0	33.0	32.0	31.0	38.0
Met & Cys:lysine ratio, %	56.0	56.0	56.0	56.0	60.0
Threonine:lysine ratio, %	59.0	62.0	58.0	58.0	65.0
Tryptophan:lysine ratio, %	20.0	17.1	18.0	19.0	17.1
Valine:lysine ratio, %	72.0	67.0	71.0	72.0	67.0
ME, kcal/lb	1,550	1,561	1,564	1,559	1,552
CP, %	23.8	21.8	23.5	23.9	19.7
Ca, %	0.90	0.77	0.87	0.87	0.90
P, %	0.75	0.72	0.73	0.72	0.72
Available P, %	0.43	0.43	0.43	0.43	0.43

[a]All diets fed in meal form.

[b]Pigs fed experimental diets from d 7 to d 17 after weaning and a common diet from d 17 to d 35.

Table 2. Effect of Replacing Fish Meal or Poultry Meal with Synthetic Amino Acids in Phase 1 Nursery Diets[a]

Item	Negative Control	Positive Control	Fish	Poultry	Synthetic Amino Acids	SE	P-value
Day 7 to 17							
ADG, lb	0.43[c]	0.51[b]	0.41[c]	0.40[c]	0.48[b]	0.02	0.0005
ADFI, lb	0.68	0.71	0.67	0.66	0.70	0.02	0.34
F/G	1.60[c]	1.39[b]	1.63[c]	1.69[c]	1.45[b]	0.05	0.0002
Day 17 to 35							
ADG, lb	0.91	0.95	0.89	0.88	0.90	0.03	0.17
ADFI, lb	1.26[c]	1.34[b]	1.25[c]	1.22[c]	1.24[c]	0.03	0.01
F/G	1.38	1.41	1.40	1.38	1.37	0.02	0.43
Day 7 to 35							
ADG, lb	0.74[cd]	0.79[b]	0.72[cd]	0.71[d]	0.75[bc]	0.02	0.01
ADFI, lb	1.05[c]	1.11[b]	1.04[c]	1.02[c]	1.04[c]	0.03	0.01
F/G	1.42	1.41	1.44	1.44	1.39	0.02	0.07
Day 17 wt	18.7[c]	19.5[b]	18.5[c]	18.4[c]	19.2[b]	0.20	0.01
Day 35 wt	35.2[de]	36.8[b]	34.8[de]	34.4[e]	35.5[cd]	0.60	0.01

[a]Each value is the mean of six replications with two pens of 25 pigs per pen sharing a common fence-line feeder as the experimental unit (initially 14.5 lbs of BW). Experimental diets fed from d 7 to d 17, and a common diet was fed from d 17 to d 35 after weaning.
[b,c,d,e]Means having different superscript letters within a row differ ($P<0.05$).