Effects of Supplemental Lysine, Methionine, and Threonine on Weanling Pigs Fed a Low-Protein Milo-Soybean Meal Diet

Gary L. Allee

Summary

Three trials involving 331 weanling pigs (5 to 7 weeks old and weighing 20 to 33 pounds) were conducted to determine the effects of supplementing low-protein starter diets with crystalline amino acids. In trials I and II, milo-soybean meal diets containing 12, 14, or 16% protein were supplemented so each contained the same quantity of lysine as an 18% protein, milo-soybean meal diet. Weight gain and feed efficiency of pigs fed the 16% protein lysine-supplemented diet was equivalent to that of pigs fed the 18% protein milo-soybean meal diet.

Trial III evaluated 14, 16, 18, and 20% protein milo-soybean meal diets and the effects of supplementing the 14% protein diet with lysine, methionine, and threonine. In addition, the effects of supplemental lysine and methionine to the 16% protein diet was also evaluated. Pigs performed similarly on diets containing 14% protein supplemented with lysine, methionine and threonine, 16% protein supplemented with lysine, and 18 or 20% protein milo-soybean meal diets.

These studies indicate that a 16% protein milo-soybean meal diet supplemented with lysine is adequate for pigs weaned at 20 pounds.

Introduction

Increased cost of supplemental protein has stimulated interest in lowering the protein level of starter diets and adding crystalline amino acids. Additionally, a relationship between supplemental lysine, protein content, and diarrhea in young pigs has been suggested. The trials reported here were designed to determine the effects of supplementing low-protein starter diets with amino acids for pigs 5 to 7 weeks old and the influence of reducing the protein level and lysine supplementation on diarrhea in young pigs.

Procedures

General. Pigs were randomly assigned to treatments based on litter and initial weight and were confined in totally slatted floor pens in an environmentally controlled (75°F) nursery.

Pigs had free access to both feed and water throughout the experiment. Composition of the experimental diets are shown in table 2.1. Amino acid additions were made at the expense of milo. L-lysine·HCl, and DL-methionine were added to bring lysine and total sulfur amino acids up to the levels in an 18% protein milo-soybean meal diet (table 2.1).

Table 2.1. Composition of Experimental Diets[a]

Ingredient	Protein Level, %				
	12	14	16	18	20
Ground milo	86.0	80.7	75.1	69.5	64.1
Soybean meal	9.5	15.1	20.9	26.6	32.1
Dicalcium phosphate	2.0	2.0	1.7	1.5	1.4
Limestone	1.0	0.7	0.8	0.9	0.9
Salt	0.5	0.5	0.5	0.5	0.5
Vitamin, trace-mineral and antibiotic premix	1.0	1.0	1.0	1.0	1.0
	100.0	100.0	100.0	100.0	100.0
% lysine	0.48	0.62	0.77	0.92	1.06
% methionine + cystine	0.34	0.40	0.46	0.53	0.58

[a]All diets were fed as pellets.

Trial I. Ninety-five pigs weaned at 5 weeks and averaging 21 pounds were assigned to 15 pens representing three replications of the five dietary treatments shown in table 2.2. Pigs were started on the experimental treatments immediately after weaning to determine the influence of reducing protein levels and adding lysine on the incidence of diarrhea. Weight gain and feed consumption were determined weekly throughout the 42 day trial.

Table 2.2 Performance of Pigs Fed 12, 14, 16, or 18% Protein Diets Supplemented with Lysine (Trial I)[a]

Protein % and lysine added	Daily gain (lbs.)	Daily feed (lbs.)	Feed/gain
1. 12% + 0.575% L-lysine·HCl	0.66[b]	1.82[b]	2.75[b]
2. 14% + 0.40% L-lysine·HCl	0.88[c]	1.99[b]	2.26[c]
3. 16% + 0.213% L-lysine·HCl	0.97[d]	1.95[b]	2.01[c]
4. 18%	0.99[d]	2.01[b]	2.03[c]
5. 18% + 0.125% L-lysine·HCl	1.00[d]	1.87[b]	1.87[c]

[a]Each value is the mean of 19 pigs with an initial weight of 21 pounds. Duration of the trial was 48 days.

[bcd]Means within a column with different superscripts differ significantly ($P<.05$).

Trial II. This trial was similar to trial I except the pigs were weaned at 5 weeks, allowed to recover from stress of weaning 10-14 days, then started on trial. Sixty-five pigs averaging 32 pounds were assigned to one of the five dietary treatments shown in table 2.3. Pigs were fed the experimental diets for 28 days.

Table 2.3. Performance of Pigs Fed 12, 14, 16, or 18% Protein Diets Supplemented with Lysine (Trial II)[a]

Protein % and lysine added	Daily gain (lbs.)	Daily feed (lbs.)	Feed/gain
1. 12% + 0.575% L-lysine·HCl	1.07[b]	2.69[b]	2.51[b]
2. 14% + 0.40% L-lysine·HCl	1.41[c]	2.89[b]	2.05[c]
3. 16% + 0.213% L-lysine·HCl	1.54[d]	2.83[b]	1.84[c]
4. 18%	1.58[d]	2.94[b]	1.86[c]
5. 18% + 0.125% L-lysine·HCl	1.59[d]	2.75[b]	1.73[c]

[a]Each value is the mean of 13 pigs with initial weight of 32 pounds. Duration of the trial was 28 days.

[bcd]Means within a column with different superscripts differ significantly ($P<.05$).

Trial III. This trial was conducted to determine the effects protein level has on the performance of young pigs and to determine which amino acid or acids besides lysine were limiting in a 14% protein diet. Pigs were handled as in trial II; 153 averaging 33 pounds were distributed among 27 pens representing three replications of the nine dietary treatments shown in table 2.4. Pigs remained on the experimental diets for 28 days.

Results and Discussion

Results of trial I and II are shown in 2.2 and 2.3 respectively. Pigs fed the 16% protein lysine supplemented diet gained at the same rate and were just as efficient in feed utilization as the pigs consuming the 18% protein-milo soybean meal control diet. Lysine addition (0.1% L-lysine) to the 18% protein diet did not improve either daily gain or feed efficiency. Pigs fed diets containing either 12 or 14% protein supplemented with lysine gained slower ($P<.05$) and required more feed per unit of gain than pigs fed the 18% protein control diet.

Table 2.4. Effects of Protein Level and Amino Acid Supplementation on the Performance of Weanling Pigs (Trial III)[a]

Protein % and amino acids added	Daily gain (lbs.)	Daily feed (lbs.)	Feed/gain
1. 14% milo-SBM	1.13[d]	2.98[b]	2.64[b]
2. As 1 + 0.40% L-lysine·HCl	1.38[bc]	2.93[b]	2.12[c]
3. As 2 + 0.20% DL-methionine	1.32[c]	2.77[b]	2.10[c]
4. As 3 + 0.10% L-threonine	1.43[b]	2.69[b]	1.89[d]
5. 16% milo-SBM	1.37[bc]	2.89[b]	2.11[c]
6. As 5 + 0.213% L-lysine·HCl	1.44[b]	2.88[b]	2.00[cd]
7. As 6 + 0.15% DL-methionine	1.40[bc]	2.78[b]	1.98[cd]
8. 18% milo-SBM	1.44[b]	2.85[b]	1.98[cd]
9. 20% milo-SBM	1.45[b]	2.82[b]	1.94[cd]

[a]Each value is the mean of 17 pigs with an initial weight of 33 pounds.

[bcd]Means within a column with different superscripts differ significantly ($P<.05$).

Close attention was given to fecal consistency during trials I and II since it has been suggested that low-protein diets and or lysine may be beneficial in reducing the incidence of diarrhea. In trial I weekly performance of pigs given no adjustment period after weaning, showed no advantage for low-protein diets containing lysine on the incidence of diarrhea. Likewise, the 18% protein diet supplemented with 0.1% L-lysine had no advantage over the 18% protein control diet. However, pig performance was very satisfactory in both trials and diarrhea was not a serious problem.

Results of trial III are shown in table 2.4. The 14% protein milo-soybean meal diet produced the slowest and most inefficient gains. The addition of lysine to the 14% protein diet markedly improved daily gain and feed efficiency. Methionine addition to the lysine supplemented 14% protein diet gave no beneficial response. The addition of threonine to the 14% protein diet supplemented with lysine and methionine resulted in a small but nonsignificant increase in daily gain but significantly ($P<.05$) improved feed efficiency. Thus suggesting that threonine was the limiting factor in the 12 and 14% protein lysine supplemented diets in trials I and II.

Lysine supplementation of the 16% protein diet resulted in slight (5%) improvement in daily gain and feed efficiency. Methionine addition to the lysine supplemented 16% protein diet had no effect. Pigs performed similarly on the 18 and 20% protien diets.

The lack of response to the addition of methionine suggests that the sulfur amino acids were adequate in the 14% protein diet. NRC (1968) lists the requirement for methionine plus cystine as 0.8% of the diet for pigs weighing 12 to 22 pounds and 0.50% for pigs weighing 44 to 77 pounds. The 14% protein diet contained 0.40% methionine plus cystine but pigs failed to respond to added methionine. These results suggest that the NRC requirements for total sulfur amino acids is high, since the actual requirement does not appear to exceed 0.46% for weanling pigs fed a 16% protein diet.