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AMINO ACID DEFICIENCIES IN A LYSINE SUPPLEMENTED LOW-PROTEIN SUNFLOWER MEAL DIET FOR YOUNG PIGS

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SWINE 84-1

There has been a dramatic increase in sunflower production during the past few years. Sunflower seeds are used primarily for the production of sunflower oil, thus, the by-product of this process is sunflower meal which is available for livestock use. Processes that remove much of the hull, result in a meal that has a protein content similar to that of soybean meal. However, the lysine level of sunflower meal is only approximately 58% of the level in soybean meal. Since synthetic lysine is now readily available it is possible that lysine supplemented sunflower meal could be an alternative for soybean meal in swine diets. This study was conducted to determine other limiting amino acids in a lysine supplemented, 12% protein, corn-sunflower meal diet for young pigs.

Experimental Procedure

Seventy-seven crossbred, weaned pigs weighing an average of approximately 20 lb were allotted by litter, weight and sex to seven dietary treatments. Each treatment was replicated three times with four pigs/pen in two replicates and three pigs/pen in the other replicate. Pigs were housed in an environmentally controlled nursery having plastic or plastic-coated expanded metal floors. Pigs were weighed weekly during the five week experiment. Blood samples were collected from all pigs on day 28 of the experiment and were analyzed for urea nitrogen.

The compositions of the 12 and 16% protein diets are shown in Table 1. Both diets were supplemented with synthetic lysine at levels above National Research Council (NRC) recommendations. Lysine was calculated to be equal in all diets.

Treatment 1 - 12% protein sunflower meal diet plus .5% L-lysine
Treatment 2 - Diet 1 plus .05% L-tryptophan
Treatment 3 - Diet 1 plus .1% L-threonine
Treatment 4 - Diet 2 plus .1% L-threonine
Treatment 5 - Diet 4 plus .1% L-isoleucine
Treatment 6 - Diet 5 plus .1% DL-methionine
Treatment 7 - 16% protein sunflower meal diet plus .37% L-lysine

Table 1. Composition of Experimental Diets (%)

Ingredient	12% protein	16% protein
Yellow corn	86.7	74.67
Sunflower meal, 41% C.P.	10.2	22.7
Dicalcium phosphate	1.25	.65
Ground limestone	.8	1.1
Salt, white	.3	.3
Trace mineral premix[a]	.05	.05
Vitamin-additive premix[b]	.18	.18
L-lysine monohydrochloride	.64	.47

[a] Supplied the following minerals in ppm: zinc, 100; iron, 75; copper, 7.5; manganese, 25; iodine, .175 and selenium, .1.

[b] Supplied the following per lb of diet: vitamin A, 1500 IU; vitamin D, 150 IU; vitamin E, 5 IU; vitamin K, 1 mg; riboflavin, 1.5 mg; pantothenic acid, 6 mg; niacin, 8 mg; vitamin B_{12}, 6 mcg and chlortetracycline, 25 mg.

Results

Rate of gain, daily feed consumption, feed/gain and blood urea nitrogen data are summarized in Table 2. Pigs fed the low protein control diet (treatment 1) gained slower and were less efficient in feed utilization than pigs fed the 16% protein diet. Supplementing the low protein diet with tryptophan or threonine alone did not improve pig performance. However, supplementation with tryptophan and threonine together resulted in increased rate of gain and reduced feed/gain. Pig performance was not improved further when isoleucine and methionine were added with tryptophan and threonine. Rate of gains, feed consumption and feed efficiency did not differ among pigs fed the 16% protein diet (treatment 7) and those pigs fed the 12% protein diet supplemented with tryptophan and threonine (treatment 4), these two amino acids plus isoleucine (treatment 5) or the above three amino acids plus methionine (treatment 6).

Blood urea nitrogen levels were lowest in pigs receiving the low protein diet supplemented with tryptophan and threonine or the combination of these amino acids with isoleucine or isoleucine and methionine. A lower blood urea nitrogen level indicates an improvement in amino acid balance of the diets. The higher level of blood urea nitrogen of pigs fed the 16% protein diet indicates that an excess of some amino acids probably existed in this diet.

Summary

Seventy-seven young weaned pigs averaging 20 lb were used to study the amino acid deficiencies of a lysine supplemented, 12% protein corn-sunflower meal diet.

Rate of gain, feed intake and feed efficiency of pigs were improved when the 12% protein diet was supplemented with both tryptophan and threonine. Isoleucine and methionine supplementation did not improve pig performance.

Results of this experiment indicate that a 12% protein corn-sunflower meal diet, supplemented with adequate lysine, is next limiting in tryptophan and threonine and that supplements of both amino acids are necessary for optimum pig performance. The 12% protein diet appeared to be adequate in isoleucine and methionine.

Table 2. Effect of Amino Acid Supplementation of a Low-Protein, Lysine Supplemented Sunflower Meal Diet

Diet			12% protein + lysine				16% protein + lysine
Added tryptophan, %	0	.05	0	.05	.05	.05	0
Added threonine, %	0	0	.1	.1	.1	.1	0
Added isoleucine, %	0	0	0	0	.1	.1	0
Added methionine, %	0	0	0	0	0	.1	
Treatment No.	1	2	3	4	5	6	7
Initial wt, lb[a]	21.4	21.5	21.6	21.5	21.5	21.9	21.5
Final wt, lb	43.8[b]	49.2[b,c]	44.2[b]	56.4[c,d]	58.3[d]	58.0[d]	59.1[d]
Avg daily gain, lb	.64[b]	.79[b,c]	.65[b]	1.00[c,d]	1.05[d]	1.03[d]	1.07[d]
Avg daily feed, lb	1.89[b,c]	2.17[b,c]	1.71[b]	2.35[d]	2.45[d]	2.44[d]	2.43[d]
Feed/gain	2.87[b]	2.75[b]	2.63[b,c]	2.37[c,d]	2.33[d]	2.38[c,d]	2.27[d]
Blood urea nitrogen, mg/dl	11.0[b]	11.4[b]	11.1[b]	9.4[b,c]	7.9[c]	9.6[b,c]	14.8[d]

[a] Three lots of four, four and three pigs each per treatment.

[b,c,d] Means in the same row with unlike superscripts differ ($P<.05$).