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EFFECT OF ADDED TRYPTOPHAN IN A LYSINE SUPPLEMENTED LOW-PROTEIN, CORN-SOYBEAN MEAL DIET

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South Dakota's production of sunflowers has been increasing during recent years and sunflowers are now recognized as an important crop in the state. Sunflowers are an excellent source of oil, with certain varieties containing up to 40% oil. Similar to soybean meal, the by-product of sunflower oil processing is a meal which can be used as a source of protein in formulating swine rations. A previous experiment, reported in the 1983 Swine Field Day Proceedings, indicated that the limiting amino acids in a corn-sunflower meal diet are lysine, tryptophan and threonine.

This study was conducted to identify the optimum level of tryptophan in a lysine fortified low-protein, corn-sunflower meal diet for young growing pigs.

Experimental Procedure

Two hundred eighty-eight weaned pigs averaging 14.3 lbs were used in the two trials of this study. Pigs were allotted to six dietary treatments according to weight and ancestry with six pigs per pen and each treatment was replicated four times. Pigs were housed in an environmentally controlled lab in the Animal Science Complex and provided feed and water ad libitum during the 28 day trials. Pig weights and feed weighbacks were taken weekly. Blood samples were collected on day 28 for serum urea nitrogen determination. DL-tryptophan, which has been shown to be 80% available, was used as the tryptophan source to supply the specified L-tryptophan levels used in trial two.

The composition of the diets for the two trials are shown in Table 1. Experimental treatments were as follows:

Trial one:

1. 13% C.P. sunflower meal basal plus .89% L-lysine .15% L-threonine, .1% L-ieoleucine and .1% DL-methioninee
2. Diet one plus .02% L-tryptophan
3. Diet one plus .04% L-tryptophan
4. Diet one plus .06% L-tryptophan
5. Diet one plus .08% L-tryptophan
6. 18% C.P. sunflower meal basal plus .62% L-lysine

Trial two:

1. 13% C.P. sunflower meal basal plus .84% L-lysine, .15% L-threonine, .1% L-isoleucine and .1% DL-methionine
2. Diet one plus .0375% DL-tryptophan (.03% L-tryptophan)
3. Diet one plus .075% DL-tryptophan (.06% L-tryptophan)
4. Diet one plus .113% DL-tryptophan (.09% L-tryptophan)
5. 18% C.P. sunflower meal basal plus .62% L-lysine
6. 18% C.P. soybean meal basal plus .15% L-lysine

Table 1. Composition of Experimental Diets (%)

Ingredient	Sunflower Meal 13% protein	Sunflower Meal 18% C.P.	Soybean Meal 18% C.P.
Yellow corn	78.3	58.95	61.29
Sunflower meal	12.57	27.87	--
Soybean meal	--	--	25.6
Dried whey	10.0	10.0	10.0
Dicalcium phosphate	.9	1.2	.76
Salt (white)	.3	.3	.3
Trace mineral premix	.05	.05	.05
Vitamin premix	.04	.04	.04
ASP-250 [a]	.25	.25	.25
L-lysine HCl	.84	.62	.15
L-threonine	.15	--	--
L-isoleucine	.1	--	--
DL-methionine	.1	--	--

[a] Aureomycin, sulfamethazine, penicillin.

Results

Trial One

Growth performance and blood urea nitrogen data are summarized in Table 2. Average daily gains increased linearly as tryptophan was added to the diets. Gains increased in all treatments when tryptophan was supplemented to the low-protein basal diet; however, supplementing this diet with .02 or .06% tryptophan resulted in non-significant increases in gain, while gains of pigs fed diets containing .04 and .08% added tryptophan were greater ($P<.05$) than those of pigs fed the unsupplemented diet. Pigs in treatment six, fed the 18% protein sunflower meal diet, gained faster and were more efficient in feed utilization than pigs fed each of the 13% protein diets.

There was a linear ($P<.01$) decrease in feed/gain with the addition of tryptophan to the 13% protein basal diet. However, feed/gain did not differ significantly among pigs fed diets supplemented with .02 to .08% L-tryptophan. Pigs fed the 18% protein diet had the best feed utilization and required significantly less feed/gain than pigs fed all other diets. Average daily feed intake was lower ($P<.05$) for pigs fed the 13% protein unsupplemented diet (treatment 1).

Serum urea nitrogen levels decreased significantly as tryptophan was supplemented to diets 2, 3 and 4 indicating a better balance of amino acids in these diets. The increase in serum urea nitrogen values for the 18% protein diet may be a result of an excess of amino acids for the young growing pig.

Trial two

Growth performance and blood urea nitrogen data are summarized in Table 3.

Pigs fed the 18% protein diets gained faster and utilized feed better than pigs fed the 13% protein diets. There were no significant differences in average daily gains or feed efficiencies between the 13% protein basal and this diet supplemented with .03, .06 or .09% L-tryptophan. Feed consumption did not differ significantly among treatments.

Daily gains were similar when pigs were fed the corn-soybean meal diet (treatment 6) or the corn-sunflower meal diet (treatment 5). However, pigs fed the soybean meal diet utilized feed more efficiently than those fed the sunflower meal diet.

Serum urea nitrogen levels decreased as tryptophan was supplemented to the diets. The increase of serum urea nitrogen in the 18% protein rations most likely indicate an excess of amino acids for the young growing pig.

The results of trial one indicate that as tryptophan is supplemented to the 13% protein basal diet average daily gain and feed utilization improve. Serum urea nitrogen values also indicate a better balance of amino acids for the young pig as tryptophan is added. These data suggest that at least .04% supplemental tryptophan is needed in 13% protein sunflower meal diets.

The results of trial two were inconclusive showing no enhancement of performance with added tryptophan as was found in trial one. In both trials, pigs fed the 18% sunflower meal diet performed better than pigs fed the lower protein tryptophan supplemented diet. These results suggest that the low protein diet may have been deficient in total nitrogen or some other nutrient. Comparing the 18% protein corn-sunflower meal diet with the 18% protein corn-soybean meal diet resulted in no difference in average daily gains but significantly better feed utilization occurred when pigs were fed the 18% soybean meal

diet. Serum urea nitrogen values indicated a better amino acid balance with the addition of tryptophan.

Summary

An experiment consisting of two trials, utilizing two hundred eighty-eight pigs, was conducted to identify the optimum level of tryptophan required by the young growing pig fed an amino acid fortified 13% protein diet.

Trial one indicated better performance of the growing pig when .04 to .08% L-tryptophan was added to the 13% protein basal diet that contained .14% tryptophan. In trial 2, pig performance did not improve when the low protein diet was supplemented with tryptophan. However, serum urea nitrogen data suggest that these diets were improved in amino acid balance by supplemented tryptophan. Improved growth and feed efficiency of pigs fed the higher protein diets indicate that the low protein diet might have been deficient in some other nutrient(s).

Table 2. Effect of Dietary Tryptophan Levels on Performance of Young Weaned Pigs (trial 1)

Diet	13% protein					18% protein
Added L-tryptophan	0	.02	.04	.06	.08	0
Treatment	1	2	3	4	5	6
Initial wt, lb[a]	13.6	13.7	13.9	13.7	13.8	13.9
Final wt, lb	28.8^{b}	$30.1^{b,c}$	31.9^{c}	$30.8^{b,c}$	32.5^{c}	35.2^{d}
Avg daily gain, lb[e]	$.54^{b}$	$.59^{b,c}$	$.64^{c}$	$.61^{b,c}$	$.66^{c}$	$.77^{d}$
Avg daily feed, lb	1.02^{b}	1.14^{c}	1.26^{d}	$1.20^{c,d}$	$1.24^{c,d}$	1.28^{d}
Feed/gain[e]	2.05^{b}	1.94^{c}	1.95^{c}	$1.96^{b,c}$	1.88^{c}	1.73^{d}
Serum urea nitrogen mg/100 ml[f]	$8.1^{b,c}$	5.7^{d}	6.0^{d}	5.9^{d}	$6.5^{c,d}$	9.9^{d}

[a] Four lots of six pigs each per treatment.

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

[e] Significant linear response, ($P<.01$).

[f] Significant quadratic response, ($P<.003$).

Table 3. Effect of Dietary Tryptophan Levels on Performance of Young Weaned Pigs (trial 2)

Diet	13% protein SFM				18% protein SFM	18% protein SBM
Added L-tryptophan, %	0	.03	.06	.09	0	0
Treatment	1	2	3	4	5	6
Initial wt, lb[a]	15.1[b]	15.0[b]	14.6[b]	15.0[b]	15.1[c]	15.0[c]
Final wt, lb	33.8[b]	33.4[b]	34.5[b]	34.4[b]	38.3[c]	38.5[c]
Avg daily gain, lb	.67[b]	.66[b]	.70[b]	.70[b]	.83[c]	.84[c]
Avg daily feed, lb	1.32[b]	1.33[b]	1.35[b]	1.40[b]	1.47[c]	1.40[d]
Feed/gain	1.98[b]	2.03[b]	2.00[b]	2.02[b]	1.83[c]	1.67[d]
Serum urea nitrogen mg/100 ml	9.1[b]	7.3[c]	5.9[c]	6.5[c]	10.1[b]	13.3[d]

[a] Four lots of six pigs each per treatment.

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