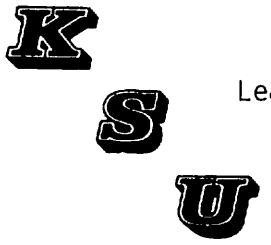

Limiting Order of Amino Acid in Alfalfa Leaf Protein Concentrate (ALPC) for Growing Pigs

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Summary

Seventy-two crossbred pigs averaging 23.5 lb initially and 12 crossbred barrows averaging 31.5 lb initially were used to study the limiting order of amino acids in ALPC for growing pigs in a feeding trial and a nitrogen balance trial. The basal diet contained 20% ALPC, as the amino acids source, and dextrose, as the energy source. Pigs fed the basal diet supplemented with methionine gained faster ($P<.05$) and more efficiently than pigs fed the basal diet, indicating that methionine was the first limiting amino acid in ALPC. Adding L- isoleucine (.2%) in the presence of methionine and lysine improved daily gain and feed efficiency ($P<.05$). These results suggest that isoleucine is the second limiting amino acid. Results from the nitrogen balance trial showed that adding .3% DL-methionine increased nitrogen retention ($P<.05$), confirming the growth trial results that showed methionine to be the first limiting amino acid in ALPC for growing pigs.

Introduction

Alfalfa leaf protein concentrate (ALPC) is a high protein feed made from the wet fractionation of fresh alfalfa. The commercially produced ALPC we used contained 55.8% crude protein, 5.37 kcal/g of gross energy on a dry matter basis. The lysine content of ALPC was 3.41% and similar to that found in the dehulled soybean meal (Table 7). The sulfur amino acids appear to be the first limiting ones in ALPC, so our objective was to determine the limiting order of amino acids in ALPC for growing pigs.

Experimental Procedures

In the feeding trial, 72 pigs averaging 23.5 lb initially were allotted to treatments based on initial weight and sex to 24 pens with four replications of the six dietary treatments. The basal diet (Table 8) contained 20% ALPC as the amino acids source with dextrose as the energy source. The treatments were: A) basal diet, B) basal + .3% DL-methionine, C) basal + .35% L-lysine HCL, D) C + .3% DL-methionine, E) D + .2% L-isoleucine, and F) 17% protein corn-soybean meal positive control. Pigs were offered feed and water and ad libitum in an environmentally controlled nursery with concrete slatted floor pens.

Table 7. Essential Amino Acid Compositions of Alfalfa Leaf Protein Concentrate and Dehulled Soybean Meal Compared

Amino acid	ALPC %	Dehulled soybean meal %
Arginine	3.45	4.11
Histidine	2.30	1.44
Isoleucine	2.36	2.89
Leucine	4.00	4.22
Lysine	3.41	3.53
Methionine	1.02	.78
Cystine	.71	.78
Phenylalanine	3.53	2.33
Tyrosine	2.66	2.22
Threonine	2.89	2.12
Valine	2.95	3.00
Total amino acid	31.95	28.16
Crude protein	55.81	53.89

Dry matter basis.

Table 8. Composition of Basal Diets Fed Growing Pigs

Diet	A %	F %
Ground corn	--	70.5
Soybean meal	--	25.0
ALPC	20.0	--
Dextrose	70.4	--
Tallow	5.0	--
Calcium phosphate, dibasic	2.8	1.6
Limestone	.3	1.4
Salt	.5	.5
Premix	1.0	1.0
Total	100.0	100.0
Calculated value, %		
Crude protein	10.05	17.20
Met. + Cys.	.34	.63
Lysine	.64	.90
Isoleucine	.44	.88

A randomized complete block design was used in the nitrogen balanced trial. Twelve barrows averaging 31.5 lb, selected from 3 litters, were housed individually in metabolism cages in the environmentally controlled building (temp. 74 F).

Four pigs in each litter were randomly assigned to one of the four treatments (diets A, B, C, and D) used in the feeding trial.

Results and Discussion

In the feeding trial, pigs fed the basal diet supplemented with methionine gained faster ($P<.05$) and more efficiently than pigs fed the basal diet, indicating that methionine was the first limiting amino acid in ALPC for growing pigs (table 9). Adding lysine with or without methionine did not significantly improve performance. Adding L-isoleucine (.2%) in the presence of methionine and lysine improved both daily gain and feed efficiency, when compared to pigs fed the diet supplemented with methionine and lysine ($P<.05$). These results suggest that isoleucine is the second limiting amino acid.

The results of a nitrogen balance trial showed that adding DL-methionine (.3%), Table 10, to the basal diet increased nitrogen retention .88 g/day and the biological value ($P<.05$). Adding L-isoleucine (.2%) to the basal diet with methionine and lysine tended to increase nitrogen retention, but not significantly. The nitrogen balance data confirmed the results of growth trial, which indicated that methionine is the first limiting amino acid in ALPC for growing pigs.

Table 9. Performance of Growing Pigs Fed ALPC Diets, Supplemented With DL-Methionine, L-lysine and L-Isoleucine[a]

Diet	Daily gain lb/day	Feed/Gain
A Basal diet, 20% ALPC	0.51^{e}	3.43^{cd}
B Basal + .3% methionine	0.66^{cd}	3.18^{cd}
C Basal + .35% lysine	0.53^{de}	3.91^{c}
D As B + .35% lysine	0.59^{de}	3.48^{c}
E As D + .20% isoleucine	0.75^{c}	2.72^{de}
F Corn-soybean, 17% protein	1.23^{b}	2.20^{e}

[a]Each value is the mean of four pens of three pigs each with an initial weight of 23.5 lb for a 28-day feeding trial.

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

Table 10. Apparent Protein Digestibility and Nitrogen Retention of Pigs Fed ALPC Diets Supplemented with DL-Methionine, L-Lysine and L-Isoleucine[a]

Diet	Apparent protein digestibility, %	Nitrogen retention g/day	Nitrogen retention BV[b]
A Basal diet	80.2[c]	6.10[d]	68.6[d]
B As A+.3% methionine	82.2[c]	6.79[c]	73.6[c]
D As B+.35% lysine	81.1[c]	6.55[cd]	70.4[cd]
E As D+.2% isoleucine	80.5[c]	6.87[c]	73.3[c]

[a]Each value is the mean of two periods of three pigs, each averaging 31.5 lb initially.

[b]Biological value, nitrogen retained as percentage of nitrogen digested.

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