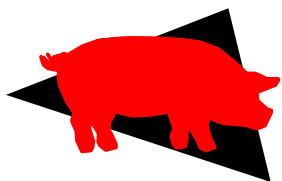


SWINE RESEARCH REPORT 9



Supplemental L-Lysine HCl Improves Amino Acid Balance of Corn-Soybean Meal Diets for Growing-Finishing Swine, Resulting in Improved Performance

Objective

To evaluate the performance of finishing swine fed corn-soybean meal diets at two levels of crude protein (12 and 14%) supplemented with L-Lysine HCl and determine the effects of improving amino acid balance to approximate that of ideal protein.

Experimental Procedures

Animals

Crossbred pigs with an average initial weight of 56 kg were assigned to pens by initial weight, sex and litter origin. The experiment was a randomized factorial design with 8 diets x 3 replicated x 5 pigs per pen for a total of 120 animals. Pigs were housed in a semi-enclosed concrete barn with partially slatted floors.

Diets

The composition of experimental diets is shown in Table 1. The eight treatment groups, arranged as a 2 x 4 factorial, were as follows:

Treatment No.	Dietary Protein (%)	Supplemental Crystalline Lysine (%)	Total Lysine (%)
1	12	.00	.51
2	12	.10	.59
3	12	.20	.67
4	14	.30	.74
5	14	.00	.66
6	14	.10	.74
7	14	.20	.82
8	14	.30	.89

Feed and water were offered ad libitum

Table 1. Composition of experimental diets (%)

	12				14			
	0	.1	.2	.3	0	.1	.2	.3
Corn	87.50	87.40	87.30	87.20	82.40	82.30	82.20	82.10
Soybean meal	9.50	9.50	9.50	9.50	14.60	14.60	14.60	14.60
Dicalcium phosphate	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Limestone	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Iodized salt	.20	.20	.20	.20	.20	.20	.20	.20
Trace minerals ^a	.10	.10	.10	.10	.10	.10	.10	.10
Vitamin premix ^b	.10	.10	.10	.10	.10	.10	.10	.10
L-Lysine HCl	--	.10	.20	.30	--	.10	.20	.30

^aSupplied by Calcium Carbonate Company, Quincy, IL. Contained 20% zinc; 10% iron, 5.5% manganese, 1.1% copper, 0.15 iodine; 0.10% cobalt and 2% calcium

^bContained 13,200 mg riboflavin; 44,000 ng niacin; 26,400 mg pantothenic acid; 176,000 mg choline chloride, 22,000 mcg vitamin B₁₂, 5,500,000 IU vitamin A; 880,000 IU vitamin D₃ and 22,000 IU vitamin E per kg of premix

Results

Protein (%)	12				14			
Crystalline lysine (%)	0	.1	.2	.3	0	.1	.2	.3
Avg initial wt, kg	56.11	56.14	56.11	56.17	56.14	56.17	56.11	56.17
Avg final wt, kg	94.61	96.58	99.88	99.00	99.52	100.94	101.00	99.58
ADG, kg	.67 ^c	.70 ^{bc}	.76 ^{ab}	.74 ^{abc}	.76 ^{ab}	.78 ^{ab}	.79 ^a	.75 ^{abc}
ADFI, kg	2.64	2.79	2.78	2.75	2.95	2.76	2.77	2.56
Feed/gain	3.95 ^d	3.98 ^d	3.64 ^c	3.72 ^c	3.89 ^{cd}	3.55 ^{ab}	3.51 ^{ab}	3.44 ^a

^{a,b,c,d}Means in the same row with different superscripts are different (P<.05)

Item	Main Effects					
	Protein		Supplemental Lysine			
	12%	14%	0	.1%	.2%	.3%
Avg int wt, kg	56.14	56.15	56.13	56.16	56.11	56.17
Avg final wt, kg	97.52	100.26	97.06	98.76	100.44	99.29
ADG, kg ^a	.72	.77	.71	.74	.78	.74
ADFI, kg	2.74	2.76	2.79	2.78	2.78	2.65
Feed/gain ^b	3.82	3.60	3.92	3.76	3.58	3.58

^aProtein effect (P<.05)
^bSupplemental lysine level linear effect (P<.05)

Treatment		Chemical Score	Ideal Protein Intake ²	ADG	ADFI	F/G
CP ¹	Lys ¹	(%)	(g/d)	(kg/d)	(kg/d)	
12	.51	66	209	.67	2.64	3.89
12	.59	77	258	.70	2.79	3.55
12	.67	87	290	.76	2.78	3.51
12	.74	96	317	.74	2.75	3.44
14	.66	73	301	.76	2.95	3.95
14	.74	82	317	.78	2.76	3.98
14	.82	91	353	.79	2.77	3.64
14	.89	97	348	.75	2.56	3.72

¹Calculated
²Ideal protein intake = CP (g/kg) x Chemical score x Feed intake (kg)
Chemical score was calculated as follows:
Chemical score = $\frac{\text{AA concentration in dietary protein} \times 100}{\text{AA concentration in ideal protein}}$
Ideal protein based upon Wang and Fuller (1989)

Compared to pigs fed the unsupplemented 12% CP diets, the inclusion of .2% crystalline lysine in the 12% CP diet permitted pig growth rate equivalent (P<.05) to pigs fed the 14% CP diets regardless of crystalline lysine supplementation. Adding crystalline lysine to the 14% CP diet did not improve (P<.05) average daily gain compared to pigs fed the unsupplemented 14% CP diet.

Pigs fed the unsupplemented 12%CP diet required more (P<.05) feed per unit body weight gain when compared to pigs fed 12% CP diets supplemented with .2 or .3% crystalline lysine or 14% CP with .1, .2 or .3% crystalline lysine (Table 2). However, feed efficiency of pigs fed the two unsupplemented diets (12 or 14% CP) or the 12% CP diets containing .1% crystalline lysine did not differ (P<.05). The imposed dietary treatments did not influence (P<.05) daily feed intake.

Average daily gain and feed efficiency of pigs fed 14% CP diets (averaged across all lysine levels) were increased (P<.05) compared to pigs fed the 12% CP diets (Table 3). Feed intake did not differ (P<.05) between pigs fed the two dietary protein levels. Comparing the supplemental lysine main effects, addition on graded levels of crystalline lysine (0, .1, .2 and .3%) resulted in linear (P<.05) reduction in feed to gain ratio. However, increasing

Discussion

A summary of the performance data is presented in Table 2. The average daily gain of pigs fed the unsupplemented 12% CP diet was depressed (P<.05) compared to pigs fed the 12% CP diet containing .2% crystalline lysine or diets containing 14% CP unsupplemented or 14% CP diets supplemented with .1 or .2% crystalline lysine.

the lysine supplementation did not influence ($P < .05$) feed intake or growth rate of pigs. Although pig growth tended to plateau with the inclusion of .2% supplemental lysine and declined when .3% lysine was included, there was not an interaction ($P < .10$) between protein level and crystalline lysine supplementation.

Although statistically significant ($P < .05$) differences in feed intake were not observed, there were rather large differences in feed intake when lysine was supplemented to both the 12 and 14% CP diet. The effect of L-Lysine HCl was not the same in both cases. Addition of L-Lysine HCl to the 12% CP diet reflected in an increase in feed intake from 110 to 150g/d. When L-Lysine HCl was supplemented to the 14% CP diet feed intake declined by 190 g/d with a further decline to 390 g/d occurring at the highest level of L-Lysine HCl supplementation (.3%). This effect of crystalline lysine supplementation to diets differing in CP content on feed intake may possibly be explained by the ideal protein concept.

The change in feed intake was similar to that observed by other researchers when lysine was supplemented ranging from deficiency to excess to an otherwise ideal protein (Cole, 1983, 1984; Ballard, 1986). These researchers observed an initial increase in feed consumption as lysine supplementation allowed amino acid balance to approach ideal protein. This was followed by a sharp decrease in feed intake as additional supplemental lysine caused dietary lysine levels to exceed ideal protein. When considering the addition of .3% crystalline lysine to the 14% CP diets, lysine was clearly in excess of ideal protein and not the first limiting amino acid. Further research needs to be conducted to more clearly define this relationship between ideal protein and feed intake, particularly as it relates to dietary lysine levels.

A numerical increase in growth rate was observed with corresponded to an increase in ideal protein intake (Table 4). This same general trend was observed for feed efficiency. The differences observed in feed efficiency with lysine supplementation are best explained by a slight improvement in growth rate coupled with a more pronounced change in feed intake.

Conclusion

Lysine supplementation of diets containing lower CP (12 vs. 14%) will maintain performance levels similar to pigs fed higher CP diets. Increased performance is obtained when L-Lysine HCl is added in sufficient quantities to supply the lysine requirement of finishing swine. Improving amino acid balance of corn-soybean meal diets increases ideal protein intake, thereby improving performance of growing-finishing swine.

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