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Amino Acid Supplementation of Wheat and Milo for the Finishing Pig

G. L. Allee and R. H. Hines

Summary

Two experiments involving 214 pigs were conducted to evaluate milo and wheat as the sole sources of amino acids for finishing swine, and the effects of supplementing these grains with lysine and methionine. Without supplemental lysine wheat and milo diets were inadequate for finishing pigs as measured by growth rate, feed efficiency, and loin eye area. There were no significant differences in daily gain or feed efficiency among the pigs fed wheat + lysine, milo + lysine + methionine, wheat + soybean meal or milo + soybean meal. Pigs fed milo supplemented with only lysine gained slower, had a smaller loin eye area, and tended to be less efficient in feed utilization than the pigs fed milo + soybean meal. The results indicate that lysine is the only limiting amino acid in wheat for the finishing pig, while milo must be supplemented with both lysine and methionine.

Procedures

Two experiments involving 214 finishing pigs were conducted. Pigs were allotted to treatments from outcome groups formed on the basis of breed, weight and sex. The amino acid compositions of the wheat and milo employed in these experiments are shown in table 1. All diets were fed in pellet form. Pigs were individually removed for slaughter when they weighed approximately 220 pounds.

Experiment I. Ninety-five pigs averaging 123 pounds were used to evaluate the following diets: (1) milo alone, (2) milo + lysine, (3) 15% crude protein milo + soybean meal, (4) wheat alone, and (5) wheat + lysine. Diets 2, 3, and 5 contained the same level of lysine. All diets had identical vitamin and trace mineral fortifications (table 2) and were fed ad libitum. This experiment was conducted during the winter in an enclosed building with propane heaters supplying supplemental heat. The performance data were summarized after 48 days.

Table 1. Adequacy of Wheat or Milo for Supplying the Amino Acid Needs of the Finishing Pig

Amino acid	Requirement[a] %	Content of grain[b]			
		Wheat		Milo	
		Trial I	Trial II	Trial I	Trial II
Arginine	0.15	0.63	0.66	0.38	0.35
Histidine	0.14	0.27	0.27	0.23	0.22
Isoleucine	0.35	0.41	0.42	0.36	0.39
Leucine	0.40	0.84	0.86	1.22	1.30
Lysine	0.50	0.38	0.40	0.25	0.23
Methionine[c]	0.30 (0.18)	0.17	0.14	0.12	0.11
Phenylalanine	0.32	0.51	0.56	0.47	0.40
Threonine	0.27	0.37	0.38	0.33	0.34
Tryptophan	0.07	----	----	----	----
Valine	0.28	0.54	0.64	0.48	0.51
Crude Protein, %	12-14	12.50	12.70	9.40	10.60

[a]Requirements expressed as percent of the diet based on 12% crude protein diet.

[b]Amino acid analyses conducted by Dr. Charles Deyoe, Department of Grain Science, KSU.

[c]Cystine can satisfy at least 40% of the total need for methionine. Thus, with adequate cystine, 0.18% methionine meets the requirement.

Table 2. Composition of Diets (Experiment I)

Grain	Milo	Milo	Milo	Wheat	Wheat
Supplement	None	Lysine	SBM	None	Lysine
Ingredient	%	%	%	%	%
Ground milo	96.0	95.1	79.1	96.0	95.3
Soybean meal (44%)	----	----	17.0	----	----
Dicalcium phosphate	2.0	2.0	1.6	2.0	2.0
Limestone	0.5	0.5	0.8	0.5	0.5
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
Lysine supplement[a]	---	0.9	---	---	0.7
Lysine concentration,%	0.24	0.69	0.68	0.36	0.70

[a]Contains 50% L-Lysine activity. Lyamine 50 was supplied by Merck and Company., Rathway, N.J.

Experiment II. One hundred ninteen pigs averaging 111 pounds were fed the following diets: (1) milo alone, (2) milo + lysine, (3) milo + lysine + methionine, (4) 14% crude protein milo + soybean meal, (5) wheat alone, (6) wheat + lysine, or (7) 14% crude protein wheat + soybean meal. The composition of the diets used in experiment II are shown in table 3. Diets 2, 3, 4, 6, and 7 contained the same level of lysine and all diets had identical vitamin, trace mineral, and antibiotic fortifications. The performance data were summarized after 54 days.

Results and Discussion

The results of experiment I are shown in table 4. Without supplemental lysine, wheat and milo were inadequate for finishing pigs as measured by growth rate, feed efficiency, and loin eye area. Pigs on wheat alone gained significantly ($P<.05$) faster and were more efficient in feed utilization than pigs on milo alone. Increased lysine content of wheat (0.38) over milo (0.25) probably accounted for this difference. Adding lysine to the milo diet increased gain and feed efficiency. However, milo supplemented with lysine was inferior to milo supplemented with soybean meal as measured by rate of gain and loin eye area, which suggest that some other amino acid limited performance of pigs on the milo + lysine diet. Wheat supplemented with lysine equalled milo + SBM for finishing pigs from 125 to 220 pounds.

The results of experiment II (table 5) confirmed observations in experiment I that milo supplemented with lysine was not adequate for finishing pigs. However, milo supplemented with both lysine and methionine equalled milo supplemented with soybean meal for finishing pigs. Thus, suggesting that lysine and methionine are the first and second limiting amino acids in milo for the finishing pig.

Pigs fed a diet of wheat supplemented with lysine gained at the same rate and were just as efficient in feed utilization as pigs fed a 14% crude protein milo-soybean meal diet or a 14% crude protein wheat-soybean meal diet. There were no significant differences in rate or efficiency of gain between pigs fed a wheat or milo diet containing 14% crude protein. Because wheat contains more protein than milo, less soybean meal is needed to formulate a 14% crude protein diet with wheat, so the lowest feed cost per pound of gain was from wheat supplemented with soybean meal. Feed cost per pound of gain were just as economical from wheat supplemented with lysine as from milo supplemented with soybean meal.

Table 3. Composition of Diets (Experiment II)

Grain Supplement	Milo None %	Milo Lysine %	Milo Lysine & Methionine %	Milo SBM %	Wheat None %	Wheat Lysine %	Wheat SBM %
Ingredient							
Ground milo	96.0	95.38	95.28	84.6	96.0	95.70	90.30
Soybean meal (44%)	--	--	--	11.5	--	--	5.80
Dicalcium Phosphate	2.0	2.0	2.0	1.6	2.0	2.0	2.0
Limestone	0.5	0.5	0.5	0.8	0.5	0.5	0.8
Salt	0.5	0.5	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	1.0	1.0
Lysine supplement[a]	--	0.62	0.62	--	--	0.62	--
DL-methionine	--	--	0.10	--	--	--	--
Crude protein,%	10.2	10.2	10.2	14.0	12.2	12.2	14.0
Lysine concentration,%	0.22	0.53	0.53	0.52	0.38	0.53	0.53

[a]Contains 50% L-lysine activity. Lyamine 50 supplied by Merck and Co., Rathway, N.J.

Table 4. Performance and Carcass Characteristics of Finishing Pigs Fed Wheat or Milo Supplemented with Lysine (Experiment I)

Grain Supplement	Milo None	Milo Lysine	Milo SBM	Wheat None	Wheat Lysine
No. of pigs	19	19	19	19	19
Avg. initial wt.,lbs.	121	123	127	119	125
Slaughter wt.,lbs.	200	222	224	218	227
Avg. daily gain,lbs.	1.21[a]	1.71[b]	1.87[c]	1.47[d]	1.92[c]
Feed/lb. gain	5.10[a]	3.52[b]	3.26[b]	3.83[b]	3.21[b]
Feed cost/lb gain,cents[e]	13.57	11.30	10.04	10.99	10.96
Backfat thickness, in.	1.24[a]	1.32[b]	1.28[c]	1.22[d]	1.30[c]
Loin eye area, $in.^2$	3.83	5.06	5.36	4.66	5.60
Ham & loin, %	44.37	43.92	44.03	43.86	44.70

[a,b,c,d] Means on the same line with different superscripts differ significantly ($P<.05$).

[e] Based on these prices: milo 2.20¢/lb; wheat 2.42¢/lb; soybean meal 4.65¢/lb; Lyamine 50, 63.0¢/lb; vitamin, trace mineral and antibiotic premix 35.0¢/lb; and grinding, mixing, and pelleting, 2.0¢/lb.

Table 5. Influence of Amino Acid Supplementation of Wheat or Milo on the Performance of Finishing Pigs (Experiment II)

Grain	Milo	Milo	Milo	Milo	Wheat	Wheat	Wheat
Supplement	None	Lysine	Lysine and Methionine	SBM	None	Lysine	SBM
No. of pigs	17	17	17	17	17	17	17
Avg. initial wt.,lb.	109	112	112	112	112	113	111
Avg. daily gain,lb.	0.79[a]	1.41[b]	1.53[c]	1.52[c]	1.08[d]	1.55[c]	1.55[c]
Feed/lb. gain	5.48[a]	3.57[b]	3.41[b]	3.50[b]	4.39[c]	3.30[b]	3.24[b]
Feed cost/lb. gain, cents[e]	14.58	10.85	10.71	10.29	12.60	10.20	9.75

[a,b,c,d] Means on the same line with different superscripts differ significantly ($P<.05$).

[e] Same as table 4.