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M De La Llata

Michael D. Tokach

Robert D. Goodband

See next page for additional authors

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Authors

M De La Llata, Michael D. Tokach, Robert D. Goodband, Jim L. Nelssen, and Steven S. Dritz

EFFECTS OF INCREASING L-LYSINE HCl IN CORN-SOYBEAN MEAL DIETS ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF GROWING-FINISHING GILTS [1]

M. De La Llata, S. S. Dritz[2], M. D. Tokach, R. D. Goodband, and J. L. Nelssen

Summary

An experiment using 1,200 gilts (65 to 260 lb) was conducted to determine the effects of increasing L-lysine HCl in corn-soybean meal diets on growth performance and carcass characteristics. The dietary treatments consisted of a control diet with no added L-lysine HCl and six increasing levels of L-lysine HCl (1, 2, 3, 4, 5, and 6 lb/ton) replacing the lysine provided by soybean meal. A negative control treatment was used to ensure that dietary lysine was not above required levels. Increasing L-lysine HCl above 3 lb/ton decreased ADG and increased F/G. Backfat was increased and FFLI decreased with increasing L-lysine HCl in the diet, and the greatest responses occurred at levels above 3 lb/ton. These results indicate that no more than 3 lb/ton (.15%) of L-lysine HCl should be added to corn-soybean meal diets for growing-finishing pigs unless other synthetic amino acids are added to avoid deficiencies that compromise growth performance.

(Key Words: Lysine, Corn, Finishing Pigs.)

Introduction

L-lysine HCl is a synthetic amino acid that can economically replace the lysine provided by soybean meal in diets for growing-finishing pigs. Although adding more than the recommended 3 lb/ton of synthetic lysine will decrease diet costs, there is a potential that deficiencies of other amino acids will limit pig performance. Two previous studies conducted by De La Llata et al. under university research settings demonstrated that increasing the amount of synthetic lysine from 0 or 3 lb/ton to 4.5 or 6 lb/ton in corn-soybean meal- and sorghum-soybean meal-based diets for growing–finishing pigs decreased performance and carcass characteristics. Therefore, the objective of this experiment was to determine how much synthetic lysine could be added to growing-finishing pig diets without adversely affecting growth performance and carcass traits of pigs reared under commercial conditions.

Procedures

A total of 1,200 gilts (PIC C22 × 337) with an initial weight of 64 lb was used in this experiment. Pigs were allotted to one of eight dietary treatments in a randomized complete block design with 25 pigs/pen and 6 pens/treatment. The finishing barn was equipped with 48 totally slatted concrete pens. Each pen was equipped with a four-hole dry self-feeder and one-cup waterer. Pen dimensions were 10 ft × 18 ft, providing 7.2 sq ft/pig. The finishing facility was a double curtain-sided, deep-pit barn that operated on manual ventilation during the summer and on automatic ventilation during the winter.

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[2]Food Animal Health and Management Center.

The treatments were corn-soybean meal-based diets fed in four phases (Tables 1, 2, 3, and 4) and consisted of a positive control diet with no added L-lysine HCl and six increasing levels of L-lysine HCl (1, 2, 3, 4, 5, and 6 lb/ton) replacing the lysine provided by soybean meal. A negative control treatment with no added L-lysine HCl was formulated to contain .10% less total lysine than the other treatments to ensure that dietary lysine was not above required levels. Vitamin and trace mineral levels were similar to KSU recommendations.

Pigs weights by pen and feed disappearance were measured every 14 d to calculate ADG, ADFI, and F/G. Diet phase changes occurred every 28 d. At the termination of the study, pigs were sent to a USDA-inspected packing plant for individual carcass data collection. The pigs in each pen were marked with a different tattoo prior to marketing to allow carcass data to be collected and attributed back to each pen. The experiment was conducted from August to December, 1999.

Analysis of variance was used to analyze the data as a randomized complete block design using GLM procedures of SAS with linear and quadratic polynomial contrasts.

Results and Discussion

The growth performance and carcass data are presented in Table 5. In general, the negative control resulted in slower growth and poorer feed conversion than the 0 lb added L-lysine HCl treatment for each phase. Also, increasing the amount of L-lysine HCl resulted in a linear decrease in growth and an increase in feed efficiency.

For the overall experiment, ADG decreased (linear, $P<.01$), F/G increased (quadratic $P<.03$), and ADFI was not affected ($P>.88$) by increasing L-lysine HCl from 0 to 6 lb/ton. Pigs fed the negative control diet had decreased ($P>.01$) ADG, increased ($P<.01$) F/G, and similar ($P>.90$) ADFI compared to those fed the 0 lb/ton treatment.

Increasing L-lysine HCl did not affect ($P>.20$) carcass yield, but increased (linear $P<.01$) backfat depth and decreased (linear $P<.02$) loin eye depth, percent lean, and fat-free lean index (FFLI). Carcass yield, loin eye depth, percent lean and FFLI were decreased ($P<.05$) in the negative control compared to the 0 lb/ton treatment.

The significant quadratic responses observed during phases 2 and 4 and for the overall experiment indicate that growth performance is affected adversely when more than 3 lb/ton of L-lysine HCl is added to the diet. The linear responses observed during phases 1 and 3 showed a numerical decrease in ADG and an increase in F/G with more than 3 lb/ton of L-lysine HCl. Similarly, the carcass characteristics were influenced negatively by the addition of more than 3 lb/ton of L-lysine HCl.

The decrease in performance observed for the negative control indicates that the dietary treatments were not formulated above the required levels. This is important, because producers using growing-finishing diets containing levels beyond 3 lb/ton of L-lysine HCl might observe that growth performance is not adversely affected, which might indicate that the diet are over-formulated in the first place.

In summary, in agreement with previous research, this experiment indicated that no more than 3 lb/ton of L-lysine HCl (.15%) should be added to corn-soybean meal-based diets for growing-finishing pigs to avoid deficiencies of other amino acids that may limit growth performance.

Table 1. Diet Compositions for Phase 1 (60 to 100 lb)

		L-Lysine HCl, lb/ton						
Ingredient, %	Neg. Control	0	1	2	3	4	5	6
Corn	58.55	54.84	56.22	57.61	59.00	60.49	61.85	63.24
Soybean meal, 46.5%	32.55	36.31	34.88	33.44	32.00	30.46	29.02	27.59
Choice white grease	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Monocal. phosphate	1.33	1.30	1.30	1.30	1.30	1.30	1.33	1.33
Limestone	1.00	.98	.98	.98	.98	.98	.98	.98
Salt, vit. & trace minerals	.58	.58	.58	.58	.58	.58	.58	.58
L-Lysine HCl	0	0	.05	.1	.15	.20	.25	.30
Calculated Analysis								
Lysine, %	1.15	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Protein, %	20.1	21.5	21	20.4	19.9	19.3	18.8	18.1
ME, Kcal/lb	1623	1623	1623	1623	1623	1623	1623	1623
Calcium, %	.74	.74	.74	.74	.74	.74	.74	.74
Phosphorus, %	.66	.66	.66	.66	.66	.66	.66	.66

Table 2. Diet Compositions for Phase 2 (100 to 150 lb)

		L-Lysine HCl, lb/ton						
Ingredient, %	Neg. Control	0	1	2	3	4	5	6
Corn	66.57	62.64	64.00	65.38	66.77	68.13	69.49	70.87
Soybean meal, 46.5%	24.68	28.66	27.23	25.79	24.36	22.92	21.49	20.05
Choice white grease	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Monocal. phosphate	1.23	1.20	1.20	1.20	1.20	1.20	1.23	1.23
Limestone	0.95	0.93	0.95	0.95	0.95	0.98	0.98	0.98
Salt, vit. & trace minerals	.58	.58	.58	.58	.58	.58	.58	.58
L-Lysine HCl	0	0	.05	.1	.15	.20	.25	.30
Calculated Analysis								
Lysine, %	.94	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Protein, %	17.1	18.7	18.1	17.6	17.0	16.4	15.9	15.3
ME, Kcal/lb	1626	1626	1626	1626	1626	1626	1626	1626
Calcium, %	.69	.69	.69	.69	.69	.69	.69	.69
Phosphorus, %	.61	.61	.61	.61	.61	.61	.61	.61

Table 3. Diet Compositions for Phase 3 (150 to 200 lb)

		L-Lysine HCl, lb/ton						
Ingredient, %	Neg. Control	0	1	2	3	4	5	6
Corn	74.99	71.18	72.57	73.95	75.31	76.67	78.06	79.42
Soybean meal, 46.5%	16.45	20.28	18.84	17.41	15.97	14.54	13.10	11.67
Choice white grease	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Monocal. phosphate	1.13	1.10	1.10	1.10	1.10	1.13	1.13	1.13
Limestone	0.93	0.93	0.93	0.93	0.95	0.95	0.95	0.98
Salt, vit. & trace minerals	.51	.51	.51	.51	.51	.51	.51	.51
L-Lysine HCl	0	0	.05	.1	.15	.20	.25	.30
Calculated Analysis								
Lysine, %	.71	.81	.81	.81	.81	.81	.81	.81
Protein, %	14.0	15.5	14.9	14.4	13.8	13.3	12.7	12.1
ME, Kcal/lb	1630	1630	1630	1630	1630	1630	1630	1630
Calcium, %	.64	.64	.64	.64	.64	.64	.64	.64
Phosphorus, %	.55	.55	.55	.55	.55	.55	.55	.55

Table 4. Diet Compositions for Phase 4 (200 to 250 lb)

		L-Lysine HCl, lb/ton						
Ingredient, %	Neg. Control	0	1	2	3	4	5	6
Corn	82.24	78.46	79.82	81.20	82.67	84.03	85.42	86.78
Soybean meal, 46.5%	9.32	13.16	11.72	10.29	8.74	7.30	5.87	4.43
Choice white grease	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Monocal. phosphate	1.08	1.05	1.05	1.05	1.05	1.08	1.08	1.08
Limestone	0.85	0.83	0.85	0.85	0.88	0.88	0.88	0.90
Salt, vit. & trace minerals	.51	.51	.51	.51	.51	.51	.51	.51
L-Lysine HCl	0	0	.05	.1	.15	.20	.25	.30
Calculated Analysis								
Lysine, %	.52	.62	.62	.62	.62	.62	.62	.62
Protein, %	11.3	12.8	12.2	11.7	11.1	10.5	10.0	9.3
ME, Kcal/lb	1631	1631	1631	1631	1631	1631	1631	1631
Calcium, %	.58	.58	.58	.58	.58	.58	.58	.58
Phosphorus, %	.51	.51	.51	.51	.51	.51	.51	.51

Table 5. Effects of Increasing L-Lysine HCl on Growth Performance and Carcass Characteristics of Growing-Finishing Gilts[a]

		L-Lysine HCl, lb/ton							Contrast P <			
Item	Neg. Control	0	1	2	3	4	5	6	Neg. vs 0	Linear	Quadratic	CV, %
Day 0 to 27												
ADG, lb	1.68	1.77	1.80	1.76	1.78	1.70	1.72	1.69	0.10	0.02	0.59	5.3
ADFI, lb	3.09	3.07	3.08	3.07	3.08	3.16	3.14	3.14	0.88	0.09	0.87	3.5
F/G	1.83	1.74	1.71	1.75	1.74	1.87	1.83	1.86	0.10	0.01	0.55	5.2
Day 27 to 54												
ADG, lb	1.74	1.88	1.90	1.94	1.90	1.84	1.79	1.72	0.06	0.01	0.05	7.0
ADFI, lb	4.54	4.51	4.68	4.57	4.49	4.68	4.59	4.66	0.91	0.48	0.79	5.1
F/G	2.62	2.41	2.47	2.37	2.37	2.54	2.57	2.72	0.02	0.01	0.02	5.9
Day 54 to 82												
ADG, lb	1.70	1.82	1.86	1.82	1.81	1.71	1.62	1.63	0.04	0.01	0.13	5.5
ADFI, lb	4.68	4.75	4.71	4.73	4.69	4.71	4.72	4.90	0.57	0.34	0.15	4.4
F/G	2.75	2.61	2.53	2.60	2.61	2.76	2.93	3.00	0.12	0.01	0.02	5.7
Day 82 to 116												
ADG, lb	1.56	1.62	1.60	1.54	1.58	1.46	1.47	1.54	0.38	0.05	0.28	8.5
ADFI, lb	5.59	5.61	5.57	5.46	5.55	5.50	5.33	5.46	0.95	0.22	0.82	6.1
F/G	3.60	3.46	3.51	3.57	3.55	3.77	3.62	3.56	0.36	0.20	0.29	7.5
Overall												
ADG, lb	1.66	1.76	1.78	1.75	1.76	1.66	1.64	1.64	0.01	0.01	0.19	3.2
ADFI, lb	4.52	4.54	4.56	4.50	4.50	4.54	4.46	4.55	0.90	0.74	0.52	3.0
F/G	2.72	2.57	2.56	2.57	2.56	2.72	2.72	2.78	0.01	0.01	0.03	2.6
Packing Plant Data[b]												
Carcass wt.	199.7	204.4	206.3	204.1	205.1	201.6	202.2	198.5	.19	.04	.32	3.0
Yield, %	75.3	76.9	75.6	75.9	76.4	76.3	75.9	75.9	0.01	0.26	0.58	.9
Backfat, in.	0.70	0.66	0.66	0.68	0.67	0.69	0.72	0.70	0.10	0.01	0.59	4.7
Loin depth, in.	2.22	2.36	2.32	2.25	2.32	2.35	2.28	2.22	0.01	0.02	0.27	3.0
Percent lean	54.78	55.80	55.61	55.25	55.51	55.29	54.67	54.78	0.01	0.01	0.90	1.1
FFLI	50.07	50.53	50.49	50.35	50.40	50.14	49.84	50.06	0.08	0.01	0.81	0.8

[a]One thousand two hundred (PIC) growing-finishing gilts, initial weight 65 lb.

[b]Carcass weight used as a covariate to analyze the backfat, loin depth, percent lean, and FFLI data.