EFFECTS OF INCREASING LYSINE:CALORIE RATIO AND DIETARY FAT ADDITION ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF GROWING-FINISHING BARROWS[1]

M. De La Llata, S. S. Dritz[2], M. D. Tokach[3], R. D. Goodband, and J. L. Nelssen

Summary

A total of 1,200 growing-finishing barrows was used to determine the effects of increasing lysine:calorie ratio and dietary fat addition. Dietary treatments were arranged in a 2 × 4 factorial with two levels of fat (0 and 6%) and four lysine:calorie ratios in each of the four phases. The appropriate lysine: calorie ratios to maximize performance were: 3.01, 2.25 to 2.50, 1.78 to 1.98, and 1.42 to 1.62 from 75 to 130, 130 to 175, 175 to 220, and 220 to 260 lb, respectively. These ratios equate to approximate total lysine levels of 1.00, .80, 65, and .53%, respectively, in corn-soybean meal-based diets with no added fat.

(Key Words: Lysine:Calorie Ratio, Fat, Lysine, Finishing Pigs.)

Introduction

A lysine:calorie ratio can be used to determine the lysine requirement based on the dietary energy concentration. Determining an accurate lysine:calorie ratio will ensure that the right amount of lysine is provided in diets varying in energy density. Several studies have been conducted to determine the appropriate lysine:calorie ratio and the influence of fat additions to growing-finishing pig diets on growth performance and carcass characteristics. However, most of these trials have been conducted in university research settings, where the responses to fat addition have been much smaller than those observed in pigs reared under field conditions. The difference in the magnitude of these responses might be due to the fact that feed intake is normally 25 to 40% higher in university research settings than under commercial conditions. Therefore, the objective of this experiment was to determine the effects of added fat and different lysine:calorie ratios on growth performance and carcass characteristics of growing-finishing barrows reared under commercial conditions.

Procedures

A total of 1,200 growing barrows (PIC C22 × 337) with an initial weight of 75 lb was used in this experiment. Pigs were allotted to one of eight dietary treatments in a completely randomized design with 25 pigs/pen and six pens/treatment. The finishing barn was equipped with 48 totally slatted concrete pens. Each pen was equipped with a four-hole dry self-feeder (Staco) and one cup waterer. Pen dimensions were 10 ft × 18 ft, providing 7.2 sq ft/pig. The finishing facility is a doubled curtain-sided, deep pit barn and operates on manual ventilation during the summer and on automatic ventilation during the winter.

The corn soybean meal-based diets were arranged in a 2 × 4 factorial with two levels

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[2]Food Animal Health and Management Center.

[3]Northeast Area Extension Office, Manhattan, KS.

of fat (0 and 6% choice white grease) and four lysine:calorie ratios in each phase. The four phases were 75 to 130, 130 to 175, 175 to 220, and 220 to 260 lb. Lysine:calorie ratios are shown in Table 1, and the corresponding lysine levels for each diet are shown in Table 2. Vitamin and trace mineral levels were similar to KSU recommendations, and all other nutrients met or exceeded the requirements estimates provided by NRC (1998).

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 USDA-inspected packing plant for collection of individual carcass data. The pigs in each pen were marked with a different tattoo prior to marketing to allow carcass data to be attributed back to each pen. The experiment was conducted from August to December, 1998.

Analysis of variance was used to analyze the data as a completely randomized design with a 2 × 4 factorial treatment arrangement using GLM procedures of SAS with linear and quadratic polynomial contrasts.

Results and Discussion

During phase 1 (75 to 130 lb), increasing lysine:calorie ratio increased (quadratic, P<.07) ADG, and decreased (linear P<.01) F/G (Table 3). During phases 2, 3, and 4 and for the overall trial, increasing the lysine: calorie ratio linearly improved (P<.01) ADG and F/G. Although quadratic trends were not found except during phase 1, the responses during each period were greatest when the lysine:calorie ratio increased from the second to the third level, and the increase to the fourth level resulted in a further smaller response.

Adding 6% choice white grease to the diets increased (P<.11) ADG during phases 1 and 2 and for the overall experiment. Adding 6% fat to the diet decreased (P<.02) ADFI and improved (P<.02) F/G during all phases and for the overall trial.

Increasing the lysine:calorie ratio did not affect (P>.65) carcass yield. Back-fat depth, loin eye depth, percent lean, and fat-free lean index were improved (linear, P<.01) as the lysine:calorie ratio was increased. Adding 6% dietary fat tended to increase (P<.08) back-fat depth and decrease (P<.08) the fat-free lean index.

The results from this experiment suggest that adding 6% fat to the diets decreases F/G by approximately 9%. Similar to other experiments, adding fat to the diet improved ADG during the growing phases (75 to 175 lb), but not in the finishing phases (175 to 260 lb). Other research also demonstrates that adding fat only during phases 1, 2, and 3 would decrease the observed tendencies for reductions in percent lean and fat-free lean index.

These data also indicate that increasing the lysine:calorie ratio linearly improves growth performance; however, the greatest response was observed to the third lysine: calorie ratio and a small further response to the fourth level. According to this experiment, the appropriate lysine:calorie ratios to maximize growth performance of growing-finishing barrows are: 3.01, 2.25 to 2.50, 1.78 to 1.98, and 1.42 to 1.62 for phases 1, 2, 3, and 4, respectively. These ratios equate to approximate total lysine levels of 1.00, .80, 65, and .53%, respectively, in corn-soybean meal-based diets with no added fat. The strong linear response observed in carcass parameters indicates that the lysine requirement to maximize carcass traits is higher than that to maximize growth performance.

Table 1. Lysine:Calorie Ratios

	Lys:Cal Ratio (g lys/Mcal ME)			
Phase	1	2	3	4
1 (75-130 lb)	2.41	2.71	3.01	3.31
2 (130-175 lb)	1.75	2.00	2.25	2.50
3 (175-220 lb)	1.38	1.58	1.78	1.98
4 (220-260 lb)	1.02	1.22	1.42	1.62

Table 2. Lysine Contents (%) of Experimental Diets

	0% Fat at Lys:Cal Ratios[a]				6% Fat at Lys:Cal Ratios			
Phase	1	2	3	4	1	2	3	4
1 (75-130 lb)	0.80	0.90	1.00	1.10	0.86	0.97	1.08	1.18
2 (130-175 lb)	0.58	0.67	0.75	0.83	0.63	0.72	0.81	0.90
3 (175-220 lb)	0.46	0.53	0.59	0.66	0.50	0.57	0.64	0.71
4 (220-260 lb)	0.34	0.41	0.47	0.54	0.37	0.44	0.51	0.59

[a]g lys/Mcal ME.

Table 3. Influence of Increasing Lysine:Calorie Ratio and Dietary Fat Addition on Growth Performance and Carcass Characteristics of Growing Finishing Barrows[a]

	0% Fat at Lys:Cal Ratios				6% Fat at Lys:Cal Ratios				Statistics P<				
Item	1	2	3	4	1	2	3	4	Fat	Lys:Cal	Fat × Lys:Cal	Linear	Quadratic
Phase 1 (d 0 to 32)													
ADG	1.59	1.63	1.66	1.67	1.59	1.71	1.75	1.70	.06	.04	.66	.02	.07
ADFI	3.91	3.84	3.75	3.81	3.68	3.74	3.80	3.58	.02	.53	.22	.19	.54
F/G	2.47	2.35	2.26	2.29	2.31	2.19	2.18	2.12	.01	.01	.72	.01	.10
Phase 2 (d 32 to 59)													
ADG	1.51	1.59	1.67	1.68	1.60	1.59	1.71	1.75	.11	.01	.76	.01	.91
ADFI	5.02	5.09	5.03	5.13	4.71	4.64	4.69	4.56	.01	.89	.45	.77	.88
F/G	3.34	3.20	3.02	3.06	2.94	2.93	2.76	2.60	.01	.01	.26	.01	.84
Phase 3 (d 59 to 85)													
ADG	1.60	1.59	1.75	1.73	1.53	1.51	1.77	1.80	.75	.01	.62	.01	.74
ADFI	5.95	6.03	6.12	6.04	6.68	5.40	5.47	5.31	.01	.44	.09	.29	.89
F/G	3.76	3.81	3.53	3.50	3.72	3.62	3.11	2.99	.02	.01	.24	.01	.80
Phase 4 (d 85 to 120)													
ADG	1.07	1.03	1.27	1.22	1.09	1.10	1.29	1.34	.22	.01	.82	.01	.80
ADFI	5.49	5.30	5.57	5.31	4.99	4.97	5.13	5.24	.01	.23	.20	.34	.84
F/G	5.16	5.18	4.45	4.37	4.70	4.58	4.06	3.94	.01	.01	.90	.01	.87
Overall (d 0 to 120)													
ADG	1.42	1.44	1.57	1.56	1.44	1.47	1.61	1.63	.04	.01	.69	.01	.54
ADFI	5.06	5.01	5.07	5.01	4.72	4.64	4.75	4.65	.01	.26	.97	.48	.80
F/G	3.56	3.47	3.24	3.21	3.29	3.17	2.95	2.85	.01	.01	.66	.01	.38
Live weight, lb	247.2	250.6	265.1	266.0	248.6	254.7	266.7	271.6	.21	.01	.92	.01	.71
Packing Plant Data[b]													
Carcass weight	187.5	193.8	197.1	204.0	189.6	203.6	209.2	211.7					
Yield	75.8	75.6	76.2	75.1	75.5	75.3	75.3	75.6	.38	.65	.25	.65	.71
Back-fat depth, in	0.92	0.85	0.77	0.74	0.93	0.86	0.82	0.78	.08	.01	.76	.01	.27
Loin eye depth, in	2.03	2.09	2.16	2.22	2.03	2.13	2.17	2.24	.47	.01	.91	.01	.74
Percent lean	50.8	52.1	53.4	54.1	50.6	51.9	52.7	53.5	.13	.01	.81	.01	.24
Fat-free lean index	47.3	48.1	49.0	49.4	47.1	47.9	48.4	48.9	.08	.01	.81	.01	.26

[a]A total of 1,200 growing barrows (PIC) with an initial weight of 75 lb.
[b]Carcass weight was used as a covariate to analyze the packing plant data.