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Abstract

An experiment using 1,200 gilts (60 to 260 lb) was conducted to determine the effects of increasing lysine:calorie ratio and dietary fat addition on growth performance and carcass characteristics. Dietary treatments were arranged in a 2 x 4 factorial with two levels of dietary fat (0 and 6%) and four lysine:calorie ratios in each of the four phases. The appropriate lysine:calorie ratios to maximize growth performance were: 3.56, 2.50 to 2.75, 2.04, and 1.72 from 60 to 100 lb, 100 to 165 lb, 165 to 220 lb, and 220 to 260 lb, respectively. These ratios equate to approximate total lysine levels of 1.15, .90, .75, and .58%, respectively, in corn-soybean meal-based diets with no added fat.; Swine Day, Manhattan, KS, November 18, 1999

Keywords

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

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Summary

An experiment using 1,200 gilts (60 to 260 lb) was conducted to determine the effects of increasing lysine:calorie ratio and dietary fat addition on growth performance and carcass characteristics. Dietary treatments were arranged in a 2 × 4 factorial with two levels of dietary fat (0 and 6%) and four lysine:calorie ratios in each of the four phases. The appropriate lysine:calorie ratios to maximize growth performance were: 3.56, 2.50 to 2.75, 2.04, and 1.72 from 60 to 100 lb, 100 to 165 lb, 165 to 220 lb, and 220 to 260 lb, respectively. These ratios equate to approximate total lysine levels of 1.15, .90, .75, and .58%, 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 gilts reared under commercial conditions.

Procedures

A total of 1,200 gilts (PIC C22 × 337) with an initial weight of 60 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 and one cup waterer. Pen dimensions were 10 ft × 18 ft, providing 7.2 sq ft/pig. The finishing facility is a double 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 of fat (0 and 6% choice white grease) and

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four lysine:calorie ratios in each phase. The four phases were 60 to 100, 100 to 165, 165 to 220, and 220 to 260 lb. Lysine:calorie ratios fed during each phase 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 a 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 July to November, 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 (60 to 100 lb), increasing the lysine:calorie ratio increased (linear, P<.01) ADG and decreased ADFI (quadratic P<.05), and F/G (linear P<.01; Table 3). The greatest response occurred when the lysine: calorie ratio was increased to the third level (3.56 g/Mcal). Adding 6% choice white grease to the diets increased (P<.01) ADG and decreased (P<.01) ADFI and F/G, similar to the response found in other trials.

During phase 2 (100 to 165 lb), increasing the lysine:calorie ratio increased ADG and decreased ADFI and F/G in a quadratic (P<.02) manner. The greatest response was obtained by increasing the lysine:calorie ratio to the second and third levels (2.50 to 2.75 g/Mcal). Increasing dietary fat form 0 to 6% increased (P<.03) ADG and decreased (P<.01) ADFI and F/G.

In phase 3 (165 to 220 lb), increasing the lysine:calorie ratio increased (linear P<.02) ADG and decreased (linear P<.01) F/G. The optimal response appeared to occur for the third and fourth lysine:calorie ratios (2.04 to 2.24). Adding fat to the diets did not affect (P>.48) ADG but decreased (P<.01) ADFI and F/G.

During phase 4 (220 to 260 lb), increasing the lysine:calorie ratio increased (linear P<.01) ADG and decreased (linear P<.01) F/G. The linear response indicates that the optimal lysine:calorie ratio was at or above the highest level fed in this phase (1.72 g/Mcal). Adding 6% fat to the diets did not affect ADG (P>.84) but decreased (P<.03) ADFI and F/G.

For the overall experiment, increasing the lysine:calorie ratio increased (quadratic P<.09) ADG and decreased (quadratic P<.05) F/G, with the optimal response at the third lysine:calorie ratio regimen. Increasing dietary fat from 0 to 6%, increased (P<.01) ADG and decreased (P<.01) ADFI and F/G.

Increasing the lysine:calorie ratio did not affect (P>.57) carcass yield. Backfat depth, loin eye depth, percent lean, and fat-free lean index were improved linearly (P<.01) by increasing the lysine:calorie ratio in the diet. Adding 6% dietary fat tended to increase backfat (P<.17) and decrease percent lean (P<.14) and fat-free lean index (P<.12).

The results from this experiment suggest that adding 6% fat to the diets decreases F/G by approximately 10%. Similar to other experiments, adding fat to the diet improved ADG during the growing phases (60 to 165 lb), but not in the finishing phases (165 to 260 lb). The greatest improvement in feed efficiency also was observed during earlier phases 1, 2, and 3 (12, 11, and 9%, respectively). 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 improves growth

performance. The quadratic response observed during phases 1 and 2 and for the overall data indicates that improvement in growth performance plateaus around the third lysine:calorie ratio. 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. It also suggests that carcass composition was heavily influenced by the linear response during the last phase of the experiment. More research is needed to verify the appropriate lysine:calorie ratio during this phase.

In summary, the appropriate lysine:calorie ratios to maximize growth performance of growing-finishing gilts were: 3.56, 2.50 to 2.75, 2.04, and 1.72 for phases 1, 2, 3, and 4, respectively. These ratios equate to approximate total lysine levels of 1.15, .90, .75, and .58%, respectively, in corn-soybean meal-based diets with no added fat.

Table 1. Lysine:Calorie Ratios

	Lys:Cal Ratio (g lysine/Mcal ME)			
Phase	1	2	3	4
1 (60-100 lb)	2.96	3.26	3.56	3.86
2 (100-165 lb)	2.25	2.50	2.75	3.00
3 (165-220 lb)	1.64	1.84	2.04	2.24
4 (220-260 lb)	1.12	1.32	1.52	1.72

Table 2. Lysine Content (%) 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 (60-100 lb)	0.98	1.08	1.15	1.28	1.06	1.17	1.28	1.38
2 (100-165 lb)	0.75	0.83	0.90	1.00	0.81	0.90	0.99	1.08
3 (165-220 lb)	0.54	0.61	0.68	0.74	0.59	0.66	0.73	0.80
4 (220-260 lb)	0.37	0.44	0.51	0.57	0.40	0.48	0.55	0.62

[a]g lysine/Mcal mE.

Table 3. Influence of Increasing Lysine:Calorie Ratio and Dietary Fat Addition on Growth Performance and Carcass Characteristics of Growing-Finishing Gilts[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 25)													
ADG	1.45	1.44	1.55	1.59	1.61	1.60	1.67	1.63	.01	.03	.34	.01	.75
ADFI	3.20	3.03	3.11	3.20	3.08	3.00	2.98	2.92	.01	.08	.08	.18	.05
F/G	2.22	2.10	2.00	2.03	1.91	1.88	1.78	1.80	.01	.01	.63	.01	.12
Phase 2 (d 25 to 63)													
ADG	1.53	1.71	1.71	1.69	1.62	1.76	1.79	1.74	.03	.01	.95	.01	.01
ADFI	4.35	4.45	4.50	4.41	4.10	4.15	4.23	4.01	.01	.10	.72	.89	.02
F/G	2.85	2.60	2.64	2.64	2.53	2.36	2.36	2.30	.01	.01	.74	.01	.01
Phase 3 (d 63 to 93)													
ADG	1.58	1.56	1.61	1.71	1.51	1.67	1.69	1.71	.48	.05	.43	.02	.89
ADFI	5.66	5.39	5.29	5.44	4.95	5.10	5.12	4.95	.01	.68	.06	.24	.75
F/G	3.63	3.46	3.30	3.19	3.29	3.07	3.04	2.91	.01	.01	.85	.01	.51
Phase 4 (d 93 to 127)													
ADG	1.24	1.38	1.43	1.55	1.17	1.34	1.52	1.62	.84	.01	.58	.01	.63
ADFI	5.86	5.81	5.88	5.91	5.35	5.29	5.60	5.21	.01	.52	.87	.87	.53
F/G	4.76	4.23	4.14	3.86	4.66	4.12	3.63	3.30	.03	.01	.55	.01	.43
Overall (d 0 to 127)													
ADG	1.45	1.53	1.68	1.64	1.48	1.59	1.67	1.68	.01	.01	.75	.01	.08
ADFI	4.78	4.74	4.77	4.80	4.42	4.44	4.56	4.33	.01	.51	.29	.93	.37
F/G	3.30	3.09	2.96	2.88	2.99	2.79	2.73	2.64	.01	.01	.87	.01	.05
Final weight, lb	248.7	255.9	269.8	274.3	249.4	263.1	273.9	267.9	.10	.01	.77	.01	.13
Packing Plant Data[b]													
Carcass weight, lb	184.9	189.1	195.6	200.5	186.2	196.7	207.5	208.7					
Yield	75.7	75.8	75.8	76.1	75.8	75.9	75.0	75.6	.33	.57	.59	.98	.51
Back-fat depth, in	0.78	0.72	0.67	0.63	0.80	0.73	0.69	0.64	.17	.01	.97	.01	.32
Loin eye depth, in	2.21	2.25	2.35	2.35	2.17	2.24	2.35	2.37	.81	.01	.58	.01	.22
Percent lean	53.6	54.7	55.6	56.2	53.1	54.3	55.4	56.1	.14	.01	.87	.01	.16
Fat -free lean index	48.9	49.6	50.2	50.6	48.6	49.4	50.0	50.5	.12	.01	.98	.01	.25

[a]A total of 1,200 growing gilts (PIC) with an initial weight of 60 lb.

[b]Carcass weight was used as a covariate to analyze the packing plant data.