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Dietary lysine requirement for optimal growth performance and carcass characteristics of late finishing gilts

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DIETARY LYSINE REQUIREMENT FOR OPTIMAL GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF LATE FINISHING GILTS

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Summary

In Exp. 1, increasing dietary lysine from .40% to .70% linearly improved ADG, F/G, 10th rib fat depth, and percentage lean in finishing gilts from 200 to 250 lb. Increasing dietary lysine also tended to improve longissimus muscle area. Results from Exp. 2 indicate no improvement in growth or carcass performance of gilts fed greater than .60% lysine. The combined results of Exp. 1 and 2 indicate that finishing gilts from 200 to 250 lb requires between .60% to .70% (18 to 20 g/d) dietary lysine to maximize both growth performance and carcass characteristics.

(Key Words: Finishing Pigs, Lysine, Lean Growth.)

Introduction

Increased selection for lean tissue growth has resulted in increased dietary lysine requirements. However, as lean growth rate declines, the need for high dietary lysine levels diminishes. With this in mind, phase-feeding regimens to optimize dietary lysine and reduce costs associated with overfeeding nutrients throughout specific growth stages have been developed. Previous research (1993 KSU Swine Day Report of Progress) suggests that gilts with a high-lean growth potential required 26 g/d of lysine from 160 to 230 lb. These gilts were littermates to terminal sire boars and had a higher lean tissue accretion potential than many terminal-cross market gilts. Additionally, growth modeling has suggested that the lysine requirement as a percentage of the diet for late-finishing gilts decreases rapidly after 200 lb as lean growth slows and body mass is in-

creased primarily through fat and bone accretion. Therefore, our objective was to determine the lysine requirement for optimal growth performance and lean tissue accretion in terminal-cross finishing gilts from 200 to 250 lb.

Procedures

Two experiments using 230 gilts (PIC 326 × C-22) were conducted to determine the lysine requirement of finishing gilts from 200 to 250 lb. Treatments were arranged in a randomized complete block design with seven or eight gilts per pen and five or four replications per treatment (Exp. 1 and Exp. 2, respectively). Pigs were blocked by weight at an average initial weight of 93 lb (Exp. 1) or 85 lb (Exp. 2).

All gilts were fed by weight in three phases from 100 to 250 lb. Pigs were weighed every 2 weeks, and diet changes were made when average block weights reached their specified values. All diets were corn-soybean meal based, with different lysine concentrations provided by adjusting the level of soybean meal in each diet. All gilts were fed a diet containing 1.0% total lysine from 100 to 150 lb. The gilts then were switched to a common diet with .80% total lysine from 150 to 200 lb body weight. When the average block weight of 200 lb was reached, all gilts within a block were switched to experimental treatments containing dietary lysine levels of .40%, .55%, and .70% (Exp. 1) or .60%, .70%, .80%, and .90% (Exp. 2). All diets contained .65% Ca and .55% P and were formulated to meet or exceed all digestible amino acid recommendations, with the exception of lysine (Table 1).

Table 1. Composition of Basal Diets with 1.0, .8, .4, and .6% Lysine^a

Item, %	100 to 150 lb	150 to 200 lb	200 to 250 lb ^b	200 to 250 lb ^c
	1.0	.8	.4	.6
Corn	69.4	77.3	91.6	84.2
Soybean meal (46.5%)	27.5	20.2	5.7	12.9
Monocalcium phosphate	1.33	1.03	.99	1.09
Limestone	1.10	.73	.95	.99
Salt	.35	.35	.35	.35
Vitamin premix	.20	.20	.20	.20
Trace mineral premix	.15	.15	.15	.15
Medication ^d	.05	.05	.05	.125

^aEach diet was formulated to contain .65% Ca and .55% P.

^bExp. 1 diets contained an additional 5.4% and 10.8% soybean meal to create the .55% and .70% diets, respectively.

^cExp. 2 diets contained an additional 3.7%, 7.3% and 10.9% soybean meal to create the .70%, .80% and .90% diets, respectively.

^dProvided 100 g per ton tylosin.

All gilts were housed in a modified open-front building with natural and mechanical ventilation. Drip coolers were activated when ambient temperatures exceeded 80°F. Each pen measured 6 × 16 ft with 50% solid and 50% slatted flooring. Each pen contained a two-hole lidded dry feeder and a single nipple waterer allowing ad libitum access to feed and water. Pig and feeder weights were recorded at approximately 2-week intervals when estimated block weights of 200, 225, and 250 lb. were reached to determine ADG, ADFI, and F/G. Feed was withheld for 1 hour during the initial and final weigh periods before pigs were bled via jugular venapuncture to determine plasma urea nitrogen values (PUN). At an estimated block weight of 250 lb (Exp. 1) or estimated block weights of 200, 225, and 250 lb (Exp. 2), each pig was scanned ultrasonically at the last lumbar position to determine 10th rib fat depth, longissimus muscle area, and calculated lean percentage.

All data were analyzed using general linear models procedures. Data were analyzed as a randomized complete block design with diet as the main effect. Pigs were blocked by initial weight with pen as the experimental unit. Linear and quadratic

polynomials were used to determine the effects of dietary lysine levels.

Results and Discussion

In Exp. 1, increasing dietary lysine from .40% to .70% improved ADG and F/G from 200 to 225 lb (linear, $P < .04$). Average daily gain, ADFI, and F/G tended to improve but showed no statistical difference ($P > .05$) from 225 to 250 lb. Increasing dietary lysine from .40% to .70% (11 to 20 g/d) linearly improved ADG, F/G, 10th rib backfat (BF), and carcass lean percentage from 200 to 250 lb (linear, $P < .05$; Table 2). Pigs fed .70% lysine had 20% better ADG and F/G overall than pigs fed the .40% dietary lysine level, with no effect observed for ADFI during the entire trial. Plasma urea nitrogen values increased with increasing lysine (linear, $P < .001$) for each growth period.

In Exp. 2, increasing dietary lysine from .60% to .90% (18 to 26 g/d) had no effect on either growth performance (Table 3) or carcass characteristics (Table 4; linear, $P < .15$). No trends were observed in growth and carcass performance for any of the weight periods.

These results tend to agree with previous research using high lean gilts at Kansas State University. Previous research at KSU indicated that terminal market gilts with a high lean growth potential require 26 g/d of lysine up to 200 lb. However, from 200 to 250 lb these gilts tended to have decreased lean tissue accretion and increased fat depths with increasing levels of lysine. The results of these experiments indicate the total dietary lysine level necessary to optimize growth performance and carcass characteristics for high lean finishing gilts from 200 to 250 lb. is approximately .60% (18 g/d). Although results from Exp. 1 indicate a linear im-

provement in performance with lysine levels up to .70% (19.8 g/d), PUN values (Exp. 1) indicate the lysine requirement is being met between .55% and .70% lysine. Additionally, these gilts had lower ADFI than the gilts in Exp. 2, resulting in a lower g/d of lysine intake at .70% total lysine. The results from Exp. 2 indicate effects on both growth performance and carcass characteristics plateau above 18 g/d or .60% total lysine. Therefore, based on the results of these experiments, the total dietary lysine requirement for optimal lean growth in gilts from 200 to 250 lb. appears to be between .60 and .70% (18 to 20 g/d) total lysine.

Table 2. Effects of Lysine on Growth Performance and Carcass Characteristics of Late Finishing Gilts (Exp. 1)^a

	Dietary Lysine, %				Lysine <i>P</i> <	
Item	0.4	0.55	0.7	CV	Linear	Quadratic
200 to 225 lb						
ADG, lb	1.57	1.77	1.87	13.07	.07	.68
ADFI, lb	7.04	6.74	6.73	7.69	.38	.65
F/G	4.61	3.86	3.60	16.68	..05	.53
PUN, mg/dl	10.16	11.31	12.76	6.99	.0009	.74
Lysine g/d	12.8	16.8	21.4	7.44	.0001	.74
225 to 250 lb						
ADG, lb	1.70	1.94	2.07	18.07	.13	.79
ADFI, lb	6.81	6.53	6.57	7.62	.48	.57
F/G	4.20	3.42	3.19	22.48	.08	.55
Lysine g/d	12.4	16.3	20.9	10.20	.0001	.73
Overall						
ADG, lb	1.64	1.85	1.97	11.42	.04	.65
ADFI, lb	6.21	6.06	6.22	6.38	.96	.51
F/G	3.83	3.28	3.18	10.42	.02	.27
Lysine g/d	11.3	15.1	19.8	7.05	.0001	.55
PUN, mg/dl	12.39	12.78	15.51	13.36	.03	.27
BF, in.	.94	.88	.81	7.59	.05	.74
LMA, in ²	5.65	5.97	5.93	2.77	.07	.09
% Lean	49.75	51.01	51.63	1.22	.01	.42

^aA total of 105 gilts (PIC C15 × 326) with an average initial weight of 200 lb. were used in a randomized complete block design with seven gilts/pen and five replicate pens/treatment.

Table 3. Effects of Lysine on Growth Performance of Late Finishing Gilts (Exp. 2)^a

Item	Dietary Lysine, %				CV	Lysine <i>P</i> <	
	.60	.70	.80	.90		Linear	Quadratic
200 to 225 lb							
ADG, lb	1.70	1.77	1.71	1.73	9.28	.91	.78
ADFI, lb	6.58	6.55	6.37	6.58	6.27	.84	.57
F/G	3.87	3.70	3.73	3.80	9.07	.72	.40
Lysine g/d	17.9	20.8	23.1	26.9	7.68	.0001	.62
225 to 250 lb							
ADG, lb	1.75	1.70	1.81	1.75	8.0	.72	.98
ADFI, lb	6.73	6.80	6.88	6.57	5.21	.63	.30
F/G	3.85	4.00	3.80	3.75	4.28	.16	.26
Lysine g/d	18.3	21.6	25.0	26.9	4.47	.0001	.19
Overall							
ADG, lb	1.72	1.72	1.76	1.74	8.18	.74	.90
ADFI, lb	6.64	6.64	6.59	6.48	4.29	.43	.72
F/G	3.86	3.86	3.76	3.75	5.66	.21	.88
Lysine g/d	18.1	21.1	23.9	26.5	4.18	.0001	.64

^aA total of 125 gilts (PIC C15 × 326) with an average initial weight of 200 lb was used in a randomized complete block design with eight gilts/pen and four replicate pens/treatment.

Table 4. Effects of Lysine on Carcass Characteristics of Late Finishing Gilts (Exp. 2)^a

Item	Dietary Lysine, %				CV	Lysine <i>P</i> <	
	.6	.7	.8	.9		Linear	Quadratic
200 lb							
BF, in.	.68	.68	.72	.68	8.72	.63	.50
LMA, in ²	5.41	5.25	5.43	5.23	7.89	.70	.92
% Lean	54.28	54.07	53.78	53.52	3.05	.50	.98
PUN, mg/dl	11.29	13.10	14.24	15.73	6.58	.0001	.72
225 lb							
BF, in.	.78	.77	.77	.73	8.06	.28	.51
LMA, in ²	5.87	5.84	5.87	5.70	3.67	.35	.53
% Lean	53.26	53.20	53.24	53.27	2.28	.98	.94
PUN, mg/dl	12.52	13.76	15.31	16.15	5.21	.0001	.61
250 lb							
BF, in.	.89	.85	.91	.84	7.30	.62	.57
LMA, in ²	6.48	6.35	6.49	6.32	6.37	.71	.91
% Lean	52.73	52.66	52.41	52.66	2.59	.88	.82
PUN, mg/dl	13.88	15.62	15.37	16.67	8.89	.01	.50

^aA total of 125 gilts (PIC C15 × 326) with an average initial weight of 200 lb was used in a randomized complete block design with eight gilts/pen and four replicate pens/treatment. Carcass measurements were calculated from scanned values.