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Dietary total sulfur amino acid requirement for optimal growth performance and carcass characteristics in finishing gilts

Abstract

Finishing gilts (initially 163 lb) were fed .58% total lysine (.50% apparent digestible) and total sulfur amino acid (TSAA) concentrations of .26,.285, .31, .335, and .36% (.225 to .325% apparent digestible). These values represent TSAA: lysine ratios of 45, 50, 55, 60, and 65%. Results suggest a linear decrease in ADG and ADFI along with poorer F/G with increasing TSAA levels. However, gilts fed .285% TSAA (50% of lysine) had the best ADG and F/G. No effect was observed on any carcass criteria. Based on the results of this study, the TSAA requirement is not greater than .285% total (.25% apparent digestible) or approximately 50% of the lysine requirement.; Swine Day, Manhattan, KS, November 21, 1996

Keywords

Swine day, 1996; Kansas Agricultural Experiment Station contribution; no. 97-142-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 772; Swine; Finishing pigs; Growth; Total sulfur amino acids

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DIETARY TOTAL SULFUR AMINO ACID REQUIREMENT FOR OPTIMAL GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS IN FINISHING GILTS[1]

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Summary

Finishing gilts (initially 163 lb) were fed .58% total lysine (.50% apparent digestible) and total sulfur amino acid (TSAA) concentrations of .26, .285, .31, .335, and .36% (.225 to .325% apparent digestible). These values represent TSAA: lysine ratios of 45, 50, 55, 60, and 65%. Results suggest a linear decrease in ADG and ADFI along with poorer F/G with increasing TSAA levels. However, gilts fed .285% TSAA (50% of lysine) had the best ADG and F/G. No effect was observed on any carcass criteria. Based on the results of this study, the TSAA requirement is not greater than .285% total (.25% apparent digestible) or approximately 50% of the lysine requirement.

(Key Words: Finishing Pigs, Growth, Total Sulfur Amino Acids.)

Introduction

Previous research at KSU indicated that the TSAA requirement of finishing gilts is not greater than 60% of lysine. Because methionine and cystine are used mainly for tissue maintenance and as substrate precursors, previous researchers have hypothesized that the requirement should increase as the pig ages and its maintenance requirement increases. Growth models have agreed with this hypothesis and indicate that the TSAA requirement for older pigs should be greater than that for younger pigs. However, empirical data have been unable to conclusively define the finishing pig's TSAA requirement. Because discrepancies still exist in TSAA recommendations for finishing pigs, our objective was to determine the TSAA requirement of finishing gilts.

Procedures

Eighty gilts (PIC 326 × C-22; initially 163 lb) were used in a 36-d growth trial to determine the effects of increasing TSAA levels on growth performance and carcass characteristics. All gilts were fed a corn-soybean meal grower diet from 50 to 160 lb that was formulated to exceed all current nutrient recommendations. Gilts were blocked by weight and assigned randomly by initial weight to one of five dietary treatments in a randomized complete block design. Experimental diets consisted of .26, .285, .31, .335, and .36% total dietary TSAA (.225, .25, .275, .30, and .325% apparent digestible) with corresponding TSAA ratios relative to apparent digestible lysine of: 45%, 50%, 55%, 60%, and 65%. The TSAA levels were obtained by substituting increasing levels of L-methionine for cornstarch. L-methionine was supplied to meet both the methionine and cystine fractions of the TSAA requirement. An 80% transsulfation efficiency for conversion of methionine to cystine was allowed in diet formulation. To ensure that TSAA were the only limiting amino acids, all others were maintained at or above ratios relative to lysine as suggested by the University of Illinois (Table 1). Grain sorghum, cornstarch, and L-methionine levels varied as the TSAA:lysine ratios increased, and all diets contained 0.65% Ca and 0.55% P (Table 2).

[1]The authors thank Degussa, Inc. of Kennesaw, GA for partial funding of this experiment.

Table 1. Basal Diet Amino Acid Analysis

Item, %	Total	Apparent Digestible
Lysine	.58	.50
Threonine	.41	.33
L-methionine[a]	.14	.13
Methionine + Cystine	.26	.23
Tryptophan	.12	.10
Valine	.60	.49
Isoleucine	.36	.30

[a]Experimental treatments were made by substituting .025%, .05%, .075%, .10% total L-methionine for equal amounts of cornstarch.

Table 2. Basal Diet Composition[a]

Ingredient	Percent
Grain sorghum	64.64
Cornstarch	18.16
Sucrose	2.50
Soybean meal, 46.5% CP	3.00
Soybean oil	5.00
Blood meal	2.00
Monocalcium phosphate	1.64
Limestone	.82
Salt	.35
Choline chloride	.04
Vitamin premix	.25
Trace mineral premix	.15
L-methionine	.002
L-threonine	.111
L-lysine HCl	.202
L-tryptophan	.017
L-glutamate	1.00
Medication[b]	.125

[a]Each diet was formulated to contain .65 Ca% and .55% P.
[b]Provided 100 g/ton tylosin.

Each pen (5 ft × 5 ft slatted pens) contained two pigs and, they were allowed ad libitum access to both feed and water from a single-hole dry feeder and one nipple waterer per pen. Pigs were housed in an environmentally controlled building with a constant temperature of 70° F, and manure was removed daily via mechanical pit scrapers. Pigs and feeders were weighed and pigs were scanned ultrasonically on d 0, d 18, and d 36 to measure growth performance and determine calculated body composition.

All data were analyzed as a randomized complete block design with pen as experimental unit. The data analysis was performed using general linear model procedures. Polynomial regression was used to determine linear and quadratic effects of TSAA concentration on pig performance.

Results and Discussion

From d 0 to 36, increasing TSAA concentrations tended to decrease ADG (linear, $P<.06$) and worsen F/G ($P<.03$). No effect was observed for ADFI or carcass composition during any growth period. However, gilts fed .285% TSAA (50% of lysine) had the best ADG and F/G.

These results indicate that the requirement for TSAA relative to lysine has been overestimated. Previous research with high-lean finishing gilts (1994 KSU Swine Day Report of Progress) indicated that optimal growth performance and carcass characteristics were achieved when methionine was less than 22% of apparent digestible lysine. Although that is lower than the current University of Illinois ideal amino acid pattern for TSAAs, it agrees with our current research, assuming that methionine constitutes 45% of the TSAA requirement. Methionine then is estimated to be 23% of lysine, and the excess methionine is converted to cystine. Therefore, based upon the results of this experiment, the dietary TSAA requirement for optimal growth performance and carcass characteristics is no greater than .285% (.25% apparent digestible TSAA), which is approximately 50% TSAA relative to apparent digestible lysine.

Table 3. Effects of Total Sulfur Amino Acid Concentration upon Finishing Pig Growth Performance and Carcass Characteristics[a]

	Apparent Digestible TSAA, %[b]						Probability $P<$	
Item,	.225%	.25%	.275%	.30%	.325%	CV	Linear	Quadratic
d 0 to 36								
ADG, lb	1.76	1.97	1.67	1.68	1.63	15.03	.06	.55
ADFI, lb	5.47	5.70	5.29	5.39	5.34	10.20	.37	.97
F/G	3.12	2.92	3.18	3.34	3.29	9.53	.03	.65
10th rib BF, in.	.94	.98	.94	.92	.96	15.07	.93	.95
LMA, in^2	5.73	5.63	5.89	5.49	6.03	9.44	.48	.40
% Lean	51.01	50.34	51.51	50.50	51.73	4.84	.57	.62

[a]A total of 80 gilts (PIC 326 × C-22; initial weight 163 lb.) were used in a randomized complete block design.
[b]L-methionine was used to create TSAA levels of 45, 50, 55, 60, and 65% of apparent digestible lysine.

Mark Nelson, Swine Farm Manager.