EFFECTS OF RATIO OF TOTAL SULFUR AMINO ACID TO LYSINE ON FINISHING-PIG GROWTH PERFORMANCE

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Summary

The objective of this study was to characterize the growth response to total sulfur amino acids (TSAA) and lysine simultaneously to estimate the true-ileal-digestible (TID) TSAA-to-lysine ratio in early finishing pigs. One hundred and twenty-six pigs were used in a 27-d growth study. Pigs (73 to 134 lb) were blocked by sex and weight and were allotted to one of nine dietary treatments with five TID lysine (0.79, 0.87, 0.94, 1.02 and 1.10%) and five TID TSAA (0.53, 0.57, 0.61, 0.66 and 0.70%) concentrations. The highest lysine (1.10%) and TSAA (0.70%) concentrations were combined to form one treatment used in both the lysine and TSAA titrations. In diets evaluating increasing TID lysine, methionine & cysteine ratios were 64 to 66% of lysine; and in diets evaluating increasing TSAA, diets were formulated to 1.10% TID lysine. Increasing TID lysine increased ADG (linear, $P<0.01$) and improved F/G (quadratic, $P<0.10$) from d 0 to 14 and from d 0 to 27. No differences ($P>0.05$) were observed in ADFI. Increasing TSAA had no effect ($P<0.05$) on ADG or F/G, but pigs fed the diet containing 0.70% TSAA had numerically greater ADG than did pigs fed lower rates. As TSAA concentration increased to 0.61%, feed efficiency numerically improved ($P = 0.16$). Using a TID lysine requirement of 1.02% and TID TSAA requirement of 0.61% suggests a TSAA-to-lysine ratio of 60%. The surface response analysis suggests a similar TSAA-to-lysine ratio of 59% for overall F/G.

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

Introduction

Previous research at Kansas State University has demonstrated that titrating the requirement for lysine and an amino acid of interest allows for the accurate determination of the optimum ratio of amino acid to lysine. With the increasing cost competitiveness of synthetic amino acids, there has been interest of supplementing swine diets with synthetic methionine and other amino acids. Research at the University of Missouri has shown that the optimum TID ratio of TSAA to lysine ranges from 58 to 62% to maximize ADG for gilts weighing 100 to 150 lb. Our objective was to determine the ADG and efficiency response to TSAA and lysine to estimate the TID TSAA-to-lysine ratio for barrows and gilts weighing 73 to 134 lb.

Procedures

One hundred and twenty-six pigs were blocked by weight (PIC L326 × C22; initially 73.0 lb) and were allotted to one of nine dietary treatments. There were two pigs per pen, with barrows (initially 74.2 lb) and gilts (initially 71.3 lb) penned separately. There were

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four replications per treatment for the barrows and three replications per treatment for the gilts. The dietary treatments consisted of five increasing concentrations of TID lysine (0.79, 0.87, 0.94, 1.02, and 1.10%) and five diets with increasing concentrations of TSAA (0.53, 0.57, 0.61, 0.66 and 0.70%). The highest lysine and TSAA were combined (1.10% lysine and 0.70% TSAA) in one diet used for both the lysine and TSAA titrations, for a total of 9 diets and 10 dietary treatments. The TID lysine diets had TSAA ratios of 64 to 66% of lysine, and the TSAA diets were formulated to 1.10% TID lysine. The diet containing .79% lysine and 1.10% lysine and diets containing .70% TID TSAA and 0.53% TID TSAA were blended to form all other diets.

All experimental diets were based on corn-soybean meal (Table 1) and were fed in a meal form throughout the 27-d experiment. Pigs were housed at the K-State Swine Teaching and Research Center and allowed ad libitum access to food and water. All pigs and feeders were weighed on d 14 and 27 to determine ADG, ADFI, and F/G.

Data were analyzed as a randomized complete-block design, with pen as the experimental unit. Pens were blocked on the basis of initial weight. Analysis of variance was performed by using the PROC MIXED procedures of SAS. Linear and quadratic polynomials were evaluated to determine the effects of increasing dietary lysine and TSAA.

Results and Discussion

Overall, increasing TID lysine increased (linear, $P<0.01$) ADG and improved (quadratic, $P<0.03$) F/G (Table 2). Pigs fed 1.02% TID lysine had the greatest ADG and best F/G, compared with ADG and F/G of the pigs fed all other diets.

Increasing TID total TSAA concentration did not significantly improve pig performance, but F/G was improved numerically ($P<0.16$) as TID TSAA increased to .61% of the diet.

Using a TID lysine requirement of 1.02% and TID total sulfur amino acid requirement of 0.61% suggests a TSAA-to-lysine ratio of 60%. The surface-response analysis suggests a similar TSAA-to-lysine ratio of 59% for overall F/G. More research is required to validate our data, but these results indicate that the optimal ratio of TSAA to lysine is approximately 60% for pigs weighing 73 to 133 lb.

Table 1. Diet Composition of True-ileal-digestible (TID) Lysine and TID TSAA[a]

	TID Lysine/TSAA, %		
Ingredient, %	0.79/0.53	1.10/0.70	1.10/0.53
Corn	74.00	73.20	73.38
Soybean meal, 46.5% CP	23.45	23.45	23.45
Monocalcium phosphate, 21%	1.00	1.00	1.00
Limestone	0.90	0.90	0.90
Salt	0.35	0.35	0.35
Vitamin premix	0.15	0.15	0.15
Trace mineral premix	0.15	0.15	0.15
Lysine HCl	0.00	0.40	0.40
DL-Methionine	0.00	0.18	0.00
L-Threonine	0.00	0.17	0.17
L-Tryptophan	0.00	0.025	0.025
L-Isoleucine	0.00	0.03	0.03
Total	100.00	100.00	100.00
Calculated Analysis			
Lysine, %	0.90	1.21	1.21
Isoleucine:lysine, %	79	61	61
Leucine:lysine, %	177	131	131
Methionine:lysine, %	31	38	23
Met & Cys:lysine, %	66	64	49
Threonine:lysine, %	72	67	67
Tryptophan:lysine, %	22	18	18
Valine:lysine, %	91	67	67
ME, kcal/lb	1,508	1,511	1,510
Protein, %	17.2	17.1	17.1
Ca, %	0.63	0.63	0.63
P, %	0.58	0.58	0.58
Available P, %	0.28	0.28	0.28
Lysine:calorie ratio, g/mcal	2.71	3.64	3.64

[a]The diets containing 0.79% TID lysine and 1.10% TID lysine were blended to form the intermediate diets containing 0.87, 0.94 and 1.02% TID lysine. In addition, the diets containing 0.53% TID TSAA and 0.70% TID TSAA were blended to form the intermediate diets containing 0.57, 0.61 and 0.66% TID TSAA.

Table 2. Effect of Increasing True-ileal-digestible (TID) Lysine in 73.0 to 133.9 lb Pigs[a]

	TID Lysine, %						P-value	
Item	0.79	0.87	0.94	1.02	1.10	SE	Linear	Quadratic
Day 0 to 14								
ADG, lb	2.01	2.08	2.05	2.34	2.30	0.104	0.0009	0.67
ADFI, lb	4.18	4.15	3.94	4.15	4.30	0.152	0.48	0.06
F/G	2.09	2.00	1.93	1.78	1.87	0.066	<0.0001	0.10
Day 14 to 27								
ADG, lb	2.18	2.29	2.36	2.37	2.35	0.101	0.06	0.22
ADFI, lb	5.09	5.13	5.02	5.06	5.23	0.238	0.70	0.50
F/G	2.35	2.26	2.12	2.13	2.24	0.115	0.18	0.07
Day 0 to 27								
ADG, lb	2.09	2.18	2.20	2.36	2.33	0.082	0.0011	0.65
ADFI, lb	4.62	4.62	4.46	4.58	4.75	0.172	0.57	0.19
F/G	2.21	2.12	2.03	1.94	2.05	0.066	0.0016	0.03

[a]Each value is the mean of seven replications with 2 pigs (PIC L326 × C22, initially 73.0 lb) per pen.

Table 3. Effect of Increasing True-ileal-digestible (TID) TSAA in 73.0 to 133.9 lb Pigs[a]

	TID TSAA, %						P-value	
Item	0.53	0.57	0.61	0.66	0.70	SE	Linear	Quadratic
Day 0 to 14								
ADG, lb	2.18	2.22	2.13	2.17	2.30	0.104	0.43	0.27
ADFI, lb	4.22	4.31	3.97	4.24	4.30	0.152	0.80	0.19
F/G	1.95	1.94	1.87	1.94	1.87	0.066	0.36	0.91
Day 14 to 27								
ADG, lb	2.22	2.29	2.36	2.32	2.35	0.101	0.23	0.53
ADFI, lb	5.18	5.21	5.10	4.96	5.23	0.238	0.81	0.48
F/G	2.33	2.27	2.21	2.15	2.24	0.115	0.28	0.32
Day 0 to 27								
ADG, lb	2.20	2.25	2.24	2.24	2.33	0.082	0.22	0.73
ADFI, lb	4.68	4.74	4.52	4.58	4.75	0.172	0.96	0.29
F/G	2.13	2.10	2.03	2.04	2.05	0.066	0.16	0.33

[a]Each value is the mean of seven replications, with 2 pigs (PIC L326 × C22, initially 73.0 lb) per pen.