IS THE TOTAL SULFUR AMINO ACID:LYSINE RATIO FOR LACTATING SOWS GREATER THAN 50%?

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Summary

A total of 75 lactating sows were used in a study to determine whether the ratio of total sulfur amino acid (TSAA) to lysine calculated from the NRC (1998) is adequate for lactating sows. Low and high sulfur amino acid diets were formulated to contain a (true ileal digestible (TID) TSAA content of 0.44 or 0.57%, respectively. Both experimental diets were based on corn and soybean meal and were formulated to contain 0.88% TID lysine (0.97% total lysine). Thus, the TID TSAA:lysine ratios were 50 and 65% for the two experimental diets, respectively. Both experimental diets contained 0.37% L-lysine HCl, with other amino acids (isoleucine, threonine, tryptophan, and valine) added to ensure that TSAA were the first limiting amino acids. Sows were farrowed in three farrowing groups and were randomly allotted to the dietary treatments on the basis of parity. The lactating sows fed the 0.57% TSAA diet had greater ADFI than did sows fed the 0.44% TSAA diet ($P<0.05$). Sow weight loss was not affected by lactation treatment, but sows fed the diet with more TSAA had greater ($P<0.02$) litter weight gain, heavier ($P<0.01$) litter weaning weights, and heavier ($P<0.06$) individual pig weaning weight than did sows fed the 0.44% TSAA diet. These data indicate that the basal diet can be used in future experiments to titrate the TSAA requirement of the sow. Results also indicate that the TID TSAA requirement is greater than 0.44% and the TSAA:lysine ratio is greater than 50% for lactating sows. Because amino acid recommendations from the NRC (1998) suggest that the TID TSAA:lysine ratio is approximately 48%, more research is warranted to more adequately determine the TID TSAA:lysine ratio for lactating sows.

(Key Words: TSAA, Lysine, Lactating Sow.)

Introduction

Due to increased litter size and milk production in modern sows, the requirements for amino acids have changed. The requirements for essential amino acids other than lysine are typically predicted from the amount secreted in milk and available from body protein. The drawback of establishing essential amino acid requirements in this manner is that not all amino acids are used for milk protein production, with some used for protein deposition and turnover. Along with conversion into protein, methionine also can be converted to S-adenosylmethionine, which acts as a methylating substrate for synthesis of other metabolites. Furthermore, we are only aware of one published study that examines the requirement of sulfur amino acid for the lactating sow. As a consequence, there is little knowledge of the total sulfur amino acid (TSAA) requirement of the modern lactating sow. Calculations based on NRC (1998) recommendations result in a

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TID TSAA:lysine ratio of approximately 48 to 49%, depending on the level of milk production. The objective of this experiment was to determine whether the TSAA:lysine ratio calculated from NRC (1998) recommendations is adequate for lactating sows. A secondary objective was to determine whether deleting methionine from a diet containing large amounts of synthetic amino acids would alter sow productivity, thus, providing a model to determine the TSAA:lysine ratio for lactating sows in future experiments.

Procedures

This study was conducted in the Kansas State University Swine Teaching and Research Center farrowing facilities. Seventy-five sows were blocked by parity and allotted to one of two diets. The 75 sows used in this study were PIC Line 1050 and were farrowed in three farrowing groups. Sows were randomly assigned to treatments balanced by parity when entering the farrowing house on day 110 of gestation. During lactation, sows were provided *ad libitum* access to feed and water, and feed disappearance was recorded. All sows were fed diets that contained large amounts of synthetic amino acids and contained either 0.44 or 0.57% TID TSAA (Table 1). The two diets were identical except that DL-methionine replaced sand in the 0.57% TSAA diet. The diets were formulated to contain 0.88% TID lysine and 1,537 kcal of ME per lb (Table 2).

All sows were weighed after farrowing and again at weaning to calculate weight change during lactation. Cross-fostering occurred before day 2 to standardize all litters with approximately 11 pigs. Pigs were weighed individually at birth, after fostering on day 2, and again at weaning. Any pigs removed from the trial were recorded, along with their date of removal and weight. Litters did not have access to supplemental milk or creep feed. Data were analyzed by using the MIXED procedure of SAS.

Results and Discussion

The lactating sows fed the diet containing 0.57% TID TSAA had greater ($P<0.05$) ADFI than did sows fed the diet containing 0.44% TID TSAA (Table 2). Sow weight loss during lactation was not affected by treatment. Litters weaned from sows fed the 0.57% TSAA diet were heavier ($P<0.01$; Table 2) than litters weaned from sows fed the 0.44% TSAA diet. The marked difference in litter weaning weight was due to the increase ($P<0.02$) in litter weight gain. At weaning, pigs reared from sows fed more TSAA averaged 13.7 lb, heavier ($P<0.06$) than the 12.8 lb averaged by pigs reared from sows fed the 0.44% TSAA diet. Litter size averaged 9.9 pigs during lactation, and mortality rate was 8.1 and 7.7% for the diets with 0.44% TSAA and 0.57% TSAA, respectively.

It is clear in this study that the sows required more than 0.44% TID TSAA. The TSAA:lysine ratio in this diet was 50%. Increasing the TSAA content to 0.57% (65% TSAA:lysine ratio) increased sow feed intake, pig weaning weight, and litter weight gain.

One concern with expressing the TSAA content on a ratio to lysine is making sure that the sows were not fed in excess of their lysine requirement. To support the 138-lb litter weaning weight and 101 lb of litter weight gain from d 2 to 21 without losing body protein, sows would have had to consume more than 54 g of TID lysine per day. With ADFI of approximately 11.5 lb/day, sows on the diets with 0.57% TSAA actually consumed approximately 46 g of TID lysine per day. Thus, sows received less than their lysine requirement, making amino acid ratio comparisons valid.

The current NRC (1998) requirement estimates for a TID TSAA:lysine ratio is calculated to be approximately 48%. Our results suggest that the NRC ratio is too low and that the requirement for these high-producing sows was greater than 50%. The large magnitude of the response suggests that the optimum ratio is probably significantly greater than 50%. These data also validate that our basal diet can be used in future research to titrate the optimal TSAA:lysine ratio for lactating sows.

Table 1. Composition of Diets (As-fed Basis)[a]

Item	Basal Diet[b]
Corn	76.09
Soybean meal (46.5% CP)	16.00
Soybean oil	2.50
Monocalcium P (21% P, 18% Ca)	2.00
Limestone	1.00
Salt	0.50
Vitamin premix	0.25
Trace mineral premix	0.15
Sow add pack	0.25
L-valine	0.31
L-isoleucine	0.04
L-tryptophan	0.05
L-threonine	0.20
L-lysine HCl	0.37
DL-methionine	---
Sand	0.30
Total	100.00
Calculated analysis	
ME, kcal/lb	1535
Crude protein, %	13.9
Total lysine, %	0.97
TID amino acids, %	
Lysine	0.88
Methionine	0.21
Methionine & Cystine	0.44
Threonine	0.64
Tryptophan	0.18
Isoleucine	0.53
Leucine	1.21
Ca, %	0.80
P, %	0.70
Available P, %	0.50

[a]All diets are formulated to contain 0.88% TID lysine.
[b]DL-methionine was added at the expense of sand to achieve the desired TID TSAA content of 0.57%.

Table 2. Effects of Increasing Dietary True Ileal Digestible TSAA During Lactation

	True Ileal Digestible TSAA (%)[a]			Probability,
Item	0.44	0.57	SE	P <
Number of sows	38	37		
Lactation length, d	20.4	20.0	0.38	0.32
ADFI, lb	10.3	11.5	0.39	0.04
Sow weight, lb				
Day 2	526.2	512.6	9.67	0.33
Weaning	476.8	463.7	8.63	0.29
Loss	49.6	48.9	5.85	0.94
Day 2 No. pigs	10.6	11.0	0.26	0.23
Day 2 litter wt.	34.9	37.1	0.94	0.11
Day 2 avg. pig wt.	3.3	3.4	0.09	0.57
Litter weaned wt.	123.1	137.9	4.07	0.01
Litter wt. gain	88.1	100.9	3.77	0.02
Avg. weaned pig wt.	12.8	13.7	0.34	0.06
Pre-weaning mortality, %	8.1	7.7	0.02	0.86

[a]All diets are formulated to contain 0.88% TID lysine.