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The optimal true ileal digestible lysine requirement for 22 to 45 lb pigs

Abstract

A total of 1,440 pigs (initially 22.5 lb and 21 d after weaning) was used in a 21-d growth assay to determine the optimal lysine level to maximize growth performance of 22- to 45-lb pigs. Pigs were fed one of five dietary treatments with increasing dietary lysine (1.1, 1.2, 1.3, 1.4 and 1.5% true digestible lysine). All diets had the same soybean meal level with crystalline amino acids added to achieve the increasing lysine levels while maintaining a minimum ratio of all other amino acids to lysine. Average daily gain and feed efficiency improved linearly ($P < 0.01$) with increasing dietary lysine. Although the response to lysine was linear ($P < 0.01$), it would appear that pigs weighing between 22 and 45 lb require approximately 1.4% true digestible lysine (1.54% total lysine) to maximize growth performance.; Swine Day, 2003, Kansas State University, Manhattan, KS, 2003

Keywords

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THE OPTIMAL TRUE ILEAL DIGESTIBLE LYSINE REQUIREMENT FOR 22 TO 45 LB PIGS¹

N.A. Lenehan, S.S. Dritz², M.D. Tokach, R.D. Goodband, J.L. Nelssen, J.M. DeRouchey, and J.L. Usry³

Summary

A total of 1,440 pigs (initially 22.5 lb and 21 d after weaning) was used in a 21-d growth assay to determine the optimal lysine level to maximize growth performance of 22- to 45-lb pigs. Pigs were fed one of five dietary treatments with increasing dietary lysine (1.1, 1.2, 1.3, 1.4 and 1.5% true digestible lysine). All diets had the same soybean meal level with crystalline amino acids added to achieve the increasing lysine levels while maintaining a minimum ratio of all other amino acids to lysine. Average daily gain and feed efficiency improved linearly ($P < 0.01$) with increasing dietary lysine. Although the response to lysine was linear ($P < 0.01$), it would appear that pigs weighing between 22 and 45 lb require approximately 1.4% true digestible lysine (1.54% total lysine) to maximize growth performance.

(Key Words: Pigs, Lysine, Growth)

Introduction

Since dietary lysine level has a major impact on growth performance, the prediction of the optimal requirement is important.

The NRC (1998) recommendations of 1.01% true ileal digestible lysine or 1.15% total lysine for the 22- to 45-lb pig is lower than current levels fed in commercial production. An accurate estimate of the lysine requirement also is essential for accurate estimation of the optimal ratio of other amino acids relative to lysine. Therefore, the objective of this experiment was to determine the optimal lysine level in diets to maximize growth performance of late nursery pigs.

Procedures

Pigs were blocked by gender, allotted, and placed on their respective experimental diets on d 21 after weaning. There were 60 pens in total and 24 pigs/pen. Two pens shared the same feeder, with feeder as the experimental unit. Thus, there were 48 pigs per experimental unit and 6 replications per treatment. Pigs were housed in an environmentally controlled nursery. Temperature was set at 74°F on d 21, and reduced to 68°F by d 32 to maintain pig comfort. Each pen (5 × 10 ft with slatted plastic flooring) contained a stainless steel self-feeder and one cup waterer to allow *ad libitum* consumption of feed and water. Experimental diets were fed for 21 d. Pigs were weighed and feed disappearance measured on d 28, 35,

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and 42 to determine the response criteria of ADG, ADFI, and F/G.

Diets were corn-soybean meal based (Table 1). Synthetic amino acids were used to achieve higher lysine levels while avoiding the addition of excessive quantities of soybean meal. L-lysine HCl addition was increased to provide 1.1, 1.2, 1.3, 1.4, and 1.5% true ileal digestible lysine. Diets were fed in meal form.

Data were analyzed as a randomized complete block design using the PROC MIXED procedure of SAS with 2 pens used as the experimental unit. Linear and quadratic polynomial contrasts were performed to determine the effects of increasing dietary lysine.

Results and Discussion

Overall, there was a linear increase in ADG ($P < 0.01$) as the lysine content increased from 1.1 to 1.5% true ileal digestible lysine

(Table 2). Feed efficiency also improved linearly ($P < 0.001$) as the level of true ileal digestible lysine increased. Although statistical analysis suggests an increase in both ADG and F/G as the level of true ileal digestible lysine increases to 1.5%, the further improvements in ADG and F/G beyond that in pigs fed a diet containing 1.4% true ileal digestible lysine was minimal.

The results of this experiment suggest that the lysine requirement of these pigs is significantly higher than the level recommended by the NRC (1998). Research previously conducted at the University of Missouri indicates a true ileal digestible lysine requirement of approximately 1.32% for pigs in this growth phase. Data from the current trial indicate a requirement of 1.4% true ileal digestible lysine. Further research needs to be conducted in order to verify that the optimum lysine level for a 22- to 45-lb pig is approximately 1.4% true ileal digestible lysine (1.54% total lysine).

Table 1. Diet Composition (As-fed Basis)

Ingredient, %	True Digestible Lysine, %				
	1.1	1.2	1.3	1.4	1.5
Corn	59.52	59.47	59.35	58.7	58.30
Soybean meal, 46.5%	33.85	33.85	33.85	33.85	33.85
Choice white grease	3.00	3.00	3.00	3.00	3.00
Dicalcium phosphate, 18.5% P	1.40	1.40	1.40	1.40	1.40
Limestone	0.75	0.75	0.75	0.75	0.75
Salt	0.35	0.35	0.35	0.35	0.35
Vitamin/trace mineral premix	0.30	0.30	0.30	0.30	0.30
Medication ^a	0.70	0.70	0.70	0.70	0.70
L-threonine	---	0.07	0.13	0.20	0.26
L-tryptophan	---	---	---	0.01	0.03
L-valine	---	---	---	0.04	0.11
L-isoleucine	---	---	---	---	0.06
Lysine HCl	0.08	---	---	0.46	0.59
DL-methionine	0.05	0.11	0.17	0.24	0.30
Total	100.0	100.0	100.0	100.0	100.0
Total lysine, %	1.24	1.34	1.44	1.54	1.64
Isoleucine:lysine ratio, %	73	67	62	58.3	56.8
Leucine:lysine ratio, %	148	137	127	118	111
Methionine:lysine ratio, %	30	33	35	36	38
Met & Cys:lysine ratio, %	60	60	60	60	60
Threonine:lysine ratio, %	64.6	64.6	64.5	64.4	64.4
Tryptophan:lysine ratio, %	21	19	18	17.4	17.4
Valine:lysine ratio, %	81	75	69	67	67
ME, kcal/lb	1,551	1,547	1,543	1,538	1,532
Protein, %	20.8	20.8	20.8	20.8	20.9
Ca, %	0.71	0.71	0.71	0.71	0.71
P, %	0.66	0.66	0.66	0.66	0.66
Available P, %	0.34	0.34	0.34	0.34	0.34
Lysine:calorie ratio, g/mcal	3.62	3.92	4.22	4.53	4.84

^aProvided 140g/ton neomycin and 140g/ton oxytetracycline.

Table 2. Influence of Dietary Lysine Level on 22- to 45-lb Pig Performance^a

Item	True Digestible Lysine, %					SEM	Probability P<	
	1.1	1.2	1.3	1.4	1.5		Linear	Quadratic
D 21 to 42								
ADG, lb	1.03	1.05	1.09	1.14	1.13	0.03	0.01	0.76
ADF, lb	1.56	1.54	1.55	1.56	1.56	0.04	0.71	0.78
F/G	1.51	1.47	1.42	1.37	1.38	0.02	0.001	0.20
Avg weight, lb								
d 21	22.6	22.5	22.6	22.6	22.8	0.4	0.84	0.72
d 42	44.3	44.5	45.5	46.5	46.6	0.8	0.01	0.93

^aA total of 1,440 pigs (24 pigs per pen) with an initial average BW of 22.6 lb.