LYSINE REQUIREMENT OF PHASE 2 NURSERY PIGS FED KARL HARD RED WINTER WHEAT BASED DIETS

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Story in Brief

Two experiments involving 120 pigs (21± 3 d of age; 13.9 lb body weight (BW)) were conducted to determine the dietary lysine requirement to maximize growth performance of phase 2 (day 10 to 38 postweaning) nursery pigs fed a hard red winter wheat (Karl variety)-soybean meal (SBM) diet. Pigs were block based on initial BW and penned in groups of five. All pigs were fed a common phase 1 diet containing 1.50% lysine for the first 10 days (Exp. 1) or 8 days (Exp. 2) following weaning. After phase 1, pigs (17 lb BW) were assigned to each of four dietary treatments (6 pens/treatment). Dietary treatments were 1.30, 1.40, 1.50 and 1.60% total lysine. Wheat (Exp. 1) and cornstarch and sucrose (Exp. 2) were replaced by SBM to provide additional lysine levels. Experimental diets were fed for 28 days (phase 2) with gain and efficiency of gain obtained weekly. From d 0 to 7 (phase 2), ADG and G/F increased linearly with increasing dietary lysine. Increasing dietary lysine improved ADG and G/F from d 7 to 14 with a maximum observed in G/F at 1.50% lysine. During d 14 to 28, ADG was improved with increasing dietary lysine. Feed intake was not affected during any phase of the study. Blood urea nitrogen (BUN) concentrations (day 14) increased with increasing dietary lysine levels. These data suggest that the dietary lysine requirement for maximum performance of phase 2 nursery pigs fed a hard red winter wheat-soybean meal diet is at least 1.60% in week 1 with some indication of a reduction in requirement after day 7.

(Key Words: Pig, Wheat, Lysine, Performance.)

Introduction

Lysine has been considered for many years the first limiting amino acid in typical corn-soybean meal diets fed to swine. The lysine requirement of early weaned pigs (22 to 44 lb) fed a corn-soybean meal diet range from .90 to 1.40% (Lin and Jensen, 1985; Martinez and Knabe, 1990, and Rose et al., 1994). The NRC (1988) lists the lysine requirement as .95% for 22 to 44 lb pigs which is generally considered too low by the swine industry. Research to determine the lysine requirement of early-weaned pigs fed a wheat-soybean meal diet is very limited. Campbell (1978) reported that optimum performance was obtained on 12 to 44 and 26 to 44 lb pigs with dietary lysine levels of 1.08 and .90%, respectively, in wheat based diets. However, the class of wheat was not identified. Aherne and Nielsen (1983) reported that 15 to 42 lb weanling pigs had a dietary lysine requirement of 1.15% when fed a wheat-barley based diet. Again the class of wheat or barley was not identified. Oklahoma is a major producer of hard red winter wheat with an annual yield of 100 to 200 million bushels (Oklahoma Department of Agriculture, 1995). Often wheat is competitively priced with yellow corn which suggests its use in swine diets as the

primary energy source. In addition, a recent study by de Rodas et al. (1996) indicated that Karl hard red winter wheat could be an excellent substitute for corn in phase 2 nursery swine diets.

The objective of this study was to determine the lysine requirements of early-weaned pigs fed a Karl hard red winter wheat based diet during phase 2 of the nursery period.

Materials and Methods

Two trials involving a total of 120 pigs (60 pigs in each of the two trials) were conducted to determine the lysine requirement of phase 2 (day 10 to 38 postweaning) nursery pigs fed a hard red winter wheat (Karl variety)-soybean meal (SBM) diet. Pigs were weaned at 21± 3 days of age with an average weight of 13.9 lb. Pigs were allotted into three groups (blocks) based on initial BW. Pigs within each weight block and trial were allotted into four equal subgroups (five pigs per subgroup) with stratification based on litter and sex. During the first 10 days (Exp. 1) or 8 days (Exp. 2) following weaning, all pigs were fed a common phase 1 diet (Table 1) containing 1.50% lysine, .93 % Ca and .84% P. After phase 1, dietary treatments were randomly assigned to pens within weight group and trial (3 pens/treatment/trial). Experimental diets were formulated by substituting SBM for wheat (Exp. 1, Table 1) or cornstarch and sucrose (Exp. 2, Table 2) to obtain lysine levels of 1.30, 1.40, 1.50 and 1.60% in the diet. All four diets contained .90% Ca and .75% P which exceeded current NRC (1988) requirements. Experimental diets were fed for 28 days (phase 2).

The temperature of the nursery rooms was maintained at 86°F during the first week and then decreased 2°F per week. Pigs had ad libitum access to one water nipple and a four-hole feeder. Body weight and feed intake were determined weekly to evaluate average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (G/F). Blood samples were taken via anterior vena cava puncture on day 14 of phase 2 (Exp. 2) and serum was analyzed for urea N concentrations (BUN).

Data were analyzed as a randomized complete block design with pen as the experimental unit. Blocks were based on initial body weight. Analysis of variance was performed using the GLM procedure of SAS (1988). Orthogonal polynomials were used to test for linear, quadratic and cubic effects.

Results and Discussion

Average daily gain, ADFI and G/F during the phase 1 adjustment period following weaning were .40 lb, .49 lb and .82 lb of gain/lb of feed, respectively. During phase 2 there was no trial x treatment interaction, therefore data from both trials were combined. From d 0 to 7 of phase 2, ADG and G/F increased linearly ($P<.01$) with increasing dietary lysine (Table 3). Average daily feed intake was not affected by dietary treatments. Increasing dietary lysine improved ADG and G/F (linear, $P<.01$; quadratic, $P<.05$, respectively) from d 7 to 14 with a maximum observed in

G/F at 1.50% lysine. Feed intake was again similar among treatments. During d 14 to 28, ADG was improved (linear, P<.07) with increasing dietary lysine while ADFI and G/F were similar. During the overall phase 2 period, ADG and G/F improved linearly (P<.01) with increasing dietary lysine. Feed intake, however, was not affected by dietary treatments. Blood urea nitrogen concentrations (day 14) increased (linear, P<.01) with increasing dietary lysine. This study confirms that wheat is an excellent grain source for nursery age pigs. Performance in this study was similar to that observed in previous work (de Rodas et al., 1996) comparing corn with wheat as an energy and protein source.

These data suggest that the dietary lysine requirement for maximum performance of phase 2 nursery pigs fed a hard red winter wheat-soybean meal diet is at least 1.60% in week 1 with some indication of a reduction in requirement after day 7.

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Table 1. Composition of experimental diets for experiment 1a.

	Phase 1	Phase 2

		Lysine, %			
Ingredient, %		1.30	1.40	1.50	1.60
Corn, ground	38.06	-	-	-	-
Wheat, hard winter	-	70.00	66.43	62.595	59.125
Soybean meal, 48%	10.00	20.00	23.625	27.50	31.00
Fishmeal	8.00	4.00	4.00	4.00	4.00
AP-301b	1.50	2.75	2.75	2.75	2.75
AP-920c	3.50	-	-	-	-
Whey, dehydrated	10.00	-	-	-	-
Lactose, 97%	11.36	-	-	-	-
Steam rolled oats	10.00	-	-	-	-
Soybean oil	4.00	-	-	-	-
Neo-terramycin 10/5d	1.00	-	-	-	-
Tylan 40-sulfae	-	.125	.125	.125	.125
Salt	.20	.30	.30	.30	.30
Calcium carbonate	-	.50	.52	.58	.60
CuSO4	.07	.05	.05	.05	.05
Micro curb	-	.10	.10	.10	.10
Dicalcium phosphate	1.45	1.625	1.55	1.45	1.40
Vit. min. premixf	.38	.25	.25	.25	.25
Zinc oxide	-	.30	.30	.30	.30
Ethoxyquin	.03	-	-	-	-
Lysine, HCl	.26	-	-	-	-
DL-Methionine	.09	-	-	-	-

Berry flavor	.10	-	-	-	-

a As fed basis. Diets were formulated to contain 1.50% lysine, .93% Ca, and .84% P in Phase 1; and .90% Ca, and .75% P in Phase 2, and to exceed the NRC (1988) standards for all nutrients.

b Blood meal source, American Protein Corp., Ames, IA.

c Plasma protein source, American Protein Corp., Ames, IA.

d Contained 10 g of Neomycin and 5 g of Oxytetracline per lb.

e Contained 40 g of Tylosin and 40 g of Sulfamethazine per lb.

f Vitamins and minerals met or exceed the NRC (1988) requirements.

Table 2. Composition of experimental diets for experiment 2a.

	Phase 2 diets Lysine, %			
Ingredient, %	1.30	1.40	1.50	1.60
Cornstarch	4.935	3.155	1.575	-
Sucrose	4.93	3.155	1.575	-
Wheat, hard winter	60.085	60.085	60.085	60.085
Soybean meal, 48%	20.00	23.60	26.80	30.00
Fishmeal	4.00	4.00	4.00	4.00
AP-301b	2.75	2.75	2.75	2.75
Tylan 40-sulfac	.125	.125	.125	.125
Salt	.30	.30	.30	.30
Calcium carbonate	.40	.50	.52	.57
CuSO4	.05	.05	.05	.05

Micro curb	.10	.10	.10	.10
Dicalcium phosphate	1.775	1.62	1.54	1.44
Vit. min. premixd	.25	.25	.25	.25
Zinc oxide	.30	.30	.30	.30
DL-methionine	-	.01	.03	.03

a As fed basis. Diets were formulated to contain .90% Ca and .75% P, and to exceed the NRC (1988) standards for all nutrients.

b Blood meal source, American Protein Corp., Ames, IA.

c Contained 40 g of Tylosin and 40 g of Sulfamethazine per lb.

d Vitamins and minerals met or exceed the NRC (1988) requirements.

Table 3. Performance of pigs fed increasing levels of dietary lysine during phase 2 of the nursery perioda.

	Lysine, %				
Item	1.30	1.40	1.50	1.60	SEM
Day 0 to 7					
ADG, lbb	.67	.78	.76	.85	.03
ADFI, lb	.92	.98	.88	.98	.04
G/Fb	.74	.80	.88	.89	.03
Day 7 to 14					
ADG, lbb	.97	1.05	1.15	1.16	.05
ADFI, lb	1.47	1.46	1.44	1.50	.06
G/Fd	.66	.72	.80	.78	.02
Day 14 to 28					

ADG, lbc	1.31	1.31	1.32	1.41	.04
ADFI, lb	2.08	1.97	2.04	2.11	.07
G/F	.63	.68	.65	.67	.02
Day 0 to 28					
ADG, lbb	1.06	1.11	1.14	1.21	.03
ADFI, lb	1.64	1.60	1.60	1.68	.05
G/Fb	.67	.72	.74	.75	.01
BUN, mg/dlb	13.89	16.34	16.94	18.60	.58

a Data are means of six pens of five pigs each. Pigs averaged 16.9 and 48.7 lb at initiation and termination, respectively.

b Linear effect of increasing dietary lysine (P<.01).

c Linear effect of increasing dietary lysine (P<.07).

d Quadratic effect of increasing dietary lysine (P<.05).

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