THE EFFECT OF DIETARY SOYBEAN MEAL LEVEL IN PHASE I ON SUBSEQUENT PHASE II GROWTH PERFORMANCE

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Summary

One hundred and four pigs (initially 11.7 lb and 21 d of age) were used to determine the effect dietary soybean meal has on growth performance in the early-weaned pig. Pigs were fed one of four diets from d 0 to 14 postweaning. Diets were formulated to 1.5% lysine and 24.4% lactose with either 0, 7.5, 15.0, or 22.5% soybean meal. Soybean meal and lactose replaced dried skim milk to maintain equal lysine and lactose levels. From d 14 to 35 postweaning, all pigs were fed a common (1.25% lysine) corn-soybean meal diet containing 10% dried whey and 4% select menhaden fish meal. Growth performance (ADG, ADFI, and F/G) was not influenced by dietary soybean meal level fed from d 0 to 14 postweaning. From d 14 to 35 postweaning, ADG was not influenced by dietary soybean meal level during d 0 to 14. Average daily feed intake was decreased linearly during d 14 to 35 as dietary soybean meal (d 0 to 14) increased. Conversely, feed efficiency during d 14 to 35 improved linearly as dietary soybean meal increased (d 0 to 14). Cumulative (d 0 to 35) ADG was not affected by the amount of dietary soybean meal (7.5, 15.0, or 22.5%) fed from d 0 to 14 postweaning, whereas ADFI decreased linearly and feed efficiency was improved linearly. These data suggest that soybean meal can be included in a high nutrient dense starter diet at levels up to 22.5% without impairing phase I (d 0 to 14 postweaning) growth performance and overall growth performance. The phase I diet must contain soybean meal for optimal subsequent performance.

(Key Words: Starter Pigs, Soybean Meal, Dried Skim Milk.)

Introduction

Previous research at Kansas State University has suggested that decreased growth performance during the first week postweaning can be attributed to an immune (allergic) reaction to soybean meal in the small intestine. This immune response impairs nutrient absorption, resulting in decreased growth performance. Further research indicates that feeding early-weaned pigs a corn-soybean meal diet following a diet without soybean meal from d 0 to 14 postweaning also results in a similar depression in growth performance. These data suggest that the early-weaned pig requires soybean meal during phase I to become acclimated to soy protein as it matures. Thus, the objective of this experiment was to determine the amount of dietary soybean meal necessary during phase I to acclimate the early-weaned pig to soy protein without impairing growth performance throughout the nursery phase.

Procedures

A total of 104 pigs averaging 11.7 lb and 21 $\pm$ 1 d of age was used to determine the optimal level of soybean meal to be included in starter diets for the early-weaned pig. From d 0 to 14, pigs were fed experimental diets containing 0, 7.5, 15.0, and 22.5% soybean meal (Table 1). Soybean meal and purified lactose replaced dried skim milk to provide the three soybean meal diets. The experimental diets were formulated to contain 1.5% lysine, and purified lactose was supple-

mented in the soybean meal diets to ensure that all four diets were equal in lactose content. From d 14 to 35 postweaning, pigs were placed on a common, 1.25% lysine diet containing 10% dried whey and 4% select menhaden fish meal. Pigs were housed in 4 ft × 5 ft pens, with four or five pigs per pen and six replicate pens per treatment. Each pen was equipped with a self-feeder and a nipple waterer to provide *ad libitum* access to feed and water. Weekly pig weights and feed consumption were collected to determine ADG, ADFI, and F/G.

Results and Discussion

Increasing soybean meal in diets for early-weaned pigs did not affect (P>.10) ADG, ADFI, and F/G from d 0 to 14 postweaning (Table 2). The performance during d 0 to 14 in this study suggests that the maximum inclusion rate of soybean meal in the starter pig diet was not detected. A previous high nutrient dense diet included 21.4% soybean meal, which is similar to the highest soybean meal inclusion rate of this experiment. Initially, the high nutrient dense diet contained a high concentration of milk products (dried skim milk and dried whey) to increase diet palatability and digestibility. Recent research from Kansas State University has suggested that spray-dried porcine plasma improves ADFI and feed efficiency, resulting in increased ADG when fed to the early-weaned pig. The high level of feed consumption in this experiment can be explained by the inclusion of spray-dried porcine plasma in the diet. This may hasten the development of immune tolerance to soy protein by increasing soybean meal intake during the starter phase and allow higher levels of SBM in the phase I diet.

From d 14 to 35, all pigs were placed on a common diet. Average daily gain was not affected (P>.10) in the final 3 weeks of the experiment (Table 2). However, from d 14 to 21, ADG tended (P<.11) to linearly decrease in pigs that had been fed low levels of soybean meal compared to pigs that had been fed a 22.5% soybean meal diet from d 0 to 14. The response was not prolonged, because ADG was not different (P>.10) from d 21 to 28 postweaning. Average daily feed intake during d 14 to 35 was decreased linearly (P<.05) and quadratically (P<.05) with increased soybean meal levels fed from d 0 to 14 postweaning.

Cumulative (d 0 to 35) ADG was not affected (P>.10) by soybean meal inclusion in the starter diet. However, as the level of soybean meal increased in the starter diet, ADFI was decreased (quadratic, P<.05). Feed efficiency from d 0 to 35 showed a quadratic (P<.05) improvement, with F/G maximized in pigs fed a 15% soybean meal diet from d 0 to 14 postweaning. Simple corn-soybean meal diets are not typically utilized for the early-weaned pig because of decreased nutrient digestibility; thus, the use of high nutrient dense diets has been proposed to increase feed intake and ADG in conjunction with improved feed efficiency. Including spray dried porcine plasma in the diets increased feed consumption, potentially masking the immune response for pigs fed higher levels of soybean meal (22.5%) on d 0 to 14 postweaning. This experiment indicates that soybean meal can be included at levels up to 22.5% from d 0 to 14 postweaning without depressing ADG or F/G. The phase I starter diet must contain soybean meal for optimal F/G during phase II.

Table 1. Composition of Diets, %[a]

Item	Soybean meal, %				
	0	7.5	15	22.5	Phase II
Corn	35.21	31.83	28.40	24.99	55.83
Soybean meal (48% CP)		7.50	15.00	22.50	22.71
Dried skim milk	26.71	17.81	8.91	—	—
Dried whey	20.00	20.00	20.00	20.00	10.00
Lactose		4.45	8.90	13.35	—
Fish meal					4.00
Spray dried porcine plasma	8.94	8.94	8.94	8.94	—
Soybean oil	6.00	6.00	6.00	6.00	4.00
					.15
Monocalcium phosphate (21% P)	1.47	1.76	2.05	2.33	1.46
Limestone	.14	.19	.26	.28	.55
Vitamin premix	.25	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15	.15
Copper sulfate	.07	.07	.07	.07	—
Salt	.05	.05	.05	.05	.25
Antibiotic[b]	1.00	1.00	1.00	1.00	.50
Total	100.00	100.00	100.00	100.00	100.00

[a]Phase I diets were formulated to contain 1.5% lysine, .90% Ca, .80% P, and 24.40% lactose. The Phase II diet was formulated to

[b]CSP-250 provided the following per lb of complete diet (g): chlortetracycline, .11, sulfathiazole, .11; penicillin, .055.

Table 2. The Effect of Soybean Meal Level on Weanling Pig Growth Performance[a]

Item	Soybean meal inclusion, %				
	0	7.5	15.0	22.5	CV
d 0 to 14					
ADG, lb	.80	.78	.76	.77	11.2
ADFI, lb	.81	.86	.77	.83	10.6
F/G	1.01	1.10	1.01	1.08	6.8
d 14 to 35					
ADG, lb	1.04	1.03	1.03	1.05	8.9
ADFI, lb[bc]	1.82	1.72	1.64	1.69	5.8
F/G[b]	1.75	1.67	1.59	1.61	5.9
d 0 to 35					
ADG, lb	.95	.93	.92	.94	5.7
ADFI, lb[c]	1.42	1.37	1.29	1.35	5.2
F/G[b]	1.49	1.47	1.40	1.44	4.1

[a]A total of 104 pigs, initial weight = 11.7 lb, 4-5 pigs/treatment, 6 pens/treatment.

[b]Linear effect of soybean meal ($P < .05$).

[c]Quadratic effect of soybean meal ($P < .05$).