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Abstract

Early-weaned pigs (weaned at 7 to 14 d of age) that are managed in a conventional, one-site production system require a more complex diet in the transition phase (11 to 15 lb) than early-weaned pigs that are managed in a segregated early weaning (SEW), multiple-site, production system.; Swine Day, Manhattan, KS, November 16, 1995

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COMBINATIONS OF SELECT MENHADEN FISH MEAL AND SPRAY-DRIED PLASMA PROTEIN IN THE TRANSITION DIET (11 TO 15 LB) FOR THE EARLY-WEANED PIG[1]

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Summary

Early-weaned pigs (weaned at 7 to 14 d of age) that are managed in a conventional, one-site production system require a more complex diet in the transition phase (11 to 15 lb) than early-weaned pigs that are managed in a segregated early weaning (SEW), multiple-site, production system.

(Key Words: Pigs, Growth Performance, Fish Meal, Plasma.)

Introduction

Segregated early weaning (SEW) technology has become more practical with the development of complex diets containing highly palatable ingredients for the early-weaned pig. Phase feeding also has become a very important concept for the modern swine producer, who strives to attain superior growth performance at the least possible cost. In order to improve upon current phase feeding practices, the traditional phase I portion of the starter period has been replaced with an SEW and transition phase, which reduces feed costs and more accurately meets the pigs' changing nutritional needs. The SEW diet is formulated to be fed to pigs weaned at 7 to 14 days of age until they weigh 11 lb. Pigs are then switched to a transition diet, which is fed from 11 to 15 lb. However, the degree of complexity required in the subsequent transition diet has been questioned. Differences in early-weaning schemes, such as on-site and off-site (SEW) nursery facilities, and health status may influence the degree of complexity required to obtain optimal growth performance.

Therefore, the objectives of the following two growth trials were to determine which combination of protein sources (soybean meal, select menhaden fish meal, and spray-dried plasma protein) would support optimal growth performance of the early-weaned pig during the transition phase and to determine if pigs managed in SEW conditions require a less complex transition diet than those managed in a conventional, one-site, production system.

Procedures

Experiment 1. A total of 300 pigs (PIC C15 × 326, and initially 14 ± 2 d of age and 8.8 ± 2.0 lb) was used in a 33-d growth trial to determine the degree of complexity required in the transition diet to optimize growth performance of the SEW pig. The pigs were delivered to the SEW facilities at Kansas State University, blocked by weight, and placed on a common SEW diet from d 0 to 5 postweaning. This pelleted diet contained 25% dried whey, 5% lactose, 7.5%

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[2]Northeast Area Extension Office.

[3]Food Animal Health and Management Center.

spray-dried plasma protein (SDPP), and 6% select menhaden fish meal (SMFM) and was formulated to 1.7% lysine, 0.49% methionine, 0.9% Ca, and 0.8% P. On d 5, the pigs were weighed (10.6 ± 2.0 lb) and allotted randomly to one of 12 experimental diets, with five pigs/pen and five replicate pens/treatment. The experimental diets were pelleted and fed from d 5 to 19 postweaning and consisted of three levels of SDPP (0, 2.5, or 5%) and four levels of SMFM (0, 2.5, 5, or 7.5%) in a 3 × 4 factorial arrangement. A corn-soybean meal basal diet containing 20% dried whey and 2.5% spray-dried blood meal was formulated to 1.6% lysine, 0.9% Ca, 0.8% P, and at least .44% methionine. This diet contained 33.4% soybean meal. Select menhaden fish meal (0, 2.5, 5, or 7.5%) and/or SDPP (0, 2.5, or 5%) replaced soybean meal in the basal diet on an equal lysine basis (Table 1).

From d 19 to 26 postweaning, all pigs were fed a common phase II diet in meal form. This corn-soybean meal-based diet contained 10% dried whey and 2.5% spray-dried blood meal and was formulated to 1.35% lysine, 0.9% Ca, and 0.8% P.

Pigs were housed in 4 × 4 ft pens at the Kansas State University SEW nurseries for the duration of the trial. Pens were equipped with one self-feeder and one nipple waterer to provide ad libitum access to feed and water.

The pigs were weighed and feed disappearance was determined on d 5, 12, 19, 26, and 33 postweaning. Average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (F/G) were the response criteria.

The data were analyzed as a randomized complete block design, with pen as the experimental unit. Pigs were blocked on the basis of initial weight. Analysis of variance was performed using the GLM procedure of SAS, with d 5 weight used as a covariate. Both linear and quadratic polynomials were evaluated for SDPP level; and linear, quadratic, and cubic polynomials were evaluated for SMFM level. The data also were analyzed for SDPP × SMFM interactions.

Experiment 2. A total of 326 pigs (PIC C15 × 326, and initially 12 ± 2 d of age and 8.6 ± 2.6 lb) was used in a 28-d growth trial to determine the degree of complexity required in the transition diet to optimize growth performance of the early-weaned pig reared in a conventional one-site production system. The pigs were fed a common SEW diet from d 0 to 7 postweaning. This diet was the same as that used in Exp. 1. On d 7, the pigs were weighed (10.6 ± 2.6 lb) and allotted randomly to one of six experimental diets, with 7 to 11 pigs/pen (depending upon the block) and six pens/treatment. The experimental diets were fed from d 7 to 21 and consisted of two levels of SDPP (0 and 2.5%) and three levels of SMFM (0, 2.5, or 5%) in a 2 × 3 factorial arrangement. These six diets were identical to six of those used in Exp. 1.

From d 21 to 28, all pigs were fed a common phase II diet identical to that fed in Exp. 1.

The pigs were housed in an environmentally-regulated nursery in 5 × 5 ft pens for the duration of the trial. Pens were equipped with one self-feeder and two nipple waterers to provide ad libitum access to feed and water.

The pigs were weighed and feed disappearance was determined on d 7, 14, 21, and 28 postweaning, with ADG, ADFI, and F/G as the response criteria.

Data were analyzed as a 2 × 3 factorial, with d 7 weight used as a covariate. Both linear and quadratic polynomials were evaluated for SMFM level.

Results and Discussion

Experiment 1. From d 0 to 5, when the pigs were on a common SEW diet, ADG, ADFI, and F/G were 0.41, 0.34, and 0.83, respectively. No significant SDPP × SMFM interactions were observed during this trial for any of the response criteria, and no differences in ADG or ADFI were observed during the study (Table 2).

From d 5 to 19, when the experimental diets were fed, F/G was improved (linear, P<.01) as SDPP increased. There was also a tendency (linear, P<.07) for improved F/G with increasing SMFM.

From d 19 to 26 postweaning, when all pigs were fed a common phase II diet, F/G was improved (linear, P<.06; quadratic, P<.04) by increasing SMFM in the diet from d 5 to 19 postweaning. However, no differences in ADG, ADFI, or F/G existed during the overall phase II period of the trial (d 19 to 33 postweaning).

For the overall trial (d 5 to 33 postweaning), there was a tendency for improved F/G (P<.11) with increasing SDPP fed from d 5 to 19. However, overall ADG was not improved by including SDPP and/or SMFM in the transition diet.

Experiment 2. When all pigs were fed a common SEW diet from d 0 to 7, ADG, ADFI, and F/G were 0.31, 0.38, and 1.22, respectively. No SDPP × SMFM interactions occurred during this trial for any of the response criteria (Table 3).

From d 7 to 14 postweaning, pigs fed the diets containing 2.5% SDPP had improved ADG (P<.004) and F/G (P<.02) when compared to pigs fed diets without SDPP (Table 3). Also, increasing SMFM tended to reduce ADFI (linear, P<.10) and improve F/G (quadratic, P<.05).

From d 14 to 21 postweaning, no differences in ADG or F/G were observed. However, ADFI tended to increase (linear, P<.07) as SMFM increased from 0 to 5%.

For the entire d 7 to 21 period, no differences in ADG were observed, but pigs that were fed diets containing 2.5% SMFM tended to have lower ADFI (quadratic, P<.07) and improved F/G (quadratic, P<.09).

No differences in growth performance occurred during phase II (d 21 to 28 postweaning), when all pigs were fed a common diet.

For the overall trial (d 0 to 28 postweaning), the inclusion of 2.5% SMFM in the diet from d 7 to 21 tended to improve F/G (linear, P<.12; quadratic, P<.13). The numerical improvement in ADG and F/G that resulted from including 2.5% SDPP in the transition diet during d 7 to 21 and the numerical differences d 21 to 28 led to an improvement in ADG (P<.08) and F/G (P<.05) for the overall trial.

Conclusions

The results obtained in these two experiments indicate that different management practices and the resulting differences in health status may influence the degree of complexity required in the transition diet for the early-weaned pig. Feeding a transition diet containing 2.5% SDPP and 2.5% SMFM to pigs managed in a one-site production system improved growth performance in Exp. 2. However, results of Exp. 1 indicated that SEW pigs of extremely high-health status can be fed a less complex (33.4% soybean meal) transition diet. Currently, Kansas State University recommendations suggest the inclusion of 2.5% SDPP and 2.5% SMFM in the transition diet for early-weaned pigs from 11 to 15 lb.

Table 1. Composition of Experimental Diets[a]

	0% Plasma protein				2.5% Plasma protein				5% Plasma protein			
Item, %	0	2.5	5	7.5[b]	0	2.5	5	7.5[b]	0	2.5	5	7.5[b]
Corn	34.67	36.70	38.73	40.76	37.35	39.38	41.41	43.44	40.03	42.06	44.09	46.12
Soy oil	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Select menhaden fish meal	-	2.50	5.00	7.50	-	2.50	5.00	7.50	-	2.50	5.00	7.50
Spray-dried plasma protein	-	-	-	-	2.50	2.50	2.50	2.50	5.00	5.00	5.00	5.00
Spray-dried blood meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Monocalcium phosphate	1.55	1.31	1.07	0.82	1.66	1.42	1.17	0.94	1.78	1.53	1.29	1.05
Antibiotic[c]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Limestone	0.67	0.49	0.32	0.15	0.67	0.50	0.33	0.16	0.67	0.50	0.33	0.16
Zinc oxide (72%)	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-lysine·HCl	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Trace mineral premix	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
DL-methionine	0.14	0.13	0.12	0.11	0.13	0.12	0.11	0.10	0.12	0.11	0.10	0.09
Salt	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[a]Diets were formulated to contain 1.6% lysine, .9% Ca, .8% P, and at least .44% methionine.
[b]Fish meal, %.
[c]Provided 50 g/ton carbadox.

Table 2. Effect of Spray-Dried Plasma Protein and Select Menhaden Fish Meal in the Transition Diet on Pig Performance (Exp. 1)[a]

	0% Plasma protein				2.5% Plasma protein				5% Plasma protein				
Item	0	2.5	5	7.5[b]	0	2.5	5	7.5[b]	0	2.5	5	7.5[b]	CV
d 5 to 19													
ADG, lb	.75	.73	.74	.73	.75	.78	.74	.80	.77	.74	.73	.75	7.1
ADFI, lb	.89	.90	.90	.88	.90	.97	.86	.91	.90	.87	.83	.87	6.5
F/G[c]	1.18	1.23	1.21	1.21	1.21	1.25	1.16	1.13	1.17	1.17	1.13	1.16	4.3
d 19 to 33													
ADG, lb	1.13	1.16	1.13	1.16	1.07	1.16	1.17	1.15	1.17	1.15	1.11	1.13	7.5
ADFI, lb	1.77	1.74	1.74	1.79	1.76	1.73	1.74	1.72	1.79	1.70	1.70	1.68	5.1
F/G	1.58	1.49	1.54	1.54	1.68	1.50	1.49	1.50	1.54	1.48	1.52	1.50	6.5
d 5 to 33													
ADG, lb	.94	.95	.93	.95	.91	.97	.95	.97	.97	.95	.92	.94	5.5
ADFI, lb	1.33	1.32	1.32	1.33	1.32	1.35	1.30	1.31	1.35	1.28	1.26	1.28	4.2
F/G[d]	1.42	1.39	1.41	1.41	1.46	1.39	1.36	1.35	1.39	1.36	1.37	1.36	3.9

[a]Three hundred weanling pigs were used (initially 8.8 lb and 14 d of age), 5 pigs/pen, 5 pens/treatment.
[b]Fish meal, %.
[c]Linear effect of plasma protein ($P<.01$).
[d]Linear effect of plasma protein ($P<.11$).

Table 3. **Effect of Spray-Dried Plasma Protein and Select Menhaden Fish Meal in the Transition Diet on Pig Performance (Exp. 2)[a]**

	0% Plasma protein			2.5% Plasma protein			
Item	0	2.5	5[b]	0	2.5	5[b]	CV
d 7 to 14							
ADG, lb[c]	.54	.52	.48	.56	.60	.57	10.5
ADFI, lb[d]	.73	.68	.66	.73	.68	.72	8.0
F/G[e]	1.35	1.32	1.39	1.30	1.14	1.25	10.9
d 14 to 21							
ADG, lb	.75	.78	.79	.79	.75	.72	11.4
ADFI, lb[f]	.95	.97	1.02	.96	.95	1.01	6.7
F/G	1.27	1.23	1.28	1.20	1.27	1.37	11.2
d 7 to 21							
ADG, lb	.65	.66	.64	.68	.68	.65	7.9
ADFI, lb[g]	.85	.83	.85	.85	.82	.87	5.0
F/G[h]	1.30	1.27	1.32	1.23	1.20	1.32	7.7
d 21 to 28							
ADG, lb	.93	.88	.90	.90	.96	.91	10.1
ADFI, lb	1.50	1.47	1.50	1.39	1.46	1.52	6.6
F/G	1.61	1.64	1.67	1.49	1.54	1.67	12.3
d 0 to 28							
ADG, lb[i]	.64	.63	.62	.65	.67	.64	5.5
ADFI, lb	.91	.89	.90	.88	.89	.92	4.3
F/G[j]	1.41	1.41	1.43	1.35	1.32	1.43	5.6

[a]Three hundred and twenty six weanling pigs were used (initially 8.6 lb and 12 d of age), 7-11 pigs/pen, 6 pens/treatment.
[b]Fish meal, %.
[c]Plasma effect ($P < .004$).
[d]Linear effect of fish meal ($P < .09$).
[e]Plasma effect ($P < .02$), quadratic effect of fish meal ($P < .05$).
[f]Linear effect of fish meal ($P < .06$).
[g]Quadratic effect of fish meal ($P < .07$).
[h]Quadratic effect of fish meal ($P < .09$).
[i]Effect of plasma ($P < .08$).
[j]Effect of plasma ($P < .05$), linear effect of fish meal ($P < .12$), and quadratic effect of fish meal ($P < .13$).