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Evaluation of Increasing Peptone Blend on Nursery Pig Performance from 15 to 40 lb[1]

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Summary

A total of 270 pigs (PIC 327 × 1050, initially 15.7 lb BW) were used in a 28-d trial to evaluate the effects of increasing levels of a new peptone blend by-product on nursery pig growth performance. The product is the result of the pharmaceutical extraction of chondroitin sulfate from bovine cartilage and processing to form the peptone blend, which was mixed with soybean hulls and drum-dried. Pigs were weaned at 21 d of age and were fed a common pelleted diet for 5 d prior to the start of the experiment. Each treatment had 8 replicate pens and 6 or 7 pigs per pen. The 5 experimental treatments were: (1) a diet with 1% blood meal and 2% select menhaden fish meal (positive control), (2) a diet with no added specialty protein source (negative control), (3) a diet containing 4% peptone blend, (4) a diet containing 8% peptone blend, or (5) a diet containing 12% peptone blend. Experimental diets were fed for 14 d, then a common Phase 2 diet was fed for an additional 14 d to determine the residual treatment effects on growth performance.

From d 0 to 14, pigs fed increasing peptone blend had increased (linear, $P < 0.001$) ADFI but poorer (linear, $P < 0.001$) F/G. Pigs fed the positive control diet had increased ($P = 0.04$) ADFI compared with pigs fed the negative control diet. From d 14 to 28, when pigs were fed a common diet, pigs previously fed increasing peptone blend had increased (linear, $P = 0.03$) ADFI and poorer (linear, $P = 0.001$) F/G. Similar to d 0 to 14 data, pigs previously fed the positive control diet had increased ($P = 0.05$) ADFI compared with pigs previously fed the negative control diet from d 14 to 28. Overall (d 0 to 28), pigs fed diets with increasing peptone blend for the first 14 d had increased ($P < 0.001$) ADFI and poorer F/G ($P < 0.001$) with no differences in ADG ($P = 0.87$). Pigs fed the positive control diet had increased ($P = 0.01$) overall ADFI compared with pigs fed negative control diet, with no differences ($P > 0.17$) in ADG or F/G. Based on these results, the peptone blend is not a suitable replacement for blood meal and select menhaden fish meal in nursery pig diets from 15 to 24 lb. Up to 4% of the peptone blend was a suitable replacement for soybean meal in the negative control diet, which contained no specialty protein sources.

Key words: growth performance, nursery pig, peptone blend, specialty protein sources

Introduction

Providing high-quality specialty protein to weanling pigs is known to improve performance and help piglets start on feed, but rising prices of some of the most common sources used by swine nutritionists have encouraged the industry to search for alterna-

[1] The authors thank Sioux Biochemical Inc., Sioux Center, IA, for providing the peptone blend used in diet formulation and for partial financial support.

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tive ingredients capable of replacing specialty proteins at lower costs without negatively affecting performance.

Previous research conducted at Kansas State University (Myers et al., 2010[3]; 2011[4]) found that a peptone blend by-product of the heparin production industry that is derived from porcine intestinal mucosa is a suitable replacement for fish meal and poultry meal in nursery diets. A new potential peptone blend by-product of the pharmaceutical extraction of chondroitin sulfate from bovine cartilage is now available for consideration (Sioux Biochemical Inc., Sioux Center, IA). To create this new peptone blend product, the bovine cartilage is processed to remove the chondroitin sulfate, and the resulting product is further processed to form a peptone blend that is mixed with soybean hulls and drum-dried. Little to no research has been conducted to determine how this new peptone blend product will affect nursery pig performance. Thus, the objective of this study was to evaluate the effects of different inclusion levels of peptone blend on growth performance of weanling pigs.

Procedures

The protocol for this experiment was approved by the Kansas State University Institutional Animal Care and Use Committee. This experiment was conducted at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. The facility is a totally enclosed, environmentally controlled, mechanically ventilated barn. Each pen contained a 4-hole, dry self-feeder and a nipple waterer to provide ad libitum access to feed and water. Pens had wire-mesh floors and allowed approximately 3 ft^2/pig.

A total of 270 pigs (PIC 327 × 1050, initially 15.7 lb BW) were used in a 28-d trial. Pigs were weaned at 21 d of age and were initially fed a common pelleted diet for 5 d prior to the start of this experiment. On d 5 after weaning, pigs were weighed and pens of pigs were allotted to 1 of 5 dietary treatments in a randomized complete block design. Each treatment had 8 replicate pens and 6 or 7 pigs per pen balanced for gender. Pig weight and feed disappearance were measured on d 0, 7, 14, and 28 of the trial to determine ADG, ADFI, and F/G.

All dietary treatments were corn-soybean meal–based. Experimental diets contained 10% spray-dried whey providing 7.2% lactose in the complete diets. The 5 experimental treatments (Table 1) were: (1) 1% blood meal and 2% select menhaden fish meal (positive control), (2) no added specialty protein source (negative control), (3) 4% peptone blend, (4) 8% peptone blend, or (5) 12% peptone blend. For diet formulation, the energy and standardized ileal digestible (SID) amino acid coefficients (Table 2) used were from previous trials conducted in our lab evaluating an enteric mucosa peptone blend product. Experimental diets were fed for 14 d, followed by a 14-d period in which all pigs were fed the same common diet. Diets were fed in meal form and were manufactured at the K-State Animal Science Feed Mill.

Samples of the peptone blend were collected during diet manufacturing and submitted to Ward Laboratories, Inc. (Kearney, NE) for analysis of DM, CP, Ca, and P. To determine the amino acid content from the peptone blend, samples were analyzed at

[3] Myers et al., Swine Day 2010, Report of Progress 1038, pp. 27–34.
[4] Myers et al., Swine Day 2011, Report of Progress 1056, pp. 81–89.

the University of Missouri Agricultural Experiment Station Chemical Laboratories (Columbia, MO).

Data were analyzed as a randomized complete block design using PROC MIXED in SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Weight block was included in the model as a random effect. The effects of increasing dietary peptone blend level on performance criteria were determined by linear and quadratic polynomial contrasts. Single degree of freedom contrasts were used to compare performance of positive and negative controls. Results were considered significant at $P \leq 0.05$ and tendencies from $P > 0.05$ to $P \leq 0.10$.

Results and Discussion

The chemical analyses of the peptone blend (Table 3) revealed that most nutrients were similar to those use in diet formulation. Crude protein, P, lysine, and methionine and cystine were slightly lower than those used for formulated values. Tryptophan, isoleucine, and valine were higher than those used for formulated values.

From d 0 to 14, pigs fed increasing peptone blend had increased (linear, $P < 0.001$) ADFI and poorer (linear, $P < 0.001$) F/G (Table 4). No differences were observed in ADG among treatments ($P > 0.19$). Pigs fed the positive control diet had increased ($P = 0.04$) ADFI compared with pigs fed the negative control diet, with no changes ($P > 0.19$) in F/G or ADG. From d 14 to 28, pigs previously fed diets with increasing peptone blend had increased (linear, $P = 0.03$) ADFI and poorer (linear, $P = 0.001$) F/G, with no changes ($P > 0.28$) in ADG. Similar to the first 14 d, pigs previously fed the positive control diet had increased ($P = 0.05$) ADFI compared with pigs previously fed the negative control diet, with no changes ($P > 0.15$) in F/G or ADG.

Overall (d 0 to 28), pigs fed diets with increasing peptone blend for 14 d had increased ($P < 0.001$) ADFI and poorer ($P < 0.001$) F/G, with no difference ($P > 0.20$) in ADG. Pigs fed the positive control diet had increased ($P = 0.01$) overall ADFI compared with pigs fed the negative control diet, with no differences ($P > 0.17$) in ADG or F/G.

In conclusion, in this experiment up to 4% of the peptone blend could replace soybean meal in the negative control diet without negatively affecting growth performance, but the peptone blend was not a suitable replacement for blood meal and select menhaden fish meal in nursery pig diets from 15 to 24 lb. In our study, actual digestibility coefficients were not available for the new product, so we used values from a previously researched peptone blend that originated from enteric mucosa. As a result, the coefficients utilized for diet formulation in this study might not reflect the actual coefficients of the product we tested. Therefore, further research is needed to characterize the energy and digestible amino acid coefficients of this specific peptone blend so diets can be formulated more accurately.

Table 1. Diet composition (as-fed basis)[1]

	Phase 1					
Item	Pos. control	Neg. control	Peptone 4%	Peptone 8%	Peptone 12%	Common Phase 2
Ingredient, %						
Corn	56.49	52.93	51.07	49.20	47.33	64.44
Soybean meal (46.5% CP)	27.15	33.42	31.29	29.17	27.05	31.85
Blood meal	1.00	--	--	--	--	--
Select menhaden fish meal	2.00	--	--	--	--	--
Spray-dried whey	10.00	10.00	10.00	10.00	10.00	--
Monocalcium P (21.5% P)	0.90	1.13	1.15	1.15	1.18	1.03
Limestone	0.83	0.90	0.85	0.83	0.78	0.98
Salt	0.30	0.30	0.30	0.30	0.30	0.35
L-lysine HCl	0.30	0.30	0.30	0.30	0.30	0.34
DL-methionine	0.165	0.165	0.165	0.165	0.165	0.13
L-threonine	0.145	0.130	0.130	0.130	0.130	0.13
L-tryptophan	--	--	--	0.005	0.013	--
L-valine	--	0.010	0.015	0.025	0.035	--
Trace mineral premix	0.15	0.15	0.15	0.15	0.15	0.15
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25
Phytase[2]	0.08	0.08	0.08	0.08	0.08	0.17
Zinc oxide	0.25	0.25	0.25	0.25	0.25	--
Peptone blend[3]	--	--	4.00	8.00	12.00	--
Antibiotic[4]	--	--	--	--	--	0.20
Total	100.00	100.00	100.00	100.00	100.00	100.00

continued

Table 1. Diet composition (as-fed basis)[1]

Item	Phase 1					Common Phase 2
	Pos. control	Neg. control	Peptone 4%	Peptone 8%	Peptone 12%	
Calculated analysis						
Standardized ileal digestible (SID) amino acids, %						
Lysine	1.30	1.30	1.30	1.30	1.30	1.22
Isoleucine:lysine	58	63	62	60	59	62
Leucine:lysine	125	124	122	119	116	127
Methionine:lysine	36	35	36	36	36	34
Met & Cys:lysine	58	58	58	58	58	57
Threonine:lysine	64	64	64	64	64	63
Tryptophan:lysine	18	19	18.3	18.1	18.1	18
Valine:lysine	68	68	68	68	68	67
Total lysine, %	1.45	1.45	1.45	1.45	1.46	1.37
ME, kcal/lb	1,492	1,482	1,464	1,446	1,429	1,480
SID lysine:ME, g/Mcal	3.95	3.98	4.03	4.08	4.13	3.74
CP, %	21.4	21.9	22.7	23.5	24.3	21.0
Ca, %	0.70	0.70	0.70	0.70	0.70	0.64
P, %	0.66	0.69	0.68	0.66	0.65	0.61
Available P, %	0.48	0.48	0.48	0.48	0.48	0.43

[1] Treatment diets were fed from d 0 to 14, and then a common diet was fed from d 14 to 28.
[2] Nutrase 600 (Consumers Supply Distributing, North Sioux City, SD) provided phytase at 205 and 450 phytase units (FTU)/lb with a release of 0.10% and 0.13% of available P for Phase 1 and Phase 2 diets, respectively.
[3] Peptone blend (Sioux Biochemical Inc., Sioux Center, IA).
[4] Aureo-50 (chlortetracycline, Pfizer Animal Health, New York City, NY) provided 200 g/ton of chlortetracycline.

Table 2. Estimated ME and standardized ileal digestibility (SID) coefficients for peptone blend used in diet formulation

Item	Peptone blend
ME, kcal/lb[1]	1,061
SID coefficients, %[2]	
Lysine	82
Methionine	84
Cysteine	66
Threonine	75
Tryptophan	83
Isoleucine	83
Valine	81

[1] ME calculated by Midwest Laboratories (Omaha, NE).
[2] SID coefficients used were from a previous study originating from swine enteric mucosa.

Table 3. Chemical analysis of peptone blend (as fed-basis)[1]

Item	Peptone blend
DM, %	92.98 (93.00)
CP, %	44.3 (48.80)
Ca, %	0.51 (0.52)
P, %	0.09 (0.14)
Total amino acid concentration, %	
Lysine	1.75 (1.80)
Met & Cys:lysine	0.80 (0.93)
Threonine	1.21 (1.22)
Tryptophan	0.31 (0.18)
Isoleucine	1.06 (0.85)
Valine	1.41 (1.17)

[1] Values in parentheses were provided by the manufacturer from analysis at Midwest Laboratories (Omaha, NE) and were used in diet formulation.

Table 4. Evaluation of increasing peptone blend on nursery pig performance from 15 to 40 lb[1,2,3]

Item	Positive control	Negative control	4% peptone	8% peptone	12% peptone	SEM	Probability, *P*<		
							Peptone inclusion[4]		
							Linear	Quadratic	Pos. control × Neg. control
d 0 to 14									
ADG, lb	0.62	0.58	0.58	0.57	0.62	0.028	0.31	0.19	0.19
ADFI, lb	0.88	0.82	0.85	0.94	1.02	0.030	0.001	0.32	0.04
F/G	1.41	1.40	1.47	1.71	1.66	0.062	0.001	0.31	0.87
d 14 to 28									
ADG, lb	1.21	1.18	1.16	1.14	1.16	0.021	0.28	0.33	0.37
ADFI, lb	2.00	1.87	1.90	1.93	2.01	0.044	0.03	0.59	0.05
F/G	1.65	1.58	1.63	1.70	1.73	0.031	0.001	0.84	0.15
d 0 to 28									
ADG, lb	0.92	0.88	0.87	0.85	0.89	0.019	0.87	0.20	0.17
ADFI, lb	1.43	1.34	1.37	1.43	1.51	0.029	0.001	0.39	0.01
F/G	1.57	1.52	1.57	1.69	1.70	0.027	0.001	0.42	0.19
BW, lb									
d 0	15.7	15.6	15.7	15.7	15.7	0.125	0.44	0.94	0.66
d 14	24.5	24.0	23.8	23.8	24.6	0.452	0.21	0.13	0.25
d 28	41.5	40.6	40.1	39.7	40.8	0.602	0.86	0.15	0.24

[1] A total of 270 nursery pigs (PIC 327 × 1050, initially 15.7 lb BW) were used in a 28-d growth trial with 6 or 7 pigs per pen and 8 pens per treatment.
[2] Treatment diets were fed from d 0 to 14, then a common diet was fed from d 14 to 28.
[3] Peptone blend (Sioux Biochemical Inc., Sioux Center, IA). Peptone blend is a by-product of pharmaceutical extraction from bovine cartilage.
[4] Contrasts were determined using negative control and the different levels of peptone inclusion.