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Effects of hydrolyzed vegetable protein or hydrolyzed vegetable and meat protein blend on nursery pig performance from 15 to 40 lb

Abstract

A total of 280 pigs (PIC 327 Ã— 1050, initially 16.7 lb BW) were used in a 28-d trial to evaluate the effects of hydrolyzed vegetable protein or a blend of hydrolyzed vegetable and meat protein for nursery pigs. Three days after weaning, pigs were allotted to 1 of 4 dietary treatments in a completely randomized design, balancing for initial BW and gender. There were 10 pens per treatment with 7 pigs per pen. The 4 treatment diets were: (1) no added specialty protein source (negative control); (2) 6% select menhaden fish meal; (3) 5% hydrolyzed vegetable protein (Hydr SF 52, International Ingredient Corporation, St. Louis, MO), or (4) 6.5% hydrolyzed vegetable and meat protein blend (HDSF Protein; International Ingredient Corporation). Diets were fed in 2 phases, with Phase 1 from d 0 to 17 (treatment diets) and Phase 2 from d 17 to 28 (common diet). From d 0 to 17, pigs fed the negative control diet had improved (P â‰¤ 0.05) F/G compared with pigs fed diets with Hydr SF 52 or HDSF Protein. No differences in ADG and ADFI were detected among treatments. From d 17 to 28 (common period), no difference was observed in growth performance between pigs previously fed any of the treatment diets. Overall (d 0 to 28), no differences were observed in ADG, ADFI, or F/G among pigs fed any of the treatment diets. Because performance did not differ from pigs fed the negative control diet, definitive conclusions regarding these specialty protein sources cannot be made.; Swine Day, Manhattan, KS, November 21, 2013

Keywords

Swine day, 2013; Kansas Agricultural Experiment Station contribution; no. 14-044-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1092; Hydrolyzed vegetable protein; Meat protein; Protein sources; Nursery pig

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Effects of Hydrolyzed Vegetable Protein or Hydrolyzed Vegetable and Meat Protein Blend on Nursery Pig Performance from 15 to 40 lb[1]

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Summary

A total of 280 pigs (PIC 327 × 1050, initially 16.7 lb BW) were used in a 28-d trial to evaluate the effects of hydrolyzed vegetable protein or a blend of hydrolyzed vegetable and meat protein for nursery pigs. Three days after weaning, pigs were allotted to 1 of 4 dietary treatments in a completely randomized design, balancing for initial BW and gender. There were 10 pens per treatment with 7 pigs per pen. The 4 treatment diets were: (1) no added specialty protein source (negative control); (2) 6% select menhaden fish meal; (3) 5% hydrolyzed vegetable protein (Hydr SF 52, International Ingredient Corporation, St. Louis, MO), or (4) 6.5% hydrolyzed vegetable and meat protein blend (HDSF Protein; International Ingredient Corporation). Diets were fed in 2 phases, with Phase 1 from d 0 to 17 (treatment diets) and Phase 2 from d 17 to 28 (common diet). From d 0 to 17, pigs fed the negative control diet had improved ($P \leq 0.05$) F/G compared with pigs fed diets with Hydr SF 52 or HDSF Protein. No differences in ADG and ADFI were detected among treatments. From d 17 to 28 (common period), no difference was observed in growth performance between pigs previously fed any of the treatment diets. Overall (d 0 to 28), no differences were observed in ADG, ADFI, or F/G among pigs fed any of the treatment diets. Because performance did not differ from pigs fed the negative control diet, definitive conclusions regarding these specialty protein sources cannot be made.

Key words: hydrolyzed vegetable and meat protein blend, hydrolyzed vegetable protein, nursery pig, protein sources

Introduction

Including specialty proteins such as fish meal, blood products, poultry meal, or further processed soy proteins is a common industry practice in pig diets fed from weaning until pigs reach approximately 25 lb. Including these ingredients helps reduce the level of dietary soybean meal and provides a highly digestible amino acid source for newly weaned nursery pigs. In addition, nursery diets containing specialty protein sources of animal origin often result in improved feed intake. Although using specialty protein sources in nursery diets has many advantages, they increase diet costs; thus, new specialty protein sources are developed continually to moderate increasing diet costs while improving growth of nursery pigs.

[1] The authors wish to thank International Ingredient Corporation, St. Louis, MO, for providing the protein and lactose sources used in diet formulation and partial financial support.
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Two new specialty protein sources contain either hydrolyzed vegetable protein (Hydr SF 52, International Ingredient Corporation, St. Louis, MO) or a combination of hydrolyzed vegetable and meat protein (HDSF Protein; International Ingredient Corporation), but no research has determined their effects in nursery diets. Therefore, the objective of this study was to determine the effects of fish meal, hydrolyzed vegetable protein, or a blend of hydrolyzed vegetable and meat protein in nursery pigs from 15 to 40 lb.

Procedures

The protocol for this experiment was approved by the Kansas State University Institutional Animal Care and Use Committee. The experiment was conducted at the K-State Swine Teaching and Research Center in Manhattan, KS. The facility is a totally enclosed, environmentally controlled, mechanically ventilated barn.

A total of 280 pigs (PIC 327 × 1050, initially 16.7 lb BW) were used in a 28-d trial. Pigs were weaned at 21 d of age and were fed a common pelleted diet for 3 d. On d 3, pigs were weighed and pens of pigs were allotted to 1 of 4 dietary treatments in a completely randomized design, balancing for initial BW and gender, with 10 pens per treatment with 7 pigs per pen. All dietary treatments were corn-soybean meal–based. The 4 dietary treatments (Table 1) contained either: (1) no added specialty protein source (negative control); (2) 6% select menhaden fish meal; (3) 5% hydrolyzed vegetable protein (Hydr SF 52), or (4) 6.5% hydrolyzed vegetable and meat protein blend (HDSF Protein). Hydr SF 52 is a drum-dried hydrolyzed vegetable protein. HDSF Protein is a co-dried product containing hydrolyzed vegetable protein, meat by-product, and animal fat. Diets were fed in 2 phases, with treatment diets fed during Phase 1 from d 0 to 17 and a common diet fed to all pigs in Phase 2 from d 17 to 28. All Phase 1 diets contained 12.5% DairyLac 80 (International Ingredient Corporation), which provided 10% lactose in the complete diets. Treatment diets 2, 3, and 4 contained 28.2% soybean meal during Phase 1, whereas the negative control diet contained 36.5% soybean meal. All diets were formulated to be isocaloric on an ME basis. For Hydr SF 52 and HDSF Protein, estimated energy, amino acid concentrations, and standardized ileal digestibility (SID) coefficients (Table 2) were based on the proportions of ingredients and values for enzymatic soy and meat meal from the NRC (2012). Diets were fed in meal form and were prepared at the K-State Animal Science Feed Mill.

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. Pig weight and feed disappearance were measured on d 0, 7, 14, 17, and 28 of the trial to determine ADG, ADFI, and F/G.

Samples of each specialty protein source were collected during the manufacturing process and submitted to Ward Laboratories, Inc. (Kearney, NE) for analysis of DM, CP, Ca, and P (Table 3).

Data were analyzed as a completely randomized design using PROC MIXED in SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Results for treatment criteria were considered significant at $P \leq 0.05$ and tendencies from $P > 0.05$ to $P \leq 0.10$.

Results and Discussion

Chemical analysis of the protein sources (Table 2) showed that most nutrients were similar to formulated values. Crude protein levels were lower in fish meal and Hydr SF 52 than formulated values, whereas the CP level for HDSF Protein was slightly higher than used in diet formulation. Analyzed Ca levels were higher than formulated values for all protein sources, and the P levels were slightly higher than the formulated values for fish meal and HDSF Protein.

From d 0 to 17, there were no differences in ADG and ADFI among pigs fed any of the treatment diets (Table 4); however, pigs fed the negative control diet had improved ($P \leq 0.05$) F/G compared with pigs fed diets containing Hydr SF 52 or HDSF Protein. From d 17 to 28 (common diet period), growth performance did not differ among pigs previously fed the treatment diets. Overall (d 0 to 28), no differences were observed in ADG, ADFI, or F/G among pigs fed any of the treatment diets.

The lack of growth response differences compared with the negative control makes definitive conclusions between specialty protein sources difficult. More research is needed to validate the efficacy of the two newly developed specialty protein sources for nursery pigs.

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

Item	Phase 1				Common Phase 2
	Negative control	Fish meal	Hydr SF 52[2,3]	HDSF Protein[3,4]	
Ingredient, %					
Corn	46.22	50.64	49.63	48.70	64.44
Soybean meal (46.5% CP)	36.55	28.20	28.20	28.20	31.85
Select menhaden fish meal	-	6.00	-	-	-
HDSF Protein	-	-	-	6.45	-
Hydr SF52	-	-	5.00	-	-
DairyLac80[5]	12.50	12.50	12.50	12.50	-
Soybean oil	0.98	-	0.65	0.13	-
Monocalcium P (21.5% P)	1.25	0.53	1.23	1.23	1.03
Limestone	0.90	0.60	0.95	0.95	0.98
Salt	0.25	0.25	0.25	0.25	0.35
L-lysine HCL	0.300	0.270	0.425	0.420	0.34
DL-methionine	0.180	0.150	0.215	0.220	0.13
L-threonine	0.150	0.140	0.190	0.195	0.13
L-tryptophan	0.005	-	0.045	0.040	-
Trace mineral premix	0.15	0.15	0.15	0.15	0.15
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Zinc oxide	0.25	0.25	0.25	0.25	-
Phytase[6]	0.08	0.08	0.08	0.08	0.17
Antibiotic[7]	-	-	-	-	0.20
Total	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
	Negative control	Fish meal	Hydr SF 52[2,3]	HDSF Protein[3,4]	
Calculated analysis					
Standardized ileal digestible (SID) amino acids, %					
Lysine	1.30	1.30	1.30	1.30	1.22
Isoleucine:lysine	63	61	59	59	62
Leucine:lysine	121	121	103	102	127
Methionine:lysine	36	37	38	38	34
Met & Cys:lysine	58	58	58	58	57
Threonine:lysine	64	64	64	64	63
Tryptophan:lysine	19	18	18	18	18
Valine:lysine	67	67	67	67	67
Total lysine, %	1.46	1.47	1.45	1.45	1.37
ME, kcal/lb	1,513	1,513	1,513	1,513	1,480
SID lysine:ME, g/Mcal	3.90	3.90	3.90	3.90	3.74
CP, %	22.1	22.3	21.1	21.1	21.0
Ca, %	0.70	0.70	0.70	0.70	0.64
P, %	0.69	0.66	0.67	0.67	0.61
Available P, %	0.48	0.48	0.48	0.48	0.43

[1] Treatment diets were fed from d 0 to 17, then a common diet was fed from d 17 to 28.
[2] Hydr SF 52 (International Ingredient Corporation, St. Louis, MO). Hydr SF 52 is a drum-dried hydrolyzed vegetable protein.
[3] For Hydr SF 52 and HDSF Protein, estimated energy, amino acid values, and SID coefficients were based on the proportions of ingredients and values for enzymatic soy and meat meal from the 2012 NRC.
[4] HDSF Protein (International Ingredient Corporation). HDSF Protein is co-dried product containing hydrolyzed vegetable protein, meat by-product and animal fat.
[5] DairyLac80 (International Ingredient Corporation).
[6] Nutrase 600 (Consumers Supply Distributing, North Sioux City, SD). Provided 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.
[7] Aureo-50 (Pfizer Animal Health, New York City, NY) provided 200 g/ton of chlortetracycline.

Table 2. Metabolizable energy (ME), amino acid concentrations and standardized ileal digestibility (SID) coefficients for Hydr SF 52 and HDSF Protein used in diet formulation

Item	Hydr SF 52[1]	HDSF Protein[2]
ME, kcal/lb	1,593	1,776
Amino acid concentration, %		
Lysine	2.68	2.20
Met & Cys:lysine	1.26	0.93
Threonine	1.86	1.43
Tryptophan	0.71	0.56
Isoleucine	2.25	1.82
Valine	2.41	2.05
SID coefficients, %		
Lysine	86	85
Met & Cys:lysine	82	81
Threonine	83	82
Trpyptophan	83	82
Isoleucine	89	87
Valine	89	87

[1] Hydr SF 52 (International Ingredient Corporation, St. Louis, MO) is a drum-dried hydrolyzed vegetable protein.
[2] HDSF Protein (International Ingredient Corporation) is a co-dried product containing hydrolyzed vegetable protein, meat by-product, and animal fat.

Table 3. Chemical analysis of fish meal, hydrolyzed vegetable protein, and hydrolyzed vegetable and meat protein blend (as fed-basis)

Item	Fish meal[1]	Hydr SF 52[2]	HDSF Protein[3]
DM, %	93.67 (93.70)	87.32 (93.0)	84.92 (88.0)
CP, %	59.30 (63.28)	46.60 (50.4)	40.10 (39.3)
Ca, %	7.34 (4.28)	0.50 (0.38)	0.35 (0.23)
P, %	3.98 (2.93)	0.70 (0.70)	0.67 (0.56)

[1] Values in parentheses indicate those used in diet formulation and are from NRC, 2012. (Nutrient Requirements of Swine, 11th ed. Natl. Acad. Press, Washington DC).
[2,3] Values in parentheses indicate those used in diet formulation and are from International Ingredient Corporation, St. Louis, MO.

Table 4. Evaluation of specialty protein sources for nursery pigs[1,2]

Item	Negative control	Fish meal	Hydr SF 52[3]	HDSF protein[4]	SEM	*P* <
d 0 to 17						
ADG, lb	0.56	0.53	0.54	0.54	0.023	0.68
ADFI, lb	0.78	0.77	0.80	0.80	0.052	0.55
F/G	1.41[a]	1.46[ab]	1.51[b]	1.51[b]	0.047	0.09
d 17 to 28						
ADG, lb	1.19	1.21	1.19	1.13	0.034	0.27
ADFI, lb	2.05	2.09	2.04	2.00	0.052	0.43
F/G	1.73	1.73	1.71	1.77	0.037	0.69
d 0 to 28						
ADG, lb	0.81	0.80	0.80	0.77	0.015	0.40
ADFI, lb	1.29	1.30	1.30	1.28	0.021	0.96
F/G	1.59	1.63	1.63	1.66	0.027	0.34
BW, lb						
d 0	16.7	16.7	16.7	16.7	0.190	1.00
d 7	17.8	17.6	17.5	17.6	0.152	0.58
d 17	26.2	26.0	25.8	25.8	0.609	0.87
d 28	39.5	39.5	39.1	38.4	0.484	0.34

[a,b] Means within the same row with different superscripts differ ($P \leq 0.05$).
[1] A total of 280 nursery pigs (PIC 327 × 1050, initially 16.7 lb BW) were used in a 28-d growth trial with 7 pigs per pen and 10 pens per treatment.
[2] Treatment diets were fed from d 0 to 17, then a common diet was fed from d 17 to 28.
[3] Hydr SF 52 (International Ingredient Corporation, St. Louis, MO) is a drum-dried hydrolyzed vegetable protein.
[4] HDSF Protein (International Ingredient Corporation) is a co-dried product containing hydrolyzed vegetable protein, meat by-product, and animal fat.