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The influence of hamlet protein 300 and fish meal on nursery pig performance

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The Influence of Hamlet Protein 300 and Fish Meal on Nursery Pig Performance

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Summary

A total of 360 nursery pigs (PIC 1050 barrows) were used in a 24-d study to evaluate the effects on growth performance of nursery diets containing Hamlet Protein 300 (HP 300) or fish meal. Pigs were weaned at approximately 21 d of age and placed on a pretest diet for 7 d before dietary treatments began. Pens of pigs were balanced by initial weight and randomly allotted to 1 of 7 dietary treatments with 9 replications per treatment. The 7 dietary treatments included a control diet containing no specialty protein sources or the control diet with 2, 4 or 6% select menhaden fish meal; or the control diet with 2, 4, or 6% HP 300. All experimental diets were fed for 14 d, followed by a common diet for 10 d. Neither fish meal nor HP 300 influenced any growth performance criteria ($P > 0.13$) from d 0 to 14. During the common period (d 14 to 24), pigs previously fed fish meal tended to have better F/G than pigs previously fed HP 300 ($P = 0.09$). Overall (d 0 to 24), there were no differences in growth performance between treatments ($P > 0.34$). In conclusion, HP 300 and fish meal had similar effects on growth performance, but neither provided a benefit compared to the pigs fed the control diet.

Key words: fish meal, Hamlet Protein 300, nursery pig

Introduction

The nursery starter diet has been considered an important factor influencing the performance of newly weaned pigs. In these diets, the amino acid sources typically include milk-based, refined plant-derived, or animal-derived sources. These ingredients can significantly influence performance during the nursery phase because of weanling pigs' immature digestive systems and the protein sources' distinct amino acid profiles. Soy proteins have been widely used to supply amino acids for nursery pig diets. However, in previous studies, the anti-nutritional factors in soybean meal have been shown to reduce protein digestibility, be destructive to villi in the small intestine, and result in cell-mediated immune responses. Various processing technologies have been developed to reduce the level of soy protein's anti-nutritional factors and to produce more absorbable protein sources. Hamlet Protein 300 (HP 300), produced through dehydrating and enzymatic treatment, is a type of soy protein that contains a lower level of anti-nutritional components and higher protein content than raw soybean meal. Therefore, it is hypothesized that HP 300 can potentially replace animal protein, such as fish meal, in nursery diets and achieve similar performance.

The objective of our study was to evaluate the effect of increasing levels of dietary HP 300 and fish meal on the performance of weanling pigs.

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Procedures

The Kansas State University (K-State) Animal Care and Use Committee approved all experimental procedures.

A total of 315 nursery pigs (PIC 1050, initially 16.3 lb) were allotted to 1 of 7 treatments. There were 5 pigs per pen and 9 pens per treatment. The study was conducted at the K-State Segregated Early Weaning Facility. Each pen (5 × 5 ft) contained a 4-hole dry self-feeder and a cup waterer to provide ad libitum access to feed and water.

A common pelleted starter diet was fed for the first 7 days postweaning. Then, pigs were fed 1 of 7 experimental diets. The 7 dietary treatments included a control diet containing no specialty protein sources or the control diet with 2, 4 or 6% select menhaden fish meal; or the control diet with 2, 4, or 6% HP 300 (Table 1). Diets were formulated to contain 1.32% SID lysine and equal amounts of soybean meal at equal inclusion levels of fish meal or HP 300. The soybean meal level in the diet was reduced as the percentage of dietary HP 300 and fish meal increased. Synthetic amino acid levels varied in diets to achieve minimum SID amino acid ratios. Experimental diets were fed in meal form for 14 days. Then, a common diet was fed to all pigs from d 14 to 24. Pigs were weighed and feed disappearance was determined on d 0, 7, 14, and 24 to calculate ADG, ADFI, and F/G.

Data were analyzed using the MIXED procedure in SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit for analysis. Contrast statements were used to compare diets containing fish meal and HP 300 with the control diet and with each other. Contrasts were also used to test the linear and quadratic effects of increasing fish meal and HP 300 levels in the diets.

Results and Discussion

From d 0 to 7, pigs fed fish meal or HP 300 had similar ($P > 0.17$) ADG, ADFI and F/G to pigs fed the control diet (Table 2). Increasing the level of HP 300 in the diet tended to result in poorer F/G (quadratic, $P = 0.10$), but did not affect ($P > 0.26$) ADG or ADFI. There was no effect of increasing fish meal levels in the diet ($P > 0.12$). Also, there were no differences ($P > 0.41$) in growth performance between pigs fed HP 300 or fish meal.

From d 7 to 14, increasing dietary fish meal resulted in a quadratic improvement in ADG ($P = 0.09$), with ADG increasing to the 4% fish meal level and then returning to control levels at the 6% rate. Pigs fed fish meal tended to have greater ($P = 0.09$) ADG compared to pigs fed HP 300. Treatments did not influence ($P > 0.21$) ADFI and F/G during this period.

For d 0 to 14, there were no differences in any growth performance parameters ($P > 0.13$).

From d 14 to 24, when all pigs were fed a common diet, no differences were observed ($P > 0.56$) for ADG or ADFI. Pigs previously fed fish meal tended to have higher ($P = 0.09$) F/G than pigs previously fed HP 300 diets.

Overall (d 0 to 24), there was no difference in growth performance between treatments ($P > 0.34$).

In conclusion, using HP 300 in nursery pig diets resulted in similar growth performance to pigs fed dietary fish meal. However, there was no benefit in our study from increasing the dietary level of either ingredient as compared to the control diet, which contained a higher level of soybean meal.

Table 1. Composition of experimental diets (as-fed basis)¹

Item	Phase 1 ²							Phase 2 ³
	Control	Fish meal			HP 300			Common diet
		2%	4%	6%	2%	4%	6%	
Ingredient, %								
Corn	55.10	62.15	63.10	64.80	61.65	62.25	63.55	64.65
Soybean meal, 46.5%, CP	40.10	31.00	28.45	25.10	31.00	28.45	25.10	31.85
Select menhaden fish meal	--	2.00	4.00	6.00	--	--	--	--
Hamlet protein 300	--	--	--	--	2.00	4.00	6.00	--
Soybean oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00	--
Monocalcium P, 21% P	1.50	1.425	1.20	1.00	1.65	1.65	1.65	1.025
Limestone	0.975	0.80	0.675	0.525	0.975	0.975	0.975	0.975
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Zinc oxide	0.25	0.25	0.25	0.25	0.25	0.25	0.25	--
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Lysine HCl	0.15	0.33	0.30	0.295	0.365	0.37	0.40	0.335
DL-methionine	0.11	0.16	0.145	0.14	0.175	0.18	0.19	0.13
L-threonine	0.05	0.135	0.135	0.135	0.14	0.15	0.15	0.13
L-tryptophan	--	--	0.0025	0.00875	--	--	0.003	--
L-isoleucine	--	--	--	--	--	--	0.0025	--
Phyzyme 600 ⁴	--	--	--	--	--	--	--	0.165 ⁴
TOTAL	100	100	100	100	100	100	100	100
Calculated analysis								
SID ⁵ amino acids								
Lysine, %	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.26
Isoleucine:lysine, %	69	60	60	60	60	60	60	61
Methionine:lysine, %	33	36	36	37	36	36	36	33
Met & Cys:lysine, %	60	60	60	60	60	60	60	58
Threonine:lysine, %	63	63	63	63	63	63	63	63
Tryptophan:lysine, %	19.9	17.0	17.0	17.0	17.2	17.1	17.0	17.4
Valine:lysine, %	75	67	68	67	67	67	66	68
Total lysine, %	1.47	1.45	1.45	1.45	1.45	1.45	1.44	1.39
ME, kcal/lb	1,514	1,521	1,526	1,531	1,515	1,515	1,516	1,503
SID Lysine:ME ratio, g/Mcal	3.95	3.94	3.92	3.91	3.95	3.95	3.95	3.81
CP, %	23.6	21.5	21.6	21.4	21.3	21.3	21.0	20.8
Ca, %	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.69
P, %	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.62
Available P, %	0.40	0.43	0.44	0.45	0.42	0.42	0.41	0.42

¹ A total of 315 weanling pigs (initially 16 lb and 7 d postweaning) were used in a 24-d study with 5 pigs per pen and 9 replications per treatment.² Phase 1 diets were fed from d 0 to 14.³ Phase 2 diet was fed from d 14 to 24.⁴ Phyzyme 600 provided 231 FTU/lb, with a release of 0.10% available P.⁵ Standardized ileal digestible.

Table 2. Effects of Hamlet Protein 300 (HP 300) and fish meal on nursery pig performance¹

Item	Probability, $P <$														
	Control	Fish meal			HP 300			SEM	Control vs. Fish meal	Control vs. HP 300	Fish meal vs. HP 300	HP 300		Fish meal	
		2%	4%	6%	2%	4%	6%					Linear	Quadratic	Linear	Quadratic
d 0 to 7															
ADG, lb	0.67	0.64	0.64	0.67	0.64	0.63	0.62	0.04	0.54	0.28	0.50	0.26	0.71	0.96	0.33
ADFI, lb	0.94	0.94	0.94	0.91	0.95	0.93	0.89	0.04	0.78	0.67	0.84	0.30	0.51	0.51	0.65
F/G	1.40	1.48	1.48	1.39	1.49	1.54	1.44	0.06	0.42	0.17	0.41	0.49	0.10	0.92	0.12
d 7 to 14															
ADG, lb	1.03	1.07	1.08	1.00	1.02	0.99	1.00	0.03	0.58	0.50	0.09	0.44	0.80	0.64	0.09
ADFI, lb	1.35	1.40	1.38	1.35	1.31	1.33	1.35	0.06	0.61	0.70	0.21	0.96	0.55	0.86	0.34
F/G	1.31	1.33	1.28	1.34	1.29	1.34	1.35	0.06	0.91	0.61	0.58	0.22	0.68	0.73	0.43
d 0 to 14															
ADG, lb	0.85	0.85	0.86	0.84	0.83	0.81	0.81	0.03	0.97	0.27	0.13	0.25	0.67	0.75	0.65
ADFI, lb	1.15	1.17	1.16	1.13	1.13	1.13	1.12	0.05	0.84	0.64	0.35	0.66	0.91	0.66	0.40
F/G	1.34	1.38	1.35	1.35	1.36	1.41	1.39	0.03	0.57	0.17	0.25	0.16	0.42	0.97	0.54
d 14 to 24															
ADG, lb	1.17	1.22	1.14	1.16	1.20	1.15	1.20	0.06	0.94	0.81	0.81	0.80	0.75	0.56	0.76
ADFI, lb	1.79	1.86	1.76	1.80	1.79	1.76	1.80	0.09	0.78	0.90	0.57	0.99	0.68	0.77	0.77
F/G	1.53	1.53	1.55	1.55	1.50	1.53	1.51	0.02	0.64	0.46	0.09	0.72	0.79	0.39	0.88
d 0 to 24															
ADG, lb	0.98	1.01	0.97	0.97	0.98	0.95	0.97	0.03	0.95	0.65	0.47	0.64	0.65	0.54	0.55
ADFI, lb	1.41	1.46	1.41	1.40	1.40	1.39	1.41	0.06	0.72	0.83	0.42	0.90	0.78	0.68	0.44
F/G	1.43	1.45	1.45	1.45	1.43	1.47	1.45	0.02	0.43	0.46	0.94	0.34	0.56	0.53	0.68

¹ A total of 315 nursery pigs (initially 16 lb and 7 d postweaning) were used in a 24-d study with 5 pigs per pen and 9 replications per treatment.