EFFECTS OF DIFFERENT PROTEIN SOURCES ON GROWTH PERFORMANCE OF NURSERY PIGS

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Summary

A total of 170 weanling pigs (initially 16.4 lb) were used to evaluate the effects of alternative protein sources on growth performance of pigs fed from d 5 to 26 after weaning. All pigs were fed a common diet from weaning to d 5. The five dietary treatments were corn-soybean meal-based and included a control diet containing 10% dried whey, or the control diet with 5% select menhaden fish meal, 2.5% spray-dried blood cells, 3.73% enzymatically hydrolyzed wheat gluten (Source 1), or 3.51% flash-dried wheat gluten (Source 2). No differences were observed in overall ADG and ADFI; however, pigs fed the diets containing 2.5% blood cells or 5% select menhaden fish meal numerically had the best overall ADG compared to pigs fed the control diet, with pigs fed either wheat gluten sources having intermediate growth. Feed efficiency was improved for pigs fed 5% select menhaden fish meal compared with those fed the control diet, and pigs fed the other diets were intermediate. There were no differences ($P<0.05$) in ADG, ADFI, or F/G between wheat gluten sources.

(Key Words: Protein Sources, Wheat Gluten, Weanling Pigs.)

Introduction

Wheat gluten is a protein concentrate that is prepared by removing starch from wheat flour and drying the remaining high protein gluten. It is mainly used in a wide variety of baking applications, including breads, rolls, bakery mixes, and pastries, as well as other consumer goods. Data presented in the 1991 KSU Swine Industry Day Report of Progress suggest that spray-dried wheat gluten substituted for dried skim milk in nursery diets will improve growth performance of nursery pigs while lowering diet costs. In the present experiment, we looked at two different wheat gluten sources. Wheat gluten Source 1 was processed by low temperature drying, called ring drying, and enzymatic hydrolyzation. Source 1 is used in the feed industry to increase digestibility of the diet and, as a soluble wheat protein, can be used in milk replacers. Wheat gluten Source 2 is non-modified flash-dried gluten. Because of the enzymatic hydrolyzation, Source 1 should have higher digestibility and therefore be of higher quality for nursery pigs than Source 2. This experiment was designed to determine the effects of two wheat gluten sources processed by different methods compared with select menhaden fish meal and spray-dried blood cells on growth performance of nursery pigs.

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Procedures

A total of 170 pigs (initially 16.4 lb and 26 ± 3 d of age) were used in a 35-d growth assay. Two replications consisted of five pigs/pen and four replications consisted of 6 pigs/pen per treatment for a total of 30 pens. Pigs were weaned at 21 d of age and fed the same common phase I diet from d 0 to 5 postweaning. Experimental diets (Table 1) were fed to all pigs from d 5 to 26 postweaning. All diets were corn-soybean meal-based and formulated to 1.35% total lysine corresponding to a range of 1.13% to 1.16% digestible lysine, 0.85% Ca, and 0.45% to 0.48% available phosphorus. Pigs were fed the same common phase III diet from d 26 to 40 post weaning (21 to 35 of the experiment).

All pigs were housed at the Kansas State University Swine Teaching and Research Center in an environmentally controlled nursery, with a self-feeder and nipple waterer in each pen to allow ad libitum access to feed and water. Average daily gain, average daily feed intake, and feed efficiency were determined by weighing pigs and measuring feed disappearance on d 7, 14, 21, 28, and 35 of the experiment.

Data were analyzed using the MIXED procedure of SAS as a randomized complete block design with pen as the experimental unit. Least significant differences were used for making pairwise comparisons of the treatment means.

Results and Discussion

From d 0 to 7, no differences ($P>0.05$) were observed in growth performance. However, from d 7 to 14, pigs fed the diet containing 2.5% spray-dried blood cells had greater ADG compared to pigs fed the control diet. Pigs fed all other diets were intermediate. There were no differences ($P>0.05$) in ADFI or F/G. From d 14 to 21, pigs fed 5% select menhaden fish meal had greater ADG and ADFI ($P<0.05$) compared to pigs fed the control diet and wheat gluten Source 1. Pigs fed 2.5% spray-dried blood cells and wheat gluten Source 2 were intermediate. For the overall treatment period, d 0 to 21, no differences ($P>0.05$) were observed in ADG or ADFI. However, pigs fed either 2.5% spray-dried blood cells and 5% select menhaden fish meal had numerically greater ADG than those fed the control diet. Those fed either wheat gluten source had intermediate ADG. Pigs fed 5% select menhaden fish meal had improved ($P<0.05$) F/G compared to pigs fed the control diet. Pigs fed 2.5% spray-dried blood cells, wheat gluten Source 1, or wheat gluten Source 2, were intermediate in F/G from the other two diets. In previous studies evaluating pigs fed wheat gluten, in the period following feeding of the wheat gluten diet, pigs showed greater ADG compared to those not previously fed wheat gluten. Therefore, we monitored growth performance for an additional 14 d after the experimental treatment period. From d 21 to 35, when pigs were all fed a corn-soybean meal diet, there were no differences ($P>0.05$) in growth performance. For the overall period, no differences ($P>0.05$) were found in growth performance. In conclusion, pigs fed 5% select menhaden fish meal had better feed efficiency than those fed the control diet; however, neither ADG nor ADFI were affected by dietary treatments. Different processing methods of wheat gluten evaluated in this study do not appear to influence growth performance of nursery pigs.

Table 1. Diet Composition[a]

Ingredient, %	Control	5% Select Menhaden Fish Meal	2.5% Spray-Dried Blood Cells	Wheat Gluten Source 1	Wheat Gluten Source 2	Common Phase III
Corn	47.21	51.01	51.97	50.56	50.74	60.80
Soybean meal, 46.5%	35.06	27.60	27.60	27.60	27.60	32.25
Spray-dried whey	10.00	10.00	10.00	10.00	10.00	-
Fish meal	-	4.48	-	-	-	-
Spray-dried blood meal	-	-	2.50	-	-	-
Wheat gluten source 1	-	-	-	3.72	-	-
Wheat gluten source 2	-	-	-	-	3.54	-
Soy oil	3.00	3.00	3.00	3.00	3.00	3.00
Monocalcium phosphate, 21% P	1.48	1.00	1.60	1.62	1.63	1.45
Limestone	0.98	0.65	0.98	0.95	0.95	1.05
Antimicrobial[b]	1.00	1.00	1.00	1.00	1.00	0.50
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	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
Threonine	0.02	0.03	0.06	0.05	0.07	-
Zinc oxide	0.35	0.35	0.35	0.35	0.35	-
Lysine HCl	0.10	0.10	0.10	0.31	0.32	0.15
DL-Methionine	0.08	0.04	0.10	0.07	0.06	0.05
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
Total lysine, %	1.35	1.35	1.35	1.35	1.35	1.25
Isoleucine:lysine, %	69	66	59	65	65	67
Met & Cys:lysine, %	58	56	56	57	59	58
Threonine:lysine, %	65	65	65	65	65	62
Tryptophan:lysine, %	20	19	19	18	19	20
Valine:lysine, %	77	76	82	74	74	77
Protein, %	21.5	21.2	20.8	21.2	21.2	20.2
Calcium, %	0.85	0.85	0.85	0.85	0.85	0.80
Phosphorus, %	0.76	0.75	0.75	0.75	0.76	0.70
Available phosphorus , %	0.45	0.47	0.48	0.48	0.48	0.38

[a]Values calculated on an as-fed basis.
[b]Provided 50g/ton carbadox.

Table 2. Effect of Different Protein Sources on Growth Performance of Weanling Pigs[a]

		Protein Source				
Treatment	Control	5% Select Menhaden-Fish Meal	2.5% Spray-Dried Blood Cells	Wheat Gluten Source 1	Wheat Gluten Source 2	SEM
Day 0 to 7						
ADG, lb	0.54	0.48	0.51	0.51	0.52	0.06
ADFI, lb	0.65	0.59	0.62	0.64	0.64	0.08
Feed/gain	1.24	1.24	1.23	1.25	1.29	0.05
Day 7 to 14						
ADG, lb	0.99[d]	1.08[de]	1.13[e]	1.10[de]	1.02[de]	0.06
ADFI, lb	1.34	1.41	1.46	1.42	1.36	0.08
Feed/gain	1.36	1.29	1.29	1.28	1.33	0.03
Day 14 to 21						
ADG, lb	0.93[d]	1.12[e]	1.02[de]	0.95[d]	1.01[de]	0.06
ADFI, lb	1.44[d]	1.60[f]	1.58[ef]	1.43[d]	1.48[de]	0.08
Feed/gain	1.56	1.43	1.54	1.51	1.46	0.05
Day 0 to 21[b]						
ADG, lb	0.82	0.89	0.89	0.86	0.85	0.05
ADFI, lb	1.14	1.20	1.22	1.16	1.16	0.07
Feed/gain	1.38[e]	1.32[d]	1.36[de]	1.35[de]	1.36[de]	0.02
Day 21 to 35[c]						
ADG, lb	1.37	1.42	1.42	1.39	1.35	0.06
ADFI, lb	2.17	2.22	2.29	2.21	2.19	0.09
Feed/gain	1.60	1.61	1.63	1.59	1.62	0.02
Day 0 to 35						
ADG, lb	1.04	1.10	1.10	1.07	1.05	0.05
ADFI, lb	1.55	1.61	1.65	1.58	1.57	0.07
Feed/gain	1.47	1.44	1.46	1.44	1.46	0.02

[a]A total of 170 weanling pigs (two reps with five pigs/pen and four reps with six pigs/pen for a total of six pens/treatment) initially 16.35 lb and 26 ± 3 d of age.

[b]Treatment diets were fed from d 0 to 21. Overall, P=0.25 for ADG, P=0.13 for ADFI, and P=0.50 for F/G. For week, the overall P-value was P<.01 for ADG, ADFI, and F/G. There was no treatment by week interaction for ADG, ADFI, and F/G (P<0.05).

[c]D 21 to 35 common Phase III diet.

[def]Means in the same row with different superscripts differ (P<0.05).