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EFFECTS OF DIFFERENT FAT SOURCES ON GROWTH PERFORMANCE OF EARLY-WEANED PIGS [1]

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Summary

One hundred and eighty weanling pigs (initially 14.6 lb and 21 ± 2 d of age) were used in a 35 d growth trial to evaluate different dietary fat sources. Treatments consisted of a control diet (no added fat) or diets with 5% added fish oil, soybean oil, choice white grease, or a combination of 2.5% fish oil and 2.5% choice white grease. The diets were fed in two phases (d 0 to 14 and d 14 to 35 after weaning). Diets were fed in a meal form and formulated to a similar lysine:calorie ratio. From d 0 to 14 after weaning, pigs fed either soybean oil or fish oil had improved ADG and F/G compared to pigs fed the control diet, with those fed choice white grease or the blend of choice white grease and fish oil having intermediate performance. From d 14 to 35 and for the cumulative period (d 0 to 35) after weaning, neither added fat nor source affected ADG; however, F/G was improved for pigs fed any of the fat sources compared with those fed the control diet. These results suggest that adding 5% fat to the diet from d 0 to 35 after weaning improved F/G approximately 8%. Fish oil, soybean oil, and choice white grease appear to be similar in their value as fat sources for weanling pigs.

(Key Words: Fat Source, Early-Weaned Pigs, Performance.)

Introduction

Recent research has demonstrated that early-weaned pigs (17 to 21 days of age) do not efficiently utilize added dietary fat for the first 14 days after weaning. However, from day 14 to 35 after weaning, added dietary fat generally increases daily gain, reduces feed intake, and improves feed efficiency. The cause for this poorer utilization of dietary fat immediately after weaning is uncertain. This is especially puzzling because sow's milk, which is high in fat, is utilized efficiently by pigs. Research from Ohio State University has shown that the concentration of intestinal fatty acid binding proteins decreases at weaning, then gradually increases after 10 to 14 days. This pattern of fatty acid binding protein secretion appears to be correlated with the observed changes in growth performance. Nonetheless, 4 to 8% fat is added to diets fed to pigs immediately after weaning. This inclusion is to provide a lubricant to facilitate pelleting and reduce dust of diets containing high concentrations of milk and other specialty protein products. Although many different fat sources have been evaluated in diets for early-weaned pigs, little is known about fish oil. Therefore, the objective of this study was to compare the effects of menhaden fish oil with those of other fat sources on starter pig performance.

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[3]Food Animal Health and Management Center.

[4]Omega Proteins, Inc., Hammond, LA.

Procedures

One hundred and eighty weanling pigs (PIC L326 × C22, initially 14.6 lb and 21 ± 2 d of age) were blocked by weight and allotted to one of five dietary treatments in a randomized complete block design. There were six pigs per pen and six pens per treatment. The dietary treatments consisted of a control diet (no added fat) and diets containing 5% added fish oil, soybean oil, or choice white grease or a combination of 2.5% fish oil and 2.5% choice white grease. Diets were formulated and fed in two phases (Table 1). The control diet fed from weaning to d 14 (phase I) was formulated to contain 1.50% lysine, whereas the diet fed from d 14 to 35 (phase II) was formulated to contain 1.30% lysine. Added-fat diets were formulated to maintain the same lysine:calorie ratio among treatments. Furthermore, because of the unsaturated fatty acid profile of menhaden fish oil, an extra 60,000 IU vitamin E (100,000 IU total) was added as a precaution to all diets. All other nutrients met or exceeded the NRC (1998) estimates. Diets were fed in a meal form.

Pigs were housed at the Kansas State University Swine Research and Teaching Center. Pigs were allowed ad libitum access to food and water through a dry feeder and one nipple waterer per pen. Fat samples were taken for chemical analysis, and fatty acid profile was determined (Table 2). Pigs were weighed and feed disappearance was determined weekly for the 35-d trial. Average daily gain, ADFI, and F/G were the response criteria.

Results and Discussion

Chemical analysis of the fat sources is presented in Table 2. Results suggest that all fat sources were of high quality; however, the fish oil had a greater initial peroxide value than either the soybean oil or choice white grease. The choice white grease had the highest free fatty acid concentration at 9.5%. Over 12% unidentified peaks occurred in the fish oil fatty acid analysis. These peaks are likely omega 3 and 6 fatty acids.

From d 0 to 14 after weaning, pigs fed either soybean oil or fish oil had greater ADG compared to those fed the control diet ($P<.05$). Pigs fed either choice white grease or the blend of fish oil and choice white grease had intermediate ADG. Pigs fed soybean oil had greater ADFI than those fed either the control diet or diets containing choice white grease or the blend of choice white grease and fish oil, and pigs fed fish oil had intermediate ADFI. Feed efficiency was not affected by dietary treatment; however, pigs fed fish oil had numerically improved feed efficiency relative to pigs fed the control diet.

From d 14 to 35, ADG was not affected by dietary treatment. Daily feed intake and F/G were lowest for pigs fed either choice white grease or the blend of choice white grease and fish oil compared to those fed the control diet ($P<.05$). Pigs fed either fish oil or soybean oil had intermediate ADFI and F/G.

For the overall period, ADG was not affected by dietary treatment. Pigs fed diets containing choice white grease or the blend of choice white grease and fish oil had decreased ADFI ($P>.05$) compared with those fed the control diet or diet containing fish oil. Feed efficiency was not different among pigs fed any of the fat sources but was improved for pigs fed all of fat sources compared to those fed the control diet ($P<.05$). These results suggest that 5% added fat from fish oil, soybean oil, or choice white grease will improve feed efficiency in early-weaned pigs from weaning to d 35.

Contrary to previous research evaluating weanling pigs fed added fat, ADG was increased during the first 14 days after weaning by adding 5% fish oil or soybean oil to the diet. In addition, pigs fed fish oil had very similar growth performance compared to those fed other fat sources, despite the fact that the fish oil had a high initial peroxide value. During phase II and for the overall period, added fat, regardless of the source, improved feed efficiency.

In summary, these results suggest that fish oil is an effective fat source relative to soy-

bean oil or choice white grease for use in diets of early-weaned pigs. Adding 5% fat to starter pig diets resulted in an 8% improvement in overall F/G.

Table 1. Diet Composition[a]

	Day 0 to 14		Day 14 to 35	
Item, %	Control	5% Fat	Control	5% Fat
Corn	50.96	41.91	57.73	48.63
Dried whey	20.00	20.00	10.00	10.00
Soybean meal (46.5 % CP)	15.35	19.42	23.37	27.45
Fat source[b]	---	5.00	---	5.00
Spray-dried animal plasma	5.00	5.00	---	---
Menhaden fish meal	2.50	2.50	5.00	5.00
Spray-dried blood meal	1.75	1.75	---	---
Monocalcium phosphate	1.23	1.23	1.04	1.04
Limestone	.82	.80	.62	.60
Mecadox	1.00	1.00	1.00	1.00
Zinc oxide	.375	.375	.375	.375
Vitamin premix	.25	.25	.25	.25
Vitamin E premix	.15	.15	.15	.15
Trace mineral premix	.15	.15	.15	.15
Salt	.20	.20	.30	.30
L-lysine HCl	.15	.15	.15	.15
DL-methionine	.125	.125	---	.035
Ethoxyquin	---	.005	---	.005
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Crude protein, %	21.4	22.5	20.3	21.4
Lysine, %	1.50	1.60	1.30	1.40
ME, Mcal/lb	1.46	1.55	1.46	1.56
Lysine/ME:(g/Mcal)	4.66	4.69	4.04	4.07
Ca, %	.90	.90	.85	.85
P, %	.80	.80	.75	.75

[a]During each phase, treatments included a control; 5% added soybean oil, fish oil, or choice white grease; or a blend of 2.5% choice white grease and 2.5% fish oil.

Table 2. Chemical Analysis of Fat Sources[a]

Item	Fat Source		
	Soybean oil	Fish oil	Choice white grease
Moisture and volatiles, %	.57	.28	.70
Insoluble impurities, %	.30	.04	.50
Unsaponifiable matter, %	.98	1.03	1.12
M.I.U. %,	1.85	1.35	2.32
Free fatty acids, %	2.10	2.80	9.50
Peroxide value, Meq/kg	.95	9.18	< .20
Fatty acid profile, %			
C 10:0 Methyl caprate	—	—	.1
C 12:0 Methyl laurate	—	.1	.1
C 13:0 Methyl tridecanoate	—	.1	—
C 14:0 Methyl myristate	.1	9.2	1.5
C 14:1 Methyl myristoleate	—	.2	.2
C 15:0 Methyl pentadecanoate	—	.5	.2
C 15:1 Methyl pentadecanoate	—	.1	.1
C 16:0 Methyl palmitate	10.9	17.6	22.8
C 16:1 Methyl palmitoleate	—	11.6	3.0
C 17:0 Methyl heptadecanoate	—	3.1	.6
C 17:1 Methyl heptadecanoleate	—	2.4	.4
C 18:0 Methyl stereate	4.4	4.1	13.5
C 18:1 Methyl oleate	24.5	12.4	39.4
C 18:2 Methyl linoleate	51.7	2.3	14.7
C 18:3 Methyl linolenate	7.5	1.9	1.5
C 20:0 Methyl arachydate	.2	3.1	.3
C 20:1 Methyl eicosenoate	.1	1.8	.8
C 20:2 Methyl eicosadienoate	.1	.5	.4
C 20:3 Methyl eicosatrienoate	—	.2	.1
C 20:4 Methyl arachinodate	—	.9	—
C 22:0 Methyl behenate	.4	1.0	.3
C 22:1 Methyl erucate	—	14.2	—
C 24:0 Methyl lignocerate	.1	.5	—
Unidentified peaks[b]	—	12.2	—

[a]Values (as-fed basis) represent one sample.
[b]Unidentified peaks likely represent omega 3 and 6 fatty acids typically contained in fish oils.

Table 3. Effects of Different Fat Sources on the Growth Performance of Weanling Pigs[a]

Item	Control	Fish Oil	Soybean Oil	Choice White Grease	Choice White Grease + Fish Oil	SEM
Day 0 to 14						
ADG, lb	.74[b]	.84[cd]	.85[d]	.77[bc]	.78[bcd]	.025
ADFI, lb	.94[b]	.98b[c]	1.06[c]	.93[b]	.97[b]	.026
F/G	1.30	1.17	1.25	1.24	1.25	.038
Day 14 to 35						
ADG, lb	1.37	1.40	1.39	1.37	1.40	.027
ADFI, lb	2.25[b]	2.18[bc]	2.08[cd]	2.03[d]	2.06[d]	.037
F/G	1.64[b]	1.56[c]	1.49[cd]	1.48[d]	1.47[d]	.026
Day 0 to 35						
ADG, lb	1.12	1.18	1.17	1.13	1.15	.021
ADFI, lb	1.72[b]	1.70[b]	1.67[bc]	1.59[c]	1.62[cd]	.025
F/G	1.55[b]	1.44[c]	1.42[c]	1.41[c]	1.41[b]	.017

[a]One hundred and eighty pigs (PIC L326 × C22, initially 14.6 lb and 21 d of age) were used with six pigs per pen and six replications (pens) per treatment.
[b,c,d]Means with different superscript differ (P<.05).