SPRAY-DRIED EGG PROTEIN IN DIETS FOR EARLY-WEANED STARTER PIGS

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Summary

A total of 197 weanling pigs (initially 11.7 lb and 18 d of age) was used in a 28 d growth trial to determine the influence of spray-dried egg protein as a protein substitute for either soybean meal or spray-dried porcine plasma on starter pig performance. Pigs were blocked by weight with six replications per treatment and seven to eight pigs per pen. Dietary treatments were based on level of egg protein (3 or 6%) added to a phase I high nutrient dense diet and the method of substitution (egg protein replacing either soybean meal or porcine plasma). A sixth treatment served as an initial test of an egg protein blend. Treatments were as follows: 1) Control, 2 and 3) 3% or 6% egg protein substituted for soybean meal, 4 and 5) 3% or 6% egg protein substituted for spray-dried porcine plasma, and 6) 4% egg protein blend substituted for spray-dried porcine plasma. The control diet contained 7.5% porcine plasma, 1.75% spray-dried blood meal, and 20% dried whey. The egg products were substituted for the soybean meal or the porcine plasma on an equal lysine basis, maintaining the lysine level of all diets at 1.5%. Total added fat was maintained at 5% All pigs were fed a common diet from d 14 to 28 postweaning. During phase I, average daily gain (ADG) indicated that spray-dried egg protein was a suitable substitute for up to 3% porcine plasma or up to 6% soybean meal. However, pigs consuming the diet substituting 6% egg protein for porcine plasma had poorer ADG. Feed efficiency became poorer as spray-dried egg protein was substituted for 6% soybean meal or 3 to 6% porcine plasma. This indicates that the fat in spray-dried egg protein may be less available than soybean oil. Pigs fed the diet containing the 4% egg protein blend had poorer ADG and F/G than pigs fed the control diet. This indicates that 4% egg protein blend cannot effectively replace porcine plasma. These data suggest that spray-dried egg protein can replace at least 6% soybean meal and up to 3% porcine plasma in the phase I diet without reducing ADG; however, further research must be conducted to determine the digestibility of fat in the egg protein product.

Introduction

Recent research at Kansas State University has evaluated several protein sources in diets for early-weaned pigs. These proteins sources include spray-dried porcine plasma, spray-dried blood meal, dried skim milk, and various soy protein concentrates. Spray-dried egg protein has an excellent amino acid profile; however, few data are available evaluating the use of egg protein in starter pig diets. If egg protein proves to be a suitable protein source for the young

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pig, it could be substituted for porcine plasma to decrease the cost of the diet while improving performance. Therefore, the objective of this experiment was to determine the influence of egg protein substituted for either soybean meal (SBM) or porcine plasma on starter pig performance.

Procedures

A total of 197 pigs (initially 18 d and 11.7 lb) was used in this 28-d growth trial. Pigs were blocked by weight and allotted to one of the six dietary treatments for a total of eight to 10 pigs/pen and six pens/treatment. Dietary treatments were based on level of egg protein (3 or 6%) added to the phase I diet and the method of substitution (egg protein replacing either soybean meal or porcine plasma). A sixth treatment served as an initial test of an egg protein blend. Treatments were as follows: 1) Control, 2 and 3) 3% or 6% egg protein substituted for soybean meal, 4 and 5) 3% or 6% egg protein substituted for spray-dried porcine plasma, and 6) 4% egg protein blend for spray-dried porcine plasma.

The trial was divided into two phases. Experimental diets were fed only during phase I (d 0 to 14 postweaning). All experimental diets were formulated to 1.5% lysine, .9% calcium, .8% phosphorus, and at least .36% methionine. The control diet was a high nutrient density diet containing 7.5% spray-dried porcine plasma, 1.75% spray-dried blood meal, and 20% dried whey. Spray-dried egg protein (3 or 6%) replaced either soybean meal (treatments 2 and 3) or porcine plasma (treatments 4 and 5) on an equal lysine basis. Experimental diet 6 was formulated by replacing porcine plasma in the control diet with 4% egg protein blend on an equal lysine basis. Total fat additions were maintained at 5% with soybean oil or the egg protein products serving as the added fat sources. Experimental diets fed during phase I were pelleted. A common corn-soybean meal-based diet containing 2.5% spray-dried blood meal and 10% dried whey was fed to all pigs during phase II (d 14 to 28 post-weaning). This diet was formulated to 1.25% lysine, .9% calcium, and .8% phosphorus and fed in a meal form.

Pigs were housed in an environmentally controlled nursery in 5 x 7 ft pens. They were allowed ad libitum access to feed and water. Pigs were weighed and feed disappearance were measured on d 7, 14, 21 and 28 after weaning to determine ADG, ADFI, and F/G.

Data were analyzed as a randomized complete block design. General linear model procedures were used with initial weight serving as the blocking factor. Single degree of freedom contrasts were used to separate treatment means.

Results and Discussion

During phase I (d 0 to 14 postweaning), pigs fed diets containing 3% egg for plasma or 3 or 6% for SBM had similar ADG. However, pigs consuming the diets substituting 6% spray-dried egg protein for porcine plasma and 4% egg protein blend for porcine plasma had poorer ADG ($P<.06$ and $P<.03$, respectively). Additionally, feed efficiency was depressed as spray-dried egg protein was substituted for 6% soybean meal ($P<.05$) or 3 ($P<.07$) and 6% ($P<.01$) porcine plasma. Substituting 4% egg protein blend for spray-dried porcine plasma resulted in a 5% poorer F/G when compared to the positive control. These data indicate that the fat in spray-dried egg protein and egg protein blend may be less available than soybean oil.

During phase II (d 14 to 28 post-weaning) and the overall trial, pigs fed the diet substituting 6% spray-dried porcine plasma with spray-dried egg protein had the poorest ADG ($P<.01$) and ADFI ($P<.01$). Over the entire trial, replacing 6% spray-dried porcine plasma with spray-dried egg protein resulted in poorer F/G ($P<.05$)compared with pigs fed the other experimental treatments. Pigs fed all other treatments had similar growth performance. These data

imply that replacing 6% spray-dried porcine plasma with spray-dried egg protein depresses performance during both phases (I and II) of production.

In conclusion, decreasing the amount of spray-dried porcine plasma in the phase I diet from 7.5 to 4.5% by replacement with spray-dried egg protein results in a $40/ton reduction in diet cost. Therefore, diet cost can be reduced in phase I and similar average daily gains acquired by replacing 3% spray-dried porcine plasma with spray-dried egg protein. However, these results warrant further investigation addressing the availability of fat in the spray-dried egg protein product.

Table 1. Composition of Diets d 0 to 14 Postweaning[a]

		SBM Substitution		SDPP Substitution		
Ingredient,%	Control	3% Egg[b]	6% Egg[c]	3% Egg[d]	6% Egg[e]	4% EPB[f]
Corn	45.54	46.92	48.31	45.34	45.13	46.78
Soybean meal (48% CP)	15.96	12.67	9.39	15.96	15.96	15.96
Porcine plasma	7.50	7.50	7.50	5.88	4.27	2.88
Egg protein	--	3.00	6.00	3.00	6.00	--
Egg protein blend (EPB)	--	--	--	--	--	4.00
Soybean oil	5.00	3.97	2.93	3.97	2.93	4.20
Dried whey	20.00	20.00	20.00	20.00	20.00	20.00
Spray-dried blood meal	1.75	1.75	1.75	1.75	1.75	1.75
Monocalcium phosphate	1.91	1.89	1.86	1.82	1.72	--
Monosodium phosphate	--	--	--	--	--	.67
Limestone	.69	.67	.66	.67	.66	1.04
Antibiotic[g]	1.00	1.00	1.00	1.00	1.00	1.00
Copper sulfate	.08	.08	.08	.08	.08	.08
L-lysine	.10	.10	.10	.10	.10	.10
DL-methionine	.08	.05	.02	.03	--	--
Vitamin premix	.25	.25	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15	.15	.15
Total	100.00	100.00	100.00	100.00	100.00	100.00

[a]All diets were formulated to contain 1.5% lysine, .9% calcium, .8% phosphorus and at least .365% methionine and .52% sodium.
[b]3% egg = 3% egg substituted for SBM.
[c]6%egg = 6% egg substituted for SBM.
[d]3%egg = 3% egg substituted for spray-dried porcine plasma.
[e]6%egg = 6% egg substituted for spray-dried porcine plasma.
[f]4%EPB = 4% egg protein blend substituted for spray-dried porcine plasma.
[g]Provided 150 g of apramyacin per ton of feed.

Table 2. Influence of Spray-Dried Egg Products on Starter Pig Performance[a]

		SBM Substitution		SDPP Substitution			
Item	Control	3% Egg[f]	6% Egg[g]	3% Egg[h]	6% Egg[i]	4% EPB[j]	CV
D 0 to 14							
ADG, lb	.59[b]	.57[b]	.55[b]	.55[b]	.48[c]	.51[c]	12.0
ADFI, lb	.672	.66	.69	.69	.65	.62	9.5
F/G	1.16[b]	1.17[b]	1.25[c]	1.25[c]	1.37[d]	1.22[b,c]	7.1
D 14 to 28							
ADG, lb	1.050[b]	1.00[b]	1.00[b]	1.05[b]	.93[c]	1.03[b]	7.9
ADFI, lb	1.660[b]	1.605[b]	1.54[b]	1.62[b]	1.43[c]	1.60[b]	7.4
F/G	1.58	1.61	1.55	1.54	1.57	1.55	6.1
D 0 to 28							
ADG, lb	.819[b]	.784[b]	.77[b]	.80[b]	.70[c]	.77[b]	7.7
ADFI, lb	1.166[b]	1.131[b]	1.12[b]	1.15[b]	1.04[c]	1.11[b]	7.3
F/G	1.43[b]	1.45[b,c]	1.44[b]	1.44[b]	1.50[c]	1.44[b]	4.6

[a]One hundred and ninety seven weanling pigs were used (initially 11.7 lbs and 21 d of age), 7 to 8 pigs/pen with 6 pens per treatment. All diets were formulated to contain 1.5% lysine, .9% calcium, .8% phosphorus and at least .365% methionine and .52% sodium.

[b,c,d,e]Means within the same row without a common superscript differ (P<.05).

[f]3% egg = 3% egg substituted for SBM.

[g]6%egg = 6% egg substituted for SBM.

[h]3%egg = 3% egg substituted for spray-dried porcine plasma.

[i]6%egg = 6% egg substituted for spray-dried porcine plasma.

[j]4%EPB = 4% egg protein blend substituted for spray-dried porcine plasma.