THE EFFECTS OF SUBSTITUTING SPRAY-DRIED WHOLE EGG FROM EGG GRADING PLANTS FOR SPRAY-DRIED PLASMA PROTEIN IN PHASE I DIETS[1]

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Summary

A study was conducted to evaluate the effects of replacing spray-dried plasma protein with spray-dried whole egg from egg grading plants on starter pig performance. Up to 50% (3.5% of the diet) of spray-dried plasma protein can be replaced with spray-dried whole egg (6% of the diet) without influencing performance of starter pigs.

(Key Words: Starter, Plasma Protein, Egg Protein.)

Introduction

Research at Kansas State University has evaluated several protein sources in diets for early-weaned pigs. These protein sources include spray-dried plasma protein, spray-dried blood meal, skim milk, and various soy protein concentrates. Spray-dried whole egg has an excellent amino acid profile; however, there are few data evaluating the use of spray-dried whole egg in starter pig diets. A study conducted at Kansas State University (Swine Day Report, 1993) indicated that spray-dried egg protein reduced feed intake when added to the diet at high levels (>6%). Additional research was needed to determine the influence of spray-dried whole eggs on starter pig performance. Therefore, the goal of this experiment was to determine the maximum level of spray-dried whole egg from egg grading plants that could replace plasma protein in the phase I diet without negatively affecting performance of starter pigs.

Procedures

A total of 270 pigs (initially 9.5 lb and 14 d of age) was used in this 28 d growth trial. Pigs were blocked by weight and allotted to one of five dietary treatments with a total of seven to 10 pigs/pen and six pens/treatment. Dietary treatments were based on level of spray-dried whole egg (0, 3, 6, 9, or 12%) substituted on a lysine basis for spray-dried plasma protein in the phase I diet. Chemical compositions of the spray-dried whole egg and plasma are presented in Table 1. The spray-dried egg protein used in this study was obtained from plants where eggs are graded and packaged.

The trial was divided into two phases, with the pelleted, experimental diets fed during phase I (d 0 to 14 postweaning). All experimental diets were formulated to 1.5% lysine, .9% Ca, .8% P, and at least .42% methionine. The control diet contained 7.0% spray-dried plasma protein, 1.75% spray dried blood meal, and 20% dried whey. Spray-dried whole egg replaced spray-dried plasma protein on an equal lysine basis, while corn and soybean meal were maintained at 36 and 16% in all diets, respectively. Therefore, diets containing 0, 3, 6, 9, or 12% spray-dried whole egg contained 7,

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Table 1. Compositions of Spray-Dried Whole Egg and Plasma Protein

Item, %	Whole egg	Plasma protein
Protein	49.00	70.00
Fat	40.10	2.00
Ash	5.20	13.00
Lysine	3.55	6.10
Methionine	1.58	.53
Tryptophan	.83	1.33
Isoleucine	2.50	1.96
Leucine	4.19	5.56
Valine	3.09	4.12
Threonine	2.31	4.13

5.25, 3.5, 1.75, or 0% plasma protein, respectively. Soybean oil was maintained at 5% in all diets. In phase II (d 14 to 28), a common corn-soybean meal diet containing 2.5% spray-dried blood meal and 10% dried whey was fed in a meal form. This common diet was formulated to 1.35% lysine, .9% Ca, and .8% P. Complete compositions of diets are shown in Table 2.

Pigs were housed in an environmentally controlled nursery in 5 × 5 ft pens. Pigs were provided ad libitum access to feed and water. Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feed disappearance on d 7, 14, 21, and 28 postweaning.

Data were analyzed as a randomized complete block design. General linear model procedures were used with initial weight to establish the blocks. Linear and quadratic polynomials were used to detect the response of replacing spray-dried plasma protein with spray-dried whole egg.

Results and Discussion

From d 0 to 7 postweaning, ADG and F/G became poorer as spray-dried whole egg increased (linear, $P<.05$) (Table 3). These linear decreases were most evident in pigs fed 9 and 12% spray-dried whole egg.

In phase I (d 0 to 14), no differences in ADG occurred among those fed the control diet and pigs fed diets containing 3 and 6% spray-dried whole egg. However, ADG was reduced as higher levels of spray-dried whole egg were added to the diet (linear, $P<.05$). As the level of spray-dried whole egg increased, F/G became poorer (quadratic, $P<.05$). However, F/G of pigs fed diets with either 3 or 6% spray-dried whole egg was not different than that of pigs fed spray-dried plasma protein.

When all pigs were fed a common diet during phase II, F/G improved as a result of increasing spray-dried whole egg in the phase I diet (linear, $P<.05$). This response in F/G was due to a tendency for decreased phase II ADFI in pigs fed the higher spray-dried whole egg levels in phase I. However, ADG was not influenced by dietary treatment fed during phase I. For the overall trial (d 0 to 28 postweaning), no differences occurred in ADG or F/G.

This research indicates that spray-dried whole egg can replace a portion of plasma protein in the phase I diet. However, further research is needed to answer these additional questions:

1) Would responses differ with various sources of spray-dried whole egg?

2) Why were the differences in performance at the end of phase I lost during phase II?

3) As the total fat level in the diet increased with higher levels of spray-dried whole egg, why did F/G become poorer in phase I?

In conclusion, based on these results, up to 50% of spray-dried plasma protein can be replaced with spray-dried whole egg without influencing ADG or F/G in phase I. A positive F/G response in phase II is related to the higher spray-dried whole egg levels in phase I. For the overall trial, the level of spray-dried whole egg in the phase I diet caused no differences in pig performance.

Table 2. Composition of Experimental Diets[a]

	Spray-dried whole egg, %					
Ingredients, %	0	3	6	9	12	Phase II[b]
Corn	35.83	35.83	35.83	35.83	35.83	56.81
Soybean meal (48% CP)	16.40	16.40	16.40	16.40	16.40	25.86
Plasma protein	7.00	5.25	3.5	1.75	--	--
Whole egg	--	3.00	6.00	9.00	12.00	--
Soybean oil	5.00	5.00	5.00	5.00	5.00	--
Dried whey	25.00	25.00	25.00	25.00	25.00	10.00
Spray dried blood meal	1.75	1.75	1.75	1.75	1.75	2.50
Monocalcium phosphate	1.85	1.75	1.66	1.56	1.46	1.85
Corn starch	4.38	3.29	2.19	1.09	--	--
Limestone	.63	.61	.60	.58	.57	.85
Antibiotic	1.00	1.00	1.00	1.00	1.00	1.00
L-lysine·HCl	.13	.13	.13	.13	.13	.15
DL methionine	.15	.11	.07	.03	--	.075
Vitamin premix	.25	.25	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15	.15	.15
Zinc oxide	.38	.38	.38	.38	.38	.25
Salt	.10	.10	.10	.10	.10	.25
Total	100	100	100	100	100	100

[a]Phase I diets were formulated to contain 1.5% lysine, .42% methionine, .9% Ca, and .8% P.
[b]Phase II diet was formulated to contain 1.35% lysine, .37% methionine, .9% Ca, and .8% P.

Table 3. Effects on Pig Performance of Substituting Spray-Dried Whole Egg for Spray-Dried Plasma Protein[a]

	Whole egg, %							
Item	0	3	6	9	12	CV	Linear	Quadratic
D 0 to 7								
ADG, lb	.27	.27	.27	.24	.23	12.3	.03	.45
ADFI, lb	.35	.36	.38	.33	.34	8.9	.39	.16
F/G	1.32	1.35	1.49	1.46	1.54	12.7	.03	.79
D 0 to 14								
ADG, lb	.46	.45	.46	.41	.42	6.1	.004	.72
ADFI, lb	.55	.53	.57	.54	.55	7.8	.96	.87
F/G	1.20	1.20	1.25	1.30	1.30	6.2	.007	.007
D 14 to 28								
ADG, lb	.87	.85	.90	.88	.89	6.8	.32	.96
ADFI, lb	1.49	1.37	1.44	1.42	1.40	5.2	.18	.34
F/G	1.74	1.63	1.62	1.62	1.58	5.0	.006	.23
D 0 to 28								
ADG, lb	.66	.64	.68	.65	.66	5.3	.76	.96
ADFI, lb	1.02	.95	1.01	.98	.97	5.4	.37	.51
F/G	1.55	1.47	1.49	1.52	1.49	4.3	.36	.32

[a]Means represent a total of 270 weanling pigs (initially 9.46 lb and 14 d of age) with 7 to 10 pigs per pen and 6 replicate pens per treatment.
[b,c,d]Means on the same row with different subscripts differ by ($P < .05$).