Spray Dried Eggs as an Ingredient in Diets for SEW Pigs

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The success of segregated early weaning (SEW) programs is heavily dependent on the availability of dense, highly nutritive ingredients that also are rich in immune-globulins (IG). SEW pigs have only gamma globulin obtained from colostrum milk, because they are incapable of producing gamma globulin for 1 to 2 weeks postweaning.

Porcine plasma protein has been extremely valuable in SEW programs, as it is rich in IG as well as amino acids and the pattern of amino acids closely aligns to the needs of pigs. The IG immune competence of porcine plasma protein would reflect the microbial environment of the pigs that were processed in the packing plant at the time the blood was collected. Although not perfect for the microbes in the SEW facilities, the pattern would reflect many of the same organisms and provide immune protection.

Eggs also are extremely rich in IG and contain a valuable source of amino acids. Egg protein is the standard to which all other dietary proteins are compared. The IG in eggs would have an immune material capable of reacting in the microbial environment of SEW units for pigs. The IG in egg is extremely critical to the survival and early growth of young chickens and could potentially provide protection in pigs.

Plasma protein has the greatest influence in SEW programs during the first week to 10 days postweaning. Work done in this laboratory demonstrates the value of plasma protein during the first week postweaning and also demonstrates justification for reducing plasma protein beyond 7 days postweaning. Increases in daily gain and feed intake are most obvious, with increases in gain of 100 to 200% not being unusual in the first week.

Studies are needed to determine if the IG and amino acids in eggs can support similar levels of performance in early-weaned pigs. This study was proposed to measure the substitution value of spray dried eggs for porcine plasma protein in pigs weaned at 14 to 16 days of age and raised in an SEW environment.

Materials and Methods

One hundred sixty-eight pigs weaned at 14 to 16 days were placed in the Purdue University SEW nursery units with initial weight averaging 9.9 lb. Pens of pigs were randomly allotted to the four experimental diets which contained the major ingredients corn, soybean meal, dried whey, and yellow swine grease (Table 1). The spray dried eggs were substituted for 0, 33 1/3, 66 2/3 and 100% of the plasma protein, substituted on an equal protein basis, recognizing that plasma protein has 78% protein while spray dried eggs have 44% protein.

Phase 1 diets were fed for 10 days (Table 2). In Phase 2 diets (Table 3), the levels of plasma protein and spray dried egg were reduced by 50% and fed for a 14-day period. All pigs received the same Phase 3 diet (Table 1) for a 14-day period, which contained neither plasma protein nor spray dried egg, to measure sustaining effects of the ingredients included for reasons other than contribution of nutrients.

Pigs were allotted by weight and gender, 6 pigs per pen and 7 replications per treatment, and placed on plastic slotted floors in an environmentally controlled room. The initial room temperature was 34°C (93.2°F) and reduced by 1.5°C per week. Each pen was 4.9 x 4.9 ft, and pigs had *ad libitum* access to feed and water. Pigs were weighed at 10, 24 and 38 days postweaning to evaluate gain, feed intake and feed efficiency. Data were analyzed with pens being the experimental unit.

Results

The growth performance data in this study are reported in Table 4. Performance was excellent across all treatments with no significant difference (P<.05) in the final weight after 38 days on test. Treatment means for pig weights ranged from 43.5 to 45.6 lbs at the finish of the experiment. There were no death losses on any treatment during the entire study. The four combinations of plasma protein and spray dried eggs supported similar gains.

During Phase 1, the first 10 days of the study, there was a small but significant (P<.05) difference in daily gain, with the two higher levels of plasma protein supporting greater gain. During the second phase, a 14-day period, only the highest level of plasma protein supported greater gain, about .1 lb/day. During Phase 3, a 14-day period, and for the overall 38 day period, there were no significant (P<.05) differences in daily gain due to treatment.

Daily feed intake appeared to be lower during Phase 1 for the diet in which all plasma protein was replaced with spray dried eggs, but the differences were not significant (P<.05). In Phase 2, feed intake appeared to decline as plasma protein was reduced, but only the diet with the lowest level of plasma protein was significantly different (P<.01). Daily feed intake for Phase 3 and for the overall 38-day period were almost constant across the four treatments.

Feed efficiency values were similar across all treatments during each phase and for the overall experiment. Feed efficiency treatment means ranged from 1.46 to 1.53 for the entire 38 day study. The spray dried egg product maintained efficiency equal to that attained with plasma protein.

Implications

This study indicates that spray dried eggs can provide an excellent alternative for plasma protein when substituted on an equal protein basis. Combinations of the two immune globulin sources providing the same total protein was no better than either source fed separately.

Spray dried eggs provide some additional energy as the product contains about 25% fat. This is an initial study, and other trials will be conducted to confirm observations made in this experiment.

Table 1. Diet composition.

	Phase 1				Phase 2				Phase 3
Diet Number	1	2	3	4	11	12	13	14	30
Spray Dried Eggs	0	4.13	8.27	12.41	0	2.06	4.13	6.20	0
Plasma Protein	7.0	4.67	2.33	0	3.50	2.34	1.16	0	0
Corn	36.6	34.49	32.69	30.78	31.32	30.32	29.38	28.42	29.04
Reg. Soybean Meal	29.5	29.8	29.8	29.9	37.75	37.85	37.90	37.95	43.9
Whey	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Yellow Grease	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
DiCal Phos.	1.51	1.51	1.51	1.51	1.18	1.18	1.18	1.18	2.11
Limestone	1.25	1.25	1.25	1.25	2.10	2.10	2.10	2.10	.80
Salt	.25	.25	.25	.25	.25	.25	.25	.25	.25
ZnO	.38	.38	.38	.38	.38	.38	.38	.38	.38
DL Methionine	.10	.10	.10	.10	.10	.10	.10	.10	.10
Antibiotic[a]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Swine Vit. Mix[b]	.25	.25	.25	.25	.25	.25	.25	.25	.25
Swine TM Mix[c]	.12	.12	.12	.12	.12	.12	.12	.12	.12
Se 600 Mix[d]	.05	.05	.05	.05	.05	.05	.05	.05	.05
Lysine	1.55	1.55	1.55	1.55	1.50	1.50	1.50	1.50	1.45
Meth/Cys	.85	.85	.85	.85	.82	.82	.82	.82	.80
Ca	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
P	80	80	80	80	80	80	80	80	0.75

[a] Mecadox, 50 g/ton.
[b] Supplied the following per pound of diet: 2750 IU Vitamin A, 275 IU Vitamin D_3, 20 IU Vitamin E, .016 mg Vitamin B_{12}, 2.77 mg Vitamin K, .91 mg Menadione, 3.2 mg Riboflavin, 10 mg d-Pantothenic Acid, 15 mg Niacin.
[c] Supplied the following per pound of diet: 11 ppm Cu, .40 ppm I, 116 ppm Fe, 14 ppm Manganese, 116 ppm Zn.
[d] Supplied .3 ppm Se per pound of diet.

Table 2. Diet variables in Phase 1.

	Porcine Plasma Protein 78% Protein	Spray Dried Egg 44% Protein
Diet 1	7.0	0
Diet 2	4.67	4.13
Diet 3	2.33	8.27
Diet 4	0	12.41

Table 3. Diet variables in Phase 2.

	Porcine Plasma Protein	Spray Dried Egg
Diet 1	3.50	0
Diet 2	2.33	2.07
Diet 3	1.17	4.13
Diet 4	0	6.20

Table 4. Results of the feeding trial[c].

Treatment	1	2	3	4	Significance
Ratio of Spray Dried Plasma Protein to Spray Dried Egg Protein	3/0	2/1	1/2	0/3	
Initial Weight, lb	11.6	11.5	11.5	11.6	NS
Final Weight, lb	45.57	45.25	43.55	43.50	NS
Daily Gain, lb					
Phase 1	.30[a]	.30[a]	.26[b]	.22[b]	.05
Phase 2	.88[a]	.80[b]	.78[b]	.79[b]	.05
Phase 3	1.33	1.39	1.32	1.33	NS
Overall	.89	.89	.84	.84	NS
Daily Feed, lb					
Phase 1	.52	.50	.49	.39	NS
Phase 2	1.42[a]	1.32[a,b]	1.27[a,b]	1.24[b]	.01
Phase 3	1.86	1.92	1.88	1.81	NS
Overall	1.34	1.32	1.29	1.23	NS
Feed/Gain Ratio					
Phase 1	1.71	1.65	1.89	1.78	NS
Phase 2	1.61	1.65	1.64	1.57	NS
Phase 3	1.40	1.37	1.42	1.36	NS
Overall	1.50	1.49	1.53	1.46	NS

[a,b] Means with different superscripts are significantly different.
[c] Phase 1, 10 days; Phase 2, 14 days; Phase 3, 14 days.