Comparison of Inedible Egg Product and Spray-Dried Plasma as Sources of Protein for Weanling Pigs

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Summary and Implications

Pigs were weaned at approximately 18 days of age and fed diets containing inedible egg product, spray-dried plasma (SDP), or the combination of both for 2 weeks post-weaning. They then received a common diet for an additional 2 weeks after the treatment period. The impact of these dietary ingredients on growth performance was evaluated.

Inedible egg product did not improve growth or feed efficiency of pigs compared with those fed the control diet during the 2-week treatment period. However, SDP increased body weight gain and feed efficiency during the treatment period. The improved performance over the control group that resulted from feeding a combination of SDP and egg product was primarily dependent upon the SDP. In the third week, a trend occurred for improved performance of pigs fed the egg product compared with those fed 4% SDP; however, the difference was not significant. During this same period, pigs previously fed SDP gained weight slower and consumed less feed than those that had not been fed SDP. Therefore, the response to SDP was partially lost when it was removed from the diet. In summary, the outcome of this study demonstrated that inedible egg product was an adequate source of protein for the weanling pig but did not provide measurable improvements over the control diet. Inedible egg product did not have an additive effect when combined with SDP. The improved feed efficiency associated with SDP resulted in increased weanling pig growth.

Introduction

Early weaned pigs are subject to a lag in post-weaning performance. Several sources of protein have been studied to try to overcome this slow growth and ease the transition from sow's milk to dry feed. One potential source of protein for the starter diet is inedible egg product. Egg should be an excellent source of essential amino acids and energy; however, there has been limited research evaluating its use in nursery diets. Often, SDP is used as a key ingredient in starter diets. It is an excellent source of protein and energy and also has growth-promoting properties that increase feed intake and growth rate of weanling pigs. Immunoglobins in the SDP are credited for the improved response in pigs. Responses are associated with health status with the greatest responses occurring in pigs of poor health.

The performance of weanling pigs fed inedible egg product was compared with that of pigs fed SDP to determine if the egg product could replace or supplement SDP in the diet. If no depression in performance occurred compared with SDP, it would be economically advantageous to use egg product as a replacement for SDP in starter diets.

Materials and Methods

One hundred forty-four pigs were weaned at an average of 18 days of age. Pigs were randomly allotted to pens (six pigs/pen) within blocks from groups based on ancestry and initial weight (14.8 lb BW). Four blocks contained five contiguous pens and five treatments; one block contained only four treatments. This replication was not represented by treatment 5 (2% plasma). Treatments were randomly allotted to pens within blocks. Pigs were housed for the 4-week experiment in an environmentally controlled and continuously lighted nursery room that contained 24 raised-deck pens with woven-wire floors. Each pen (4 × 4 ft) contained a stainless steel self-feeder and a nipple waterer to allow ad libitum consumption of feed and water. An electric heat pad (4 × 1 ft) was used in the pens during the first 2 weeks of the experiment. The average temperature of the nursery room during the 4-week trial was 72°F. Five treatment diets (Table 1) were formulated. They are defined as 1) negative control, 2) 4 % SDP, 3) 6.4% inedible egg product, 4) 2% SDP and 3.15% egg, and 5) 2 % SDP. Treatments 2 and 3 were to supply a similar quantity of protein from SDP or egg. Treatment 4 was to supply equal amounts of protein from egg and SDP. Treatment 5 was included to indicate whether the expected growth response to SDP required only a 2% addition rather than a 4% addition. The dietary treatments were fed for 2 weeks post-weaning. Then all pigs were fed a common diet (Table 1) for an additional 2 weeks. Pigs were weighed initially and weekly. Feed disappearance data were collected weekly. Subjective diarrhea scores were recorded for the first 2 weeks. Scoring was based on a four point system: 1 = firm, 2 = slight, 3 = loose, and 4 = watery. Chemical analyses performed on the inedible egg product after diet formulation indicated that it contained less fat and more protein than was anticipated when the diets were formulated. Therefore, diets were not isocaloric and isonitrogenous (see Table 1).

Results and Discussion

Treatment averages for daily gain (ADG), daily feed intake (ADFI), and gain to feed ratio (G:F) are presented for each of the 1-week periods, and cumulative periods (Table 2).

Dietary additions of 6.3% egg product did not significantly improve ADG, ADFI, or G:F compared with other diets throughout the 2-week treatment period. The diet

combination of 2% SDP and 3.15% egg product improved ADG and G:F ratio by 15% above the control; however, this difference was not statistically significant (P<.10). The improvement in performance was probably a result of the 2% SDP and not the 3.15% egg product. The results from the diet containing only 2% SDP support this conclusion. This diet improved ADG and G:F by 18% and 16%, respectively. Pigs fed the diet containing 4% SDP had an ADG (P<.02) and a G:F ratio (P<.02) improvement over the control by 24% and 23%, respectively, during the same 2-week period. In comparison of 6.3 % egg product versus 4% SDP, the SDP resulted in greater ADG (P<.04) and improved G:F (P<.06) during the 2-week treatment period. Pigs fed the diet containing 4% SDP had an increased ADFI (P<.07) in the first week; a 16% increase over the control group. Feeding 4% SDP did not effect ADFI for the overall 4-week period.

In the third week of the trial, pigs previously fed SDP grew slower and ate less than those that had not received SDP. This is a typical response that occurs when SDP is withdrawn from the diet. The pigs receiving the 6.3% egg product showed a trend in the third week of increased ADG (P<.09) and G:F compared with pigs fed 4% SDP.

Over the entire length of the experiment, the pigs fed 4% SDP grew faster and had improved feed efficiency compared with the other treatment groups. The 2% SDP demonstrated improved growth response, but the response was less that that of pigs fed the 4% SDP diet.

Diarrhea score averages (Table 2) recorded during the 2-week treatment period demonstrated that 4% SDP reduced diarrhea compared with 6.3% egg product (P<.08). The diet containing 3.15% egg product and 2% SDP also resulted in less diarrhea than the 6.3% egg diet (P<.06). Pigs fed the diet containing 3.15% egg and 2% SDP; however, showed a tendency of less diarrhea (P<.16) compared with those fed 2% SDP. The decreased diarrhea associated with SDP was probably a result of the immunoglobins in SDP.

Economical Evaluation

An economical assessment of gains was made with feed costs of May 31, 1999, feed consumed and body weight gains. Inedible egg product was valued at $.40/lb. The costs are expressed as dollars per pound of body weight gain (Table 2). In this evaluation, even though pigs fed SDP gained the most weight and had the greatest gain:feed ratio, their cost of gain was greatest because of the high cost ($2.00/kg) of SDP. Pigs fed the control diet had the least expensive weight gain. Pigs fed egg product and combinations of egg product and SDP had intermediate costs of gain.

Table 1. Diet composition of phase I and phase II diets (as-fed basis).

	Phase 1[a]					Phase II[a]
Ingredients, %	Control	4% SDP	6.3% Egg	3.15% Egg and 2% SDP	2% SDP	
Corn	32.68	39.91	38.21	39.13	36.35	47.83
Soybean meal (50%)	34.51	23.70	26.07	24.88	29.09	34.15
Dried whey	25.00	25.00	25.00	25.00	25.00	10.00
Soy oil	3.33	2.94	-	1.44	3.14	2.92
Dicalcium phosphate	1.49	1.21	1.29	1.25	1.35	2.08
Mecadox premix	1.00	1.00	1.00	1.00	1.00	1.00
Zinc oxide	.35	.35	.35	.35	.35	.35
Limestone	.59	.83	.74	.78	.71	.59
Vitamin premix[b]	.40	.40	.40	.40	.40	.40
Trace mineral[c]	.07	.07	.07	.07	.07	.07
Selenium premix[d]	.05	.05	.05	.05	.05	.05
Salt	.25	.25	.32	.25	.25	.25
L-Lysine	.14	.20	.20	.20	.17	.16
DL-Methionine	.05	.09	.01	.05	.07	.12
Endox	.01	.01	.01	.01	.01	.01
Spray-dried plasma	-	4.00	-	2.00	2.00	-
Inedible egg product	-	-	6.30	3.15	-	-
Calculated analysis, %						
Crude protein	22.56	21.00	21.87	21.44	21.76	21.51
Lysine (total)	1.50	1.50	1.50	1.50	1.50	1.40
Met + cys (total)	.77	.82	.79	.81	.80	.81
Calcium	.89	.89	.89	.89	.89	.89
Phosphorus	.78	.75	.75	.75	.76	.82
ME (Kcal/lb)	1,488	1,488	1,488	1,488	1,488	1,486
Chemical analysis, %						
Dry matter	90.45	90.75	90.58	90.61	90.37	89.95
Crude protein	23.36	21.87	22.85	22.20	22.79	22.17
Ether extract	4.65	4.66	3.29	3.67	4.21	-
Diet cost, $/lb[e]	.093	.168	.110	.139	.131	.072

[a] Phase I, weeks 1 and 2; phase II, weeks 3 and 4.

[b] Supplied 4,000 IU vitamin A; 1,000 IU vitamin D_3; 6 mg riboflavin; 16 mg pantothenic acid; 30 mg niacin; and 20 µg vitamin B_{12} per pound of diet.

[c] Supplied 165 ppm Zn, 193 ppm FE, 66 ppm Mn, 19.29 ppm Cu, and .2 ppm I.

[d] Supplied .3 ppm Se.

[e] Diet cost on May 31, 1999. Inedible egg product valued at $.40/lb and spray-dried plasma at $2.00/lb.

Table 2. Effect of inedible egg product and spray-dried blood plasma on weanling pig growth performance.

Item	Period (week)	Treatments: Control	4% SDP	6.3% Egg	3.15% Egg and 2% SDP	2% SDP	CV, %
ADG, lb							
	1[abc]	.20	.29	.24	.26	.23	21.7
	2[de]	.72	.84	.72	.79	.82	12.7
	3[f]	1.19	1.10	1.27	1.14	1.14	13.1
	4	1.50	1.59	1.53	1.53	1.50	6.2
	1 & 2[gh]	.46	1.57	.48	.53	.54	12.9
	1, 2 & 3	.70	1.74	.74	.73	.73	11.3
	1, 2, 3 & 4	.90	1.95	.94	.93	.92	7.7
ADFI, lb							
	1[i]	.34	.39	.38	.38	.37	11.7
	2	1.14	1.09	1.08	1.11	1.11	5.1
	3	1.54	1.49	1.58	1.50	1.48	9.1
	4	2.12	2.17	2.15	2.14	2.18	5.6
	1 & 2	.74	.74	.73	.75	.74	2.0
	1, 2 & 3	1.01	.99	1.01	1.02	1.01	6.6
	1, 2, 3 & 4	1.29	1.29	1.30	1.30	1.30	5.5
G:F							
	1[jkl]	.568	.733	.586	.695	.629	18.0
	2[mn]	.636	.773	.675	.730	.757	13.8
	3	.769	.739	.811	.761	.763	7.1
	4	.711	.730	.711	.720	.698	6.1
	1 & 2[op]	.620	.764	.649	.713	.719	12.9
	1, 2 & 3[q]	.695	.749	.722	.718	.719	6.3
	1, 2, 3 & 4[r]	.702	.741	.716	.717	.709	3.9
Diarrhea Score[s]							
	1 & 2[tuv]	2.4	2.2	2.7	2.2	2.4	15.4
Cost of gain, $/lb		.111	.135	.115	.126	.124	

[a] Control vs. 4% SDP, P<.01.
[b] Control vs. 2% SDP and 3.15% egg, P<.06.
[c] 4% SDP vs. 6.3% egg, P<.10.
[d] Control vs. 4% SDP, P<.08.
[e] 4% SDP vs. 6.3% egg, P<.06.
[f] 4% SDP vs. 6.3% egg, P<.09.
[g] Control vs. 4% SDP, P<.02.
[h] 4% SDP vs. 6.3% egg, P<.04.
[i] Control vs. 4% SDP, P<.07.
[j] Control vs. 4% SDP, P<.04.
[k] Control vs. 2% SDP and 3.15% egg, P<.10.
[l] 4% SDP vs. 6.3% egg, P<.06.
[m] Control vs. 4% SDP, P<.04.
[n] Control vs. 2% SDP, P<.09.
[o] Control vs. 4% SDP, P<.02.
[p] 4% SDP vs. 6.3% egg, P<.06.
[q] Control vs. 4% SDP, P<.08.
[r] Control vs. 4% SDP, P<.04.

[s] Based on four point system: 1 = firm, 2 = slight, 3 = loose, and 4 = watery.
[t] 4% SDP vs. 6.3% egg, P<.06.
[u] 6.3% egg vs. 3.15% egg and 2% SDP, P<.06.
[v] 2% SDP vs. 3.15% egg and 2% SDP, P<.16.