POTENTIAL FOR EGG PROTEIN AND PORCINE SPRAY-DRIED BLOOD AS A REPLACEMENT FOR PLASMA PROTEIN (AP-920) IN EARLY-WEANING PIG DIETS

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Story in Brief

One growth trial involving 64 weanling pigs (16± 4 days of age and 12.6 lb initial BW) was conducted to determine the potential of a combination of egg protein and spray-dried porcine blood (SDPB) as a replacement for plasma protein (AP-920) in early weaning pig diets. Pigs were penned in groups of four (8 pens per treatment) and housed in an off-site nursery. During the first 10 days postweaning (Phase 1), pigs were fed a Phase 1 control diet containing 3.75% AP-920 or the control diet with a combination of egg protein and SDPB replacing AP-920. Substitutions were made an equal lysine basis at the expense of plasma protein and corn. Experimental diets were formulated to contain 1.58% lysine and .90% methionine plus cystine. From day 10 to 24 and 24 to 38 postweaning, pigs were fed a common Phase 2 (1.35% lysine) and Phase 3 (1.15% lysine) diet, respectively. During day 0 to 10, 24 to 38, and for the overall 38-day experimental period, pigs fed the diet containing AP-920 had greater daily gains and daily feed intakes than pigs fed the diet containing a combination of egg protein and SDPB. These results suggest that a combination of egg protein and SDPB cannot effectively replace AP-920 in early-weaning pig diets during Phase 1 of the nursery period.

(Key Words: Early-Weaned Pig, Protein Source, Growth Performance.)

Introduction

Numerous studies have confirmed a consistent improvement in ADG, ADFI, and gain:feed in pigs fed nutrient-dense diets containing plasma protein. Efficacy has been documented at levels up to 10% dietary plasma protein. Although the improved performance has been remarkably consistent, two recent studies at the University of Kentucky (Coffey and Cromwell, 1995) and Iowa State University (Gatnau and Zimmerman, 1991) have suggested the response to plasma protein is dependent upon environment. Pigs weaned at an early age and reared in isolation (segregated early weaning in off-site facilities) were less responsive to dietary plasma protein than pigs reared in a conventional system. In addition, the plasma protein supply is limited and, therefore, very expensive. Several studies have suggested the use of other, less expensive protein sources, such as egg protein and spray-dried blood meal as protein sources which can potentially be used to replace plasma protein. The replacement potential of other protein sources may be very good in off-site facilities which optimize early-weaning performance. Therefore, the objective of this experiment was to determine the potential of a combination of egg protein and spray-dried porcine blood (SDPB) as a replacement for plasma protein (AP-920) in early-weaning pig diets.

Materials and Methods

One trial involving a total of 64 early-weaned pigs (16± 4 days of age and 12.6 lb initial BW) was conducted to evaluate the potential for egg protein and SDPB as a replacement for AP-920 in segregated early-weaned pigs diets. Pigs were sorted by weight, and divided into four groups (blocks). Weight groups contained 16 pigs each. Pigs within each weight group were allotted into four equal subgroups (four pigs per pen subgroup or pen) with stratification based on sex and litter. The pens within each of the four weight group were randomly assigned to two dietary treatments (8 pens/treatment). Dietary treatments were: 1) a Phase 1 control diet containing 3.75% AP-920, or 2) the control diet with egg protein and SDPB replacing AP-920 (Table 1). Substitutions were made on an equal lysine basis at the expense of plasma protein and corn. Experimental diets were fed from day 0 to 10 postweaning (Phase 1) and formulated to contain 1.58% lysine, .90% methionine plus cystine, and 14.53% lactose. Upon completion of the Phase 1 diets, pigs were fed a common Phase 2 diet (1.35% lysine) from day 10 to 24 postweaning and a Phase 3 diet (1.15% lysine) from day 24 to 38 postweaning.

Pigs were housed in an environmentally controlled off-site nursery in elevated pens (3□7" x 5□) with woven wire flooring. The initial temperature of 88°F was subsequently decreased 2°F per week. Pigs in each pen had ad libitum access to one nipple waterer and a three-hole feeder. Pig body weight and feed intake were determined at the time of each diet change to evaluate average daily gain (ADG), average daily feed intake (ADFI), and gain:feed.

Data were analyzed according to a randomized complete block design with pen as the experimental unit and blocks based on initial body weight. Analysis of variance was performed using the GLM procedures of SAS (1988).

Results and Discussion

From day 0 to 10 postweaning, pigs fed a diet containing AP-920 had greater ADG ($P<.01$) and ADFI ($P<.05$) than pigs fed a diet containing a combination of egg protein and SDPB (Table 2). Gain:feed, however, was not affected ($P>.1$) by dietary treatment. Pigs fed AP-920 grew 23% faster and consumed 21% more feed than pigs fed a combination of egg protein and SDPB.

From day 10 to 24 postweaning, ADG, ADFI, and gain:feed were not affected by diets fed during the initial 10 days of study. From day 24 to 38, however, ADG of pigs previously fed AP-920 was greater ($P<.01$) than those previously fed a combination of egg protein and SDPB. Similarly, during the overall 38-day experimental period, pigs fed AP-920 during the initial 10 days of the experiment had greater ($P<.05$) ADG than pigs fed a combination of egg protein and SDPB.

Veum et al. (1994) reported that from day 0 to 7 postweaning, pigs fed diets containing 10% porcine plasma protein or 5% porcine plasma protein plus 5% spray-dried blood meal had higher daily gains than pigs fed a diet containing 11.98% spray-dried poultry by-product or a diet containing 5.49% spray-dried poultry by-product plus 5% spray-dried blood meal. However, during day 0 to 14 and 14 to 28 postweaning, ADG, ADFI, and gain:feed ratio of pigs fed diets containing spray-dried poultry by-product or the spray-dried poultry by-product plus spray-dried blood meal were similar to that of pigs fed diets containing plasma protein or plasma protein plus blood meal. Owen et al. (1993) reported the spray dried egg can replace up to 3% of porcine plasma in Phase 1 (day 0 to 14 postweaning) diets without reducing performance. Nessmith et al. (1995) also reported 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 in Phase 1 (Day 0 to 14 postweaning) diets of nursery pigs. Nessmith et al. (1996), on the other hand, observed a decrease in performance in pigs fed a diet containing egg protein or spray-dried blood meal when compared to those fed a diet containing menhaden fish meal or extruded soy protein concentrate.

In the present study, pigs fed the diet containing 3.75% AP-920 during day 0 to 10 postweaning outperformed those fed a diet containing 2.15% egg protein and 2.15% SDPB. The difference in the results of the present study compared to other results (Owen et al., 1993; Veum et al., 1994; Nessmith et al., 1995) may, in part, be due to: 1) differences in quality of the egg protein and/or spray-dried porcine blood used, 2) differences in the level of replacement, and/or 3) differences in age and management of the pigs.

In conclusion, the results of the present study indicate that a combination of egg protein and SDPB cannot effectively replace AP-920 in Phase 1 (day 0 to 10 postweaning) diets of nursery pigs reared in isolated off-site facilities. However, further research is needed to test different egg protein sources and level of replacement.

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Table 1. Composition of experimental diets a.				
	Phase 1		Phase 2	Phase 3
	Protein source[b]			
Ingredient, %	AP-920	EP:SDPB		
Corn, ground	41.62	41.05	48.73	63.55
Steam rolled oats	5.00	5.00	-	-
AP-920	3.75	-	-	-
Egg protein	-	2.15	-	-
SDPB	-	2.15	-	-
Dep. Whey	17.50	17.50	10.00	-
Soy protein conc.	5.70	5.70	-	-
Soybean meal, 48%	10.00	10.00	30.00	28.50
Fish meal	8.50	8.50	4.00	-
Soy oil	4.00	4.00	4.00	4.00
Ethoxyquin	.03	.03	.03	.03
Lysine, HCL	.15	.15	.15	.15
Methionine	.14	.12	.07	.01
Neoterramycin[c]	1.00	1.00	-	-

Zinc Oxide	.30	.30	.30	.30
Flavor	.10	.10	-	-
$CUSO_4$	.07	.07	.07	.07
Calcium carbonate	.16	-	.40	.61
Vitamin premix[d]	.38	.38	.25	.25
Dical	1.30	1.50	1.35	1.88
Salt	.30	.30	.40	.40
Mecadox[e]	-	-	.25	.25
Calculated Composition				
Lysine	1.58	1.58	1.35	1.15
Threonine	.96	.94	.84	.74
Tryptophan	.24	.22	.25	.23
Met+Cys	.90	.90	.77	.65
Lactose	14.53	14.53	8.30	-

a As fed basis.

b AP-920: plasma protein source, American Protein Corp. Ames, IA; EP: egg protein; SDPB: spray-dried porcine blood.

c Contained 10 g of neomycin and 5 g of oxytetracline per lb.

d Vitamins and minerals met or exceeded the NRC (1988) requirements.

e Contained 10g of Carbadox per lb.

Table 2. The effect different protein sources on growth performance in early-weaning pigsa.

	Protein Source[b]		
Item	AP-920	EP:SDPB	SEM
Day 0 to 10			
ADG, lb	.38[c]	.31[d]	.016
ADFI, lb	.47[e]	.39[f]	.020
Gain:feed	.83	.80	.038
Day 10 to 24			
ADG, lb	.77	.76	.042
ADFI, lb	1.05	1.01	.070
Gain:feed	.78	.77	.025
Day 24 to 38			
ADG, lb	1.36[c]	1.24[d]	.021
ADFI, lb	2.09	1.82	.052
Gain:feed	.66	.64	.018
Day 0 to 38			
ADG, lb	.93[e]	.86[f]	.021
ADFI, lb	1.35	1.26	.047
Gain:feed	.74	.72	.014

a Data are means of 8 pens of 4 pigs each. Pigs averaged 12.6 lb and 45.0 lb at initiation and termination, respectively.

b AP-920: plasma protein source; EP: egg protein; SDPB: spray-dried porcine blood.

c,d Means in a row with different superscripts letter differ ($P<.01$).

e,f Means in a row with different superscripts letter differ ($P<.05$).

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