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COMPARISON OF CONCEPT PR 100 AND SPRAY-DRIED ANIMAL PLASMA ON NURSERY PIG PERFORMANCE[1]

J. M. DeRouchey, E. J. Wiedmann, M. D. Tokach, S. S. Dritz[2], R. D. Goodband, and J. L. Nelssen

Summary

One hundred eighty weanling pigs (initially 12.1 lb and 18 ± 2 d of age) were used in a 28-d growth assay to determine if Concept PR 100 (CNPR), a plant-based protein ingredient with added synthetic amino acids and nucleic acids, can replace spray-dried animal plasma (SDAP) in nursery pig diets. The five experimental treatments were: 1) control (no specialty protein source); 2) 2.5% SDAP; 3) 5.0% SDAP; 4) 2.5% CNPR; and 5) 5.0% CNPR. Treatment diets were fed from d 0 to 14 after weaning, with a common diet fed to all pigs from d 14 to 28 after weaning. From d 0 to 14, pigs fed increasing amounts of SDAP had improved (linear and quadratic, P<0.01) ADG and ADFI, which was primarily due to a large improvement from 0 to 2.5% SDAP, with a smaller increase when 5.0% was fed. In addition, pigs fed diets containing increasing amounts of CNPR had increased (linear and quadratic, P<0.003) ADG and ADFI, with the maximum response observed in pigs fed 2.5% CNPR. Furthermore, pigs fed increasing amounts of SDAP or CNPR had improved F/G (linear, P<0.001 and quadratic, P<0.07, respectively), compared with F/G of control pigs. When comparing the means of pigs fed diets containing SDAP versus those fed CNPR, pigs fed SDAP had greater (P<0.002) ADG, ADFI, and pig weight at d 14, compared with pigs fed CNPR.

Overall, (d 0 to 28), pigs fed increasing amounts of SDAP and CNPR had greater ADG, ADFI, and final weight (linear, P<0.01) than did pigs fed the control diet. The greatest improvement for pigs fed both protein sources was observed at 2.5% inclusion in the diet, with a smaller increase up to a 5.0% inclusion. Although either protein source improved growth performance, compared with the control diet, pigs fed SDAP tended to have greater overall ADG (P<0.12) and final body weight (P<0.11) than pigs fed CNPR.

(Key Words: Nursery Pig, Specialty Protein Sources, Spray-dried Animal Plasma, Growth.)

Introduction

Spray-dried animal plasma (SDAP) is commonly used in pelleted starter diets to increase daily gain and feed intake of newly weaned pigs. With increased consumer and regulatory pressure to potentially remove animal protein sources from swine diets, however, alternatives must be evaluated. A newly developed product, Concept PR 100 (CNPR), is a plant-based protein product that is rec-

[1]Appreciation is expressed to Charles Schel, Concept Nutrition Ltd., United Kingdom, for donation of Concept PR 100 for use in this trial. Concept is a trademark of Concept Nutrition Ltd., United Kingdom.

[2]Food Animal Health and Management Center, College of Veterinary Medicine.

ommended to replace spray-dried animal plasma (SDAP) on a 1:1 basis. Although past research evaluating plant-based protein replacements for SDAP in starter pig diets have shown limited success, evaluation of newly developed products, such as CNPR, is critical if substitutes are to be discovered for commercial use. Therefore, the objective of this study was to determine if CNPR, a plant-based protein ingredient, can be a substitute for SDAP in nursery pig diets.

Procedures

A total of 180 pigs (BW of 12.1 lb and 18 ± 2 d of age) were used in a 28-d growth assay. Pigs were blocked by weight and were allotted to 1 of 5 dietary treatments. There were 6 pigs/pen and 6 pens/treatment. Each pen contained one self-feeder and one nipple water to provide *ad libitum* access to feed and water. Pigs were housed in the Kansas State University Swine Teaching and Research Center.

The experimental treatments were: 1) control (no specialty protein source); 2) 2.5% SDAP; 3) 5.0% SDAP; 4) 2.5% CNPR; and 5) 5.0% CNPR. Treatment diets were fed from d 0 to 14 after weaning, with a common diet fed to all pigs from d 14 to 28 after weaning. All diets were fed in meal form. The CNPR (Concept Plasma Replacer 100; Concept Nutrition Ltd., UK) is a proprietary blend of plant protein ingredients, synthetic amino acids, and nucleic acids, which was substituted on a 1:1 basis for SDAP (APC 920; American Proteins Corp., Ankeny IA). Nutrient values from NRC (1998) were used for SDAP, and nutrient values for CNPR were provided by the manufacturer (Table 1). Experimental diets were formulated to contain 1.50% total lysine (Table 2). All pigs were fed a common Phase 2 diet (without SDAP or CNPR) from d 14 to 28. Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feed disappearance on d 7, 14, 21, and 28 after weaning.

Data were analyzed as a randomized complete-block design, with pen as the experimental unit. Pigs were blocked based on weaning weight, and analysis of variance was performed by using the MIXED procedure of SAS. Linear and quadratic polynomial contrasts were used to determine the effects of increasing SDAP or CNPR in the diet. Also, a contrast comparing the means of pigs fed SDAP and fed CNPR was performed to determine differences between the two protein sources.

Table 1. Nutrient Composition of Specialty Ingredients (As-fed Basis)

Nutrient	SDAP[a]	CNPR[b]
CP, %	78.00	67.79
Ca, %	0.15	1.03
P, %	1.71	0.64
Amino Acids, %		
Arginine	4.55	4.70
Cysteine	2.63	0.92
Histidine	2.55	1.61
Isoleucine	2.71	2.89
Leucine	7.61	4.60
Lysine	6.84	6.85
Methionine	0.75	2.39
Threonine	4.72	4.64
Tryptophan	1.36	1.50
Valine	4.94	2.94

[a]Spray-dried animal plasma, nutrient values from NRC (1998).
[b]Concept Nutrition Plasma Replacer 100, nutrient values provided by the manufacturer.

Results and Discussion

From d 0 to 14, pigs fed diets with increasing amounts of SDAP had improved (linear and quadratic, P<0.01) ADG and ADFI, which was primarily due to a large improvement from 0 to 2.5% SDAP inclusions, with further increases when 5.0% was fed (Table 3). Pigs fed diets containing more CNPR also had increased (linear and quadratic, P<0.003) ADG and ADFI, with the maximum response observed in pigs fed 2.5%. Furthermore, pigs fed increasing amounts of SDAP (linear, P<0.001) or CNPR (quadratic, P<0.07) had improved F/G, compared with F/G of pigs fed the control diet. When comparing the means of pigs fed diets containing SDAP and fed CNPR, pigs fed SDAP had increased (P<0.002) ADG, ADFI, and pig weight at d 14, compared with pigs fed CNPR.

During the common feeding period (d 14 to 28), pigs previously fed increasing amounts of CNPR tended to have improved (linear, P<0.13) ADG and ADFI (linear, P<0.02), which was due to increased gain for pigs previously fed 5.0% CNPR. In addition, pigs previously fed increasing amounts of SDAP or CNPR tended to have increased (linear, P<0.13 and P<0.02, respectively) ADFI. During Phase 2, F/G was worse for pigs previously fed increasing amounts of SDAP (linear, P<0.04) or CNPR (linear and quadratic, P<0.03), with the poorest F/G observed at the 2.5% inclusion for either protein product. There were no differences in ADG, ADFI, or F/G (P>0.41) with pigs previously fed SDAP, compared with those previously fed CNPR.

Overall, (d 0 to 28), pigs had greater ADG and ADFI when fed diets with increasing amounts of SDAP (linear, P<0.001) or CNPR (linear, P<0.004), which was primarily due to large improvements for both protein sources when included at 2.5% of the diet, with further increases when fed at 5.0% of the diet. Also, pigs fed diets containing increasing amounts of either SDAP or CNPR had greater (linear, P<0.002) final body weight. The mean ADG and final body weight of pigs fed SDAP tended (P<0.12) to be greater than the BW for pigs fed CNPR.

Results from this study indicate that nursery pig performance improved, as expected, when a specialty protein source was used to partly replace soybean meal in the diet. At the end of the study, pigs fed diets containing SDAP or CNPR were approximately 3.7 lb and 2.7 lb heavier, respectively, than pigs fed the control diet.

These results indicated that SDAP and CNPR can effectively be used in nursery pig diets to improve growth performance, but it seems that SDAP increases ADG and final weight to a greater extent than CNPR does.

Table 2. Composition of Experimental Diets (As-fed Basis)[a]

		SDAP		CNPR		Phase 2
Ingredient, %	Control	2.5%	5.0%	2.5%	5.0%	Common
Corn	44.05	47.60	51.20	47.60	51.20	59.20
Soybean meal (46.5% CP)	37.50	31.50	25.50	31.50	25.50	34.75
Spray-dried animal plasma	-	2.50	5.00	-	-	-
Concept PR 100	-	-	-	2.50	5.00	-
Dried whey	15.00	15.00	15.00	15.00	15.00	-
Soy oil	-	-	-	-	-	2.00
Monocalcium P (21 % P)	1.40	1.25	1.13	1.25	1.13	1.60
Limestone	1.00	1.10	1.20	1.10	1.20	1.10
Salt	0.30	0.30	0.30	0.30	0.30	0.35
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.25	0.25	0.25	0.25	0.15
L-lysine HCl	0.15	0.15	0.15	0.15	0.15	0.30
DL-methionine	0.12	0.11	0.10	0.11	0.10	0.15
L-threonine	0.07	0.05	0.03	0.05	0.03	0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis: [b]						
Total lysine, %	1.50	1.50	1.50	1.50	1.50	1.44
TID amino acids, %[c]						
Lysine	1.34	1.35	1.35	1.35	1.35	1.30
Methionine:lysine	32	31	29	31	29	35
Met & Cys:lysine	58	58	58	58	58	59
Threonine:lysine	64	64	64	64	64	65
Tryptophan:lysine	20	19	19	19	19	18
Isoleucine:lysine	67	64	60	64	60	62
Protein, %	23.3	22.7	22.2	22.5	21.6	21.7
Ca, %	0.89	0.89	0.89	0.91	0.93	0.85
P, %	0.78	0.76	0.75	0.74	0.70	0.74

[a]Experimental diets fed from d 0 to 14 after weaning, and all pigs were fed a common diet from d 14 to 28 after weaning.
[b]Nutrient values from NRC (1998) were used for SDAP, and nutrient values for CNPR were provided by the manufacturer.
[c]True ileal digestible amino acids.

Table 3. Effect of Specialty Protein Source on Nursery Pig Performance[a]

							Probability, P <				
		SDAP[b]		CNPR[c]			SDAP vs	SDAP		CNPR	
Item	Control	2.5%	5.0%	2.5%	5.0%	SEM	CNPR	Linear	Quadratic	Linear	Quadratic
d 0 to 14											
ADG, lb	0.26	0.45	0.52	0.42	0.41	0.03	0.001	0.001	0.01	0.001	0.002
ADFI, lb	0.37	0.59	0.62	0.52	0.50	0.03	0.001	0.001	0.002	0.001	0.003
F/G	1.46	1.31	1.22	1.25	1.23	0.04	0.55	0.001	0.48	0.001	0.07
d 14 to 28											
ADG, lb	1.08	1.12	1.12	1.08	1.16	0.05	0.92	0.47	0.67	0.13	0.39
ADFI, lb	1.33	1.44	1.43	1.42	1.49	0.07	0.62	0.13	0.31	0.02	0.86
F/G	1.23	1.29	1.28	1.31	1.29	0.02	0.41	0.04	0.21	0.03	0.03
d 0 to 28											
ADG, lb	0.67	0.78	0.82	0.75	0.78	0.04	0.12	0.001	0.12	0.001	0.34
ADFI, lb	0.85	1.01	1.03	0.97	0.99	0.05	0.24	0.001	0.06	0.004	0.21
F/G	1.27	1.29	1.26	1.29	1.27	0.02	0.67	0.76	0.26	0.88	0.29
Pig weight, lb											
d 0	12.1	12.3	12.1	12.1	12.1	0.7	0.30	0.79	0.06	0.90	0.63
d 14	15.7	18.6	19.3	18.0	17.8	1.0	0.002	0.001	0.009	0.001	0.004
d 28	30.9	34.2	35.0	33.2	34.0	1.6	0.11	0.001	0.09	0.002	0.34

[a]A total of 180 pigs (6 pigs per pen and 6 pens per treatment) with an initial BW of 12.1 lbs. Pigs were fed experimental diets from d 0 to 14 after weaning, and all pigs were fed a common diet from d 14 to 28 after weaning.
[b]Spray-dried animal plasma (APC 920; American Proteins Corp., Ankeny IA).
[c]Concept Plasma Replacer 100 (Concept Nutrition Ltd., UK).