Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 1158

2007

Comparison of modified Concept PR 100 and spray-dried animal plasma on nursery pig performance (2007)

E J. Wiedmann

Joel M. DeRouchey

Michael D. Tokach

See next page for additional authors

Recommended Citation

Wiedmann, E J.; DeRouchey, Joel M.; Tokach, Michael D.; Goodband, Robert D.; Nelssen, Jim L.; and Dritz, Steven S. (2007) "Comparison of modified Concept PR 100 and spray-dried animal plasma on nursery pig performance (2007)," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6998

Comparison of modified Concept PR 100 and spray-dried animal plasma on nursery pig performance (2007)

Authors

E J. Wiedmann, Joel M. DeRouchey, Michael D. Tokach, Robert D. Goodband, Jim L. Nelssen, and Steven S. Dritz

COMPARISON OF MODIFIED 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 11.3 lb and 18 ± 2 d of age) were used in a 28-d growth assay to determine if Modified Concept PR 100 (MCNPR), a plant-based protein ingredient containing 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% MCNPR; and 5) 5.0% MCNPR. Treatment diets were fed from d 0 to 14 post-weaning, with a common diet fed to all pigs from d 14 to 28 post-weaning. Analyzed values of MCNPR were noticeably lower than the manufacturer-provided values used in diet formulation. The difference in calculated and analyzed lysine values would decrease the total dietary lysine content by 0.027 and 0.056% for the 2.5 and 5.0% MCNPR, respectively.

From d 0 to 14, pigs fed increasing SDAP had improved (linear, $P<0.01$) ADG, ADFI, and F/G, which was primarily due to a large improvement from the 0 to 2.5% SDAP inclusion, with further increases when 5.0% was fed. In addition pigs fed increasing levels of MCNPR had improved (quadratic, $P<0.002$) feed efficiency, with pigs fed 2.5% MCNPR having the maximum response. While no statistical differences ($P>0.21$) were detected in ADG and ADFI for pigs fed increasing levels of MCNPR, there were improvements by approximately 21 and 11%, respectively, over the control diet. However, pigs fed SDAP had greater ($P<0.05$) ADG, ADFI, and BW at d 14 compared to pigs fed MCNPR.

Overall (d 0 to 28), pigs fed increasing SDAP from d 0 to 14 had greater ($P<0.03$) ADG and tended to have improved ($P<0.08$) ADFI and F/G. Also, pigs fed increasing MCNPR had improved (quadratic, $P<0.01$) feed efficiency, with pigs fed 2.5% MCNPR having the maximum response. While no statistical differences ($P>0.18$) were detected in ADG and ADFI for pigs previously fed increasing MCNPR, there were improvements by approximately 10 and 7%, respectively, over the control diet. Although the magnitude of difference between pigs fed SDAP and MCNPR was maintained to the end of the trial, there were no overall significant differences in growth between pigs fed SDAP and MCNPR ($P>0.21$). These results indicated that SDAP and MCNPR can effectively be used in nursery pig diets to improve growth performance when used as a partial replacement for soybean meal. However, pigs fed SDAP had greater performance than pigs fed

[1]Appreciation expressed to John Whitehead and Charles Schel, Concept Nutrition Ltd., for partial funding of this experiment.

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

MCNPR during the test period, but these differences were not found at the conclusion of the studies.

(Key words: feed ingredients, modified concept PR 100, spray-dried animal plasma.)

Introduction

Spray-dried animal plasma (SDAP) is commonly used in pelleted starter diets to increase daily gain and feed intake of newly weaned pigs. However, with increased consumer and regulatory pressure to remove animal protein sources from swine diets, effective alternatives must be developed and evaluated. In the 2006 KSU Swine Day Report, a newly developed product, Concept PR 100, which is a plant-based protein source, was evaluated to replace SDAP in nursery diets. This data showed that pigs fed diets with Concept PR 100 had improved growth post-weaning but did not equal the improvement shown with pigs fed SDAP. Because of the improvements in growth for pigs fed Concept PR 100, modifications to the existing formula were made by the manufacturer in an attempt to replace SDAP in diets for nursery pigs. Therefore, the objective of this study was to determine if a Modified Concept PR 100 (MCNPR) can fully replace SDAP in nursery pig diets.

Procedures

A total of 180 weanling pigs (initially 11.3 lb and 18 ± 2 d of age) were used in a 28-d growth assay. Pigs were blocked by weight and allotted to one of five dietary treatments. There were six pigs per pen and six pens per treatment. Each pen contained one self-feeder and one nipple waterer to provide *ad libitum* access to feed and water. Pigs were housed in the Kansas State University Swine Teaching and Research Center.

The five experimental treatments were: 1) control (no specialty protein source); 2) 2.5% SDAP; 3) 5.0% SDAP; 4) 2.5% MCNPR; and 5) 5.0% MCNPR. Treatment diets were fed from d 0 to 14 post-weaning, with a common diet fed to all pigs from d 14 to 28 post-weaning. All diets were fed in meal form. The MCNPR (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 with SDAP (APC 920; American Proteins Corp., Ankeny, IA). In experimental diet formulation, nutrient values from NRC (1998) were used for SDAP while nutrient values for MCNPR were provided by the manufacturer (Table 1). Experimental diets were formulated to contain 1.50% total lysine (Table 2). Analysis for crude protein and amino acids of SDAP and MCNPR were conducted at the conclusion of the experiment. All pigs were fed a common Phase 2 diet (without SDAP or MCNPR) from d 15 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 post-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 using the MIXED procedure of SAS. Linear and quadratic polynomial contrasts were used to determine the effects of increasing SDAP or MCNPR in the diet. Also, a contrast comparing the mean of pigs fed SDAP and MCNPR was performed to determine differences between the two protein sources.

Results and Discussion

Crude protein and amino acid analyses of SDAP revealed similar levels as compared to those used in diet formulation (Table 1). However, analyzed values of MCNPR were noticeably lower than the manufacturer provided values used in diet formulation. The difference in calculated and analyzed lysine values would decrease the total dietary lysine

content by 0.027 and 0.056% for the 2.5 and 5.0% MCNPR, respectively.

From d 0 to 14, pigs fed increasing SDAP had improved (linear, $P<0.01$) ADG, ADFI, and F/G, which was primarily due to a large improvement from the 0 to 2.5% SDAP inclusion, with smaller increases when 5.0% was fed (Table 3). In addition, pigs fed increasing MCNPR had improved (quadratic, $P<0.002$) feed efficiency with pigs fed 2.5% having the maximum response. While no statistical differences ($P>0.21$) were detected in ADG and ADFI for pigs fed increasing MCNPR, there were improvements by approximately 21 and 11%, respectively, compared to the control diet. However, pigs fed SDAP had greater ($P<0.05$) ADG, ADFI, and BW at d 14 compared to pigs fed MCNPR.

From d 15 to 28 (common feeding period), there were no differences among pigs fed any of the dietary treatments ($P>0.15$).

Overall (d 0 to 28), pigs fed increasing SDAP from d 0 to 14 had greater (linear, $P<0.03$) ADG and tended to have improved (linear $P<0.08$) ADFI and F/G. Also, pigs fed increasing MCNPR had improved (quadratic, $P<0.01$) feed efficiency, with pigs fed 2.5% having the maximum response. While no statistical differences ($P>0.18$) were detected in ADG and ADFI for pigs fed increasing MCNPR, there were improvements by approximately 10 and 7%, respectively, compared to pigs fed the control diet. There were no overall differences in growth between pigs fed SDAP and MCNPR ($P>0.21$).

Results from this study indicate that nursery pig performance improved, as expected, when a specialty protein source was used as partial replacement for soybean meal in the diet. However, while the typical growth improvement was seen with the addition of SDAP, the inclusion of MCNPR did not improve growth performance to the extent of SDAP. This may be due to the lower analyzed crude protein and amino acids than were used in diet formulation. These lower values may have contributed to the inability of MCNPR to equal the response seen when pigs were fed SDAP.

These results indicate that SDAP and MCNPR can effectively be used in nursery pig diets to improve growth performance when used as a partial replacement for soybean meal. However, pigs fed SDAP had greater performance than pigs fed MCNPR during the test period, but these differences were not found at the conclusion of the study.

The use of MCNPR in nursery diets to provide a plant protein-based alternative to animal products needs to be further evaluated, based on improvements seen in this study and previously reported research.

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

	SDAP[1]		MCNPR[2]	
Nutrient	Formulated[3]	Analyzed[4]	Formulated[5]	Analyzed[4]
Crude Protein, %	78.00	79.25	67.79	62.17
Amino Acids, %:				
Arginine	4.55	4.67	4.70	3.86
Cysteine	2.63	2.56	0.92	0.74
Histidine	2.55	2.57	1.61	1.37
Isoleucine	2.71	2.88	2.89	2.40
Leucine	7.61	7.62	4.60	4.16
Lysine	6.84	6.90	6.85	5.76
Methionine	0.75	0.65	2.39	2.17
Threonine	4.72	4.48	4.64	4.03
Tryptophan	1.36	1.35	1.50	1.11
Valine	4.94	5.00	2.94	2.51

[1]Spray-dried animal plasma (APC 920; American Proteins Corp., Ankeny, IA).
[2]Modified Concept Nutrition Plasma Replacer 100 (Concept Nutrition Ltd., UK).
[3] Nutrient values from NRC (1998).
[4]Mean value of one sample analyzed in duplicate.
[5] Nutrient values provided by the manufacturer.

Table 2. Composition of Experimental Diets (as-fed basis)[1]

		SDAP[2]		MCNPR[3]		
Ingredient, %	Control	2.50%	5.00%	2.50%	5.00%	Phase 2
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	-	-	-
Modified 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:[4]						
Total Lysine, %	1.50	1.50	1.50	1.50	1.50	1.44
TID amino acids, %[5]						
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
Crude 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

[1]Experimental diets fed from d 0 to 14 post-weaning and with all pigs fed a common diet from d 15 to 28 post-weaning.
[2]Spray-dried animal plasma (APC 920; American Proteins Corp., Ankeny, IA).
[3]Modified Concept Plasma Replacer 100 (Concept Nutrition Ltd., UK).
[4]Nutrient values from NRC (1998) were used for SDAP and nutrient values for MCNPR were provided by the manufacturer.
[5]True ileal digestible amino acids.

Table 3. Effect of Specialty Protein Source on Nursery Pig Performance[1]

							Probability, $P <$				
		SDAP[2]		MCNPR[3]			SDAP vs	SDAP		MCNPR	
Item	Control	2.5%	5.0%	2.5%	5.0%	SEM	MCNPR	Linear	Quadratic	Linear	Quadratic
D 0 to 14											
ADG, lb	0.35	0.49	0.52	0.43	0.42	0.04	0.04	0.003	0.24	0.21	0.29
ADFI, lb	0.46	0.58	0.61	0.50	0.52	0.04	0.03	0.01	0.38	0.26	0.90
F/G	1.33	1.19	1.18	1.15	1.26	0.03	0.62	0.01	0.12	0.15	0.002
D 15 to 28											
ADG, lb	0.99	1.04	1.06	1.02	1.06	0.05	0.87	0.23	0.85	0.23	0.95
ADFI, lb	1.31	1.36	1.40	1.35	1.43	0.08	0.85	0.29	0.94	0.15	0.74
F/G	1.32	1.31	1.31	1.31	1.35	0.02	0.33	0.78	0.72	0.29	0.27
D 0 to 28											
ADG, lb	0.67	0.76	0.79	0.73	0.74	0.04	0.24	0.03	0.50	0.21	0.61
ADFI, lb	0.88	0.97	1.01	0.92	0.97	0.06	0.42	0.08	0.69	0.18	0.90
F/G	1.32	1.27	1.27	1.26	1.32	0.02	0.21	0.06	0.27	0.85	0.01
Pig Weight, lb											
D 0	11.35	11.33	11.29	11.35	11.39	0.52	0.05	0.15	0.73	0.31	0.52
D 14	16.30	18.14	18.52	17.39	17.24	0.89	0.05	0.004	0.23	0.18	0.31
D 28	30.15	32.64	33.40	31.70	32.11	1.53	0.28	0.03	0.49	0.18	0.65

[1]A total of 180 pigs (six pigs per pen and six pens per treatment) with an initial BW of 11.3 lbs. Pigs were fed experimental diets from d 0 to 14 post-weaning, with all pigs fed a common diet from d 15 to 28 post-weaning.
[2]Spray-dried animal plasma (APC 920; American Proteins Corp., Ankeny, IA).
[3]Modified Concept Plasma Replacer 100 (Concept Nutrition Ltd., UK).