Effects of Supplemental Pantothenic Acid During All or Part of the Grow-Finish Period on Growth Performance and Carcass Composition

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Introduction

Pantothenic acid (PA) is a component of coenzymne A, and is required in the diet of pigs at concentrations of 7 to 12 ppm (NRC, 1998). However, recent interest has surrounded the elevated supplementation of this vitamin and its potential effects on carcass lean. Stahly and Lutz (2001) observed a quadratic increase in estimated fat free lean (%) as PA supplementation increased from 0 to 120 ppm in the diet of pigs from wean to finish. Further research from this same group (Autrey et al., 2002) reported a linear increase in estimated fat free lean (%) as the level of supplemental PA was increased from 0 to 45 ppm from wean to finish. These studies indicate that pantothenic acid may be a very cost effective method of increasing carcass lean. However, the diets fed contained elevated levels of all B vitamins (6x NRC) and lysine. Therefore, the results observed may not accurately represent a commercial situation. Therefore, this study was designed to determine whether feeding elevated levels of PA during the whole grow-finish period or during the finisher period only has any effects on growth or carcass characteristics in typical commercial swine diets.

Materials and Methods

One hundred eighty crossbred pigs (equal barrows and gilts) were used to study the effects of supplemental PA during all or part of the grow-finish period. Pigs were blocked by BW and gender and randomly assigned to dietary treatments. Pigs were started on test at approximately 63.9 lb BW, and remained on test for 15 weeks, at which time the average BW was 260.2 lb. Pigs were split-sex fed and housed 6 pigs/pen. Four dietary phases (Table 1) were fed during this grow-finish period. All diets were corn-soybean meal based and formulated to contain adequate levels of all nutrients (NRC, 1998). Each diet phase was fed for 4 weeks, with the exception of the last phase, which was fed for 3 weeks. The basal diet contained 13.2 ppm supplemental PA provided by the vitamin premix. Pigs were fed one of three dietary treatments: 1) Basal diet with no added PA (Control), 2) Basal diet supplemented with 30 ppm of added PA in the grower and finisher phases (GFPA; G1, G2, F1, and F2), and 3) Basal diet supplemented with 30 ppm PA in the finisher phases only (FOPA; F1 and F2). Five replicate blocks were used for a total of 30 pens on test (3 trt x 2 sexes x 5 reps). Pigs were weighed and pen feed intake recorded biweekly throughout the experiment. Three pigs out of each pen were ultrasonically scanned at the start and end of the experiment and at 4-wk intervals during the experiment (5 scans/pig total). Pigs were harvested at IBP and individual hot carcass weights, and ultrasound (AUS) backfat and loin muscle depth measurements were recorded.

All data were analyzed using the GLM procedure of SAS (2000). Pen served as the experimental unit. Main effects included pantothenic acid and sex. The interactions of pantothenic acid and sex were tested.

Results

Performance data. No interactions of sex and dietary treatment were significant ($P > 0.05$), therefore, only the main effects of diet and sex are presented (Table 2). Dietary treatment effects on performance were minimal. Average daily gain during the finisher 2 period was higher for pigs receiving FOPA treatment compared with pigs receiving GFPA treatment ($P < 0.05$). Overall, there were no significant effects of dietary treatment on ADG. An effect of sex was observed on ADG for most periods. Overall, barrows grew faster ($P < 0.05$) than gilts.

Average daily feed intake (ADFI) was lower during the finisher 1 phase for pigs fed the GFPA treatment compared with pigs fed the control ($P < 0.05$). However, overall ADFI was not different for pigs fed the GFPA treatment compared to pigs receiving the control, but overall ADFI was higher for pigs receiving the FOPA compared with pigs receiving the GFPA treatment. With the exception of the grower 1 phase, barrows consumed more feed than did gilts ($P < 0.05$), and had a 7.6% overall higher feed intake than gilts.

Feed efficiency was not affected by dietary treatment ($P > 0.10$). Gilt feed efficiency was higher ($P < 0.05$) than barrow feed efficiency throughout the experiment.

Ultrasound data. Loineye area (LEA) was larger for pigs fed the GFPA treatment compared with pigs fed the FOPA treatment during the grower 1phase ($P<.05$). During the grower 2 phase, the GFPA treatment had larger LEA than pigs fed the control treatment ($P<.05$). However, during the finisher 1 phase, pigs fed the control treatment had larger LEA than pigs fed the GFPA treatment ($P<.05$). It is unclear why this difference occurred during the finisher 1 phase. The smaller LEA area found during the finisher 1 phase, in pigs fed the GFPA treatment compared to pigs fed the control treatment did coincide with a lower feed intake of pigs fed the GFPA treatment during the finisher 1 phase. Overall, LEA was unaffected by dietary treatment, although pigs fed supplemental PA treatments did have numerically larger LEA. Except for the grower 1 period, sex did not affect LEA.

Tenth rib and last rib backfat measurements were unaffected by dietary treatment. However, as with LEA, numerical values favored pigs fed supplemental PA. As expected, barrows were fatter than gilts by the end of the grower 2 phase, and remained that way for the remainder of the trial ($P<.05$).

Carcass data. Pigs fed the GFPA treatment had a higher percent lean in the carcass compared with pigs receiving the control treatment ($P<.05$). However, carcass weights were lighter for pigs fed the GFPA treatment than for pigs fed the control treatment ($P<.05$). It is unclear as to why this occurred. However, differences in carcass weight did not significantly affect carcass lean. Therefore, it is safe to conclude, that pigs fed the GFPA treatment produced leaner carcasses. Fat depth and loin depth were numerically improved for pigs fed the GFPA treatment. However, these improvements were not significant. Gilts had lighter, leaner carcasses, with less backfat thickness and greater loin depth compared to barrows, as would be expected ($P < 0.05$).

Conclusions

Supplementing PA during the growing and finishing periods had minimal effects on growth rate and feed efficiency. Supplementing 30 ppm PA (to a basal diet containing 13.2 ppm PA) during the grower period increased LEA at the end of the grower period, but did not affect final LEA. Supplementing the diet of pigs throughout a 15-wk grow-finish phase did result in an increased carcass percent lean. However, a 5 lb decrease in carcass weight was also observed. These results differ from those previously reported (Stahly and Lutz, 2001; Autrey et al., 2002).

In previous research supplemental PA was fed from weaning to slaughter, and the level of lysine fed was much greater. In addition, control pigs used in this experiment had a higher carcass percent lean than those reported in earlier research. Clearly more research is needed to determine whether supplementing pig diets with elevated levels of PA is an effective method of increasing carcass lean.

References

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Table 1. Basal dietary composition for pigs fed elevated levels of pantothenic acid during the grow-finish period

Sex	Gilts				Barrows			
Grow-finish phase	**G1**	**G2**	**F1**	**F2**	**G1**	**G2**	**F1**	**F1**
Ingredient, %								
Corn, Ground	63.85	70.01	76.28	80.71	67.27	72.93	78.73	82.79
SBM, 48% CP	28.07	22.13	16.17	11.97	24.84	19.39	13.90	10.04
Choice white grease	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Dical. Phos.	1.17	0.94	0.72	0.47	1.05	0.84	0.64	0.41
Limestone	0.97	0.98	0.98	1.01	0.90	0.90	0.90	0.93
Salt	0.35	0.35	0.25	0.25	0.35	0.35	0.25	0.25
Swine Vit Px[a]	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Swine Tr Min[b]	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Tylan40	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Se premix	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Natuphos600	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Space[c]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Calculated composition, %								
ME, Kcal/lb	1601.55	1605.94	1611.83	1616.02	1605.19	1609.22	1614.74	1618.62
CP, %	19.15	16.80	14.44	12.78	17.88	15.72	13.55	12.02
Lys, %	1.15	0.98	0.81	0.69	1.06	0.90	0.75	0.64
Met + Cys, %	0.65	0.59	0.53	0.49	0.62	0.57	0.51	0.47
Ca, %	0.75	0.69	0.63	0.58	0.69	0.64	0.58	0.53
tP, %	0.63	0.56	0.50	0.44	0.59	0.53	0.48	0.42
aP, %	0.34	0.29	0.24	0.19	0.31	0.27	0.22	0.18
Na, %	0.15	0.15	0.11	0.11	0.15	0.15	0.11	0.11
Met, %	0.31	0.28	0.25	0.23	0.30	0.27	0.24	0.22
Thr, %	0.76	0.67	0.58	0.52	0.71	0.63	0.55	0.49
Trp, %	0.25	0.22	0.18	0.16	0.23	0.20	0.17	0.14

[a]Vitamin premix includes the following guaranteed minimums per pound of premix: Vitamin A: 1,100,000 IU; Vitamin D_3: 110,000 IU, Vitamin E: 8,000 IU, Menadione: 365 mg, Vitamin B_{12}: 6.40 mg, Riboflavin: 1,280 mg, d-Pantothenic acid: 4,000 mg, and Niacin: 6,000 mg.

[b]Trace mineral premix includes the following guaranteed minimums for the premix: Iron: 9.7%, Zinc: 9.7%, Manganese: 1.2%, Copper: 0.90%, and Iodine: 0.0335%.

[c]Space will be filled with corn starch or a pantothenic acid-corn starch blend formulated to supply 30 ppm added pantothenic acid when supplied at 0.05% of the diet.

Table 2. Effect of supplemental pantothenic acid on growth performance of grow-finish pigs

	Dietary Treatments[a]			Sex			P values		
	Control	**GFPA**	**FOPA**	**B**	**G**	**MSE**	**Diet**	**Sex**	**Diet*Sex**
Body weight, lb									
Initial	65.2	65.4	65.5	65.2	65.5	1.78	0.944	0.698	0.822
Grower 1	117.5	117.9	117.6	117.5	117.8	4.01	0.978	0.875	0.777
Grower 2	170.9	171.1	171.5	173.0	169.2	5.73	0.969	0.085	0.889
Finisher 1	222.8	219.9	221.8	226.6	216.5	6.93	0.635	0.001	0.862
Finisher 2	260.1	257.3	261.8	265.1	254.4	6.18	0.279	0.001	0.825
ADG, lb									
Grower 1	1.89	1.90	1.87	1.90	1.87	0.082	0.572	0.276	0.595
Grower 2	1.90	1.92	1.92	1.95	1.88	0.104	0.874	0.068	0.121
Finisher 1	1.84	1.77	1.81	1.87	1.74	0.098	0.295	0.001	0.743
Finisher 2	$1.82^{x,y}$	1.80^{y}	1.90^{x}	1.87	1.81	0.093	0.055	0.099	0.384
Overall	1.86	1.82	1.90	1.89	1.82	0.084	0.118	0.042	0.651
ADFI, lb									
Grower 1	3.82	3.84	3.92	3.86	3.86	0.200	0.493	0.976	0.893
Grower 2	5.10	5.13	5.11	5.43	4.80	0.189	0.953	0.001	0.420
Finisher 1	5.40^{x}	5.08^{y}	$5.26^{x,y}$	5.53	4.96	0.209	0.013	0.001	0.101
Finisher 2	6.09	6.18	6.36	6.36	6.06	0.385	0.338	0.052	0.735
Overall	$5.05^{x,y}$	4.97^{y}	5.10^{x}	5.23	4.86	0.149	0.240	0.001	0.576
Gain:Feed									
Grower 1	0.493	0.497	0.478	0.493	0.486	0.024	0.185	0.467	0.545
Grower 2	0.375	0.372	0.376	0.357	0.392	0.018	0.865	0.001	0.059
Finisher 1	0.345	0.348	0.345	0.339	0.354	0.014	0.848	0.013	0.342
Finisher 2	0.300	0.291	0.302	0.294	0.301	0.018	0.438	0.337	0.297
Overall	0.368	0.361	0.377	0.358	0.379	0.018	0.186	0.011	0.876

[a]Control = No additional supplemental PA (basal level was 13.2 ppm PA; GFPA = 30 ppm supplemental PA in grower and finisher periods; FOPA = 30 ppm supplemental PA in finisher period only.

[x,y,z]Means within a row containing different superscripts are different ($P < 0.05$).

Table 3. Effect of supplemental pantothenic acid on loin eye area and backfat thickness as determined by ultrasound

	Dietary Treatments[a]			Sex			P values		
	Control	**GFPA**	**FOPA**	**B**	**G**	**MSE**	**Diet**	**Sex**	**Diet*Sex**
LEA, in²									
Initial	2.05	1.97	2.00	1.97	2.04	0.201	0.377	0.143	0.972
Grower 1	3.83^{x,y}	3.99^{x}	3.73^{y}	3.70	4.00	0.337	0.014	0.001	0.120
Grower 2	5.31^{y}	5.60^{x}	5.35^{x}	5.42	5.42	0.371	0.010	0.945	0.156
Finisher 1	6.60^{x}	6.35^{y}	6.36^{x,y}	6.41	6.47	0.458	0.064	0.582	0.146
Finisher 2	7.34	7.42	7.41	7.36	7.42	0.581	0.840	0.692	0.123
10th rib Backfat, in									
Initial	0.309	0.297	0.292	0.300	0.298	0.041	0.279	0.837	0.434
Grower 1	0.428	0.443	0.429	0.445	0.421	0.076	0.715	0.164	0.884
Grower 2	0.502	0.508	0.509	0.530	0.483	0.080	0.929	0.014	0.378
Finisher 1	0.679	0.625	0.659	0.702	0.607	0.109	0.181	0.001	0.442
Finisher 2	0.772	0.737	0.763	0.821	0.693	0.121	0.536	0.001	0.513
Last Rib Backfat, in									
Initial	0.276	0.285	0.281	0.272	0.288	0.030	0.527	0.022	0.804
Grower 1	0.396	0.397	0.369	0.381	0.387	0.057	0.192	0.656	0.957
Grower 2	0.456	0.452	0.458	0.494	0.417	0.064	0.934	0.001	0.502
Finisher 1	0.631	0.611	0.613	0.636	0.601	0.072	0.529	0.042	0.483
Finisher 2	0.710	0.668	0.696	0.727	0.656	0.100	0.289	0.003	0.960

[a]Control = No additional supplemental PA (basal level was 13.2 ppm PA); GFPA = 30 ppm supplemental PA in grower and finisher periods; FOPA = 30 ppm supplemental PA in finisher period only.

[x,y,z]Means within a row containing different superscripts are different ($P < 0.05$).

Table 4. Effect of supplemental pantothenic acid on carcass characteristic measurements

	Dietary treatment[a]			Sex			P values		
	Control	**GFPA**	**FOPA**	**B**	**G**	**MSE**	**Diet**	**Sex**	**Diet*Sex**
Fat depth, in	0.735	0.708	0.709	0.760	0.675	0.118	0.423	0.001	0.850
Loin depth, in	2.83	2.86	2.80	2.81	2.86	0.187	0.223	0.104	0.641
Lean, %	55.41^{y}	55.91^{x}	55.64^{x,y}	55.20	56.11	1.116	0.077	0.001	0.512
Carcass wt, lb	208^{x}	203^{y}	205^{x,y}	209	202	11.845	0.166	0.001	0.985

[a]Control = No additional supplemental PA (basal level was 13.2 ppm); GFPA = 30 ppm supplemental PA in grower and finisher periods; FOPA = 30 ppm supplemental PA in finisher period only.

[x,y,z]Means within a row containing different superscripts are different ($P < 0.05$).