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The influence of dietary threonine on growth performance and carcass characteristics of pST-treated finishing pigs

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Abstract

Eighty crossbred barrows (initial wt = 131 lb) were utilized to determine the dietary threonine requirement of finishing pigs injected with porcine somatotropin (PST). Barrows were injected daily in the extensor muscle of the neck with either 4 mg pST or a placebo and fed diets containing either .45, .55, .65, or .75% threonine. All other amino acids, vitamins, and minerals were calculated to be at least double current requirements for finishing pigs so as not to limit performance. Pigs were housed in an open-sided building with two pigs per pen and five replications of the eight treatments. Feed and water were provided ad libitum. When the mean weight of the two pigs per pen averaged 235 +1- 5 lb, pigs were slaughtered and carcass data collected. Porcine somatotropin-treated pigs had greater average daily gain (ADG), reduced daily feed intake (ADFI), and improved feed efficiency (F/G) compared to control pigs. A dietary threonine X pST interaction was observed for ADG. Control pigs exhibited no improvement in ADG with increasing dietary threonine. However, pST-treated pigs had a 22% increase in ADG as dietary threonine increased from .45 to .65%. Increasing dietary threonine resulted in increased ADFI, but had no effect on F/G. Average backfat thickness, tenth rib fat depth, and kidney fat were reduced by pST administration. Longissimus muscle area and trimmed ham and loin weights were greater in pST treated pigs. Dietary threonine tended to reduce average backfat thickness but had no effect on other carcass criteria measured. These results suggest that growth rate of pSTtreated pigs is increased by dietary threonine level compared to control pigs. This interactive response between pST and threonine was not observed in feed efficiency or carcass criteria measured; however, there were numerical trends similar to those observed for daily gain.; Swine Day, Manhattan, KS, November 21. 1991

Keywords

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THE INFLUENCE OF DIETARY THREONINE ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF PST-TREATED FINISHING PIGS[1]

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Summary

Eighty crossbred barrows (initial wt = 131 lb) were utilized to determine the dietary threonine requirement of finishing pigs injected with porcine somatotropin (pST). Barrows were injected daily in the extensor muscle of the neck with either 4 mg pST or a placebo and fed diets containing either .45, .55, .65, or .75% threonine. All other amino acids, vitamins, and minerals were calculated to be at least double current requirements for finishing pigs so as not to limit performance. Pigs were housed in an open-sided building with two pigs per pen and five replications of the eight treatments. Feed and water were provided ad libitum. When the mean weight of the two pigs per pen averaged 235 +/- 5 lb, pigs were slaughtered and carcass data collected. Porcine somatotropin-treated pigs had greater average daily gain (ADG), reduced daily feed intake (ADFI), and improved feed efficiency (F/G) compared to control pigs. A dietary threonine × pST interaction was observed for ADG. Control pigs exhibited no improvement in ADG with increasing dietary threonine. However, pST-treated pigs had a 22% increase in ADG as dietary threonine increased from .45 to .65%. Increasing dietary threonine resulted in increased ADFI, but had no effect on F/G. Average backfat thickness, tenth rib fat depth, and kidney fat were reduced by pST administration. Longissimus muscle area and trimmed ham and loin weights were greater in pST-treated pigs. Dietary threonine tended to reduce average backfat thickness but had no effect on other carcass criteria measured. These results suggest that growth rate of pST-treated pigs is increased by dietary threonine level compared to control pigs. This interactive response between pST and threonine was not observed in feed efficiency or carcass criteria measured; however, there were numerical trends similar to those observed for daily gain.

(Key Words: G-F, Performance, Threonine, Repartition, Carcass.)

Introduction

Porcine somatotropin (pST) is an effective modifier of swine growth, feed utilization, and carcass criteria. However, the magnitude of response to pST administration has been determined to be interactively linked with the nutritional allowances of the pig. Research at Kansas State University has established that the response of finishing pigs to pST administration is directly dependent on the dietary lysine level. The lysine requirement of a pST-treated pig is approximately 25 to 30 g/d compared to the 18 to 20 g/d for a non-pST-treated finishing pig. Based on these data, we hypothesize that other amino acid requirements may be altered by pST administration. In addition, the extent that one amino acid requirement is changed in proportion to another may be altered if growth rate is significantly altered (i.e., a change in amino acid ratio). Therefore, the objective of

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this experiment was to determine the influence of dietary threonine on growth performance and carcass characteristics of control and pST-treated finishing pigs.

Procedures

Eighty crossbred barrows averaging 131 lb were allotted on the basis of weight and ancestry to one of eight experimental treatments. Treatments included either a daily injection of 4 mg pST or a placebo in combination with a pelleted milo-peanut meal diet containing either .45, .55, .65, or .75% threonine provided by L-threonine (Table 1). All other amino acids, vitamins, and minerals were calculated to be at least double current requirements for finishing pigs so as not to limit performance (Table 2). Pigs were housed in an open-sided building with two pigs per pen and five replicate pens per treatment. When the mean weight of the two pigs per pen averaged 230 +/- 5 lb, pigs were slaughtered and carcass data collected.

Table 1. Composition of Basal Diet

Ingredient	%
Sorghum	65.04
Peanut meal, solvent	20.03
Soybean oil	7.00
Monocalcium phosphate	3.31
Limestone	1.13
L-lysine HCl	1.47
Vitamin premix	.50
Trace mineral premix	.20
DL-methionine	.34
Salt	.25
L-isoleucine	.21
L-tryptophan	.06
Selenium premix[a]	.05
Sucrose/threonine[b]	.40
Total	100.00

[a]Provided .3 ppm Selenium.
[b]Sucrose was replaced by threonine to provide levels of .55,.65, and .75%.

Data were analyzed as a 2 × 4 factorial arrangement with pST and dietary threonine as main effects. Average backfat, longissimus muscle area (10th thoracic vertebrae), and length were all adjusted to a constant weight of 230 lb using NPPC (1988) guidelines. Other carcass criteria were adjusted using final weight as a covariate.

Table 2. Chemical Analysis of Basal Diet

Item	%
Crude Protein	18.63
Ca[1]	1.10
P[1]	1.00
Essential Amino Acids	
Threonine	0.45
Arginine	1.31
Cystine	0.23
Histidine	0.38
Isoleucine	0.78
Leucine	1.48
Lysine	1.49
Methionine	.49
Phenylalanine	.82
Tyrosine	.59
Tryptophan	.21
Valine	.73

[1]Calculated values.

Results and Discussion

Porcine somatotropin-treated pigs had greater average daily gain (ADG; $P < .05$) than control pigs (Table 3). In addition, increasing dietary threonine level increased ADG ($P < .06$); however the greatest response was observed for pST-treated pigs. This resulted in a pST × threonine interaction ($P < .10$) because control pigs exhibited no change in ADG, but pST-treated pigs had a 22% increase in ADG as threonine increased from .45 to .65%. Average daily feed intake (ADFI) was reduced in pST-treated pigs ($P < .10$); however, pST-treated pigs fed the diet containing .65% threonine unexplainably had the greatest feed intake of any treatment group. Porcine somatotropin-treated pigs were more efficient than control pigs (P < .05); however, there was no improvement with increasing threonine level. Because of the high feed intake, pST-treated pigs fed the .65% threonine diet had the poorest feed efficiency among pST-treated pigs.

Because all pigs were slaughtered when their mean weight was 235 lb, there were no differences in hot carcass weight or skinned dressing percent. Average backfat thickness and 10th rib fat depth were reduced (P < .05) for pST-treated pigs. Longissimus muscle area was increased for pST-treated pigs (P < .05) and tended to increase (8%) with increasing threonine level compared to control pigs. Weight of kidney fat was reduced (P < .05) in pST-treated pigs compared to control pigs. Within pST-treated pigs, there was a 30% reduction in kidney fat as threonine level increased from .45 to .65%. Trimmed loin and ham weights were greater in pST-treated pigs. Control pigs had no changes in ham or loin weight in response to increasing dietary threonine; however, pST-treated pigs tended (P > .10) to have numerically heavier ham and loin weights as threonine increased.

These results suggest that growth rate of pST-treated pigs is increased by dietary threonine level compared to control-treated pigs. This interactive response between pST and threonine was not observed in feed efficiency or carcass criteria measured; however, there were numerical trends similar to those observed for daily gain. Based on results of previous research, pST administration may increase the dietary lysine and threonine requirements of finishing pigs. However, there appears to be a much greater increase in the pig's lysine requirement compared to threonine. Therefore, pST administration may change the optimal amino acid ratio. This change is similar to the changes in amino acid ratios between starter pigs, which have a relatively wide lysine to threonine ratio (dietary threonine level is approximately 57% of dietary lysine level) compared to finishing pigs (dietary threonine level is approximately 66% of lysine level).

Table 3. Influence of Dietary Threonine and pST on Growth Performance of Finishing Pigs[a]

	Threonine, %				
Item	.45	.55	.65	.75	CV
ADG, lb.[bcd]					
Control	1.94	1.86	1.97	1.98	10.5
4 mg pST	2.00	2.23	2.44	2.01	
ADFI, lb.[ce]					
Control	5.55	5.25	5.78	5.32	13.4
4 mg pST	4.48	5.08	6.07	4.53	
F/G[b]					
Control	2.85	2.82	2.91	2.69	9.7
4 mg pST	2.24	2.25	2.50	2.25	

[a]A total of 80 pigs (five observations per treatment), average initial weight 131 lb, average final wt 235 lb.
[b]PST effect (P < .05).
[c]Quadratic effect of threonine (P < .05).
[d]PST × threonine interaction (P < .10).
[e]PST effect (P < .10).

Table 4. The Influence of pST and Dietary Threonine on Carcass Measurements[a]

Item	Threonine, %				
	.45	.55	.65	.75	CV
Hot carcass wt, lb					
Control	148.8	151.6	148.1	149.4	2.5
4 mg pST	149.4	145.4	150.7	153.1	
Skinned dressing percentage					
Control	62.9	64.2	62.6	63.2	4.2
4 mg pST	63.3	61.7	63.9	64.9	
Backfat thickness, in.[bc]					
Control	1.68	1.59	1.62	1.74	15.9
4 mg pST	1.35	1.18	1.23	1.25	
Tenth rib fat depth, in.[b]					
Control	1.20	1.17	1.16	1.19	22.7
4 mg pST	.97	.79	.90	.78	
Longissimus muscle area, in.[b]					
Control	5.27	5.10	4.98	5.02	15.6
4 mg pST	6.09	5.97	6.34	6.56	
Carcass length, in.					
Control	31.52	31.63	32.05	31.47	2.6
4 mg pST	32.51	32.52	31.87	30.86	
Kidney fat, g[b]					
Control	1457.0	1366.0	1474.0	1458.0	25.7
4 mg pST	1195.0	943.0	841.0	871.0	
Trimmed loin wt, lb.[b]					
Control	15.52	16.15	15.71	14.97	8.4
4 mg pST	17.22	16.97	17.84	17.79	
Trimmed ham wt, lb.[b]					
Control	16.09	16.20	15.60	15.84	9.3
4 mg pST	17.28	16.96	18.01	18.03	

[a]A total of 80 pigs, average initial wt 131 lb, average final wt 235 lb. Means represent 10 observations/treatment.
[b]PST effect ($P < .05$).
[c]Quadratic effect of threonine ($P < .10$).