EFFECTS OF PORCINE SOMATOTROPIN DOSAGE AND LYSINE LEVEL ON GROWTH PERFORMANCE OF GROWING PIGS

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Summary

Eighty crossbred barrows initially weighing 70.5 lb were used in a 5 wk trial to determine the optimum dosage of porcine somatotropin (pST) required to promote maximum growth response in growing pigs fed diets containing either 1.0 or 2.0% lysine. Pigs received a daily injection of placebo or 2, 4, or 8 mg pST in combination with one of two experimental diets containing either 1.0 or 2.0% dietary lysine. Increasing the dosage of pST of pigs fed both diets resulted in an increase in average daily gain (ADG), a reduction in average daily feed intake (ADFI), and an improvement in feed conversion (F/G). Average backfat, calculated from ultrasonic measurements at the first rib, last rib, and last lumbar vertebra, was reduced in pigs fed both diets as pST dosage increased. Serum pST increased and urea nitrogen decreased for pigs fed both diets as pST dosage increased. The improvement in ADG and F/G of pigs fed both diets was quadratic, indicating that a plateau was achieved between 4 and 8 mg/d pST administration. The serum urea nitrogen response appeared to plateau near 8 mg/d. The combination of these response criteria indicates that the dosage required for maximum response is about 7 mg/d pST, whereas the more optimum level of pST administration may be about 5 mg/d for growing pigs fed diets containing 1.0 or 2.0% lysine.

(Key Words: GF, Repartition, Performance, Lysine.)

Introduction

The effects of porcine somatotropin (pST) on growth performance of finishing swine have been much greater than those seen in growing pigs. Increased levels of dietary lysine improved growth performance of growing pigs injected with pST by only 10% in an experiment reported in the 1990 Swine Day, Report of Progress 610. Pigs in that experiment were injected with either a placebo or 3 mg/d pST. The optimum dosage of pST has not been previously determined for the growing pig. Therefore, this experiment was designed to determine the dosage of pST administration required to promote maximum response in growing pigs fed either 1.0 or 2.0% dietary lysine.

Procedures

Eighty crossbred barrows initially weighing 70.5 lb were allotted by weight and ancestry to one of eight experimental treatments. Treatments included two corn-corn gluten meal-soybean meal diets (Table 1) formulated to contain either 1.0 or 2.0% lysine in combination with injections of placebo or 2, 4, or 8 mg/d pST. L-lysine HCl was substituted for corn in the diet containing 2.0% lysine. Diets were formulated to provide 200% of NRC recommended levels for all other essential amino acids, vitamins, and minerals. Pigs were allowed ad libitum access to feed and water. There were two pigs per pen and five pens per treatment. Pigs were housed in a modified open front building with solid con-

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crete floors. All pigs and feeders were weighed weekly for calculations of average daily gain (ADG). average daily feed intake (ADFI), and feed conversion (F/G). Blood samples were obtained on d 14 and d 28 for analysis of serum pST and urea nitrogen. At the end of the 5 wk growth trial, average backfat thickness, measured ultrasonically at the first rib, last rib, and last lumbar vertebra, was determined.

Results and Discussion

During the first 2 wk of the trial, there was no effect of pST dosage on average daily gain (ADG) for pigs fed 1.0% dietary lysine (Table 2). However, there was a linear reduction ($P < .01$) in average daily feed intake (ADFI), which resulted in a linear and quadratic improvement in feed conversion F/G as pST dosage increased. Porcine somatotropin dosage had no effect on ADFI of pigs fed diets containing 2.0% dietary lysine. Increasing the dosage of pST from 0 to 8 mg/d resulted in increased ADG (linear, $P < .01$) and improved F/G (linear, $P < .01$ and quadratic, $P < .05$) of pigs fed 2.0% lysine. Increasing the dietary lysine level of pigs from 1.0 to 2.0% resulted in an improvement in F/G ($P < .05$).

Pigs fed 1.0% dietary lysine for the total 5 wk trial had increased ADG (linear, $P < .01$ and quadratic, $P < .05$), reduced ADFI (linear, $P < .01$), and improved F/G (linear, $P < .01$ and quadratic, $P < .05$) as pST dosage increased. Increasing the pST dosage also reduced average backfat (linear, $P < .01$) of pigs fed 1.0% lysine diets.

During the 5 wk trial, pigs injected with an increasing pST dosage and fed diets with 2.0% lysine had greater ADG (linear, $P < .01$ and quadratic, $P < .05$), reduced ADFI (linear, $P < .01$), and improved F/G (linear, $P < .01$ and quadratic, $P < .05$). The quadratic nature of the response for ADG and F/G of pigs to pST dosage indicates that the dosage of pST required to achieve maximum growth response of pigs fed 2.0% lysine diets was achieved and was between 4 and 8 mg/d. Increasing pST dosage of pigs fed 2.0% dietary lysine resulted in a decrease (linear, $P < .01$) in average backfat.

As expected, increasing the pST dosage resulted in a linear increase ($P < .01$) in serum

Table 1. Composition of Diets

Ingredient	Dietary Lysine, % 1.0	2.0
Corn	55.31	54.03
Soybean meal (48% CP)	24.65	24.65
Corn gluten meal (60% CP)	8.95	8.95
Soybean oil	5.00	5.00
Monocalcium phosphate (21% P)	3.02	3.02
Limestone	1.38	1.38
L-lysine HCl	—	1.28
L-threonine	.09	.09
Salt	.30	.30
Vitamin premix	.50	.50
Trace mineral premix	.20	.20
Antibiotic[a]	.50	.50
Copper sulphate	.05	.05
Selenium premix	.05	.05
Total	100.00	100.00
Calculated Analysis, %		
CP	22.1	22.1
Lysine	1.00	2.00
Ca	1.20	1.20
P	1.10	1.10

[a]Each lb of antibiotic contained 10 g chlortetracycline, 10 g sulfathiazole, and 5 g penicillin.

pST of pigs fed both the 1.0 and 2.0% lysine diets. The reduction in wk 2 serum urea nitrogen of pigs fed the 2.0% lysine diet compared to those fed the 1.0% lysine diet suggests that the dietary amino acids metabolized by the pigs were better utilized, which is an indication that lysine was limiting in those pigs fed the 1.0% lysine diet. The improvement in F/G ($P < .05$) of pigs fed the diet containing 2.0% lysine compared to those fed the 1.0% lysine diet also supports the theory of an improvement in utilization of dietary amino acids. The linear ($P < .01$) and quadratic ($P < .05$) reduction in serum urea nitrogen as pST dosage was increased suggests that there was better utilization and less deamination of the dietary amino acids. A statistical analysis indicated that the response in serum urea nitrogen was maximized near 8 mg/d.

The improvements in growth performance (ADG and F/G) indicate that growing pigs fed 1.0 and 2.0% dietary lysine require between 4 and 8 mg/d pST administration for maximum response. The point of inflection for ADG and F/G is approximately 5 mg/d. The level of pST required to optimize serum urea nitrogen is near 8 mg/d. The point of inflection for serum urea nitrogen is approximately 7 mg/d pST administration. The dosage required for maximum response in serum urea nitrogen was higher than the dosage required for maximum growth performance. The dosage of pST required for optimum growth performance of growing pigs fed 1.0 or 2.0% dietary lysine was determined to be near 5 mg/d.

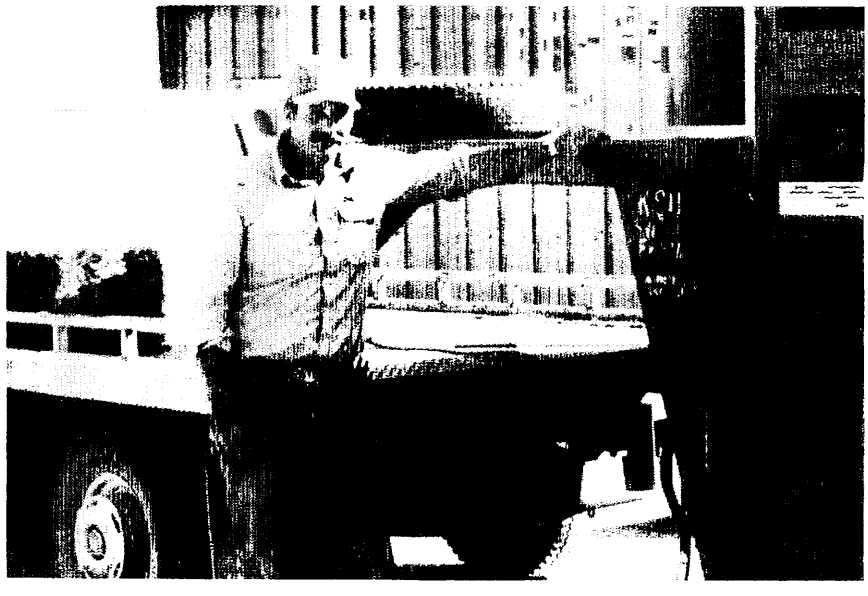

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Table 2. Performance, Carcass, and Blood Characteristics of Pigs Fed 1.0 or 2.0% Dietary Lysine and Injected with Porcine Somatotropin (pST)

	Lysine, %								
	1.0				2.0				
	pST Dosage, mg/d				pST Dosage, mg/d				
Characteristics	0	2	4	8	0	2	4	8	CV
Growth Performance[a]									
Wk 0-2									
ADG, lb[b]	2.05	2.35	2.14	2.18	2.14	2.28	2.36	2.54	11.1
ADFI, lb[c]	4.58	4.67	4.36	3.86	4.65	4.30	4.08	4.26	8.5
F/G[bcde]	2.23	1.99	2.13	1.77	2.17	1.88	1.73	1.68	10.1
Wk 0-5									
ADG, lb[bcf]	2.01	2.29	2.41	2.32	2.11	2.25	2.36	2.42	6.2
ADFI, lb[bc]	5.47	5.63	5.24	4.93	5.71	5.41	5.07	4.80	5.5
F/G[bcef]	2.72	2.46	2.19	2.13	2.72	2.40	2.15	1.99	5.5
Carcass and Blood Parameters[g]									
Average backfat, in[bch]	.32	.33	.29	.26	.34	.30	.28	.25	10.6
Wk 2 serum urea nitrogen, mg/dl[bcdef]	40.8	33.2	23.8	24.2	42.8	27.5	19.2	13.5	14.0
Wk 4 serum urea nitrogen, mg/dl[bcef]	42.1	34.0	28.8	23.8	43.3	33.3	24.9	19.9	10.9
Wk 2 serum pST, ng/ml[bc]	3.60	8.59	14.37	23.27	2.16	10.23	14.11	20.21	18.9
Wk 4 serum pST ng/ml[bc]	3.17	7.98	13.49	18.30	3.89	7.41	13.41	20.15	23.6

[a]A total of 80 pigs initially weighing 70.5 lb, 2 pigs/pen, 5 pens/treatment.
[b]Pigs fed 2.0% lysine, linear response to pST ($P < .01$).
[c]Pigs fed 1.0% lysine, linear response to pST ($P < .01$).
[d]Lysine effect ($P < .05$).
[e]Pigs fed 2.0% lysine, quadratic response to pST ($P < .05$).
[f]Pigs fed 1.0% lysine, quadratic response to pST ($P < .05$).
[g]Serum samples obtained 4 h post-injection, 3 h post-prandial.
[h]An average of ultrasonic measurements at the first rib, last rib, and last lumbar vertebra at the end of the 5 wk trial.