EFFECTS OF DAILY PORCINE SOMATOTROPIN ADMINISTRATION ON THE LYSINE REQUIREMENT OF GROWING PIGS[1]

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Summary

One-hundred twenty crossbred barrows initially weighing 68.7 lb were used to determine the lysine requirement of growing pigs injected with 5 mg/d porcine somatotropin (pST) during a 5-wk growth trial. Pigs received one of six levels of dietary lysine (.7, 1.1, 1.5, 1.9, 2.3, or 2.7%) and were injected daily with either 5 mg pST or placebo. During the 5 wk trial, pST-injected pigs had increased average daily gain (ADG), decreased average daily feed intake (ADFI), and improved feed conversion (F/G) compared with placebo-injected pigs. With increasing dietary lysine, ADFI of pigs injected with both pST and placebo was reduced. Pigs injected with pST had improved ADG as dietary lysine increased to 1.5% and improved F/G as dietary lysine increased to 1.9%. Dietary lysine had no effect on ADG or F/G of placebo-injected pigs. Pigs injected with pST had improved average backfat, tenth rib fat depth, and longissimus area compared to placebo-injected pigs. Tenth rib fat depth of both placebo- and pST-injected pigs was reduced as dietary lysine increased. Longissimus area of pST-injected pigs improved as dietary lysine increased to 1.5%. The improvements in ADG, ADFI, F/G, and longissimus area of pST-injected pigs indicate that the dietary lysine requirement of growing pigs injected with 5 mg/d pST is 1.5 to 1.9%.

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

Introduction

Administration of porcine somatotropin (pST) to growing pigs has been shown to be an effective means of improving growth performance and carcass characteristics. The dosage of pST required to elicit the greatest response has been found to be greater in growing pigs than in finishing pigs. The lysine requirement of finishing pigs injected daily with pST has been determined to be about twice that recommended by the NRC. The lack of response in experiments using growing pigs may be because the dosage of pST or the dietary lysine was inadequate to provide for the maximum response. This experiment was designed to determine the lysine requirement of growing pigs injected with 5 mg/d pST.

Procedures

One-hundred twenty crossbred barrows initially weighing 68.7 lb were allotted by weight and ancestry to one of 12 experimental treatments. Treatments included six diets (Table 1) formulated to contain either .7, 1.1, 1.5, 1.9, 2.3, or 2.7% lysine in combination with daily injections of either placebo or 5 mg pST. A mixture of soybean meal and L-lysine HCl were substituted for corn to increase the dietary lysine from .7 to 2.7%. Diets were formulated to contain 250% of NRC recommendations for all other essential amino acids using synthetic L-threonine, L-isoleucine, L-tryptophan, L-valine, and DL-methionine. Vitamins and minerals were included in diets to

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provide 200% of NRC recommended levels. 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 fully enclosed, environmentally regulated building with a totally slatted floor. All pigs and feeders were weighed weekly, and all feed additions were recorded for calculations of average daily gain (ADG), average daily feed intake (ADFI), and feed conversion (F/G). At the end of the 5 wk experiment, six pigs from each treatment were slaughtered for determination of carcass characteristics.

Results and Discussion

During the first 2 wk of the experiment, ADG increased, ADFI decreased, and F/G improved for pigs injected with pST ($P < .01$) compared to pigs injected with placebo (Table 2). Average daily gain of pigs injected with pST increased ($P < .05$) with increasing levels of dietary lysine up to 1.9%, whereas ADG of pigs injected with placebo increased up to 1.5% dietary lysine. Feed intake of both placebo- ($P < .05$) and pST-injected pigs ($P < .01$) decreased as dietary lysine levels increased. This resulted in improved F/G of pST-treated pigs up to 1.9% dietary lysine and of placebo-injected pigs up to 1.5% dietary lysine ($P < .01$).

During the overall 5 wk trial, pigs injected with pST had increased ADG, reduced ADFI, and improved F/G compared to placebo-injected pigs ($P < .01$). Injection of pigs with pST also resulted in reduced average backfat, reduced 10th rib fat depth, and increased longissimus area compared to injection with placebo ($P < .01$).

Increasing the dietary lysine level of pST-injected pigs resulted in an increase ($P < .05$) in ADG up to a lysine level of 1.5%, a linear ($P < .02$) reduction in ADFI, and an improvement ($P < .05$) in F/G to between 1.5 and 1.9% dietary lysine. Carcasses of pST-injected pigs had less ($P < .05$) backfat as dietary lysine was increased to 1.5% and a linear reduction ($P < .02$) in 10th rib fat depth with increasing levels of dietary lysine. Longissimus area of pST-injected pigs increased ($P < .05$) as dietary lysine was increased to 1.5 and 1.9%.

Increasing the dietary lysine had no effect on ADG, F/G, or average backfat of placebo-injected pigs. Pigs injected with placebo had a linear reduction ($P < .02$) in ADFI and 10th rib fat depth with increasing levels of dietary lysine. The longissimus area of placebo-injected pigs increased as dietary lysine increased up to a level of 1.1%.

The only trait indicating that the dietary lysine level of placebo-injected pigs was inadequate was the increase in longissimus area up to 1.1% dietary lysine. Thus, the current NRC recommendation of .75% lysine closely approximates the requirement of the placebo-injected pigs in this experiment. The lysine intake of placebo-injected pigs fed diets containing .7 and 1.1% lysine was 14 and 21 g/d, respectively. Because of the large differences in dietary lysine in this experiment, it is possible that a response occurred in placebo-injected pigs between .7 and 1.1% and was not detected. The improvement in growth performance of pST-treated pigs with increasing levels of dietary lysine up to 1.5% (ADG) or 1.9% (ADFI and F/G) along with the increase in longissimus area up to 1.9% indicates that the lysine requirement of growing pigs injected with 5 mg/d pST is between 1.5 and 1.9%. The lysine intake of pST-injected pigs was 24 and 28 g/d for pigs fed diets containing 1.5 and 1.9% lysine, respectively. These recommendations represent a 200 to 250% increase in the lysine requirement of pST-injected pigs compared to the NRC recommendation of .75% lysine for 44 to 110 lb pigs on the basis of dietary percentage. The NRC recommendation for lysine is 14.25 g/d. Comparing the lysine requirement of pST-injected pigs in g/d, the increase is between 170 and 195% of the NRC recommendation.

Table 1. Composition of Diets

Ingredient	Percentage Lysine					
	.7	1.1	1.5	1.9	2.3	2.7
Corn	59.95	52.15	44.15	36.05	27.75	19.45
Corn gluten meal (60% CP)	20.00	20.00	20.00	20.00	20.00	20.00
Soybean meal (48% CP)	5.00	13.20	21.40	29.60	37.80	46.10
Menhaden fishmeal	4.00	4.00	4.00	4.00	4.00	4.00
Soybean oil	5.00	5.00	5.00	5.00	5.00	5.00
Monocalcium phosphate(21% P)	2.85	2.70	2.56	2.42	2.28	2.13
Limestone	1.09	1.05	1.02	.99	.95	.92
L-lysine HCl	—	.21	.42	.63	.84	1.05
Vitamin premix	.50	.50	.50	.50	.50	.50
Antibiotic[a]	.25	.25	.25	.25	.25	.25
Salt	.30	.30	.30	.30	.30	.30
Trace mineral premix	.20	.20	.20	.20	.20	.20
Copper sulfate	.05	.05	.05	.05	.05	.05
Selenium premix	.05	.05	.05	.05	.05	.05
L-threonine	.35	.22	.10	—	—	—
L-isoleucine	.21	.07	—	—	—	—
L-tryptophan	.15	.09	.04	—	—	—
L-valine	.04	—	—	—	—	—
DL-methionine	.06	—	—	—	—	—
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analyses						
CP, %	22.16	25.55	28.97	32.38	35.79	39.20
Lysine, %	.7	1.1	1.5	1.9	2.3	2.7
Ca, %	1.20	1.20	1.20	1.20	1.20	1.20
P, %	1.00	1.00	1.00	1.00	1.00	1.00
ME, Kcal/lb	1552	1557	1559	1559	1558	1556

[a]Each lb of antibiotic contained 10 g chlortetracycline.

Table 2. Performance and Carcass Characteristics of Pigs Injected Daily with Placebo (0) or pST (5 mg)

	Porcine Somatotropin (pST), mg/d												
	0						5						
	Lysine, %						Lysine, %						
Item	.7	1.1	1.5	1.9	2.3	2.7	.7	1.1	1.5	1.9	2.3	2.7	CV
Growth Performance[a]													
Wk 0-2													
ADG, lb[bcd]	1.56	1.76	2.01	1.66	1.62	1.64	1.48	2.05	2.11	2.18	1.85	1.99	14.4
ADFI, lb[bef]	3.75	3.75	3.38	3.45	3.16	3.21	3.11	3.44	3.09	2.96	2.66	2.81	9.6
F/G[bcdef]	2.41	2.15	1.68	2.11	1.95	1.96	2.11	1.68	1.47	1.38	1.48	1.45	10.2
Wk 0-5													
ADG, lb[bdg]	1.76	1.81	1.84	1.75	1.68	1.71	1.62	2.13	2.20	2.10	2.00	1.92	9.4
ADFI, lb[bef]	4.30	4.19	4.10	4.13	3.72	3.93	3.74	3.88	3.54	3.28	3.21	3.09	7.3
F/G[bdfg]	2.44	2.33	2.27	2.37	2.21	2.32	2.30	1.82	1.61	1.56	1.61	1.61	7.0
Carcass Characteristics[h]													
Slaughter wt, lb	130.8	129.7	132.7	131.0	128.7	126.0	124.8	146.0	141.7	141.5	136.2	138.5	
Average backfat, in[bdfi]	.93	.93	.88	.89	.85	.84	.83	.72	.63	.63	.68	.66	15.6
Fat depth, 10th rib, in[bef]	.85	.82	.72	.82	.64	.68	.65	.52	.46	.43	.44	.37	18.6
Longissimus area, sq in[bdf]	3.12	3.51	3.49	3.24	3.54	3.36	3.13	4.13	4.42	4.45	4.09	4.27	13.0

[a]A total of 120 pigs initially weighing 68.7 lb, 2 pigs/pen, 5 pens/treatment.
[b]pST effect ($P < .01$).
[c]placebo injected pigs, quadratic response to lysine ($P < .05$).
[d]pST injected pigs, quadratic response to lysine ($P < .05$).
[e]placebo injected pigs, linear response to lysine ($P < .02$).
[f]pST injected pigs, linear response to lysine ($P < .02$).
[g]Lysine X pST ($P < .05$).
[h]A total of 72 pigs, 6 pigs/treatment.
[i]Mean of measurements taken over the first rib, the last rib and the last lumbar vertebra.