Kansas Agricultural Experiment Station Research Reports

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

Article 440

1990

Effects of porcine somatotropin and dietary lysine level on growth performance and carcass characteristics of finishing swine fed to 280 lb.

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Abstract

One hundred twenty barrows with an initial wt of 130 lb were utilized to determine the effects of dietary lysine level and porcine somatotropin (pST) injection on growth performance and carcass characteristics of finishing pigs fed to heavy market weights (280 lb). Pigs were injected daily in the extensor muscle of the neck with either 4 mg pST or a placebo and fed diets containing either .8, 1.0, 1.2, or 1.4% dietary lysine. Performance data were collected and evaluated for three weight ranges : 130 to 230 lb, 230 to 280 lb, and 130 to 280 lb. Two pigs from each pen were slaughtered to determine carcass measurements. The first pig was slaughtered at 230 lb and the second pig at 280 lb. Average daily gain (ADG) was maximized at the 1.0% lysine level for the pigs fed from 130 to 230 lb and for those fed from 130 to 280 lb. From 230 to 280 lb, ADG was improved for pigs fed the 1.0 and 1.4% lysine levels. Pigs injected with pST had a significant improvement in ADG compared to control pigs at all weight ranges. There was a linear decrease in average daily feed intake (ADFI) with increasing dietary lysine levels from 130 to 230 lb and from 130 to 280 lb. Feed conversion (F/G) improved as dietary lysine levels increased for pigs from 130 to 280 lb and was improved in response to pST-treatment. No pST x lysine interactions were observed for either ADG, ADFI, or F/G. Percent carcass muscle increased with increasing dietary lysine level and pST-treatment at both slaughter weights. A pST x lysine interaction was seen for percent muscle when pigs were slaughtered at 230 lb. Backfat thickness, kidney fat, and longissimus muscle area (LEA) were unaffected by dietary lysine level, but did show a pST response for pigs slaughtered at 230 lb. Longissimus muscle area was also increased with pST-treatment but was unchanged by changing lysine level for pigs killed at 280 lb. Kidney fat and backfat thickness decreased with pST-treatment and as lysine level increased in 280-lb pigs. There was no pST X lysine interaction at either slaughter weight for backfat thickness, kidney fat, or LEA. At slaughter weights of 230 and 280 Ib, there was an increase in trimmed ham weight with increasing dietary lysine level and pST-treatment, but no pST x lysine interaction. Organ weights were unaffected by lysine level, but were heavier with pST-treatment. These data indicate that growth performance was maximized at 1.0% dietary lysine, and carcass traits were optimized at dietary lysine of 1.2 to 1.4%. These results further demonstrate that pigs fed to 280 lb, when injected daily with pST, are more efficient, grow faster, and are leaner than control pigs.; Swine Day, Manhattan, KS, November 15, 1990

Keywords

Swine day, 1990; Kansas Agricultural Experiment Station contribution; no. 91-189-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 610; Swine; Repartition; Lysine; GF; Performance; Carcass; Heavy; Weight

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EFFECTS OF PORCINE SOMATOTROPIN AND DIETARY LYSINE LEVEL ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING SWINE FED TO 280 LB

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Summary

One hundred twenty barrows with an initial wt of 130 lb were utilized to determine the effects of dietary lysine level and porcine somatotropin (pST) injection on growth performance and carcass characteristics of finishing pigs fed to heavy market weights (280 lb). Pigs were injected daily in the extensor muscle of the neck with either 4 mg pST or a placebo and fed diets containing either .8, 1.0, 1.2, or 1.4% dietary lysine. Performance data were collected and evaluated for three weight ranges : 130 to 230 lb, 230 to 280 lb, and 130 to 280 lb. Two pigs from each pen were slaughtered to determine carcass measurements. The first pig was slaughtered at 230 lb and the second pig at 280 lb. Average daily gain (ADG) was maximized at the 1.0% lysine level for the pigs fed from 130 to 230 lb and for those fed from 130 to 280 lb. From 230 to 280 lb, ADG was improved for pigs fed the 1.0 and 1.4% lysine levels. Pigs injected with pST had a significant improvement in ADG compared to control pigs at all weight ranges. There was a linear decrease in average daily feed intake (ADFI) with increasing dietary lysine levels from 130 to 230 lb and from 130 to 280 lb. Feed conversion (F/G) improved as dietary lysine levels increased for pigs from 130 to 280 lb and was improved in response to pST-treatment. No pST × lysine interactions were observed for either ADG, ADFI, or F/G. Percent carcass muscle increased with increasing dietary lysine level and pST-treatment at both slaughter weights. A pST × lysine interaction was seen for percent muscle when pigs were slaughtered at 230 lb. Backfat thickness, kidney fat, and longissimus muscle area (LEA) were unaffected by dietary lysine level, but did show a pST response for pigs slaughtered at 230 lb. Longissimus muscle area was also increased with pST-treatment but was unchanged by changing lysine level for pigs killed at 280 lb. Kidney fat and backfat thickness decreased with pST-treatment and as lysine level increased in 280-lb pigs. There was no pST × lysine interaction at either slaughter weight for backfat thickness, kidney fat, or LEA. At slaughter weights of 230 and 280 lb, there was an increase in trimmed ham weight with increasing dietary lysine level and pST-treatment, but no pST × lysine interaction. Organ weights were unaffected by lysine level, but were heavier with pST-treatment. These data indicate that growth performance was maximized at 1.0% dietary lysine, and carcass traits were optimized at dietary lysine of 1.2 to 1.4%. These results further demonstrate that pigs fed to 280 lb, when injected daily with pST, are more efficient, grow faster, and are leaner than control pigs.

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

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[1]Pitman-Moore, Inc., Terre Haute, IN 47808

[2]We would like to acknowledge Nutri-Quest, St. Louis, MO for partial support of this research.

Introduction

The ideal market weight of finishing swine often has been governed by the efficiency of the animal and the quality of the carcass. Pigs fed to heavier weights start to deposit more fat and less protein and are less efficient than those slaughtered at the more conventional weight of 230 lb. Also, with health-conscious consumers looking for leaner meat, the swine producer cannot afford to market an overly fat hog. Even if it would be more desirable to market a heavier pig, the producer has been unable to do so.

Research with pST-treated pigs has shown an improvement in gain and feed conversion, reduced carcass lipid content, and an increase in protein deposition. When given daily injections of pST, finishing pigs appear to have a delay in the fattening phase of their growth curve and, thus, a leaner carcass. If pST treatment would delay the fattening phase long enough, producers could market a leaner, much heavier hog that would meet consumer standards and still be efficient to raise. The accelerated growth rate of the pST-treated pigs requires that their nutritional requirements be reevaluated when they are fed to the heavier market weight of 280 lb.

Therefore, the objective of this experiment was to determine the effects of lysine level and pST administration on growth performance and carcass characteristics of finishing swine fed to 280 lb.

Procedures

One hundred twenty crossbred barrows (Duroc × Yorkshire × Hampshire) averaging 130 lb were allotted on the basis of weight and ancestry to one of eight treatments. Treatments included either a daily injection of 4 mg pST or placebo in combination with a corn-soybean meal diet (Table 1) containing either .8, 1.0, 1.2, or 1.4% lysine. All diets were formulated to contain at least 200% of NRC (1988) recommendations for other amino acids. There were three pigs per pen and five replicates per treatment. Pigs were weighed at 14-d intervals until the pen mean weight reached 230 lb. At this time, one pig per pen was slaughtered for recording carcass measurements and organ weights. The other two pigs remained on experimental treatment and were weighed at 7 d intervals until they reached a final mean weight of 280 lb. One of the two remaining pigs was then slaughtered for carcass measurements and recording of organ weights. Pigs slaughtered at 230 and 280 lb had the right ham removed for evaluation. A whole ham weight was recorded; then the ham was trimmed and trimmed weight also was recorded. Each ham was also evaluated for color, firmness, and marbling. Production measurements taken included average daily gain (ADG), average daily feed intake (ADFI), and feed conversion (F/G).

Results and Discussion

Average daily gain for pigs fed from 130 to 230 lb was maximized at the 1.0% dietary lysine level (Table 2). Pigs fed 1.0% dietary lysine and receiving pST gained 15% more than the control pigs at the same dietary lysine level ($P<.01$) and 5% more than the pST-treated pigs at the other three lysine levels. There was a decrease (linear, $P<.01$) in ADFI with increasing dietary lysine levels. Control pigs consumed more feed than pST-treated pigs, with an average increase of 21% in daily feed intake across all dietary lysine levels. Feed conversion was improved (P<.01) for pST-treated pigs by 42% compared to the control pigs at the 1.4% lysine level. Porcine somatotropin-treated pigs fed to 230 lb had an average improvement of 29% in F/G (P<.01) over the control pigs across the remaining three lysine levels.

When performance was evaluated from 230 to 280 lb, ADG was highest (P<.04) for pST-treated pigs at the 1.0 and 1.4% lysine levels. This was a 19% improvement over the control pigs fed the same dietary lysine levels. Feed intake averaged across all lysine levels numerically decreased 4% for pST-treated pigs compared to the control animals. Feed conversion was optimized (quadratic, P<.07) at the 1.4% lysine level for pigs treated with pST. Pigs treated with pST had a 15% improvement (P<.01) in F/G compared to placebo-injected pigs.

Looking at performance for the entire trial (130 to 280 lb), those pigs treated with pST had an improvement of 12% in ADG (P<.01) compared to control pigs. There was a numerical advantage in gain for pST-treated pigs at the 1.0% dietary lysine level, with a 7% increase in gain over the other three lysine treatments. Control pigs fed to 280 lb consumed 17% more feed than pST-treated pigs taken to the same weight (P<.01). There was a trend (linear, P=.07) toward decreasing feed intake with increasing lysine levels. Increasing dietary lysine levels resulted in improved F/G (linear, P<.01) for pST-treated pigs. Feed conversion showed the most improvement at the 1.0 and 1.4% lysine levels; with pST-treated pigs being 36% more efficient than the control pigs.

Backfat thickness of pigs slaughtered at 230 lb was unaffected by dietary lysine level in the diet. However, pST-treated pigs did have 30% less backfat (P<.01) than control pigs (Table 3). Increasing lysine level also had no effect on longissimus muscle area (LEA), but there was a 22% increase (P<.01) in LEA at the 1.4% lysine level for pST-treated pigs compared to control pigs. Percent carcass muscle increased (linear, P<.02) with increasing dietary lysine levels. Porcine somatotropin-treated pigs had 8% more muscle than control pigs (P<.01) slaughtered at 230 lb. Whole ham weight was not affected by pST or lysine level, but trimmed ham weight increased (quadratic, P<.03) with increasing levels of lysine. Kidney fat showed a numerical decrease (linear, P<.08) with increasing dietary lysine levels, with pST-treated pigs having 34% less kidney fat than control pigs (P<.01). Subjective evaluations of ham firmness and marbling were unaffected by lysine level. However, pST-treated pigs had a 57% decrease (P<.01) in marbling compared to control pigs. Ham color showed an improvement (linear, P<.02) with increasing dietary lysine level.

Evaluation of the same carcass measurements for pigs slaughtered at 280 lb shows a decrease (linear, P<.05) with increasing dietary lysine levels in backfat thickness, with control pigs having 36% more backfat than pST-treated pigs (P<.01). Longissimus muscle area was not affected by dietary lysine level, but it was maximized numerically at the 1.2% lysine level. Pigs injected daily with pST showed a 28% increase (P<.01) in LEA over control pigs slaughtered at 280 lb. Percent carcass muscle showed an increase (linear, P<.03) with increasing lysine levels. Pigs slaughtered at 280 lb exhibited a trend (linear, P<.06) toward increased whole ham weight with increasing lysine levels, but there was no effect (P>.2) on whole ham weight from pST treatment. Trimmed hams from 280 lb pigs also showed an increase (linear, P<.02) in weight with increasing dietary lysine levels. Pigs injected with pST had 8% heavier trimmed hams than control pigs (P<.01). Kidney fat decreased (linear, P<.02) with increasing lysine levels for pigs slaughtered at 280 lb. Ham firmness and marbling scores showed a decrease (linear, P<.01) with increasing lysine level, but ham color was unaffected by pST treatment or lysine level.

Weights of heart, liver, spleen, and lungs were not affected by dietary lysine level. However, organ weights of pST-treated pigs were significantly heavier (P<.01) than those of control pigs slaughtered at 230 lb (Table 4). Kidney weight of these pigs increased (linear, P<.02) as dietary lysine level increased. Liver weight of pigs slaughtered at 280 lb showed an increase (linear, quadratic, P<.01) with increasing lysine levels as did kidney weight (linear, P<.01). Weights of heart, lungs, and spleen were again unaffected by dietary lysine level.

The results of this study indicate that growth performance of pST-treated pigs fed to 230 or 280 lb was maximized at a dietary lysine level of 1.0%. Carcass traits were optimized at dietary lysine levels of 1.2 to 1.4%. Although control pigs showed some improvement with increasing lysine level, pST-treated pigs showed a greater magnitude of response. Porcine somatotropin-treated pigs fed to 280 lb proved to be 27% more efficient than control pigs fed to 230 lb and had a 13% improvement in ADG. The carcasses of these 280 lb pST-treated pigs yielded 36% larger LEA while showing a 26% decrease in backfat thickness in comparison to the control pigs at 230 lb. These results demonstrate that with injections of pST, finishing pigs can be fed to a heavier market weight with no loss of efficiency or desirable carcass characteristics.

Table 1. Composition of Experimental Diets

	Lysine level, %			
Ingredients	.8	1.0	1.2	1.4
Corn	68.48	61.32	54.55	47.80
Soybean meal (48%)	20.00	27.20	34.10	41.02
D-L methionine	.05	.05	.05	.05
Soybean oil	6.00	6.00	6.00	6.00
Monocalcium phosphate	3.22	3.15	3.05	2.92
Limestone	1.00	1.03	1.00	.96
Vitamin premix[a]	.50	.50	.50	.50
Trace mineral premix[b]	.20	.20	.20	.20
Selenium premix[c]	.05	.05	.05	.05
Salt	.50	.50	.50	.50
Calculated Analysis				
Crude protein, %	15.33	18.14	20.84	23.55
Ca, %	1.23	1.26	1.26	1.25
P, %	1.06	1.07	1.08	1.07

[a]Each lb of premix contains the following: 1,000,000 million IU vitamin A, 100,000 IU vitamin D_3, 4000 IU vitamin E, 1000 mg riboflavin, 400 mg menadione, 2500 mg d-pantothenic acid, 5,500 mg niacin, 100,000 mg choline chloride, 5 mg vitamin B_{12}.
[b]Each lb of premix contains: 25 g Mn, 45.4 g Fe, 5 g Cu, 91 g Zn, .7 g I, and .45 g Co.
[c]Each lb of premix contains 272 mg Se.

Table 2. **Effect of PST and Lysine Level on Growth Performance**

	0 pST+				4 mg/d pST+			
	Dietary lysine level, %				Dietary lysine level, %			
Item	.8	1.0	1.2	1.4	.8	1.0	1.2	1.4
ADG, lb								
130-230 lb[a]	1.95	1.84	1.87	1.79	2.02	2.12	2.02	2.01
230-280 lb[a]	2.09	1.93	1.90	2.11	1.97	2.43	2.13	2.51
130-280 lb[a]	1.95	1.84	1.86	1.90	1.95	2.22	2.04	2.18
ADFI, lb								
130-230 lb[ab]	7.30	6.74	6.86	6.81	6.16	5.73	5.75	5.37
230-280 lb	7.77	7.48	7.64	7.59	6.31	8.02	7.28	7.58
130-280 lb[ac]	7.42	6.99	7.13	6.98	6.20	6.21	6.20	5.80
F/G								
130-230 lb[a]	3.76	3.68	3.67	3.82	3.05	2.71	2.85	2.68
230-280 lb[ad]	3.79	3.96	4.04	3.64	3.28	3.33	3.43	3.01
130-280 lb[ab]	3.81	3.80	3.83	3.68	3.19	2.80	2.99	2.67

[a]Effect of PST ($P<.05$).
[b]Effect of lysine (linear, $P<.01$).
[c]Effect of lysine (linear, $P<.07$).
[d]Effect of lysine (quadratic, $P<.07$).

Joe Carpenter, farrowing house manager.

Table 3. **Effect of PST and Lysine Level on Carcass Characteristics**

	0 pST+ Dietary lysine level, %				4 mg/d pST+ Dietary lysine level, %			
Item	.8	1.0	1.2	1.4	.8	1.0	1.2	1.4
Backfat, in								
230 lb[a]	1.45	1.34	1.35	1.37	1.07	1.07	1.03	1.06
280 lb[ad]	1.60	1.46	1.49	1.42	1.13	1.15	1.06	1.04
Longissimus muscle, in^2								
230 lb[a]	4.52	5.14	5.17	4.73	5.32	5.45	5.45	5.80
280 lb[a]	5.52	5.49	5.53	5.82	6.06	6.89	7.10	6.62
Percent Muscle								
230 lb[ac]	50	53	53	52	55	55	57	58
280 lb[ad]	49	51	51	52	56	57	57	58
Kidney fat, g								
230 lb[a]	1672	1431	1389	1539	1210	1277	1048	972
280 lb[ac]	2636	2398	2235	2179	1554	1483	1353	1091
Whole ham weight, lb								
230 lb	20.98	21.60	21.36	20.62	21.18	21.62	21.72	21.42
280 lb[e]	24.36	24.84	25.94	26.20	25.92	25.64	25.96	25.96
Trimmed ham weight, lb								
230 lb[af]	16.42	17.36	17.10	16.28	17.54	17.72	18.34	17.90
280 lb[ac]	18.88	19.62	20.72	20.94	21.46	21.66	21.78	21.90
Ham color score[g]								
230 lb[bc]	2.8	2.8	3.0	3.0	2.4	2.4	2.6	3.0
280 lb	2.8	2.8	3.0	2.8	3.0	2.8	3.0	2.6
Ham firmness score[h]								
230 lb[b]	2.2	2.4	2.2	2.4	2.0	2.0	2.0	2.0
280 lb[ac]	2.8	2.4	2.4	2.0	2.2	2.0	2.0	1.8
Ham marbling score[i]								
230 lb[a]	1.8	1.6	1.6	1.6	1.2	1.0	1.0	1.0
280 lb[ac]	2.6	2.0	2.2	1.6	1.4	1.6	1.2	1.2

[a]Effect of PST ($P<.01$).
[b]Effect of PST ($P<.03$).
[c]Effect of lysine (linear, $P<.02$).
[d]Effect of lysine (linear, $P<.05$).
[e]Effect of lysine (linear, $P<.06$).
[f]Effect of lysine (quadratic, $P<.05$).
[g]Based on a scale with 1=extremely pale, 3=uniformly grayish pink, 5=dark
[h]Based on a scale with 1=soft and watery, 3=moderately firm and dry, 5=very firm and dry
[i]Based on a scale with 1=trace, 3=small, 5=abundant

Table 4. Effect of PST and Lysine Level on Organ Weight

	0 pST+ Dietary lysine level, %				4 mg/d pST+ Dietary lysine level, %			
Item	.8	1.0	1.2	1.4	.8	1.0	1.2	1.4
Heart, g								
230 lb[a]	372	382	358	370	418	403	462	452
280 lb[a]	402	393	414	465	474	476	474	443
Liver, g								
230 lb[a]	1500	1453	1592	1614	1931	1967	1793	2040
280 lb[abc]	1427	1532	1569	1618	1748	2269	2226	2108
Kidney, g								
230 lb[ab]	371	348	386	402	426	461	451	493
280 lb[ab]	345	344	377	466	440	535	519	523
Lungs, g								
230 lb[a]	779	715	720	764	959	923	824	1226
280 lb[a]	942	975	790	977	1341	1077	1121	1107
Spleen, g								
230 lb[ac]	182	154	179	207	228	210	204	274
280 lb[a]	190	241	212	201	263	270	238	275

[a]Effect of PST (P<.01).
[b]Effect of lysine (linear, P<.02).
[c]Effect of lysine (quadratic, P<.02).

John Blaske, finishing barn manager.