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Effects of Protein Level and Gender on Estimation of Lean Gain per Day of Pigs from a Terminal Crossbreeding System

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Lean growth potential is currently used to typify pigs when designing nutritional programs. The most common method of estimating lean growth type is by measuring gain over the grow-finish period and obtaining carcass information for the pigs evaluated. This information is placed in a model to calculate lean gain/day. Excess protein is fed to ensure that the genetic potential for lean gain per day is not limited by nutrition. The data reported herein are the results of determining the lean growth potential of the SDSU research herd in 1992 with pigs fed two different protein regimens.

(Key Words: Growing swine, Lean gain, Protein level, Sex.)

Experimental Procedure

The effect of protein regimen on lean growth of the SDSU swine research herd was evaluated with a factorial arrangement of sex and protein regimen in a complete block design. Seventy-two pigs averaging 28.7 kg, the result of a terminal cross (Landrace x Large White by Duroc x Hampshire), were allotted to dietary treatments and sex groups from within six sire outcome groups (blocks). Pigs were housed by sex, three per pen, in an environment-modified confinement building with slatted floors. Two dietary protein regimens were fed ad libitum: (1) 16% protein from initial weight to a pen average weight of 50 kg and 14% protein after 50 kg or (2) 18% protein for the entire test. Diets (Table 1) were formulated with corn and soybean meal and fortified with vitamins and minerals. Pigs were removed individually from test on weekly weigh dates when they reached 110 kg, were slaughtered, and carcass data collected. Calculation of lean gain/day (5% fat) was made with the NPPC (1991) formula utilizing hot carcass weight, 10th rib fat, longissimus muscle area, initial weight, and days on test.

TABLE 1. PERCENTAGE COMPOSITION OF GROWER AND FINISHER DIETS

Ingredients	Grower 16%	Finisher 14%	Grower-Finisher 18%
Ground corn	75.14	81.13	68.10
Soybean meal, 44%	21.69	15.99	28.60
Dicalcium phosphate	1.07	.91	1.20
Limestone	.85	.72	.85
White salt	.25	.25	.25
Premix[a]	1.00	1.00	1.00
Calculated analysis, (%)			
Crude protein	16.0	14.0	18.0
Calcium	.65	.65	.65
Phosphorus	.55	.55	.55
Lysine	.82	.65	1.00

[a]Provided per kg of complete diet: 100 mg Zn, 75 mg FE, 7.5 mg Cu, 25 mg Mn, 175 :g I, 1300 :g Se, 16.5 IU vitamin E, 3.3 mg riboflavin, 17.6 mg niacin, 13.2 :g vitamin B_{12}, 2.2 mg vitamin K_3, 13.2 mg pantothenic acid, 3960 IU vitamin A, and 396 IU vitamin D_3.

Results

Sex differences in pig performance to 110 kg and carcass traits were typical of those expected for barrows and gilts (Table 2). Barrows gained at a faster rate (P<.05) than gilts resulting from greater feed intake (P<.05). Gain/feed (P>.10) was similar between gilts and barrows. At the same slaughter weight, barrow carcasses measured more 10th rib fat (P<.01) and smaller longissumus muscle area (P<.01).

Both barrows and gilts consumed more feed (P<.05) when fed the dietary protein regimen that supplied 18% protein during the entire growth period (Table 2). However, gain/feed, 10th rib fat, and longissumus muscle area, the criteria typically affected by protein level, were unaffected by protein regimen (P>.10).

In spite of the differences observed in average daily gain, 10th rib fat, and longissimus muscle between sexes, lean gain/day was similar (P>.10) between barrows and gilts. The additional energy consumed by barrows was apparently converted to fat and did not contribute to additional muscle deposition. Although protein regimen had affected feed intake and average daily gain, the 16% to 14% protein regimen was adequate for barrows and gilts with no improvement in lean gain/day for pigs fed 18% protein (P>.10). At the time this research was conducted, lean gain/day (5% fat) for the SDSU herd was estimated to be between .29 and .30 kg. This would be considered to be within, but at the high end of, the medium lean growth range.

TABLE 2. LEAST SQUARES MEANS FOR MAIN EFFECTS OF SEX AND PROTEIN REGIMEN

Item	Sex	P	Protein regimen	
			16% to 14%	18%
Average daily gain, kg				
	Barrows	.86*	.84	.89
	Gilts	.80	.78	.82
			.81	.86*
Average daily feed, kg				
	Barrows	3.25*	3.09	3.40
	Gilts	3.06	3.03	3.09
			3.06	3.25*
Gain/feed				
	Barrows	.26	.27	.26
	Gilts	.26	.26	.27
			.26	.26
10th rib fat, cm				
	Barrows	2.47**	2.43	2.50
	Gilts	1.86	1.82	1.90
			2.13	2.20
Longissimus area, cm^2				
	Barrows	31.48**	31.9	31.1
	Gilts	35.00	34.3	35.7
			33.1	33.4
Lean gain/day, kg				
	Barrows	**.29**	**.28**	**.29**
	Gilts	**.30**	**.29**	**.31**
			.29	**.30**

Probabilities for main effects (sex or protein regimen), *P<.05, **P<.01.

Although means for the six sire groups evaluated in this study are not reported, differences among sire groups were found for all criteria evaluated. There were also interactions between sire groups and protein regimen as well as between sire groups and sex. Average lean gain/day for sire groups ranged from a low of .25 kg to a high of .34 kg.

Summary

The effect of protein regimen on lean gain/day was determined for the SDSU swine research herd utilizing 72 barrows and gilts from six sire groups. The two protein regimens were either 16% followed by 14% at 50 kg or 18% protein for the entire growth period from 28.7 to 110 kg. Barrows consumed more feed, gained faster, and measured more 10th rib fat and less longissumus muscle area than gilts. Barrows or gilts consuming the higher protein level consumed more feed and gained faster than those provided the lower protein regimen. However, protein regimen did not affect 10th rib fat, longissumus muscle area, or gain/feed. Lean growth was similar for barrows and gilts and unaffected by dietary protein regimen. Lean gain/day for the SDSU swine research herd was estimated to be between .29 and .30 kg.

Implications

Although the 18% protein regimen provided for more feed intake and greater daily gain, the lean gain observed was similar to that obtained with the 16% to 14% protein sequence. Either the 16% to 14% sequence was adequate to allow both barrows and gilts to express their lean gain capabilities or the equations used to calculate lean gain are not sensitive enough to allow detection of lean gain caused by protein regimen. Lean growth for barrows and gilts is similar even though barrows typically have higher feed intake and gain. Additional weight gain of barrows is apparently primarily gain in fat tissue rather than lean tissue. Lean gain/day for this herd was evaluated across six sire groups with documented differences in performance and carcass characteristics among sire groups. While the entire herd was estimated to have a lean gain/day of between .29 to .30 kg, individual sire groups ranged in estimated lean growth from .25 to .34 kg. These data point out that an estimate of average lean gain/day for a herd can be obtained with either barrows or gilts or with both barrows and gilts. Protein levels fed need not be higher than those, which will produce maximum feed intake and gain. However, errors in the estimate of a herd's average lean gain/day are likely if small samples of pigs are tested which do not accurately represent the range of genetic potential for lean growth found in the herd.