Effect of Low Energy, High Fiber Diets on Pigs Selected for Residual Feed Intake

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Summary and Implications

The ever high feed costs in swine production contribute to the largest variable expense for today's producers. Due to this fact, research has focused on increasing feed efficiency. In this study, residual feed intake (RFI) was utilized as a measure of feed efficiency in lines of purebred Yorkshire pigs that were selected for increased and decreased feed efficiency on a standard corn-soybean diet that was high in energy and low in fiber (control diet). The low RFI (LRFI) line was selected for increased feed efficiency while the high RFI (HRFI) line was selected for reduced feed efficiency. In generations 8 and 9, the low and high RFI lines were challenged with a low energy, high fiber diet (LEHF). This diet reflects the addition of alternative feed stuffs to swine diets in commercial settings in order to decrease feed costs. Results indicate that the difference in feed efficiency between the two lines was substantially lower when fed the LEHF diet compared to the control diet. Thus, when pigs are fed diets with substantial byproducts, it is important that pigs are also selected for efficiency under such diets.

Introduction

Residual feed intake (RFI) is a measure of feed efficiency that is defined as the difference between an animal's observed and expected feed intake based upon growth and backfat. In purebred Yorkshire pigs, selection of the LRFI line (i.e. increased efficiency) occurred in all generations while a randomly selected control line was maintained for the first 5 generations but has since been selected for HRFI (i.e. decreased efficiency). In generations 8 and 9, a 2x2 factorial design was utilized to study the effect of a LEHF versus a control diet on performance of the LRFI and HRFI lines. The objective of this study was to determine if pigs selected for reduced RFI on a control diet would maintain their feed efficiency advantage over HRFI pigs when challenged with a LEHF diet.

Materials and Methods

From generations 8 (G8) and 9 (G9) of the ISU RFI lines, 168 and 166 pigs were utilized to evaluate their performance on a LEHF diet compared to a control diet. The LEHF diet contained 2.87 Mcal ME/kg of feed and 25.9% neutral detergent fiber (NDF) while the control diet contained 3.32 Mcal ME/kg and 9.5% NDF.

In two replications (G8 and G9), littermate gilts and barrows from the LRFI and HRFI lines were split between the two diets and grown out from approximately 40 to 118 kg in 12 pens, each equipped with a single-space electronic feeder (FIRE©) to record individual feed intake. Body weight was recorded every two weeks and ultrasound scans for backfat depth (BF) and loin muscle area (LMA) were taken at the end of the test period. Average daily feed intake (ADFI), average daily gain (ADG), gain to feed ratio (G:F), BF and LMA were evaluated throughout the test period.

Results and Discussion

Line effect within control diet

As shown in Table 1, consistent with previous studies on the control diet, compared to the HRFI line, the LRFI line had similar ADG ($P>0.05$), lower ADFI and BF (G8: $P<0.01$, G9: $P<0.1$), and greater G:F ($P<0.05$) and LMA (G8: $P<0.01$, G9: $P=0.45$).

Control versus LEHF across lines

Compared to the control diet, pigs on the LEHF diet had similar ADFI in G8 ($P=0.37$) but greater ADFI in G9 ($P<0.01$), lower ADG, BF and G:F ($P<0.03$), and greater LMA in G8 ($P<0.01$) but lower LMA in G9 ($P<0.01$).

Line effect within LEHF diet

On the LEHF diet, compared with the HRFI line, the LRFI line had similar ADG and G:F ($P>0.05$), lower ADFI (G8: $P=0.14$, G9: $P=0.03$) and BF (G8: $P<0.1$, G9: $P<0.01$), and greater LMA (G8: $P<0.05$, G9: $P<0.1$).

Discussion

On a control diet, compared to the HRFI line, the LRFI line had more lean and less fat growth, while eating less and gaining similarly, and thus had greater feed efficiency.

On the LEHF diet across lines, pigs consistently had lower feed efficiency, less fat and lower weight gain than pigs fed the control diet. However, other performance traits had conflicting results between generations 8 and 9. Within lines, compared to the control diet, pigs fed a LEHF diet had lower feed efficiency and less fat while gaining less weight.

Additionally, under a LEHF diet, compared to the HRFI line, the LRFI line had more lean and less fat growth, while eating less and gaining similarly, yet had similar feed efficiency. This change in effect on feed efficiency from the control to LEHF diet is likely due to larger differences in feed consumed by pigs under the control diet.

Overall, feed efficiency advantages selected for when fed one diet may not be seen when the diet is altered. Thus, utilization of alternative feed stuffs that decrease total feed

energy and increase fiber content of feed may decrease feed efficiency in all pigs.

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Table 1. Performance trait results by line*diet interaction.

		Control diet		LEHF diet	
		LRFI	HRFI	LRFI	HRFI
G8	ADFI, kg/d	2.17[b]	2.39[a]	2.14[b]	2.23[a,b]
	ADG, kg/d	0.64[a]	0.64[a]	0.51[b]	0.54[b]
	G:F	0.30[a]	0.27[b]	0.24[b]	0.25[b]
	BF, mm	22.42[b]	26.43[a]	17.97[c]	20.22[b,c]
	LMA, cm^2	45.19[a,b]	37.44[c]	46.57[a]	43.19[b]
G9	ADFI, kg/d	2.34[c]	2.44[b,c]	2.60[b]	2.73[a]
	ADG, kg/d	0.78[a]	0.76[a]	0.68[b]	0.70[b]
	G:F	0.34[a]	0.31[b]	0.26[c]	0.26[c]
	BF, mm	23.68[a]	25.82[a]	19.98[b]	23.92[a]
	LMA, cm^2	48.39[a]	47.35[a]	43.66[b]	41.38[b]

*Values within a row with different superscripts differ by P<0.05