Divergent Selection for Residual Feed Intake Impacts Carcass Composition of Pigs on High or Low Energy Diets

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Summary and Implications

Animals divergently selected for low and high residual feed intake (RFI) were fed either a high energy, low fiber (HELF) or low energy, high fiber (LEHF) diet. Regardless of line, pigs fed the LEHF diet had carcasses with reduced fat depth, loin depth, and greater percent lean. Line had no significant effect on carcass composition traits possibly due to line by sex interactions. Within the low RFI line, barrows had heavier carcasses with greater fat depth, while gilts had carcasses with a greater percent lean. Diet was the largest factor in final carcass composition of pigs in this study.

Introduction

Feed accounts for the largest cost in modern pork production. With feed prices on the rise, focus is being placed on alternate feedstuffs and improved animal efficiency. RFI is a feed efficiency measure currently being researched. RFI can be defined as the difference in observed feed intake of an animal from its expected feed intake based on average daily gain and back fat. Low RFI (LRFI) pigs are more efficient, consuming less feed than expected. High RFI (HRFI) animals consume more feed than expected, making them less efficient. Results of the fifth generation of ISU RFI selection projection indicate carcasses from LRFI pigs had greater loin depth and tended to have less backfat than a randomly selected control line. Research at the Insitut National de la Recherche Agronomique (INRA, France) in generation four of an RFI selection project concluded that carcasses from LRFI animals had less backfat and greater lean meat content than those of the HRFI line. Similar results were found in generation six. Therefore, the objective of this study was to evaluate the effects of divergent selection for RFI on carcass composition of pigs fed diets differing in energy and fiber content.

Materials and Methods

Pigs of the eighth and ninth generations of the ISU RFI selection project were used [n=161 LRFI (83 HELF, 78 LEHF), n=154 HRFI (79 HELF, 75 LEHF)]. LRFI animals have been selected since generation one, and divergent selection for a HRFI line was initiated in generation five. For each generation six pens were placed on the HELF diet (3.32 Mcal/Kg ME; 9.5% NDF) and six on the LEHF diet (2.87 Mcal/Kg ME; 24.6% NDF). Pigs were put on-test at 89.3 ± 3.9 days (35.8 ± 4.8 kg) and 107.2 ± 8.3 days (42.6 ± 7.0 kg) for generations eight and nine, respectively. Pigs were slaughtered in a commercial slaughter facility, and carcasses were chilled using a spray-chill scenario. In generation eight, harvests occurred in three groups over an eight week period (February – April) and generation nine occurred in two groups over a five week period (June – July). Mean off-test ages were 239.4 ± 19.8 days (122.5 ± 8.0 kg) and 227.2 ± 14.5 days (128.4 ± 8.0 kg) for generations eight and nine, respectively. Composition data collected in plant included hot carcass weight (HCW), and fat depth and LM depth using a Fat-O-Meat'er probe (SFK Technology A/S. Herlev, Denmark) collected at the 3rd/4th last rib eight cm off the midline. Calculated percent lean was calculated using the equation: 58.86 – [fat depth (mm) x 0.61] + [loin depth (mm) x 0.12].

Data were analyzed using MIXED procedure in SAS (v. 9.3, SAS Institute Inc., Cary, NC). The model included fixed effects of line, diet, sex, generation, line*diet, significant interactions between line*sex, sex*diet, and line*sex*diet were tested and left in the model if $P \leq 0.10$; random effects of slaughter group, pen, litter, and sire; and covariate of off-test live weight except for live weight itself.

Results and Discussion

LRFI pigs fed the HELF diet off-tested with a greater live weight and had carcasses with greater loin depth than all other line by diet interactions ($P<0.05$). Carcasses from LRFI gilts had greater hot carcass weight ($P=0.01$), fat depth ($P<0.05$), and tended to have a greater calculated percent lean ($P=0.06$) than carcasses from barrows. Regardless of line, pigs fed the HELF diet had a greater final live weight ($P<0.01$), and had carcasses with a greater HCW ($P<0.01$), fat depth ($P<0.01$), loin depth ($P<0.05$), and lesser percent lean ($P<0.01$; table 1). Increased energy may result in greater fat depth in pork carcasses as a lower proportion of the dietary energy intake must be used for maintenance. Gilts had carcasses with a greater loin depth ($P<0.05$) than carcasses from barrows. While line did not have an effect of HCW, fat depth, or percent lean, interactions did exist. In conclusion, carcass composition differences were observed within the LRFI line due to sex

and diet. However, regardless of line or sex, diet affected composition, with pigs on the LEHF diet having lighter carcasses with less fat depth and a greater percent lean.

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Table 1. Effect of selection of divergent residual feed intake (RFI), diets differing in fiber and energy content and sex on carcass composition traits of generation eight and nine pigs.

Trait	LRFI	HRFI	P-value	HELF	LEHF	P-value	Barrow	Gilt	P-value	Gen 8	Gen 9	P-value
Off-test live weight, Kg	125.8[1] (0.8)[2]	125.2 (0.8)	0.52	127.8 (0.9)	123.3 (0.9)	**<0.01**	126.7 (0.8)	124.4 (0.8)	**<0.01**	122.6 (0.9)	128.4 (0.9)	**<0.01**
HCW, Kg	94.4 (0.6)	94.0 (0.6)	0.34	96.9 (0.6)	91.5 (0.7)	**<0.0001**	94.5 (0.6)	93.9 (0.6)	0.26	96.8 (0.8)	91.6 (0.9)	**<0.05**
Fat depth, mm	19.8 (0.6)	20.7 (0.6)	0.25	21.6 (0.6)	18.9 (0.6)	**<0.01**	20.6 (0.5)	19.9 (0.5)	0.20	20.3 (0.6)	20.2 (0.7)	0.97
Loin depth, mm	59.9 (0.7)	58.5 (0.7)	*0.09*	60.4 (0.7)	58.0 (0.8)	**<0.05**	58.4 (0.7)	59.9 (0.7)	**<0.05**	58.8 (0.8)	59.5 (0.9)	0.56
Percent lean, %	53.96 (0.40)	53.25 (0.40)	0.21	52.93 (0.35)	54.28 (0.36)	**<0.01**	53.30 (0.36)	53.91 (0.34)	*0.09*	53.53 (0.40)	53.68 (0.44)	0.81

[1] Least square mean shown for each trait.
[2] (SE) shown for each trait.