PLASMA CONCENTRATIONS OF INSULIN-LIKE GROWTH FACTOR-I IN GILTS FROM TWO DIVERGENT GROWTH GENOTYPES

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Story in Brief

Concentrations of insulin-like growth factor-I (IGF-I) were measured in two lines of pigs selected for postweaning growth. The selection criteria were increased average daily gain for a rapid growth line (RGL) and decreased average daily gain for a slow growth line (SGL). A total of 28 gilts were sampled. Gilts were bled at 0, 4, 8, 16, 24, and 48 h postfeeding after an overnight fast. Throughout the sampling period, RGL gilts had significantly greater plasma insulin-like growth factor-I (IGF-I) concentrations than SGL gilts. In addition, plasma IGF-I concentrations increased between 0 and 48 h post-refeeding in both lines of gilts. In conclusion, plasma IGF-I concentrations are altered when pigs are selected for growth rate.

(Key Words: Insulin-like Growth Factor-I, Growth, Genotype, Swine.)

Introduction

A positive association between concentrations of insulin-like growth factor-I (IGF-I) in blood of farm animals and skeletal mass, protein accretion and body weight gain has been observed in numerous studies. Also, concentrations of IGF-I in blood of pigs are affected by quantity and composition of diet. Moreover, a positive association between plasma IGF-I and growth rate in pigs has been reported (Buonomo et al., 1987). Results of studies like these suggest that selection for an improved economic trait (e.g., daily gain) may alter expression of a single gene product such as IGF-I. Because previous studies have demonstrated possible genetic determinants of blood concentrations of IGF-I in several species including pigs (Buonomo et al., 1987) and cattle (Echternkamp et al., 1990; Spicer et al., 1991), our objective was to determine if concentrations of plasma IGF-I differed between

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two lines of pigs selected for rapid or slow postweaning gain.

Materials and Methods

Twenty-eight gilts were obtained from two lines of pigs selected for either increased average daily gain during postweaning growth (rapid growth line, RGL) or decreased average daily gain during postweaning growth (slow growth line, SGL). Each selection line was replicated in spring and fall farrowing groups. During the growing phase, intravenous catheters were inserted into gilts, then gilts were fasted for approximately 24 h and refed. Blood samples were collected at 0, 8, 16, 24 and 48 h post-refeeding. Concentrations of IGF-I in all plasma samples were measured by radioimmuonassay and total IGF-I binding protein activity in plasma samples from four gilts in each line was measured using a charcoal displacement assay (Echternkamp et al., 1990). Data were analyzed as a split-plot design with line and replicate as main plots, time post-refeeding as a subplot, and all appropriate interactions.

Results and Discussion

Line and time post-refeeding had a significant effect on concentrations of plasma IGF-I (Figure 1). No significant line x time interaction was observed. Averaged over time, RGL gilts had 37% greater concentrations of IGF-I than SGL gilts (464 versus 339 ng/ml, respectively). Breed differences exist in concentrations of IGF-I in blood of pigs (Buonomo et al., 1987). Specifically, larger, faster growing pigs (¼ Large White x ¼ Landrace x ½ Duroc) had 24 to 105% greater IGF-I concentrations than did smaller Yucatan micro and Hanford miniature pigs. Thus, the present and previous studies provide evidence for a genetic determinant of systemic IGF-I concentrations in pigs.

Concentrations of plasma IGF-I increased slowly with time post-refeeding in both lines of gilts (Figure 1). This suggests that the difference in plasma IGF-I between RGL and SGL gilts exists regardless of the level of nutrient intake. A slow increase in blood IGF-I levels after refeeding from a fasted state also has been reported in rats and humans (Underwood et al., 1986).

IGF-I binding protein activity tended ($P<.11$) to be greater in RGL versus SGL gilts (Table 1). Generally, IGF-I and IGF-I binding proteins are secreted concomitantly into the systemic circulation (Sara and Hall, 1990), consistent with the present findings. Genotypic differences in levels of IGF-I binding proteins have not been reported previously.

In summary, this research demonstrates that genotypic differences in

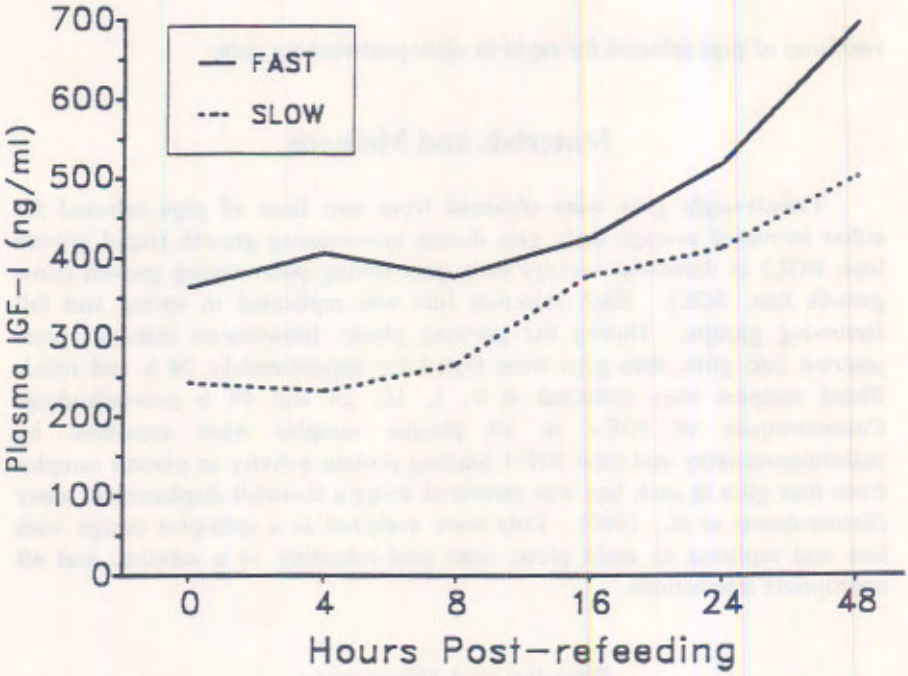

Figure 1. Differences in concentrations of plasma IGF-I in gilts selected for either rapid or slow growth. Pooled SE for rapid and slow growth gilts were 47 and 45 ng/ml, respectively.

Table 1. Least squares means of IGF-I binding protein activity (BPA) in plasma of gilts selected for rapid growth (RGL) or slow growth (SGL).

		IGF-I BPA (%)[a]			
		Volume of plasma (μl)			
Line[b]	N[c]	2	4	8	Pooled SE
RGL	4	1.3	4.0	6.1	.7
SGL	4	1.1	2.4	5.0	.6

[a]IGF-I BPA is expressed as percentage of [^{125}I]IGF-I specifically bound per sample.
[b]Line effect ($P < .11$).
[c]Number of gilts.

plasma IGF-I exists both pre- and post-refeeding in pigs. Thus, IGF-I may hold potential as a genetic marker for economical and biological important traits in swine.

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