Analysis of Body Weight and Feed Intake Curves in Selection Lines for Residual Feed Intake in Pigs

A.S. Leaflet R2455

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Summary and Implications

A selection experiment for reducing residual feed intake (RFI= feed consumed over and above expected requirements for production and maintenance) in Yorkshire pigs consists of a line selected for lower RFI (LRFI) and a random control line (CTRL). Using 64 LRFI and 87 CTRL boars from generation 5 of the selection experiment, cubic polynomial random regression with heterogeneous residual variance for daily feed intake (DFI) and with homogeneous residual variance for bi-weekly body weight (BW) were identified as the best linear mixed models to describe feed intake and body weight curves. Based on the Gompertz model, significant differences in the decay parameter for DFI and in mature body weight and the inflection point for BW were observed between the lines. In conclusion, selection for lower RFI has resulted in a lower feed intake curve toward maturity, lower mature body weight, and earlier inflection points for growth.

Introduction

To better understand the genetic basis of feed efficiency, a selection experiment for reducing RFI in Yorkshire pigs was begun in 2001. The selection experiment consists of two lines: a line selected for lower RFI (LRFI) and a randomly selected control line (CTRL). Previous generations used simple quadratic and linear regression on age on a pig-by-pig basis for DFI and BW, but these may not be optimal. The purposes of this study were to find the best linear mixed model to predict DFI and BW, and to evaluate the effect of selection for LRFI on BW and DFI curves.

Materials and Methods

A total of 151 pigs, 64 LRFI and 87 CTRL boars, from generation 5 with DFI and BW from ~3 to ~8 months of age were used. Forty linear mixed models with different order polynomials of age as fixed and random effects, and with homogeneous or heterogeneous residual variance by month of age, were fitted for both DFI and BW. Based on predicted residual sum of squares (PRESS) and residual diagnostics, the cubic polynomial random regression model was identified as the best linear mixed model for both DFI and BW. Both Logistic and Gompertz non-linear models were also fitted. Since both gave similar results, only results from the Gompertz model will be reported.

Results and Discussion

Compared to the original pig-by-pig models, the cubic polynomial random regression models fitted the data considerably better and decreased PRESS by 4% for DFI and by 42% for BW. The estimated population curves for the two lines based on the cubic polynomial regression and Gompertz models are shown in Figure 1 and 2.

Figure 1. Population curve for DFI

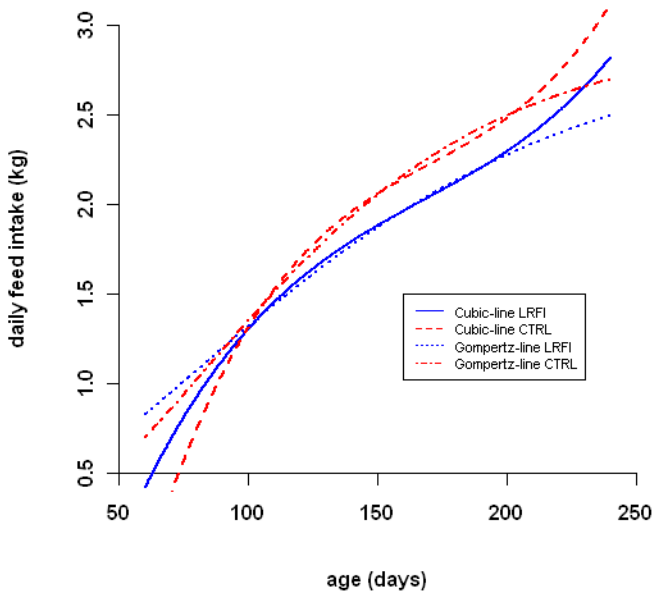
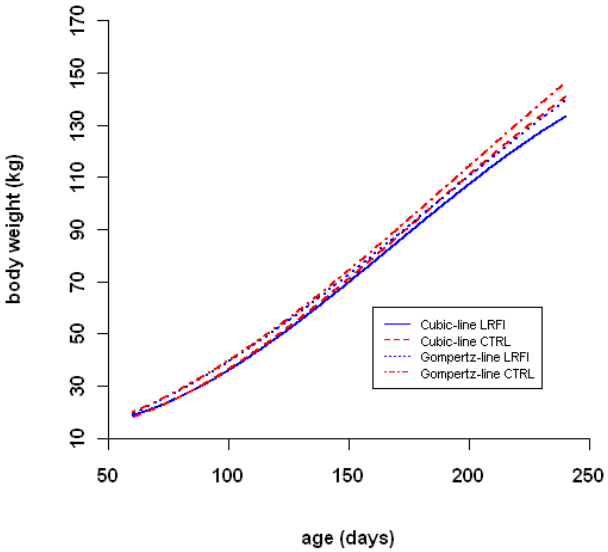


Figure 2. Population curve for BW



Curves from the Gompertz and the cubic polynomial regression models were very similar. However, for DFI, curves obtained from the cubic polynomial regression model increased or decreased sharply outside the range where the majority of the data was (~3 to ~6 months of age). For DFI, LRFI pigs had slightly lower mature feed intake (2.93 vs. 2.96 kg) and an earlier inflection point (80 vs. 84 d) but differences were not significant ($p > 0.1$). The LRFI line, however, had a significantly ($p=0.06$) greater decay parameter (87 vs. 65 d). For BW, LRFI pigs had a significantly ($p=0.02$) lower mature body weight (263 vs. 298 kg) and a significantly ($p=0.07$) earlier inflection point (182 vs. 194 d). The decay parameter was lower for LRFI pigs (128 vs. 135 d) but not significant ($p>0.1$).

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