

Growth Curves of Pigs on Test

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- 52 to 200 days of age
- Up to 120 kg BWT (or 140 kg?)
- 3 and more weights
- Daily feed intake, visits, duration.
- 1-3 backfat scans, last weighing.

- Pigs from 34 Quebec farms.
- Three breeds (Y, L, D).
- 2007 to 2010.
- 1082 pigs.
- 6-9 wts per pigs, complete feed intake.

- 21,592 pigs in, 956 insufficient data, discarded.
- 20,636 pigs with FI data and with pedigree info.
- Three breeds (Y, L, D).
- 2004 to 2012.
- Birth, start of test, end of test - minimum wts.
- Feed Intake: 14 consecutive days or more.

Objectives

- Estimate daily body weights
- Estimate accumulated feed intake curve
- Estimate daily protein and lipid deposition
- Estimate breeding values for each pig for their curve parameters

$$BWT_t = A / (1 + B \cdot \exp(-C \cdot x))$$

- t = age in days, and $x = 2(t - 103.5)/51.5$
- Birthweight of 1.5 kg assumed, unless known.
- Weights should be continuously increasing.
- A , B , and C estimated for each pig, then daily weights calculated over test period. (Evolutionary Algorithm)

Example Weight Curve Values

	YO F	YO M	LA F	LA M	DU F	DU M
A	132.2	132.8	133.6	133.2	129.2	130.6
B	1.74	1.50	1.68	1.40	1.00	1.51
C	0.92	1.01	0.94	1.03	1.02	1.03



Accumulated Feed Intake Curve

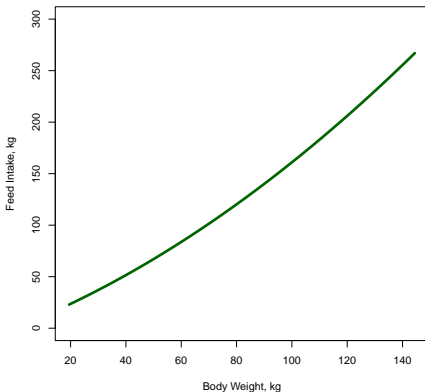
$$acfi_t = b_0 + b_1 \cdot BWT_t + b_2 \cdot (BWT_t)^2$$

- $BWT = WT / (MaxWT)$ to give numbers from 0 to 1.
- $acfi$ scaled to make all of them a positive number.
- Simple linear regression.

Example ACFI Curve Values

	YO F	YO M	LA F	LA M	DU F	DU M
b_0	-291.1	-212.9	-330.8	-228.4	-115.28	-189.8
b_1	472.6	390.6	507.7	405.8	341.0	370.0
b_2	0	0	0	0	0	0

Average Feed Intake Curve



$$TL_t = c_0 + c_1 \cdot acfi_t$$

$$TP_t = d_0 + d_1 \cdot BWT_t$$

Differential Evolutionary Algorithm.

DE Procedure I

1. Starting values for c_0 , c_1 , d_0 , d_1 .
2. Calculate TL and TP for all days on test.
3. Convert to daily lipid and protein values.
4. Determine $PDmax$.
5. Water content,

$$h2o = 4.322 + 0.0044 \cdot PDmax$$

6. Empty body weight

$$eBW1_t = BWT_t - 0.3043 \cdot (BWT_t)^{0.6}$$

and

$$eBW2_t = (1.189 \cdot TP_t + TL_t) + h2o \cdot (TP_t)^{0.855}$$

7.

$$err_t = eBW1_t - eBW2_t$$

and

$$cfit = cfit - (err_t)^2$$

over all t .

8. Metabolizable energy intake, (total end of test)

$$MEi = 3250 \cdot \sum (DFI)_t$$

9. Maintenance energy is

$$ME_m = NRG \cdot \sum (BWT)_t^{0.6}$$

10. Difference is

$$(MEi - ME_m) = 12.5 \cdot TL + 10.6 \cdot TP.$$

11. NRG, energy requirement of pig is

$$NRG = (ME_i - 12.5 \cdot TL - 10.6 \cdot TP) / (\sum (BWT)^{0.6})$$

12. Lipid to Protein Ratio

$$LPR = TL/TP$$

13. Predicted backfat

$$pBF = -5.0 + 12.3 \cdot LPR + 0.13 \cdot TP$$

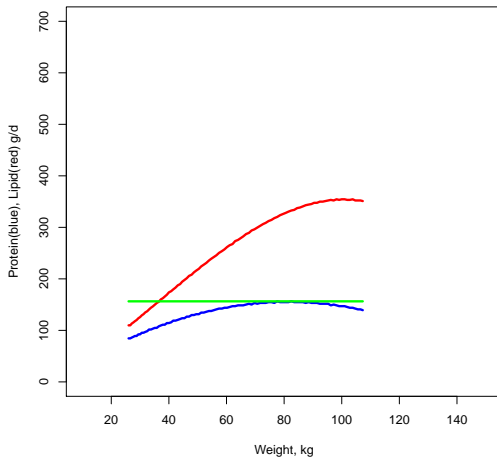
14. Difference between pBF and actual BF minimized too.

Example Protein, Lipid Functions

	YO F	YO M	LA F	LA M	DU F	DU M
c_0	.0113	.0050	.0111	.0050	.0242	.0032
c_1	.0926	.1042	.0866	.0999	.1367	.1167
d_0	.0081	.0030	.0065	.0027	.0124	.0020
d_1	.1485	.1476	.1492	.1478	.1517	.1475
PD_{max}	173.4	191.4	179.1	194.5	189.8	191.1
NRG	450.1	358.4	520.7	389.2	190.6	304.1

Example Animal

8400 156.39 80.05 127.5 172.46 18.2



Estimation of Genetic Parameters

Multiple trait model (11 traits)

- weights (A, B, C)
- feed intake (b_1)
- Lipid (c_1)
- Protein (d_1)
- LPR , Backfat, NRG, PD_{max}
- Number of visits, duration of feeding (averages)

Pedigrees, 38,894 animals

Bayesian, Gibbs Sampling, 100,000 samples

Questions?