Prediction of individual breeding values from group recordings

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gudp

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Introduction

Breeding for reduced feed intake is important to

- reduce cost
- reduce CO2 emission

Individual feed records are costly

How can we get more phenotypes?

Solution: Group records of feed intake

- Set up an experiment

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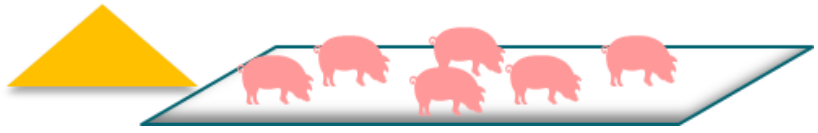
Objectives

1) To investigate if group feed records of large groups (20 pigs) are feasible in a practical selection program
2) To predict individual breeding values for feed intake

Feed intake of groups



Mean feed intake: 47.7*kg/day*

Literature

- Olson et al. (2006) *J Anim Sci 84:88-92*
- Su et al. (2018) *Genet Sel Evol 50:42*
- Hongding et al. (2019) *Genet Sel Evol ?:?*

Experimental set up

1) Group records (single nucleus herd) 646 records
   from 323 feeding group 2 pen/group & ~10 pigs/pen
   6439 pigs growing from ~30 kg to 100 kg
2) Individual records (test station)
   271001 daily FI records from
   4526 Landrace boars growing from ~30 kg to 100 kg
3) Pedigree size: 19734

ad libitum feeding

Scenario

1. Individual records with **A**
2. Individual + group records with **A**

Regression models with random coefficients

individual records

$$y_{ik} = \boldsymbol{x}_{ik}^T \boldsymbol{\alpha} + \sum_{m=0}^{d} \beta_m t_{ik}^m + \sum_{m=0}^{s} a_{im} t_{ik}^m + \varepsilon_{ik}$$

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individual records

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group records

$$y_{jk} = \boldsymbol{x}_{jk}^T \boldsymbol{\alpha}^* + \sum_{m=0}^{d*} \beta_m^* t_{jk}^m + \sum_{i=1}^{n_{jk}} \sum_{m=0}^{s*} a_{im}^* t_{ik}^m + e_{jk}$$

Regression models with random coefficients

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group records

$$y_{jk} = \boldsymbol{x}_{jk}^T \boldsymbol{\alpha}^* + \sum_{m=0}^{d*} \beta_m^* t_{jk}^m + \sum_{i=1}^{n_{jk}} \sum_{m=0}^{s*} a_{im}^* t_{ik}^m + e_{jk}$$

$$\begin{pmatrix} a_0^* & \cdots & a_{s*}^* a_0 & \cdots & a_s \\ \vdots & & \vdots & \vdots & \vdots \end{pmatrix} \sim N(G \times A)$$

$$e_{ik} \sim N(0, \sigma_\varepsilon^2), e_{jk} \sim N(0, \sigma_e^2)$$

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Genetic co-variances in ***G*** and correlations

Co-variances above / correlations below diagonal

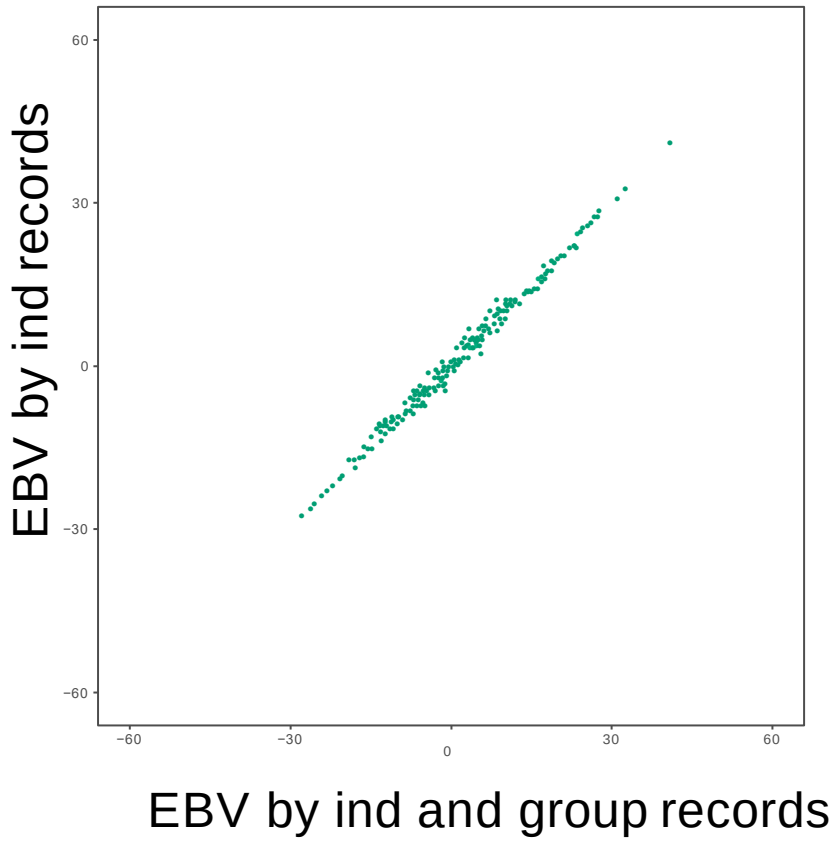
	a_0^*	a_1^*	a_0	a_1	a_2
a_0^*	0.37	0.25	0.05	0.02	0.01
a_1^*	0.76	0.28	0.04	0.03	0.01
a_0	0.33	0.27	0.06	0.05	0.01
a_1	0.15	0.23	0.73	0.06	0.02
a_2	0.11	0.23	0.20	0.66	0.01

Individual breeding values

An individual BV for each animal was calculated as the aggregated sum of daily feed intake from day 0 to day 60

$$a_{FI,i} = \sum_{k=0}^{60} \sum_{m=0}^{s} a_{im} t_{ik}^{m}$$

Breeding values



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Discussion

- Effect of group records was less than expected.
- Su et al. (2018) found genetic correlation up to 0.7
- Individual and group recordings are different traits
- $G \times E$
  - insufficient recording of the group
  - prior selection of boars to test station

Conclusion

- Even though, the effect was less than expected
- group records increase the accuracy of breeding values of feed intake

Thank You !