Estimates of genetic parameters for scan measurements in Australian Brahman and Santa Gertrudis adjusting for age versus adjusting for weight at scanning

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Introduction

- Scan records taken in the field provide information for BREEDPLAN carcass EBVs
  - adjusted to common market weight
- Should scan records be adjusted to common age or common weight?
  - effects on genetic parameters?
Data

- Field ultrasound scan records (up to 9/96)
- Breeds
  - Santa Gertrudis (N=5587)
  - Brahman (N=3634)
- Traits
  - P8 fat depth (mm)
  - Fat depth at 12th/13th rib (mm)
  - Eye muscle area (cm²)
  - Weight at scanning (kg)
Adjustment of records

- Account for age within model of analysis
  - fit linear & quadratic covariable (within sex)
- Pre-adjust to mean age
  - X-intercept approach
- Pre-adjust to mean weight
  - Calculate predicted age at mean weight
  - X-intercept adjustment using predicted age
Adjusting to common age

Mean trait

Adjusted trait

X-intercept

Mean age

Estimated regression of trait on age

Observed trait

‘Observed’ age
Adjust to common weight: Step 1
Adjust to common weight: Step 2

Mean trait

Adjusted trait

X-intercept

Mean age

Observed trait

Predicted age at mean weight

age

age*
Notation

- No superscript :
  - unadjusted trait

- Superscript “+” :
  - trait pre-adjusted to mean age

- Superscript “*”
  - trait pre-adjusted to mean weight
Effect of adjustments
(P8, 600 days, Santa Gertrudis)

- Adjust to mean age
  - little effect on mean & sd of trait
- Adjust to mean weight
  - slight ↓ in mean
  - bigger ↓ in sd of trait
  - ↑ in mean age*
  - ↑ ↑ in sd age*
Analyses

- REML analyses - simple animal model
  - univariate & fourvariate
- Fixed effects
  - contemporary groups
  - “heifer factor” (heifer vs cow)
  - Dam age - linear & quadratic covariable
  - Age at scanning - linear & quadratic cov.
    - unadjusted records only → supply estimates of regression on age
### No. of records

<table>
<thead>
<tr>
<th></th>
<th>400 d</th>
<th>600 d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Santa Gertrudis</strong></td>
<td>1152-1230</td>
<td>3684-3688</td>
</tr>
<tr>
<td><strong>Brahman</strong></td>
<td>745-791</td>
<td>2177-2303</td>
</tr>
</tbody>
</table>
P8 fat depth

Santa Gertrudis

Brahman

Variance

Heritability

400 days

600 days

400 days

600 days

P8
P8+
P8*
RIB fat depth

Santa Gertrudis

Brahman

Variance

Heritability

400 days  600 days

400 days  600 days

RIB
RIB+
RIB*

Legend:

- RIB
- RIB+
- RIB*
Eye muscle area

Santa Gertrudis

Brahman

Variance

Heritability

EMA
EMA+
EMA*

400 days
600 days

400 days
600 days
Results - 1

- Heritabilities
  - similar magnitude than in *bos taurus*
  - higher for scanning at later ages

- Adjusting to common weight tended
  - to reduce phenotypic variance (EMA*, RIB*)
  - to increase heritabilities
  - produce predicted ages with much larger ranges & variances than observed ages

- Similar results for pre-adjustment for age & adjustment within model of analysis
Estimates of correlations -1
600 days

Santa Gertrudis

Brahman

Genetic

Phenotypic

Original scale
P8*, RIB*, EMA*
Estimates of correlations -2

600 days

Santa Gertrudis

Brahman

Genetic

Phenotypic

SWT,P8  SWT,RIB  SWT,EMA  SWT,P8  SWT,RIB  SWT,EMA

Original Scale
P8*, RIB*, EMA*
Results -2

● Correlation estimates
  ● high $r$ (P8, RIB)
  ● moderate $r$ (SWT, EMA)
  ● low $r$ otherwise

● Adjusting to common weight changes correlation structure
  ● no change $r$ (P8, RIB)
  ● slight $\downarrow$ $r$ (EMA, fat depth)
  ● $\downarrow \downarrow$ $r$ (SWT, scan traits)
Conclusions

- Adjusting scan records to common weight rather than age increases heritabilities.
- But: correlations with scanning weight are reduced/close to zero.
  - Implications for genetic evaluation when most animals have weight records only & obtain EBVs for carcass traits through correlated information?