Estimates of genetic correlations between pelvic measurements and calving ease for Australian Angus

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Introduction

- Calving difficulties: discrepancies
  - size & shape of calf
  - size & shape of pelvic opening of dam
- Pelvic measurements useful to reduce incidence of difficult calvings?
- Auxiliary selection criterion?
  - heritability & variability
  - genetic correlation with calving ease
Data

- 300 to 700 days of age
- Rice pelvimeter
  - internal measurement
  - invasive procedure

Earlier results (Bunter & Upton 1995)
- PM moderately to highly heritable
- strong, positive genetic correlation between PM on males & females
Data - 2

- Need records on calving performance of heifers measured to assess correlation with calving ease
  - now available

- Calving ease scores (1-5)
  - 21,191 Angus calves born 1989-96
  - low incidence of difficult calvings
    - 1.85% of birth “assisted” (2)
    - 0.76% of birth “difficult” (3)
    - 6 births “veterinary assistance” (4)
Traits

- Measured on heifers
  - $\text{PH}$: pelvic height (cm)
  - $\text{PW}$: pelvic width (cm)
  - $\text{PA}$: pelvic area (cm$^2$)
  - $\text{HH}$: hip height (cm)
- Treated as trait of the calf
  - $\text{CE}$: calving ease (score 1-5)
# No. of records - PM

<table>
<thead>
<tr>
<th></th>
<th>400 d</th>
<th>600 d</th>
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</thead>
<tbody>
<tr>
<td><strong>PH, PW, PA</strong></td>
<td>6034</td>
<td>1952</td>
</tr>
<tr>
<td><strong>with CE score</strong></td>
<td>3952</td>
<td>943</td>
</tr>
<tr>
<td></td>
<td>PH</td>
<td>PW</td>
</tr>
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<td>-------</td>
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</tr>
<tr>
<td>400 d</td>
<td>14.4</td>
<td>12.1</td>
</tr>
<tr>
<td>600 d</td>
<td>16.0</td>
<td>13.5</td>
</tr>
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</table>
CE : Univariate analyses

- REML, animal model
  - pedigree info up to 2 generations back
- examine importance of maternal eff.s
  - genetic
  - permanent environmental
- Fixed effects
  - contemporary groups
  - “heifer factor” (age of dam class)
  - dam age as linear & quadratic covariable
Treat CE
- as continuous trait
- as trait of the calf born

\[ P_{CE} \quad h^2 \quad A_{calf} \]

\[ c^2 \quad m^2 \quad r_{AM} \]

\[ C_{dam} \quad M_{dam} \quad A_{dam} \]

1/2
CE : Results

- Model fitting genetic & p.e. maternal effects assuming $r_{AM} \neq 0$ fitted best
  - Direct heritability $h^2 = 0.05$
  - Maternal heritability $m^2 = 0.04$
  - Permanent environmental maternal effect $c^2 = 0.33$
  - Direct-maternal genetic correlation $r_{AM} = -0.47$
  - Antagonistic relationship plausible (size)
  - Some bias?
CE + PM: Bivariate analyses

- PM: Fit direct genetic effects only
- CE: Fit
  - direct & maternal genetic effects
  - maternal perm. environmental effects

Estimate correlations CE & PM
- direct genetic correlation
- direct-maternal genetic correlation
- residual
Direct heritability estimates for PM
CE + PM: Estimates -2

Direct genetic correlations

- PH
- PW
- PA
- HH

400 d
600 d
Correlations between direct effects for PM & maternal effects for CE
Results

- Low correlations for records at 400 d

- Records at 600 d:
  - Low to moderate, antagonistic direct genetic correlations (0.2 to 0.6)
    - calves with larger PM tend to have more difficult birth
  - Low, favourable direct-maternal genetic correlations (-0.3 to -0.5)
    - cows with larger PM tend to have calves born with lower CE scores
Conclusions

- PM *can* assist in selection against calving difficulties ...
- But:
  - Invasive procedure
  - Correlations are low!
    - different for breeds with higher incidence of calving difficulties?
- Recommend:
  - selection based on EBVs for CE, BW & GL