Genetic variation and consistency among feed efficiency traits in Holstein and Jersey cows

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Feed efficiency

• Importance
  – Feeding costs
  – Environment

• Difficulties
  – Recording feed efficiency traits
Holstein vs. Jersey cows

• Size/weight
• Milk production
• Intake capacity
Aims

• Do genetic parameters of feed efficiency traits differ between breeds?

• Do these parameters change throughout lactation?
Materials and methods

• Danish Cattle Research Centre
• 518 first parity Holstein and 264 Jersey cows
• Weekly records from weeks 1-40 of lactation
  – Dry matter intake (DMI)
  – Energy corrected milk yield (ECM)
  – Live weight (LW)
    • Metabolic body weight (MBW) = LW^{0.75}
• Lactation divided in ten four week periods
Model

- Within period model:

\[ DMI = \mu + \text{week} + \text{year} + \text{season} + \text{management} + \text{animal} + \text{permanent environment} + \text{residual} \]
Model

• Within period model:

\[ \text{DMI} = \mu + \text{week} + \text{year} + \text{season} + \text{management} + \text{animal} + \text{permanent environment} + \text{residual} \]
Model

• Within period model:

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Dry matter intake - heritability

- Holstein
- Jersey

Heritability

Week of lactation
Dry matter intake - repeatability

Repeatability vs. Week of lactation for Holstein and Jersey cows.
Genetic correlations

• Bivariate model (DMI, ECM, MBW)

\[ Y = \mu + \text{week} + \text{year} + \text{season} + \text{management} + \text{animal} + \text{permanent environment} + \text{residual} \]
# Genetic correlations

<table>
<thead>
<tr>
<th></th>
<th>DMI</th>
<th>ECM</th>
<th>MBW</th>
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</thead>
<tbody>
<tr>
<td>Holstein</td>
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<tr>
<td>DMI</td>
<td>0.28</td>
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<tr>
<td>ECM</td>
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<td>MBW</td>
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</table>
Adjusted feed intake

\[ DMI = \mu + \text{week} + \text{year} + \text{season} + \text{management} + \beta_1 \cdot ECM + \beta_2 \cdot MBW + \beta_3 \cdot LWchange + \text{animal} + \text{permanent environment} + \text{residual} \]
Adjusted feed intake

\[ DMI = \mu + \text{week} + \text{year} + \text{season} + \text{management} + \beta_1 \cdot \text{ECM} + \beta_2 \cdot \text{MBW} + \beta_3 \cdot \text{LWchange} + \text{animal} + \text{permanent environment} + \text{residual} \]
Adjusted feed intake

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Adjusted feed intake

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Adjusted feed intake - heritability

![Graph showing adjusted feed intake heritability over the week of lactation for Holstein and Jersey cows. The graph plots heritability on the y-axis and week of lactation on the x-axis. The data points for Holstein are represented by black dots, and the data points for Jersey are represented by orange dots.](image-url)
Adjusted feed intake - repeatability
Conclusion

- Dry matter intake and adjusted feed intake are heritable traits
- Genetic parameters do not differ significantly between breeds or throughout lactation