Maternal components affect the genetic variation of meat production in reindeer

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• A middle-sized domesticated deer
• Weight comparable to a heavy sheep breed

<table>
<thead>
<tr>
<th>Weight</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>birth weight</td>
<td>5 kg</td>
</tr>
<tr>
<td>autumn weight</td>
<td>40-60 kg</td>
</tr>
<tr>
<td>(carcass)</td>
<td>25 kg</td>
</tr>
<tr>
<td>biggest males</td>
<td>100 kg</td>
</tr>
</tbody>
</table>

• Unique ability to digest lichen
• Well adapted to arctic/subarctic condition
• Females have antlers – even over winter
• Seasonally migrating

Reindeer
The Fennoscandian reindeer herding area

Lat. 60°N
Lat. 70°N

Sami reindeer herding

Non-Sami reindeer herding

Fennoscandian reindeer herding area

Öje Danell
If meat production is to be improved, the selected traits would be

- **calf survival**

- **calf weight**

Calves grow over a limited period → **growth important**
Before selection, understanding of genetic variation

Research data from Reindeer Herders’ experimental herd (Kutuharju), collected by Fish and Game Research Institute

Records on reindeer born over the period 1987-2009, altogether 1709 individuals

Weight has lots of variation, influenced also by non-genetic factors.
Kutuharju reindeer – individual growth (kg) by age (y)

fast growth in the summer – weight changes little or rather decreases in the winter
Parity effect on birth weight (kg)

Males
Females
Fixed effects

birth weight and growth rate
  • sex (2 classes)
  • birth year (23 classes)
  • parity (small no. records → only three classes: parities 1–2, 3–8, 9–)

calving time in spring (two periods with varying cut point over years) for birth weight

autumn weights not corrected for the age at weighing.
Kutuharju data is unique because

1) sires of individuals are also known -

Norwegian research on male reindeer’s reproductive research
Oystein Holand’s group
research done at Kutuharju
microsatellite typing for sire assignment
→ possible to separate maternal effects

2) birth weights are recorded
Number of weighed animals and of their known dams and sires in the data of the period 1987 – 2009 (purchased animals’ parents outside the pedigree)

<table>
<thead>
<tr>
<th></th>
<th>number born</th>
<th>sires unknown, dam known</th>
<th>both sire and dam known</th>
<th>purchased animals</th>
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<tbody>
<tr>
<td>No. animals</td>
<td>1706</td>
<td>871</td>
<td>835</td>
<td>48</td>
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<tr>
<td>No. known parents</td>
<td>289 dams</td>
<td>245 dams</td>
<td>71 sires</td>
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In addition to the recorded individuals, pedigree information is available from 3096 individuals.

Annually no. sires, 3-5 on average (max 13), no. dams 57-94.
Models

Calf’s direct effect

Calf’s direct effect + maternal effect

Calf’s direct effect + maternal genetic and permanent environmental effect
Estimates of direct ($h^2_a$) and maternal ($h^2_m$) heritabilities, proportion of dam’s permanent environmental variance over phenotypic variance ($c^2$) and direct-maternal correlations ($r_{am}$) in reindeer birth weight and growth rate.

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<th>model</th>
<th>$h^2_a$</th>
<th>$h^2_m$</th>
<th>$c^2$</th>
<th>$r_{am}$</th>
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<tr>
<td>BW</td>
<td>a</td>
<td>0.50±0.05</td>
<td></td>
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Dam affects calf’s growth and survival in many ways

- calving time (depends on dam’s fitness)

- milk production

- guidance over the first winter
Conclusions

- further analysis of maternal effect
  - jointly with other traits

- more traits: yearling weight, calving time, survival (summer, winter)

- more data needed
  - Swedish records, high numbers but unknown sires
  - use of records from ordinary herds
  - SNP typing to construct pedigrees?

- analysis of herder interviews on selection practices
Acknowledgements

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