Possibilities of implementing measures from Automatic Milking Systems in routine evaluations of Udder Conformation and Milking Speed

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Outline

- Background and data collection
- Udder conformation
  - Teat co-ordinates
- Time usage
  - Fat and protein flow
Advantages of data from milking robots

- Repeated measurements of a variety of traits
- Objective measurements
- Measured on all cows in milk
- Measured over more lactations
- Data is available – why not use them?
Data collection from AMS herds

- Collected by technicians in connection with milk recording
- Data are subsequently transferred to the national cattle database
- At present only data from Lely’s milking robots
- Danish Cattle Federation collaborates with Lely in transferring data in real time – long-term strategy
How to handle repeated measurements

- Great many observations
- Average of the variable in question over a period of time
- Presumably more sophisticated methods to utilize the information to the full
Udder conformation

- 130 000 Danish cows are classified per year
- The majority of the cows are 1st parity cows

- Wish for EBVs based on later parities

- Possibility to apply information on teat co-ordinates in the genetic evaluation?
Teat co-ordinates

- Front teat placement
- Rear teat placement
- Distance, front - rear
- Udder balance
- Udder depth
Data set and choice of model

- The udder conformation study is based on Holstein $1^{st}$ parity data
  - 2,591 cows with AMS data
    - AMS data from February ‘11 to May ’12
    - Avg. of obs. 30-60 DIM
  - 102,816 classified cows
    - Year > 2006
  - 1,490 cows having both
Model – udder conformation

- Bi-variate linear animal model

\[ AMS = HY + AGE + MO + a + e \]

**Assessment** = HYS + AGE + MO + CLA + CA + a + e

- Where

HY = herd*year, HYS = herd*6 month, AGE = age at calving, MO = calving month, CLA = classifier*2 month, CA = distance calving-assessment, a = additive genetic effect, and e = residual
Heritabilities and genetic correlations

<table>
<thead>
<tr>
<th>Trait</th>
<th>$h^2$ (S.E.) - AMS</th>
<th>$h^2$ (S.E.) – CLA</th>
<th>$r_g$ (S.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front teat placement</td>
<td>0.46 (0.06)</td>
<td>0.31 (0.01)</td>
<td>0.92 (0.04)</td>
</tr>
<tr>
<td>Rear teat placement</td>
<td>0.38 (0.05)</td>
<td>0.32 (0.01)</td>
<td>0.94 (0.04)</td>
</tr>
<tr>
<td>Distance, front - rear</td>
<td>0.46 (0.09)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Udder balance</td>
<td>0.44 (0.07)</td>
<td>0.22 (0.01)</td>
<td>0.90 (0.04)</td>
</tr>
<tr>
<td>Udder depth</td>
<td>0.65 (0.06)</td>
<td>0.42 (0.01)</td>
<td>0.94 (0.02)</td>
</tr>
</tbody>
</table>

- High heritabilities
  - AMS > Classifiers assessments

- High genetic correlations
Partial conclusion – Udder conformation

- Teat co-ordinates from robots will be included in the genetic evaluation in the future
- More reliable indices for later lactations
- More reliable indices for cows not classified
- Cheaper registrations
Fat and protein flow in kg per minute

- Fat and protein flow is already included in joint Nordic routine evaluation for milkability
  - Milkmeters (DK) or assessed by dairy farmers

- Data from milking robots are not yet included in the genetic evaluation

- Possibility to add information on fat and protein flow from milking robots in routine evaluation?
Time usage

- Preparation time
- Attachment time
- Milk let-down
- Milking time
- Post treatment time

Box time - start

Box time - end

Durations
Data set and choice of model

- The flow study is based on Holstein 1\textsuperscript{st} parity data

- 4 050 cows with F+P flow from AMS
  - 900 with assessments

- 272 043 cows with F+P flow from milkmeters
  - 47 000 with assessments

- No cows with both types of F+P flow

- AMS data from May ‘05 to February ‘11
Calculated F+P flow AMS

- One observation per cow
  - First milk recording 30-240 DIM

- 14 days moving average of milk yield per milking calculated in the robot

- Fat and protein percentages from milk recording

- 14 days moving average of milking time
Model – Fat and protein flow

- Tri-variate linear animal model

\[
\text{F+P flow}_{\text{AMS}} = HYS + \text{AGE} + \text{MO} + \text{CM} + a + e
\]

\[
\text{F+P flow}_{\text{Milkmeter}} = HYS + \text{AGE} + \text{MO} + \text{CM} + a + e
\]

\[
\text{Assessment} = HYS + \text{AGE} + \text{MO} + \text{CA} + a + e
\]

- Where

  - HYS = herd*6 month
  - AGE = age at calving
  - MO = calving month
  - CM = distance calving-milkrecording
  - CA = distance calving-assessment
  - a = additive genetic effect
  - e = residual
Genetic parameters for flow

- $h^2$ for flow from robots and milk recording are high
- $h^2$ for assessments and flow from milk recording are very close to previous estimates
- High genetic correlations between the traits

Heritabilities and **genetic correlations** (S.E.)

<table>
<thead>
<tr>
<th></th>
<th>$h^2$</th>
<th>Assessments</th>
<th>Flow, milkmeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow (F+P), AMS</td>
<td>0.63 (0.07)</td>
<td>0.91 (0.05)</td>
<td>0.94 (0.03)</td>
</tr>
<tr>
<td>Assessments</td>
<td>0.20 (0.02)</td>
<td>-</td>
<td>0.91 (0.02)</td>
</tr>
<tr>
<td>Flow (F+P), milkmeter</td>
<td>0.41 (0.01)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Partial conclusion - Flow

- It is possible to use flow from robots in the genetic evaluation

- Limited effect on the EBVs of the bulls
  - There are already many observations from electronic milkmeters

- Cows from AMS herds will be genetically evaluated
Conclusions

- According to the preliminary results it is possible to use:
  - Teat co-ordinates in the genetic evaluation of udder conformation
  - Fat and protein flow from milking robots in the genetic evaluation of milking speed