Mare's milk production with Lipizzan mares

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Background

- Small, not competitive populations
- From 2004 the responsibility for horse breeding in the Faculty
- Reorganization of the EER centre
- Indigenous breed – Lipizzan horse
- All-round horse
The aim

- How to make breeding sustainable?
Possibilities

- Sport - just some horses
- Riding – driving school
- Leisure use
- Tourism
- EAAT
- Agriculture and forestry
- Meat production & processing
- Milk production & processing
Equine Education & Research centre

- Unit of Biotechnical Faculty
- Only Lipizzan horses from 2009
- First foals in 2009
- First mare’s milk samples in 2010
- First routine milking in 2011
Lipizzan mares

- All three in 8\textsuperscript{th} year of age
- 2\textsuperscript{nd} foaling

<table>
<thead>
<tr>
<th>Mare</th>
<th>WH</th>
<th>CG</th>
<th>Foaling Date</th>
<th>Foal sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bistrica IV</td>
<td>156</td>
<td>187</td>
<td>14\textsuperscript{th} of March</td>
<td>female</td>
</tr>
<tr>
<td>Thais VII</td>
<td>159</td>
<td>186</td>
<td>27\textsuperscript{th} of April</td>
<td>female</td>
</tr>
<tr>
<td>Famosa XI</td>
<td>160</td>
<td>198</td>
<td>10\textsuperscript{th} of March</td>
<td>male</td>
</tr>
</tbody>
</table>
Routine milking

- Machine milking

- Starting in 9th week of lactation
  - From Monday to Friday
  - Weekend - resting

- Weaning at 7:30 AM

- Milking at 10:30 AM, 1:30 and 4:30 PM
Milking technology

- 5 weeks experiment:
  - from mid August to mid September
  - 4\textsuperscript{th} to 6\textsuperscript{th} month of lactation

- Each week on Thursday:
  - Collecting milk samples
    - Each milking (n = 3/day) of each mare (n = 3)
  - Milk yield recording (volume – mL)
  - Chest girth of mare’s and foals recording
Experiment ≠ Routine!

- Even we train experiment work flow before

- After each mare milking
  - Measure the volume of the milk yield
  - Prepare the milk samples for lab

- Other people involved
Mare’s milk quality & quantity

- Milk yield (MY)
- Protein content (PC)
- Fat content (FC)
- Lactose content (LC)
- Somatic cell count (SCC)
- Total bacteria count (BC)
- Freezing point (FP)
Chest girth

- Measured each TD after weaning
  - Foals
  - Mares

**Estimated Body Weight (kg) = G³ x 90**

G = chest girth in metres

- Daily gain = gain EBW/28 days
Data analysis

- PCA – outliers detection
- Descriptive statistics
- Correlations
- Variance analysis
  - Effects mare, milking, TD, foal CG, mare CG, DIM, …
## Descriptive statistics (N=45)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Mean</th>
<th>Std</th>
<th>CV</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield (g)</td>
<td>1029.8</td>
<td>706.88</td>
<td>68.6</td>
<td>160</td>
<td>2680</td>
</tr>
<tr>
<td>Protein content</td>
<td>1.51</td>
<td>0.106</td>
<td>7.1</td>
<td>1.25</td>
<td>1.71</td>
</tr>
<tr>
<td>Fat content</td>
<td>0.40</td>
<td>0.296</td>
<td>73.4</td>
<td>0.03</td>
<td>1.28</td>
</tr>
<tr>
<td>Lactose content</td>
<td>6.32</td>
<td>0.214</td>
<td>3.4</td>
<td>5.76</td>
<td>6.61</td>
</tr>
<tr>
<td>Somatic cell count</td>
<td>6556</td>
<td>3194.9</td>
<td>48.7</td>
<td>2000</td>
<td>17000</td>
</tr>
<tr>
<td>ISCC (LOG2)</td>
<td>12.5</td>
<td>0.72</td>
<td>5.8</td>
<td>11.0</td>
<td>14.1</td>
</tr>
<tr>
<td>Total bacteria count</td>
<td>114,689</td>
<td>145,667</td>
<td>127.0</td>
<td>7,000</td>
<td>650,000</td>
</tr>
<tr>
<td>IBC (LOG10)</td>
<td>4.74</td>
<td>0.551</td>
<td>11.6</td>
<td>3.85</td>
<td>5.81</td>
</tr>
<tr>
<td>Freezing point</td>
<td>-0.505</td>
<td>0.020</td>
<td>4.0</td>
<td>-0.528</td>
<td>-0.443</td>
</tr>
</tbody>
</table>
Raw data of 1st TD

<table>
<thead>
<tr>
<th>My (mL)</th>
<th>Content %</th>
<th>Milking Mare</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
<td>PC</td>
<td>MY</td>
</tr>
<tr>
<td>Thais</td>
<td>Thais</td>
<td>Famosa</td>
</tr>
<tr>
<td>Bistrica</td>
<td>Bistrica</td>
<td>Bistrica</td>
</tr>
</tbody>
</table>
Raw data of 1st TD - BC

![Bar chart showing bacteria count for Thais, Famosa, and Bistrica samples over 700,000 counts]
Correlations - significant

<table>
<thead>
<tr>
<th>Trait</th>
<th>MY</th>
<th>PC</th>
<th>IBC</th>
<th>FP</th>
<th>ISCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MY</td>
<td>-</td>
<td>NS</td>
<td>-0.48 ***</td>
<td>-0.44 **</td>
<td>-0.37 (*)</td>
</tr>
<tr>
<td>PC</td>
<td>-</td>
<td></td>
<td>0.42 **</td>
<td>-0.41 **</td>
<td>+0.31 (*)</td>
</tr>
<tr>
<td>FC</td>
<td>+0.51 ***</td>
<td>-0.33 (*)</td>
<td>-0.52 ***</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>LC</td>
<td>+0.38 (*)</td>
<td></td>
<td>NS</td>
<td>-0.92 ***</td>
<td>-0.37 (*)</td>
</tr>
<tr>
<td>ISCC</td>
<td>+0.31 (*)</td>
<td>+0.39 **</td>
<td>NS</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

* p< 0.05; ** p < 0.01; *** p < 0.001; NS – non significant
## Analysis of Variance

<table>
<thead>
<tr>
<th>Trait</th>
<th>Mare</th>
<th>Milking</th>
<th>Foal chest width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Protein content</td>
<td>NS</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Fat content</td>
<td>NS</td>
<td>NS</td>
<td>*</td>
</tr>
<tr>
<td>Lactose content</td>
<td>NS</td>
<td>*</td>
<td>NS</td>
</tr>
<tr>
<td>logSCC</td>
<td>NS</td>
<td>NS</td>
<td>**</td>
</tr>
<tr>
<td>logBC</td>
<td>NS</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Freezing point</td>
<td>***</td>
<td>**</td>
<td>***</td>
</tr>
</tbody>
</table>

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Foals

- Estimated body weight
  - Start of experiment 180 - 236 kg
  - Daily gain from 600 to 700 g

- The heaviest foal grown fastest
  - $r_{CGM:CGF}=+0.83$ (***)

- Growth is not related to mare‘s MY
Indirect effects on mares milking

- More work 😞
- More feed 😞
- More contact with foals & mares as usual
- Foals development
  - More developed than peers
  - Easy to handle – nice behaviour
Discussion & Conclusions

- Lippizan mare’s
  - Sensitive
  - Need more time for adoption than draft mare’s
  - Lactation yield > 500 kg

- Milk composition
  - Large variation (BC, FC, MY, SCC)
  - Quite stable (LA, PY)
Discussion & Conclusions

- Data analysis
  - Very high r between LC and FP
  - Low variation between mares (FP?)
  - Last milked mare & last daily milking
    - Lowest FP & BC → rest water in tube, …
  - Moderate and neg. r between BC and MY
    - Indicate hygiene problems
  - Moderate and neg. r between FC and MY
    - Indicate high FC in rest milk in udder
preservation of breed & milking?

- It can be additional activity!
- Add value with
  - Milk processing → some possibilities will be shown on IE
  - Selling via on farm therapies, …
- Foals
  - Nice behaviour
  - Well developed
- Socio-economics
  - New jobs
  - Attractive for young people
  - Attraction for tourism, …
Future work

- Comparison of different type of milk sampling
  - Huge variation between published equine milk parameters
- Slovenian draft horse
  - Routine – commercial milking
  - Comparison between results from first jets & total milked milk yield
Thank you for your attention