Genetic analyses of ketosis and a newly developed risk indicator in Fleckvieh, Braunvieh and German Holstein

H. Hamann, A. Werner, L. Dale, P. Herold

Speaker: Pera Herold
Genetic analyses of ketosis and a newly developed risk indicator in Fleckvieh, Braunvieh and German Holstein

H. Hamann¹, A. Werner², L. Dale², P. Herold¹

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Outline

1. Goal and derivation of the KetoMIR index

2. Genetic analyses

3. Results

4. Conclusion
Goal and derivation of the KetoMIR index:

- Modelling of ketosis risk via KetoMIR index
- Ketosis reference: Ketosis diagnoses registered in LKV-Baden-Württemberg health monitoring project GMON
  - 1000 dairy farms
  - primarily herd management tool
- Variables:
  - Standardized MIR spectra available from January 2012 (Bentley & Foss, from November 2012 Bentley only) from regular milk analysis
    - Indirect usage by via MIR based components (standard milk recording components, fatty acids, minerals, aceton, BHB, citrat)
  - Environmental factors (Days in milk, breed, calving number)

Grelet et al.
Goal and derivation of the KetoMIR index:

KetoMIR index:
- based on logistic regression
- numeric range between 0 and 1
- partition in three classes
  - „healthy“: 0.00 - 0.50
  - „low risk“: 0.50 - 0.75
  - „high risk“: 0.75 - 1.00

Calibration set (n=109.479)  Validation set (n=2.966)
Sensitivity: 0.70  0.72
Specificity 0.86  0.84
Probability functions of the KetoMIR index and derivation of KetoMIR classes

- Healthy
- Low risk
- High risk

Probability function vs. Cumulative probability function
Distribution of KetoMIR classes for breeds and weeks in milk

Fleckvieh (Dual purpose Simmental)

Braunvieh (German Brown)

Deutsch Holstein (German Holstein)

Weeks in milk

- **Healthy**
- **Low risk**
- **High risk**
Genetic analyses:

Can the KetoMIR index be used as auxiliary trait in breeding programmes?

- Is the KetoMIR index (classes) heritable?

- How is the KetoMIR index genetically related to ketosis?

- (How is the KetoMIR index genetically related to other traits of interest?)
Genetic analyses:

Data:

Fleckvieh: 37.846 lactations with information for the first three test day records (analysed separately or as average)
Braunvieh: 15.771
Deutsch Holstein: 31.425

Repeatability model (within breed):
HYS, lactation number, days in milk, permanent environmental effect, animal effect

KetoMIR index ➔ KetoMIR classes (categorical)
healthy – low risk – high risk ➔ C3

➔ KetoMIR classes (binary)
healthy vs low risk + high risk ➔ B050
healthy + low risk vs high risk ➔ B075
Genetic analyses:

Is the KetoMIR index (classes) heritable?

Heritabilities for the KetoMIR index, categorical and binary classes

<table>
<thead>
<tr>
<th>Fleckvieh (Dual purpose Simmental)</th>
<th>Braunvieh (German Brown)</th>
<th>Deutsch Holstein (German Holstein)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>TD Index C3 B050 B075</td>
<td>TD Index C3 B050 B075</td>
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Genetic analyses:

How is the KetoMIR index genetically related to ketosis?

Genetic correlations between ketosis (clinical) and the KetoMIR index and categorical classes

<table>
<thead>
<tr>
<th>TD</th>
<th>Fleckvieh Index</th>
<th>C3</th>
<th>Braunvieh Index</th>
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Genetic analyses:

How is the KetoMIR index genetically related to other traits of interest?

Genetic correlations between KetoMIR index and traits for milk components

<table>
<thead>
<tr>
<th></th>
<th>TD</th>
<th>Fleckvieh</th>
<th>Braunvieh</th>
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Genetic analyses:

Can the KetoMIR index be used as auxiliary trait in breeding programmes?

- Is the KetoMIR index (classes) heritable? ✓

- How is the KetoMIR index genetically related to ketosis? ✓

- How is the KetoMIR index genetically related to other traits of interest? ✓
Conclusion:

Data collecting as a matter of the routine milk analyses

Requirements for breeding value estimation are given

Establishment of a breeding value evaluation for the KetoMIR index
  - based on a single test day record
  - based on the average of several test day records

Calculation of economic weights

Cross validation based on breeding values
Thank you for your attention!
Breeding strategies:

Selection against ketosis liability:

- based on a single (first) test day record (strategy I)
  „breaking“ the peaks in the KetoMIR curve

- based on the average of several test day records (strategy II)
  „lowering“ the general level of the KetoMIR curve
Breeding strategies

Initial curve (hypothetical)

Strategy I

Strategy II

KetoMIR index

Days in milk
Genetic analyses:

How is the KetoMIR index genetically related to other traits of interest?

Genetic correlations between KetoMIR index and traits for milk components

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