Introduction (1)
- Clinical ketosis - metabolic disease in high producing dairy cattle
- Sub-clinical ketosis - blood BHB above a threshold
- Prevalence - literature
  - clinical - 5%
  - sub-clinical - 15-30%

Introduction (2)
- Clinical and subclinical ketosis related with elevated levels of ketone bodies
  - acetone (Ac)
  - acetoacetate (AcAc)
  - β-hydroxy-butyrate (BHB)
- Correlation ketone bodies milk - blood: 0.66-0.96
- Tests on milk are available

Introduction (3)
- Current indicator for farmers on milkrecording sheet
  - fat:protein > 1.25
  - not reliable - > measurement of ketone bodies can add reliability
- Goal:
  - development of routine measurement (cheap) to measure Ac, AcAc and BHB using FTIR -> calibration for MilcoScan FT6000 (FOSS)
  - better indicator for subclinical ketosis

Data - collection (1)
- Milk samples in 217 herds in the Netherlands
  - March-April 2005
  - Herds:
    - breed: > 85% HF
    - milkproduction: > 8500 kg
    - fresh cows with fat%/protein% > 1.25: >15%
    - farmers select 5 cows, one sample
    - cows lactation >1 (no heifers)
    - cows DIM <60 days
- Total 1080 milk samples

Data - measurements (2)
- Reference method:
  - Ac, AcAc and BHB determined with segmented flow analysis using SAN++ equipment of SKALAR
- Infrared spectrometry method
  - MilkoScan FT6000 (FOSS Analytical A/S)
  - spectra recorded in data files
Development calibration

- Based on
  - reference measure for Ac, AcAc and BHB spectra
  - algorithms of FOSS
- calibration models were developed

Results

- 42% of reference method result for AcAc negative - further neglected
- Ac and BHB resp 1.0% and 0.4% negative results

Relationship Ac - BHB

correlation 0.82

Effect of week after calving

(% samples in highest 10% for Ac and BHB)

Effect of parity

(% samples in highest 10% for Ac and BHB)

Infrared measurements - calibration

- Comparing correlation
  - non-transformed and log-transformed data
  - non-transformed    log-transformed
  - Ac                 0.61    0.85
  - BHB                0.80    0.79
- log-transformation chosen for calibration
Relation reference - predicted Ac

Relation reference - predicted BHB

Relation reference - prediction

- Correlation reference - prediction
  - Ac: 0.85
  - BHB: 0.79

- Correlation may be not very high
  - compared to other calibrations (fat, protein etc)

- But still useful for screening the cow population?!

Screening for subclinical ketosis

- Set for Ac and BHB threshold and determine sensitivity and specificity

<table>
<thead>
<tr>
<th></th>
<th>Ac</th>
<th>BHB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold</td>
<td>0.15 mM</td>
<td>0.10 mM</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.70</td>
<td>0.69</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>False positives</td>
<td>0.27</td>
<td>0.25</td>
</tr>
<tr>
<td>False negatives</td>
<td>0.06</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Screening cows

- Ac and BHB can be routinely measured using FTIR

Usage:
- list cows above a certain threshold
- in combination with fat, protein, lactation stage risk estimators can be developed
- herd parameter

Conclusions

- Ac and BHB can be measured using FTIR accurately enough for screening cows for subclinical ketosis

- In combination with other indicators FTIR predictions for Ac and BHB can be used to evaluate the herd management