Screening for subclinical ketosis in dairy cattle by Fourier transform infrared spectrometry

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Introduction (1)

- Clinical ketosis - metabolic disease in high producing dairy cattle
- Sub-clinical ketosis - blood BHB above a treshold
- 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

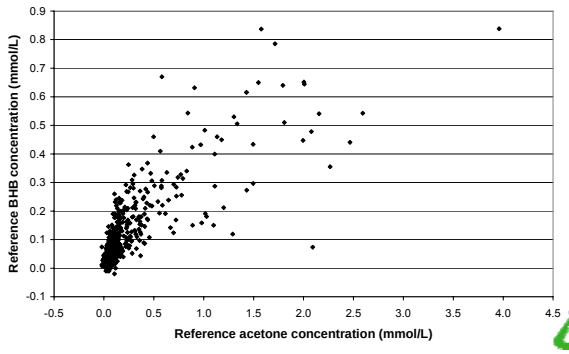
- Based on
  - reference measure for Ac, AcAc and BHB
  - spectra
  - algorithms of FOSS
- calibration models were developed

Results

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

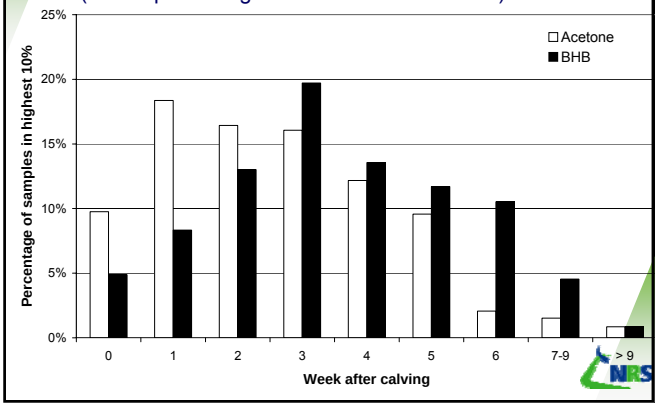
Relationship Ac - BHB

correlation 0.82



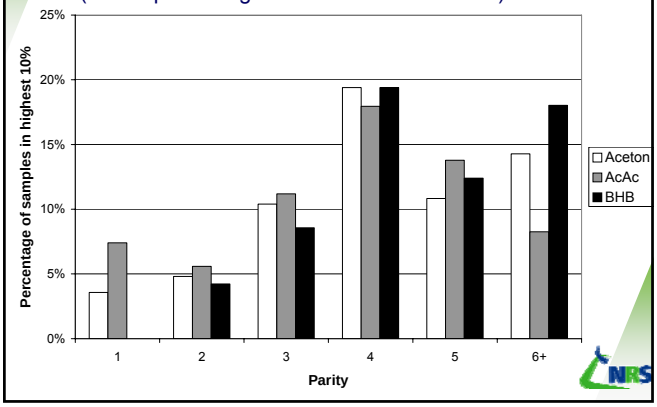
Effect of week after calving

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



Effect of parity

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



Infrared measurements -calibration

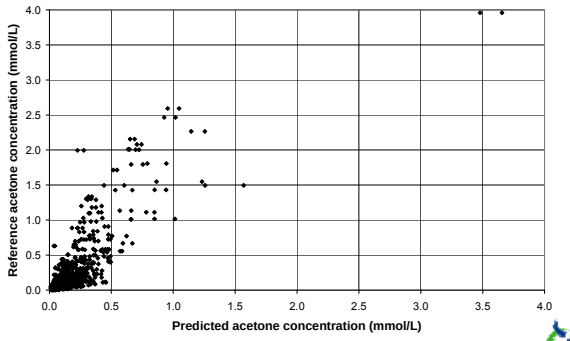
- Comparing correlation
  - non-transformed and log-transformed data

	non-transformed	log-transformed
Ac	0.61	0.85
BHB	0.80	0.79

- log-transformation chosen for calibration

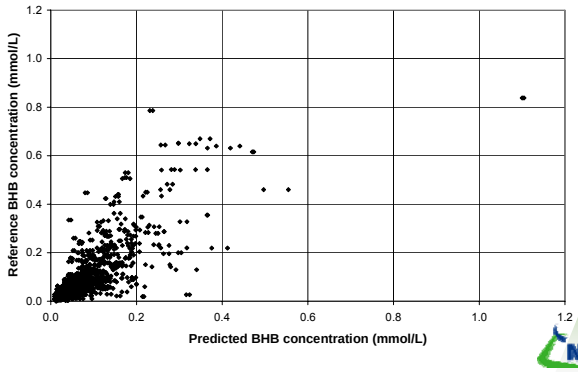
Relation reference - predicted Ac

(how works the calibration)



Relation reference - predicted BHB

(how works the calibration)



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 usefull for screening the cow population?!

Screening for subclinical ketosis

Set for Ac and BHB treshold and determine sensitivity and specificity

	Ac	BHB
Treshold	0.15 mM	0.10 mM
sensitivity	0.70	0.69
specificity	0.95	0.95
false positives	0.27	0.25
false negatives	0.06	0.07

Screening cows

- Ac and BHB can be routinely measured using FTIR
- Usage:
  - list cows above a certain treshold
  - 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