Ketosis is a frequently occurring metabolic disease
- Mainly occurring in the early lactation – severe negative energy balance (NEB)
- Mobilisation of body fat to compensate NEB → ketone bodies (i.e. acetone (Ac), β-hydroxybutyrate (BHB)) originate and accumulate
- Major impact on future production, reproduction and overall health of the cow (e.g., Opsina et al., 2010; Duffield et al., 2009)
- Cost per case of ketosis: $300 (Mc Art et al., 2015)

Diagnosis of subclinical ketosis:
- No visible symptoms – need for measurement of ketone bodies in blood, milk, or urine (Andersson, 1988)
- On-farm solutions: electronic hand-held blood BHB meters; high accuracy but labour-intensive (Iwersen et al., 2009)

In 1999, Fourier Transformed InfraRed (FTIR): Fast and inexpensive method for ketosis screening by predicting milk Ac (Hansen, 1999)

In 2006:
- Joint project of CRV, FOSS and Qlip; development of milk Ac and BHB predictions; appropriate for herd level screening (de Roos et al., 2007)

Ketosis screening service on Dairy Herd Improvement (DHI) samples:
- 2011: Qlip, CRV and MCC Flanders, the Netherlands and Belgium; Valacta, Canada
- 2012: CLASEL, France
- 2013: Polish Breeders Association, Poland; Eurofins and Danish Cattle Federation, Denmark; Tokachi DHI, Japan
- 2014: CanWest DHI, Canada
- 2015: AgSource, US; DairyOne, US; CIS, England; ARAL, Italy; IGAL, Spain

FOSS

Instrument: Milkoscan FT+ (FTIR) with FOSS calibration for Ac and BHB

Establishment of method:
- 2,000 milk samples, analysis by a segmented flow analyser and FTIR to build Ac and BHB calibration

Maintenance of method:
- Monthly analysis of 100 random samples (pilot milk) by reference method (Skalar)
- Valacta and CLASEL: Validation of FTIR predictions
- Qlip: no slope adjustment, no bias setting (original basic calibration established in 2006)
Combination of Ac and BHB values with:
- Fat-protein ratio
- Parity
- Month of milk recording

→ Binary (yes/no) score for ketosis for cows with DIM <60 only

Overview on the proportion of samples, farms and cows under ketosis screening from January 1, 2012 to December 31, 2014.

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>Total number of DHI samples analysed</th>
<th>Proportion of samples with milk BHB analysis (%)</th>
<th>Proportion of farms using ketosis screening (%)</th>
<th>Proportion of cows under ketosis screening (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valacta</td>
<td>7,600,000</td>
<td>54</td>
<td>71(^1)</td>
<td>54</td>
</tr>
<tr>
<td>CLASEL</td>
<td>9,600,000</td>
<td>100(^2)</td>
<td>48</td>
<td>51</td>
</tr>
<tr>
<td>Qlip</td>
<td>35,000,000</td>
<td>100(^3)</td>
<td>85</td>
<td>90</td>
</tr>
</tbody>
</table>

\(^1\)Proportion of farms that used the service for at least one test-day
\(^2\)Ac and BHB values were predicted for all samples, but reported back to farms enrolled for CetoDetect® only
\(^3\)All milk recording samples; however, just reported back for cows with days in milk <60

**KETOSIS IMPACTS PRODUCTION**

Average milk yield depending on risk of ketosis

<table>
<thead>
<tr>
<th>Ketosis risk group</th>
<th>Parity 1</th>
<th>Parity 2</th>
<th>Parity 3, 4, 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>32.5(^b)</td>
<td>4.10(^a)</td>
<td>3.25(^c)</td>
</tr>
<tr>
<td>medium</td>
<td>32.3(^b)</td>
<td>4.62(^a)</td>
<td>3.17(^a)</td>
</tr>
<tr>
<td>high</td>
<td>30.1(^b)</td>
<td>5.07(^a)</td>
<td>3.19(^a)</td>
</tr>
</tbody>
</table>

**ASSOCIATION WITH OTHER DISEASES**

SCC (mastitis) depending on risk of ketosis

Koeck et al., 2014
KETOSIS IMPACTS REPRODUCTION

Days Open

Ketosis risk group

Days

Prevalence of ketosis (low, medium, high risk) in Canada (Valacta), France (CLASEL) and Belgium (region Flanders) and the Netherlands (Qlip) in 2012 and 2014, respectively. Data for Belgium and the Netherlands are expressed as ketosis yes (high risk) or no (low risk).

a, b: bars with different letters differ significantly at a level of P < 0.001

DEVELOPMENT OF KETOSIS PREVALENCE OVER TIME

REAL LIFE EXAMPLE – KETOSIS MANAGEMENT

Overview 1:
BHB values in cows with less than 90 days in milk

Type I*

Type II**

Overview 2:
BHB values at first test day over time

Advisor’s suggestion: “Focus first on dry cow (far-off) rations as they obviously bring too much energy.”

REAL LIFE EXAMPLE – KETOSIS MANAGEMENT

Herd Results December 2013 (8 month later)

→ Proportion of cows with high BHB decreased from 40% to less than 10%
KETOSIS IMPACTS PROFITABILITY

Simulation for a herd with 50 cows

1) Economical losses

   a) Milk loss
      € 750
      300 l / lactation; ketosis prevalence: 15%; 2,250 l / lactation and herd; 0.33 € / l
   b) Losses due to associated diseases

2) Costs for ketosis screening

   a) € 150 per cow and year
   b) Interventions (e.g., treatment, optimised feeding ration)

   Total costs

3) Assumption: Improved animal health management due to ketosis screening

   a) Reduction of milk loss by 50%
      € 375
   b) Prevention of 50% of the associated diseases
      € 375

   Total gain

Return on investment:

A MESSAGE TO TAKE HOME

- Experience from 3 years of ketosis screening in Canada, France, Belgium and the Netherlands using FTIR technology on regular DHI milk samples:
  - Simple, practical and at low cost for milk producer
  - Elevates awareness of an otherwise undetected problem
  - With monthly testing, not all cows are tested in the period most at risk

- Ketosis screening offers high value to milk recording clients ➔ can help reduce the incidence of the problem

- Development of recommendations for generation, application and interpretation of results

For further information, please do not hesitate to contact: das@foss.dk

REFERENCES


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