Renewed estimation method for 24-hour fat percentage in AM/PM milk recording scheme

R.M.G. Roelofs, G. de Jong and A.P.W. de Roos

Background

AM/PM milk recording in The Netherlands
- alternating collection
- Peeters and Galesloot, 2002

24h-fat% = b_0 + b_1*fat%(n) + b_2*prot%(n) + b_3*milk(n) + b_4*int(n) + b_5*milk(n-1) + b_6*int(n-1) + e

Farmers experience fluctuations in fat percentage

Deviation

Preliminary results:
- a.m.-sample: -0.09%
- p.m.-sample: 0.05%

Possible origin deviation:
- fluctuations in milk-fat syntheses between AM-PM
  - Gilbert et al. (1972) and Lee and Wardorp (1984)
- lactation stage and parity
  - Liu et al. (2000)

Objective

Increasing the accuracy of the estimated 24-hour fat percentage by testing for non-linearity of current effects and introducing new explanatory variables

Material

Data of farms using Automatic Milking System
- January 20th 2001 - July 1st 2004
- Cows with 2 samplings per test day
- Data split in 2 datasets per cow-test day
  - Dataset 1: estimation
  - Dataset 2: validation

<table>
<thead>
<tr>
<th>Dataset 1</th>
<th>Dataset 2</th>
</tr>
</thead>
<tbody>
<tr>
<td># samplings</td>
<td>371.528</td>
</tr>
<tr>
<td># cows</td>
<td>50.591</td>
</tr>
<tr>
<td># farms</td>
<td>537</td>
</tr>
</tbody>
</table>

Methods

Subsequently adding changes to the regression
- non-linearity of current effects
- new explanatory variables
  - time of sampling
  - lactation stage
  - parity
  - month of milk sampling

Monitoring the accuracy of the estimated 24-hour fat percentage
- st.dev of the difference true-estimated
- correlation between true-estimated
- b-factor (slope of linear regression true-estimated)
<table>
<thead>
<tr>
<th>Parity</th>
<th>Estimate</th>
<th>Month of sampling</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-6.58</td>
<td>January</td>
<td>0.24</td>
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<tr>
<td>2</td>
<td>-3.56</td>
<td>February</td>
<td>0.28</td>
</tr>
<tr>
<td>3</td>
<td>-1.42</td>
<td>March</td>
<td>0.54</td>
</tr>
<tr>
<td>4</td>
<td>-0.48</td>
<td>April</td>
<td>-0.27</td>
</tr>
<tr>
<td>5</td>
<td>-0.33</td>
<td>May</td>
<td>-2.07</td>
</tr>
<tr>
<td>6</td>
<td>-0.33</td>
<td>June</td>
<td>-3.36</td>
</tr>
<tr>
<td>7+</td>
<td>0.00</td>
<td>July</td>
<td>-4.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>August</td>
<td>-5.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>September</td>
<td>-4.74</td>
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<td></td>
<td></td>
<td>October</td>
<td>-2.24</td>
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<tr>
<td></td>
<td></td>
<td>November</td>
<td>-0.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>December</td>
<td>-0.00</td>
</tr>
</tbody>
</table>

**Accuracy of regression**

- **Difference between true-estimated 24-hour fat %**
  - **Regression**
    - Current, re-estimated: 0.2856, 0.898, 0.807
    - Non-linearity: 0.2820, 0.901, 0.812
    - Time of sampling: 0.2817, 0.903, 0.813
    - Lactation stage: 0.2803, 0.902, 0.814
    - Parity: 0.2784, 0.903, 0.816
    - Month of sampling: 0.2784, 0.903, 0.817

- **reduction in st.dev. of difference is 2.4%**
- **correlation increases from 0.898 to 0.903**
- **b-factor increases from 0.807 to 0.817**

**Validation AM/PM milk recording**

- **Preliminary results:**
  - a.m.-sample: -0.09%
  - p.m.-sample: 0.05%

- **Current regression formula**
  - a.m.-sample: -0.00%
  - p.m.-sample: 0.01%

**Conclusions**

- **Improvement of Peeters and Galesloot, 2002**

  \[ 24\text{h-fat}\% = b_0 + b_1 \text{fat}%(n) + \text{pol(prot}%(n),3) + \text{pol(milk}(n),3) + \text{pol(int}(n),3) + \text{pol(milk}(n-1),3) + \text{pol(int}(n-1),2) + \text{time of sampling}(n) + \text{pol(lactation stage}(n),3) + \text{parity}(n) + \text{month of sampling}(n) + e \]