Validation of RumiWatch pedometers measuring lying, standing and walking of cattle

Sari Kajava¹, Mikaela Mughal², Lilli Frondelius¹, Salla Ruuska², Nils Zehner³, Jaakko Mononen¹,²

¹ MTT Agrifood Research Finland, Animal Production Research, Halolantie 31 A, 71750 Maaninka, Finland
² University of Eastern Finland, Department of Biology, Finland
³ Agroscope, Institute for Sustainability Sciences, Ettenhausen, Switzerland

Introduction

• RumiWatch pedometer (ITIN+HOCH GmbH, Switzerland; RW) is a 3D accelerometer based system that automatically measures cows’ lying (LT), standing (ST) and walking times (WT)
• The aim of the study was to validate RW measurements against video-based continuous behaviour recording (VCR)

Materials and methods

• Six non-lactating multiparous dairy cows were housed in pens (3x6m)
• RW pedometers were fastened to the right hind leg of the cows (Figure 1)
• Two observers monitored from videos LT, ST and WT of six cows using continuous recording
  ➢ Other hind leg movements were added to WT to form an “all leg movement” behaviour class
• The random coefficient regression model was used to reveal random errors between RW and VCR measurements
• An unstructured covariance matrix was used for calculating the intercepts and slopes

Results

The relationship between RW and VCR measurements of LT, ST and WT and time when all hind leg movements were taken into account (six cows, 12-15 hours of observations per cow). The coefficients of determination ($R^2$), slope and its 95% confidence interval (95% CI) and intercept and its standard error of the mean (SEM).

<table>
<thead>
<tr>
<th></th>
<th>Lying</th>
<th>Standing</th>
<th>Walking</th>
<th>All leg movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$</td>
<td>0.999</td>
<td>0.989</td>
<td>0.687</td>
<td>0.888</td>
</tr>
<tr>
<td>Slope (95% CI)</td>
<td>1.001</td>
<td>0.979</td>
<td>1.970</td>
<td>1.091</td>
</tr>
<tr>
<td>(0.9 - 1.0)</td>
<td>(0.9 - 1.1)</td>
<td>(0.07 - 1.9)</td>
<td>(0.6 - 1.4)</td>
<td></td>
</tr>
<tr>
<td>Intercept (min/h, SEM)</td>
<td>0.026</td>
<td>0.035</td>
<td>1.062</td>
<td>-0.013</td>
</tr>
<tr>
<td>(0.2)</td>
<td>(0.4)</td>
<td>(0.4)</td>
<td>(0.3)</td>
<td></td>
</tr>
<tr>
<td>P-value¹</td>
<td>0.895</td>
<td>0.926</td>
<td>0.043</td>
<td>0.962</td>
</tr>
</tbody>
</table>

¹Probability that the intercept differs from zero.

Conclusions

• RW is a reliable device for measuring lying and standing times of dairy cows
• There is a need to develop the precision of RW walking time measurements