Fully-automated HRV assessment in dairy cows

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Measurement of heart rate variability (HRV) has been described as a useful method to assess stress load in cattle. However, assessment of HRV is technically difficult to perform and interpretation requires expertise of the observer. The aim of the study is to test a fully-automated HRV acquisition system and software in cattle.

Twelve healthy mature Holstein Frisian cows (weight: 703 ± 65 kg) were studied. Cows were kept tethered in stalls and fed at 8:00 a.m. Cows were equipped with base-apex ECG at 9:00 a.m. to allow adaptation to the test equipment and ECG was recorded for 23 hours from 9:30 a.m. to 8:30 a.m. the day after.

Time domain analysis was evaluated in 3 bouts of 30 minutes from 9:30 to 11:00 a.m. and revealed a mean ($\pm$ SD) SDNN of 77 ± 22.8 ms, SDANN of 53.4 ± 23.5 ms, SDNN IDX of 53.4 ± 23.5 ms, RMSSD of 36.9 ± 15.1 ms, pNN50 of 4.1 ± 3.4 % and NN50 of 69.2 ± 58.2. Time domain analysis for the 23 hours recording of 10 cows revealed a mean ($\pm$ SD) SDNN of 163.6 ± 26.9 ms, SDANN of 145.0 ± 32.3 ms, SDNN IDX of 61.8 ± 15.1 ms, RMSSD of 53.1 ± 22.9 ms, pNN50 of 6.3 ± 2.2 %, NN50 of 3299 ± 1886, and a mean NN of 1032 ± 72.3. Frequency domain analysis revealed HF power of 158.8 ± 93.4 $msec^2$, LF power of 648.1 ± 377.7 $msec^2$ and a LF/HF ratio of 4.73 ± 2.0.

In the present study, the LF band was 0.04 - 0.15 Hz and the HF band was 0.15 - 0.4 Hz, while for the use in cattle LF of 0.04-0.25 Hz and HF bands of 0.25 - 0.58 Hz, are recommended. Despite of some overlapping, data are similar to those reported in the literature. In conclusion, fully automated HRV assessment is feasible in cows, but further studies are needed to determine the best duration of recordings and to assess the usefulness of this method in stress assessment of cows.