Pilot study: heart rate and muscle activity as an indicator of sleep in dairy cattle

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Sleep is an innate part of all mammal physiology. For dairy cows, evaluating sleep can give us insight into the comfort of the facilities and may be linked to disease risk and productivity. Researchers have accurately estimated sleep in dairy cows, but the technology used to date is cumbersome and not practical in a commercial setting. The purpose of this project is to investigate the practicality of estimating sleep in dairy cattle from muscle activity (using surface electromyography; sEMG) and heart rate variability (HRV). The specific objectives are to: 1) determine if there is agreement between two sEMG sensors placed on the neck and back muscles of dairy cows, and 2) compare HRV and muscle activity in cows during different postures indicative of rapid eye movement (REM) sleep and wake states. Three indoor-housed dairy cattle from one dairy farm on Prince Edward Island will be used in this study. All measurements will be recorded for 8 hours overnight. To record muscle activity, Delsys Trigno Avanti wireless sensors will be attached to the skin of the trapezius and gluteobiceps muscles. To record HRV, a Polar equine belt will be secured around the chest of each cow. A video camera will be used to determine postures associated with sleep and wake. The hypotheses are that the sEMG data from the neck and back muscles will be similar, and that the muscle activity and HRV values will differ when cows are in postures related to different vigilance states. It is anticipated that muscle activity will decrease during REM sleep, but that HRV will increase during REM sleep. Validating these physiological measures as indicators for sleep will facilitate future dairy cattle sleep research.