Technical note: Accuracy of an ear tag-attached accelerometer to monitor rumination and feeding behavior in feedlot cattle

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ABSTRACT: Early identification of sick cattle increases treatment success and decreases mortality. Continuous automated records of behavior can be used to identify sick cattle early in the disease process. The objective was to evaluate accuracy of an ear-attached accelerometer (SensOor) that quantified ear movements and estimated feeding and rumination time through a proprietary algorithm. Accelerometers were attached to the ear tag of 18 steers with an initial mean BW of 326 ± 46 kg. The manufacturer’s proprietary software was used to determine time spent “feeding,” “ruminating,” “active,” and “resting.” Direct visual observation was used to validate the accelerometer. Sensitivity, specificity, and predictive values were calculated for rumination and feeding separately. Repeated measures were accounted for using mixed model logistic regression. Single minutes of either feeding or rumination in a run of other behavior minutes were changed to the preceding behavior. Accuracy and precision of hourly recorded feeding and rumination times were assessed using the concordance correlation coefficient adjusted for repeated measurements. Sensitivity and specificity were 95 and 76% for feeding and 49 and 96% for rumination, respectively. Concordance correlation between observations and the sensor were 0.79 (95% CI: 0.61 to 0.85) and 0.44 (95% CI: 0.23 to 0.60) for feeding and rumination, respectively. There was large variability among steers, with concordance correlations ranging from 0.09 to 0.98 for rumination time and from 0.58 to 0.96 for feeding time. We conclude that the accelerometer is a promising monitoring system for feeding behavior.

Key words: automation, behavior monitoring, cattle, feeding, rumination, validation

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INTRODUCTION

Feeding and rumination behavior can be monitored to assess health status of ruminants. For example, records of feeding behavior have been used to detect bovine respiratory disease in feedlot cattle (Sowell et al., 1999; Borderas et al., 2008), and monitoring rumination behavior helped detect subacute ruminal acidosis in dairy cows (DeVries et al., 2009). However, behavioral assessments using visual appraisal are very time consuming and typically done only once or twice daily for relatively short intervals. Consequently, monitoring devices have been developed to continuously measure either feeding (Mendes et al., 2011) or rumination behavior (Elischer et al., 2013). Such devices are based on radio-frequency identification (RFID) at the feed bunk (Schwartzkopf-Genswein et al., 2011), movements of the jaw (Beauchemin et al., 1989), or acoustics (Schirmann et al., 2009).

Based on observed differences in the movement patterns of cows’ ears, a system has been developed to monitor ear movements and calculate feeding, rumination, activity, and resting times (SensOor; Agis Automatisering BV, Harmelen, The Netherlands). A 3-dimensional accelerometer is attached to the RFID ear tag, and an online application provided by the manufacturer records time spent feeding, ruminating, active, and resting per hour and per day. A validation study in dairy cows suggests that this accelerometer was accurate for calculating feeding and rumination times (Bikker et al., 2011).