

The association between automatically captured rumen temperature bolus temperatures and morbidity in group housed, pre-weaned dairy calves

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Introduction

Group housing of dairy calves offers several advantages for dairy producers, yet calves housed in these systems have an increased risk of disease and it can be more challenging to detect a sick calf in a group. Fever is a widely used indicator of infectious diseases in dairy calves and often accompanies the two most common calf hood morbidities, diarrhea (DIA) and respiratory (RESP) disease. Indwelling rumen temperature bolus (RTB) systems are newly available for calves, but their utility in a field setting has not been formally evaluated. As a first step towards describing the utility (test characteristics) of this technology to detect morbidity, the objective of this study was to describe the relationship between automatically captured RTB temperatures and morbidity in group housed, pre-weaned dairy calves.

Materials and Methods

We conducted a prospective observational study on two MN farms between Feb and Aug 2014, selected based on their willingness to participate and allow the installation of the Bella AG Cattle Temperature Sensing System (Bella AG LLC, Greeley, CO) on their operations. Both farms housed their calves in groups and fed them automatically during the pre-weaning period. Each week, the study technician visited the farm and orally administered a RTB to calves that were at least 24 h prior to entry to the group pen. RTB serial number and calf ID was entered into computer software, and the calf was followed until weaning. During farm visits, the study technician retrieved automatically captured RTB temperatures from computer software for the previous week, as well as producer reported calf health events. Farm personnel were blinded to RTB temperature data. Because boluses were periodically lost (spit up), calves with RTB temperature readings that persisted for > 5 readings at $34.5^{\circ}\text{C} > T < 41.7^{\circ}\text{C}$ were excluded from analysis. Raw temperature data was averaged over 1 and 6 h time intervals (e.g. 24 or 4 readings per calf per day, respectively) and descriptive data included daily averages by 1h and 6h periods for all enrolled calves, overall, by day, month, and farm. A matched analysis was then performed

where treated calves were matched by farm, pen, age, and pen entry date ($\pm 7\text{d}$) to healthy control calves. Linear mixed models were developed to describe the association between RTB temperature ($^{\circ}\text{C}$) and sick (vs healthy) calves during the 8 d interval preceding and following a treatment event, overall and by disease treated (diarrhea (DIA); pneumonia/fever (RESP/FEV)). Significance was determined at $p < 0.05$.

Results

281 heifer calves were enrolled in the study representing 572,154 total RTB readings and 155,473 and 33,189 1h and 6h average readings respectively. Calves entered the group pen at 9.8 (3.4) d and were weaned at 49 (4.9) d. Twenty three percent (65/281) of calves lost their RTB at an average of 35.2 (7.9) days of age. Fifty-eight percent (64/281) of calves had a first treatment event. There was diurnal variation in RTB temperature (T) with the temperature nadir (reduced by 0.23°C) from 9AM to 11AM, then steadily increasing T over the rest of the day. This variation differed by farm and month. Fifty eight pairs of treated:control calves were available for the matched analysis, representing 65 6h average readings and 6241 total readings. Treated calves had an increased RTB temperature measurement 24h before a treatment event ($0.28 \pm 0.09^{\circ}\text{C}$; $p = 0.0012$) as compared to matched healthy calves, although an interaction did exist by disease treated; Specifically, T was not different between treated and healthy calves when considering calves treated for DIA (n=29 pairs). However, when considering calves treated for FEV/RESP (n=28), treated calves had an increased RTB T 24h prior to treatment ($0.43 \pm 0.12^{\circ}\text{C}$; $p = 0.0003$) as compared to age and pen-matched control calves.

Significance

As compared to age-matched control calves, RTB T measures were increased 1 day before illness diagnosis for calves experiencing FEV/RESP, but not for calves experiencing DIA. Future work will explore the diagnostic test characteristics and the timeliness of RTB T measures to detect a sick calf.