The use of precision dairy technologies to detect illness in group housed automatically fed pre-weaned dairy calves

W.A. Knauer, VMD[1]; **S.M. Godden**, DVM, DVSc[1]; **A.M. Dietrich**, BS[2]; **R.E. James**, PhD[2]
[1]Department of Veterinary Population Medicine, College of Veterinary Medicine, University of Minnesota, Saint Paul, MN 55108
[2]Department of Dairy Science, Virginia Tech, Blacksburg, VA 24061

Introduction

Precision dairy management is the use of sensor derived parameters to measure physiological, behavioral, and production indicators on individual animals to improve management strategies and farm performance. Automated milk feeding systems for group housed pre-weaned calves may offer some benefits including reallocation of labor, earlier socialization of calves, and an easy way to deliver more milk. However, there are some important disadvantages including increased risk for morbidity and mortality as well as delays in disease detection. Software programs aim to assist in the detection of sick calves through such methods as flagging calves when there has been a large reduction in milk intake or large changes in drinking speed over the last 24 hr period as compared to the previous 72 hr period. However, early research suggests that these simplistic algorithms may not be any more sensitive or timely than a human observer, and in some cases may miss detecting sick calves altogether. The greater aim of our research program is to determine if we can use different algorithms or approaches to examine feeding behavior that may improve the sensitivity and timeliness of detecting sick calves. As a first step towards this aim, the objective of the current preliminary study was to identify which feeding behaviors are most different between healthy and sick calves.

Materials and Methods

This preliminary study was conducted on four Minnesota dairy farms utilizing group housing and automatic feeding for pre-weaned calves, representing 7 feeders and 14 pens. Calves were enrolled between February and August 2014 at time of entry into the group pen. Sick calves were detected and treated by farm personnel, and all treatments recorded. Farms were visited weekly to collect feeding behavior measures from feeder software (drinking speed (mL/min), total milk consumed (L/d), and both rewarded and unrewarded visits to the feeder), and to record calf treatment events. Descriptive statistics were generated to describe general calf management (e.g. age at entry and exit from the pen, group sizes), to describe the proportion of calves experiencing a first treatment event, and to describe various feeding behaviors on days when calves were classified as either treated (sick) or untreated (healthy), including total milk consumed, drinking speed, and number of unrewarded and rewarded visits to the feeder.

Results

Records were analyzed for 674 calves and 25,940 calf-days. Mean (+/- SD) age at entry and exit from the pen was 10.5 (4.4) and 61 (18.6) days, respectively. Mean (SD) group size was 20 (4.3) calves per group. Sixty-four and a half percent (435/674) of calves experienced a first treatment event, with the average onset of this first illness occurring 8.1 (7.7) days after introduction to the pen. The majority of first illness events were classified as digestive disease (35.2%, 153/435), respiratory illness (19.5%, 85/435) or fever/ill thrift (43%, 189/435). Of the 25,940 calf-day records analyzed, 2,242 (9.5%) treated days and 23,698 (90.5%) healthy days were observed. Drinking speed was higher on healthy (977 +/- 341 mL/min) as compared to treated (712 +/- 349 mL/min) calf-days. There was also a large difference in the number of unrewarded visits for healthy calf-days (8.4 +/- 8.1 visits) vs. treated calf-days (4.7 +/- 6.3 visits). Smaller differences were observed between healthy vs. treated calf-days when examining total milk intake (healthy=6.9 +/- 2.1; treated=6.6 +/- 2.1 L/d) and when comparing rewarded visits per day (healthy=4.3 +/- 2.3; treated=5.0 +/- 2.9).

Significance

Although several feeding behaviors differed between healthy vs treated calf-days, the magnitude of difference was greatest for drinking speed and unrewarded visits. As such, these two parameters may offer the greatest potential to be useful as an indicator of morbidity in group-housed, computer-fed calves. Continuing research will investigate this hypothesis.