

Automated Daily Body Weight Measurements in Dairy Cattle: What Can We Do with Them?

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Automated daily body weight (BW) measurements have been suggested as a managerial tool in the early 90's of the previous century (Peiper et al., 1993). However, an analysis of BW data from commercial dairy farms was not available until recently (van Straten et al., 2008). We summarize a comprehensive analysis of automated daily BW measurements originating from commercial dairy farms and suggest ways in which these data could be applied as a managerial tool.

Objective

To analyze and identify factors of daily BW curves in high producing dairy cows that could be used to identify cows or farms suffering from excessive negative energy balance (NEB). BW changes in the first 120 days of lactation were analyzed and quantified. Subsequently, associations between daily BW variables in early lactation and reproductive performance and udder health were quantified.

Materials and Methods

An observational prospective cohort study was performed in seven commercial dairy farms from different geographical regions in Israel. Cows were automatically weighed on their way back from the milking parlor. These data alongside calving, management, reproduction and milk production data were retrieved from the farm computer. Classical time series analysis techniques using polynomial functions of day in lactation and pairs of sine and cosine functions representing 7 day and 21 day cycles were performed on each individual series of measurements. For generating variables representing BW change and further analysis of the BW data, individual measurements were smoothed using penalized cubic splines. To quantify associations between variables of interest and outcomes we used generalized estimating equations regression models, generalized mixed models and multivariate survival analysis.

Results

Standard relative BW curves were constructed based on 250,920 daily BW measurements (figure 1). From calving to nadir BW, first parity cows lost 6.5% of their initial BW. In second and third and above parity cows, relative BW loss was 8.5% and 8.4%, respectively. Analysis of BW data from 2,167 cows revealed a 7 day cycle in BW in 247 cows (11.4%) and a 21 day cycle in 715 cows (33.0%). Cows without 21 days cycles were more likely to be diagnosed with inactive ovaries than cows with 21 day cycles (OR = 1.51, $P = 0.001$).

In an analysis of data from 2,020 dairy cows, cows losing more relative BW from calving to nadir and cows with 7 day cycles in BW were less likely to conceive at first artificial insemination (AI). The percentage of BW lost from calving to nadir BW was associated with a prolonged first AI to conception interval in first and in third and greater parity cows. A BW loss $\geq 7\%$ from calving to 10 of lactation was associated with prolonged calving to AI and calving to conception intervals in first parity cows. The absence of a 21-d cycle in BW was associated with a prolonged calving to first AI interval in first parity cows, and a prolonged calving to conception interval in second parity cows.

For the analysis of the association between BW loss udder health, data from 1,720 cows were available. The odds of an event of somatic cell count (SCC) $> 250,000$ cells/mL were 25% greater for cows belonging to the upper quartile in relative BW loss from calving to nadir BW (loss $> 12.3\%$, 15.0% and 15.7% for first, second and third and greater parity, respectively) compared to cows losing less relative BW. The odds of an event of SCC $> 400,000$ cells/mL were 43% greater for cows belonging to the upper quartile in relative BW loss from calving to nadir BW compared to cows losing less relative BW.

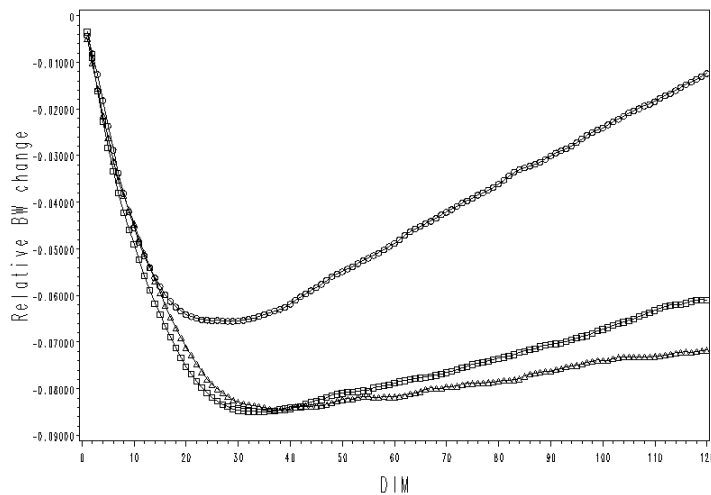


Figure 2. Relative BW change from calving to 120 days in lactation for first parity (\circ), second parity (\square) and older (\triangle) cows, adjusted for farm and repeated BW measurements of the same cow (van Straten et al., 2008).

Discussion and Conclusions

Standard relative BW curves could be used to identify farms in which cows are suffering from extreme relative BW loss in early lactation. Monitoring the presence of 21 day cycles in BW could be useful for indirectly assessing ovarian activity in a herd. Variables indicating a more severe NEB in early lactation were associated with poor reproductive performance. Greater NEB in early lactation predisposed dairy cows to events of elevated SCC throughout their lactation. Variables representing relative BW loss (%) were better predictors for impaired reproductive performance and udder health than those representing absolute BW loss (kg). We propose the use of automated daily BW for the identification of farms and cows suffering from extreme NEB in early lactation.

References

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