

# Evaluation of the respective relationships between rumination time within the first 10 days in milk and periparturient diseases, subclinical hypocalcemia, negative energy balance, and milk production in dairy cows

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## Introduction

Healthy dairy cows ruminate approximately 400 to 500 minutes per day; however, rumination time can be affected by several factors such as diet composition, health status, environment, and stress. Increased rumination time can be associated with increased health because of increased saliva production, whereas decreased rumination time has been associated with negative health effects. Historically, evaluating rumination time was laborious and limited to a few animals at a time; however, adoption of new technology like rumination collars has allowed increased data collection and monitoring of rumination time at both the individual and herd level. The effect of rumination time early in the postpartum period, based on rumination collar data, on milk production has not been thoroughly evaluated.

The objectives of this pilot study were to evaluate the maximum number minutes per day spent ruminating during the first 10 days-in-milk (DIM) for cows that developed displaced abomasum (DA), clinical ketosis (CK), subclinical hypocalcemia, or excessive negative energy balance, and to evaluate the association between rumination minutes and total milk production during the first 30 DIM after controlling for potential confounders.

## Materials and Methods

Data from a longitudinal prospective observational study of 2 herds that use Lely Astronaut A3 automatic milking systems and the QWES-HR Tag rumination collars were analyzed. Cows were conveniently sampled if they calved between June 2012 and August 2012; however, they were only included in the analysis if complete rumination records were available and appropriate blood or serum samples had been analyzed for calcium, nonesterified fatty acids (NEFA), and  $\beta$ -hydroxybutyrate (BHB) concentrations.

Statistical analyses were performed using SAS version 9.3. The *t*-test procedure was used to evaluate the mean difference in rumination minutes on the basis of whether the cows developed DA, CK (defined as serum

BHB concentration  $\geq 1.2$  mmol/L), or excessive negative energy balance (defined by a blood NEFA concentration  $\geq 0.7$  mEq/L). Only rumination minutes that were recorded prior to the event were used in the analysis.

The Mixed procedure in SAS was used to evaluate the association between rumination minutes and total milk production during the first 30 DIM after controlling for potential dichotomous confounders including subclinical hypocalcemia (serum calcium concentration, 6 to 8mg/dL); elevated BHB and NEFA concentrations, and disease. Cows were clustered within herd.

## Results

Herd A milked approximately 700 cows through 13 robots, and herd B milked approximately 400 cows through 7 robots. Fifty-three cows were included in the analysis. Although there was no statistically significant difference in the maximum rumination minutes between groups with and without a given condition, those that developed a given condition consistently had a numerically lower number of rumination minutes than those that did not develop a given condition. Cows with a DA spent a maximum of 370 minutes ruminating per day, whereas cows without a DA spent a maximum of 444 minutes ruminating per day ( $P=0.2$ ). Cows with hypocalcemia spent a maximum of 406 minutes ruminating per day, whereas cows without hypocalcemia spent 431 minutes ruminating per day ( $P=0.3$ ). Cows with CK spent 399 minutes ruminating per day, whereas cows without CK spent 447 minutes ruminating per day ( $P=0.3$ ). Cows with an excessive negative energy balance spent 410 minutes ruminating per day, whereas cows without an excessive negative energy balance spent 446 minutes ruminating per day ( $P=0.5$ ).

After controlling for disease, hypocalcemia, and excessive negative energy balance, each minute increase in rumination time during the first 10 DIM was associated with a 0.29 lb (0.13 kg) increase in milk production ( $P=0.1$ ) during the first 30 DIM. Difference in rumination minutes ranged from 9 to 482 minutes, which can result in a difference of 4.4 lb (2 kg) of milk/day.

## **Significance**

Rumination time measured by rumination collars within the first 10 DIM might be used to predict cow health and performance outcomes during early lactation. Future studies with a larger population are necessary to

adequately evaluate the critical threshold below which cows are more likely to experience adverse outcomes. Adaptation of this technology will allow for improved animal health and performance through automated, real-time monitoring.