

Proxies for dairy cows' resilience to heat waves

Differences in lying, rumination and activity times can identify 'sensitive' and 'resilient' cows to severe heat waves

Problem

Heat stress has detrimental effects on dairy cows that lead to lower milk yield, higher somatic cell count, increased risk of mastitis and other diseases, decreased conception rate, and even death. Cows of the same herd, however, can be more or less able to cope with the heat waves. Identifying and selecting those animals that are more resilient to heat stress would considerably improve cows' health and welfare, as well as herds' efficiency, in temperate regions. However, proxies for individual cows' resilience to heat stress are still lacking.

Solution

Nowadays, sensor systems installed on farms provide high-frequency records of individual cow behavioral data that could allow identifying new proxies for resilience to heat stress in dairy cows. By analyzing cows' behavioral patterns during heat waves, it could be possible to distinguish between animals that are sensitive to heat stress and those that are resilient, and therefore to adjust herd management decisions as well as select for the most resilient animals.

Outcome

Data of daily lying, rumination and activity times of 107 Italian Holstein cows were retrieved from *Smartbow* ear-tag accelerometers in the period 28th March – 31st October 2021. Data on daily milk yield automatically recorded by the milking parlour were also collected. Daily temperature-humidity index (THI) was used to identify the heat waves, which were defined as at least 3 consecutive days of THI higher than 75 (Figure 1, top plot). Cows were classified as 'sensitive' to the heat wave if they had at least one perturbation in the lactation curve (excluding those caused by health events) that started during that heat wave, otherwise they were classified as 'resilient'. The perturbations of the lactation curve were detected estimating the expected milk production with the iterative Wood model for each cow proposed by Adriaens et al. (2020) (Figure 1, bottom plot). Using GEE (Generalized Estimating Equations) models, we compared daily minutes of lying, rumination and activity in the two groups of cows ('sensitive' vs. 'resilient') in the total period of observation, adjusting by the individual parity, stage of lactation and milk production level, and by the intensity and length of the heat waves. No differences between the two groups of cows were detected during moderate heat waves ($75 < \text{THI} \leq 79$), whereas 'sensitive' cows tended to spend more time of the day ruminating and being active, as well as less time lying, during the severe heat wave ($\text{THI} > 79$) compared to 'resilient' cows. The longer the heat wave was, the more these differences were pronounced.

Practical recommendations

The detected behavioral differences have to be interpreted carefully due to the modest sample size and length of the observation period. For more robust analyses and outcomes, further research is needed considering several years of observations (i.e., 'hot seasons'), as well as different herds.

On-farm application

If incorporated into on-farm decision support tools, this kind of analysis could support farmers in identifying the most heat stress resilient cows in their herd by observing their behaviors. In the face of the global warming issue, genetic evaluation centers could also benefit from new indicators for selection of heat resilient genotypes.

Author(s)

Giovanna Ranzato ([UNIPD](#)), Isabella Lora ([UNIPD](#)), Ben Aernouts ([KU LEUVEN](#)), Giulio Cozzi ([UNIPD](#))

Publication

Ranzato G., Lora, I., Aernouts B., and Cozzi, G. 2022 Detecting behaviours of dairy cows during heat waves. Abstract at the 4th Precision Livestock Farming Workshop Seminar. Wageningen 28th–29th April, 2022.

Keywords

Behavior, Dairy cows, Heat wave, Sensor data

Illustrations

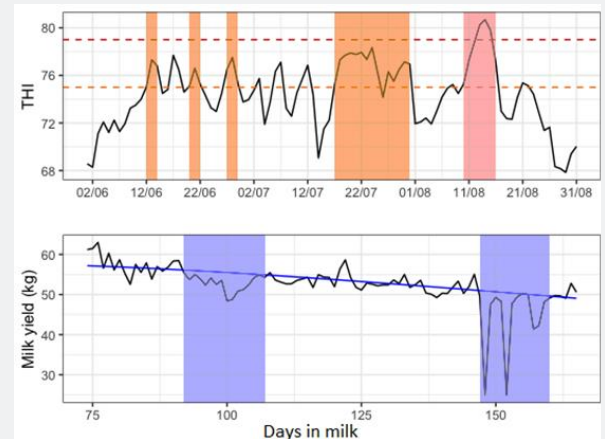


Figure 1. Top plot: THI trend during summer 2021 and detected heat waves (orange: moderate; red: severe). Bottom plot: milk production for one cow in

"GENomic management Tools to Optimize Resilience and Efficiency - GenTORE" is an H2020 project which aims to develop innovative genome-enabled selection and management tools to empower farmers to optimize cattle resilience and efficiency in different and changing environments. www.gentore.eu

