



Animal Welfare

Housing and management

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Behavioural indicators of early heat stress in dairy cows in pasture-based systems in Switzerland

Nina Keil¹, Frigga Dohme-Meier², Mirjam Holinger³, Rupert Bruckmaier⁴, Stefanie Ammer⁵

¹Federal Food Safety and Veterinary Office, Centre for Proper Housing of Ruminants and Pigs, Agroscope, CH-8356 Ettenhausen; ²Ruminant Research Unit, Agroscope, CH-1725 Posieux; ³Livestock Sciences, Research Institute of Organic Agriculture (FiBL), CH-5070 Frick; ⁴Veterinary Physiology, Vetsuisse Faculty, University of Bern, CH-3001 Bern; ⁵Department of Animal Sciences, University of Göttingen, DE-37075 Göttingen

Key words

Dairy cows, pasture-based system, heat stress, behaviour, indicators, cooling measures

Aim of the study

The objectives of the project were (1) to establish an overview of common cooling measures (shade or indoor housing) on pasture-based Swiss dairy farms and to assess at which climatic thresholds farmers take these measures; to investigate (2a) which validated physiological parameters of early heat stress are reflected by behavioural indicators that can be directly observed on pasture and (2b) to evaluate if keeping dairy cows inside the barn during the hottest time of day is an efficient measure to reduce heat stress for dairy cattle in pasture-based systems; and (3) to validate the identified behavioural indicators under field conditions in order to provide reliable measures for pasture-based dairy farms.

Material and methods

(1) An online survey in March 2018 and on-farm data collection during summer 2019 was carried out. Dairy farmers were asked about their grazing management and cooling measures. (2) During summer 2018 and 2019 an experimental study was conducted at Agroscope Posieux with lactating dairy cows during 12 periods with mild to moderate heat load. Physiological (heart rate, respiration rate; in blood: beta-hydroxybutyrate, glucose, non-esterified fatty acids, plasma urea nitrogen, thyroxine (T4) and triiodothyronine (T3); in milk: fat, protein, lactose, somatic cell counts, cortisol, Na⁺, K⁺, and Cl⁻) and behavioural parameters were assessed and related to the individual cows' body core temperature. In each period, half of the cows were kept inside the barn during the hottest time of day whereas the other half of the cows stayed on pasture. (3) During summer 2021 several behavioural indicators of heat stress on pasture that had been assessed in the experimental study were monitored on four commercial dairy farms under varying climatic conditions.

Results and significance

The online survey revealed that the majority of farmers classified heat stress in dairy cows as a relevant problem, but set the climatic threshold for the use of cooling measures significantly too high. The experimental study showed that even under rather moderate climatic conditions cows responded with elevated levels of core body temperature. Although the cows were comparable with regard to various factors on heat stress susceptibility (e.g. body weight, milk yield) they reacted differently to an increasing heat load. Animal-related indicators are therefore necessary to adequately assess the individuals' heat stress. T3 and T4, heart rate and concentration of cortisol, Na⁺ and K⁺ sampled from milk were closely related to body core temperature in the short-term. Especially parameters that can be measured non-invasively in the milk are promising physiological indicators to assess heat stress. On pasture, cows with heat stress showed increased respiration rate, closer proximity to the water trough, had small inter-individual distances and decreased their activity. It was confirmed also in the

dairy herds studied on farm that cows stand together more, lie down less and stay near the water trough more often with increasing heat load. Although the thresholds of these behavioural indicators still need to be established in further studies, they should be useful and applicable for farmers to monitor their cows' heat stress on pasture. According to the online survey and on-farm research, keeping dairy cows inside the barn during the hottest part of the day is widely used by Swiss dairy farmers to mitigate heat stress. Our experimental study supported that it effectively reduces heat stress and can therefore be recommended as an appropriate cooling measure in farming practice.

Publications, posters and presentations

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