Development of a threshold model to isolate and investigate water intake in dairy cattle fitted with a reticuloruminal sensor

A.K. Shirley[AB], P.C. Thomson[A], A. Chlingaryan[A], and C.E.F. Clark[A],
[A] Livestock Production and Welfare Group, School of Life and Environmental Sciences, University of Sydney, Camden NSW 2570, Australia
[B] Corresponding author: alice.shirley@sydney.edu.au

An increase in climate variability across the Australian landscape lends itself to a heightened risk of cattle heat stress. Most thermal indices used to indicate heat stress are herd-level predictions, therefore there is an industry wide requirement for a thermal index for dairy cattle that accounts for individual animal variability. The use of reticuloruminal sensors, whilst able to monitor animals on an individual basis, are impacted by drinking events due to the device location. However, the consumption of water at varying temperatures and volumes can have a sizable, sustained impact on reticuloruminal temperature and as such may be indicative of individual coping strategies dictated by external climatic conditions. The objective of this study was to develop a water intake model for dairy cattle under varying levels of heat stress. Data acquired at 10-minute intervals by reticuloruminal sensors from three Victorian pasture-based dairy farms (A = 658, B = 426, C = 344 dairy cattle, mixed breeds) were utilised. Drinking events were identified based on the pattern and magnitude of temperature drop between up to three consecutive observations. Overall temperature drops and other characteristics of the drinking event were then calculated by the algorithm. The developed model was then validated on a fourth dairy farm. Results indicate a peak in the mean number of drinks per day across summer periods (mean = 3.87) compared to winter (mean = 2.85), in agreement with seasonal variation. Average temperature drops due to drinking events were smaller in summer (A = 4.2˚C, B = 3.6˚C, C = 3.7˚C) compared to winter (A = 5.7˚C, B = 5.3˚C, C = 5.2˚C). Examining the association between number of drinks per day and drop in reticuloruminal temperature demonstrated that with a smaller number of drinks, there was an increase in water consumption per event (Spearman's correlation: A = - 0.23, B = -0.48, C = -0.41). Further research is required to demonstrate how these short-term fluctuations in core body temperature may impact the rumen environment. By provision of a water threshold model, this preliminary study provides a basis to the development of a core body temperature phenotype for genetic selection of heat tolerant animals.

Additional keywords: cattle heat stress, drinking behaviour, reticuloruminal temperature, dairy cattle, sensors