Can heat stress be detected in the milk of dairy cows?

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Abstract: Cows take on heat from their surroundings and generate metabolic heat during digestion. They need to maintain their core body temperature between (38.6-39.3°C). Problems arise when temperature and humidity increase, preventing cows from effectively managing their metabolic and environmental heat. Different factors are related to increased heat stress (HS) in cows, including genotype, and physiological state (Fig 1). Early detection of HS through non-invasive methods empowers farmers to respond promptly to HS cows, making crucial management decisions. This pilot experiment aims to monitor Heat Shock Protein 70 (HSP70) as a potential biomarker for early detection of HS in dairy cows in different seasons. Milk, blood, and saliva samples were collected in winter 2023 at Corstorphine Dairy (n=20, Holstein Friesian), The University of Sydney, Camden, NSW, Australia. All cows were selected from 3rd parity with similar (average 110) days in milk and no prior health issues like lameness or mastitis. HSP70 was detected using an in-house competitive ELISA method. Environmental temperature, milk yield and proximate compositions were recorded. Environmental temperature ranged from (12.3-23.5°C), proximate composition in protein (3.3-3.6%), fat (4.7-5.3%), lactose (4.9-5.3%), and milk yield (13.7-51.25 L/day). Results showed that the levels of HSP70 in saliva (40.0-82.6 ng/mL) were similar to milk (32.4-128.1 ng/mL). Conversely, blood (238.7-389.3 ng/mL) exhibited four times higher levels of HSP70 compared to milk. Although the levels in blood might indicate highly sensitive responses, being an invasive method might elevate HSP70 levels due to stress, whereas milking is a non-invasive method and may not produce the same responses. Future work includes collecting samples in spring, summer and autumn, and farms across NSW, along with animal behaviour data from sensors. If successful, potential applications of our research include phenotyping HS-tolerant cows for genetic selection; managing affected cows differently; and assisting processors in pinpointing areas with higher HS incidence.

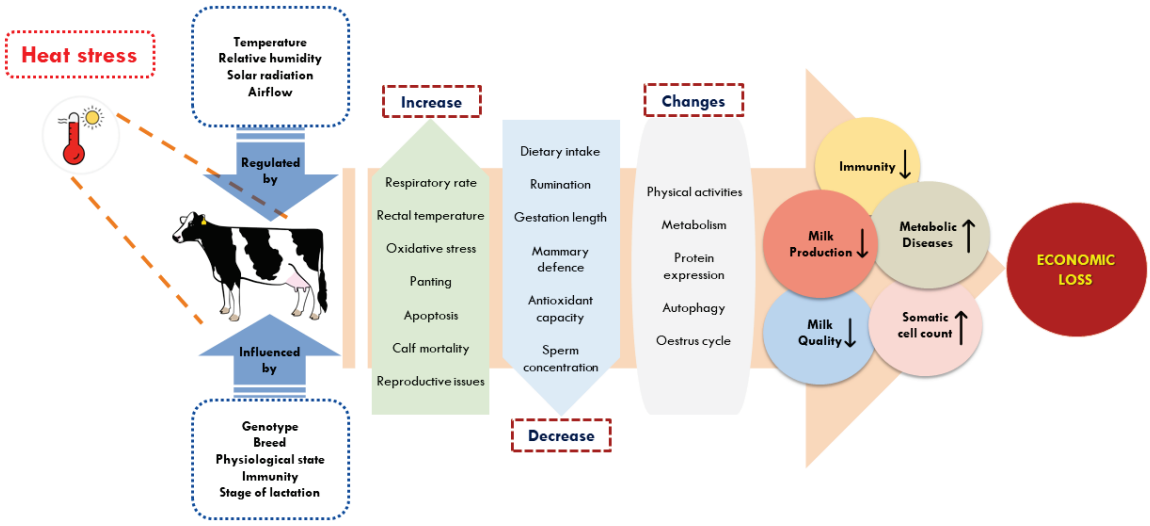

Figure 1. Impact of heat stress on the health and productivity of dairy cows

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