



## Abstract

# Metabolism and Endocrinology of Cattle in High Environmental Temperatures <sup>†</sup>

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**Abstract:** Close-to-market weight grain fed cattle experience high heat loads during summer. There are health, welfare and production impacts on these high value animals. Two cohorts of 600 kg Black Angus steers ( $n = 12$ ) were subjected to heatwave conditions during a thermal challenge in climate chambers. Frequent blood sampling enabled a detailed description of the metabolic and endocrine trajectories during high heat load and recovery in feedlot cattle. In high heat load ruminants, blood flow is diverted from the major organs impacting metabolic rate and cellular functions. The metabolic rate will slow with falls in the thyroid hormone plasma concentrations. Insulin and the adipokines gave an indifferent response. The high heat load cattle were hypoglycaemic and oxidising fatty acids. Liver involvement was evidenced by the build-up of bilirubin in plasma, and reduced release of cholesterol and ALP. Thermal challenge saw markedly increased plasma creatinine and urea implicating reduced glomerular filtration; although the kidneys were working to retain chloride ions to balance the loss of bicarbonate from the increased respiration rate. As heat load reduced during recovery, rumen temperature and respiration rate normalised and feed intake gradually returned. Plasma glucose levels increased also. With increased blood supply to the organs, there was a rise in liver enzymes into the blood, although liver function had not fully restored during the recovery period; plasma bilirubin concentrations were still high, and ALP and cholesterol levels low. Twelve days after the thermal challenge, most blood parameters had returned to normal and the steers had gained weight.

**Keywords:** hyperthermia; heat stress; insulin; adipokines; thyroid; glucose; bilirubin; cholesterol; ALP; creatinine; urea

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