The Physiological and Behavioural Responses of Sheep Exposed to Heat Load within Intensive Sheep Industries

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I declare this thesis is my own account of my research, and contains as its main content of work that has not previously been submitted for a degree at any university.

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ABSTRACT

The live export and feedlotting industries are the major intensive sheep industries in Australia. During live shipment, sheep are exposed to prolonged periods of high heat and humidity, with little relief for several days, while environmental conditions in a Western Australian sheep feedlot have not yet been assessed. The research described in this thesis was conducted to determine the physiological responses of sheep to conditions within the live export and feedlotting industries, with particular focus on that of heat stress.

Merino wethers and Awassi rams developed significant change in physiological variables when exposed to prolonged periods of high heat and humidity, such as during long haul, live export voyages to the Northern Hemisphere. Physiological changes such as increased core temperature, respiratory rate, panting score and associated changes in blood gas variables were apparent in Merino wethers. However, Awassi rams showed exceptional ability to maintain homeostasis under the same environmental conditions, with no significant changes in core temperature and only slight alteration in blood gas variables. Results from this study indicated that electrolyte supplementation of sheep during live export would not be warranted because plasma electrolytes did not drastically change and blood gas variables quickly returned to normal following the heat.

Further studies developed methods to determine the critical wet bulb temperature, otherwise known as the heat stress threshold (HST) of Merino rams, ram lambs and wethers exposed to live export conditions. These studies found that ram lambs had a lower HST than both adult rams and wethers. However, both adult rams and wethers had a similar HST. Heat stress thresholds determined from these studies have been used in a model to predict high risk shipments for particular classes of sheep (Stacey 2003).

This thesis also details the environmental conditions within a Western Australian summer feedlot and the physiological responses of cross bred ewes and wethers to these conditions when fed feedlot rations. This study found that temperatures in a typical Western Australian feedlot in summer increased above 40˚C with low humidity; however, temperatures generally decreased to be within the sheep's thermoneutral zone at night. Both ewes and wethers had significantly increased core temperatures in response to these conditions, with sheep spending significantly more time in the shade than in the sun during the day. Both ewes and wethers had increased respiratory rates and panting scores during an intensive climate room experiment with similar environmental conditions. However, feed intake did not decrease even when climate room temperatures increased at night and humidity levels were higher than that found in typical feedlot conditions in Western Australia.

Work completed within this thesis has led to a greater understanding of the physiological responses of sheep to prolonged and continuous high heat such as during live export and to conditions of a typical Western Australian summer feedlot. This research has set a foundation for further study of management of sheep during live export and feedlotting.

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