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Using Infrared Thermography as a Measure of Body Temperature in Cattle

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Body temperature (BT) is a reliable indicator of thermal balance in cattle and is commonly measured at several locations e.g. tympanic (Davis et al., 2003), rectal (Gaughan et al., 2008) and more recently rumen (T_{RUM}; Rose-Dye et al., 2011). Due to increasing animal welfare concerns non-invasive methods of obtaining BT that are fast, efficient and reliable need to be investigated. Infrared thermography (IRT) is a non-invasive method used to visualise and determine body surface temperature (T_{BS}). However studies investigating the relationship between BT and T_{BS} are limited, thus need to be explored at this time.

In this study IRT images of the head and body of 12 Angus steers were collected using an infrared thermal camera (Fluke Ti25, Fluke Corporation, Everett, WA, USA) and these images were used to assess the relationship between T_{BS} and T_{RUM}. Cattle were housed in individual pens (10 m × 3.4 m) with access to shade for a period of 5 days. Animal observations were conducted at 3 hour intervals to determine individual behaviour (ruminating/eating/drinking); posture (standing/laying); location (shaded/unshaded); panting score (using 0 – 4.5 score; where 0 is no panting, and 4.5 is open mouth, tongue extended panting); and IRT images of the head and body. Mean T_{BS} were recorded along the medial line on the head between the poll and the nose and on the transverse medial plane between the point of the shoulder (greater tubercle of humerus) and the hind limb of the animal. Rumen temperature was obtained every 10 min from each animal via orally administered rumen boluses. The boluses were an active RFID transmitter which relayed a signal to a base station and then into a database. Individual 10 min T_{RUM} data were converted to an hourly mean.

Pearson's correlation coefficient (Minitab® 16.2.0, 2010 Minitab, Inc.) was used to determine the relationship between the T_{BS} and T_{RUM}. A strong relationship between mean T_{BS} of the head and body (r = 0.88; P = 0.00) was determined. However there was little relationship between T_{RUM} and mean T_{BS} (Figure 1) of the head (r = 0.08; P = 0.12) and body (r = 0.07; P = 0.18). Temperatures recorded by IRT were generally lower than that of T_{RUM}, where mean T_{BS} of the head and body were 7.79 ± 0.24 °C and 7.25 ± 0.17 °C below T_{RUM} respectively.

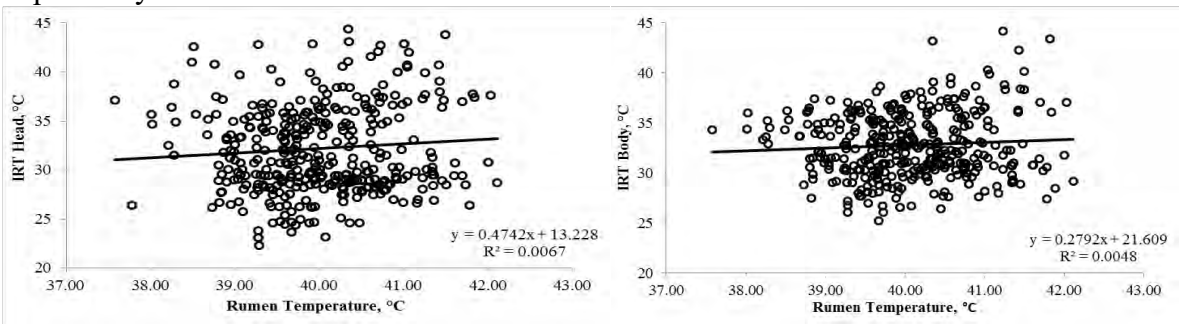

Figure 1: Linear trend between mean body surface temperature as measured by infrared thermography (IRT; Y axis) of the head and body against rumen temperature (X axis)

Infrared thermography may not be a suitable method to accurately determination of BT, as these data suggest that there was little relationship between mean T_{BS} of the head and body and T_{RUM}. However further analysis is required to determine the true relationship between T_{BS} and T_{RUM}. Furthermore on-going work will assess the usefulness of IRT from other parts of the body, e.g. eye, as potential indicators of BT.

Davis, M. S. et al. (2003). *Journal of Animal Science* **81**: 649 - 661
Gaughan, J. B et al. (2008). *Livestock Science* **113**: 226 - 233
Rose-Dye, T. K. et al. (2011). *Journal of Animal Science* **89**: 1193 – 1200