Infrared thermography to measure negative emotions in dairy cows

Jashim Uddin [1], *Clive J.C. Phillips* [2] *and David M. McNeill* [3]

[1] *Department of Veterinary & Animal Sciences, University of Rajshahi, Bangladesh.*

[2] *Curtin University Sustainability Policy Institute, Kent St., Bentley, Perth, Australia.*

[3] *School of Environmental and Rural Science, University of New England, Armidale, NSW 2350, Australia.*

Correspondence: jashimvet2008@ru.ac.bd

Introduction

- In commercial dairy farms, the condition in which cows are kept may lead to **negative emotional states (fear, stress, and anxiety)** with the development of **chronic physiological (high temperature)** and **behavioural abnormalities (right laterality)** that may compromise their health, welfare, and productivity.
- **Behavioural** rather than physiological tests are more likely to be used to indicate these **negative emotional states** but can be limited by their **subjectivity and additional stress to the animals for handling**.
- We hypothesized and investigated the positive association between **non-invasive and objective Infrared Temperatures (IRT)** of cow's external body surfaces with their right laterality and opposite with milk productivity.

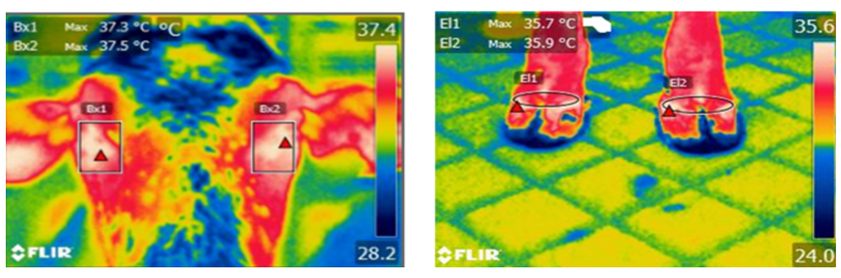
Materials and Methods

- We used 15 Left (less anxious) and 16 Right (more anxious) extreme lateralised cows.
- **Laterality** determines the preference of side of passing a person by a cow while leaving their milking parlour after evening milking **(Figure 1),** tested for 10 days, and calculated lateralisation score of each cow.

An individual cow was assumed to be left (L) lateralised when lateralisation score ∑L+1 / ∑R+1 is > 1 or right (R) when <1. Lateralisation score of L cows (n = 15) was 5.57 ± 0.78 and R cows (n = 16) was 0.37 ± 0.78.

Figure 1 *The way of laterality test in the lane, the position of the person is marked as a star in the diagram.*

- Thermal images of cow head and forelimbs were captured from a meter distance between cow body parts and camera lens (FLIR E40 Camera) during milking of cows in the parlour for 6 days **(Figure 2),** maximum IRT of eyes, and coronary band of forelimbs were identified and averaged.



Triangle marker within a shape (Right eye = Bx1, left eye = Bx2, coronary band of right forelimb = El1, and coronary band of left forelimb = El2) indicating the pixel with maximum infrared temperature.

Figure 2 *Front on view of thermal images of a cow's head and lower forelimbs.*

- Daily milk yield were recorded for those 6 days of thermal image capturing, used averaged value.
- Milk composition, somatic cell count, and days in milk were determined by averaging the monthly herd test data either side of the current IRT/ behavioural period.

Results

- From **ANOVA,** the right lateralised cow had higher eye IRT than left lateralised cows
  (Eye IRT of Right lateralised cow = 36.5°C, Eye IRT of Left lateralised cow = 36.1°C, SED = 0.16 °C, P = 0.01).
- **Multivariate regression** also showed a **positive relationship between right laterality and eye IRT (P = 0.02),** while **negative between eye IRT and milk fat content (P = 0.05).**

Conclusions

- Cows with negative emotions had high IRT on their eyes, right lateralised, and produced lower-quality milk.
- Cow health, welfare, and productivity could all be further enhanced and optimised by using a technique that objectively measures emotional responses such as laterality and applying early interventional management.

11th OHBC
12-14 June, 2023
One Health Bangladesh Conference