POSTER

Technical Session 4

Heat stress, health and welfare: genetics and management

A Mobile Infrared Thermography System for Precision Phenotyping and Health Monitoring of Dairy Cows under Heat Stress Conditions

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The increasing scale of dairy production systems necessitates efficient and animal-friendly approaches for continuous health monitoring, particularly in subtropical regions characterized by high temperature–humidity index (THI). In Taiwan, prolonged exposure to elevated THI compromises thermoregulation, increases disease susceptibility, and negatively affects animal welfare and productivity. Body temperature is a fundamental physiological trait reflecting health and stress status; however, routine rectal temperature measurement is invasive, labor-intensive, and impractical for large-scale phenotyping. Infrared thermography (IRT) offers a non-invasive method to quantify surface temperature and has been proposed as a precision phenotyping tool for health and welfare traits. This study evaluated a mobile, self-propelled IRT system integrated with radio-frequency identification (RFID) technology for rapid health screening of dairy cows under heat stress conditions.

The study was conducted in a lactating cow barn at the Hsinchu Branch of the Livestock Research Institute, Taiwan, where environmental conditions were typical of high THI dairy housing. A total of 20–26 lactating Holstein cows equipped with RFID tags were monitored weekly for five consecutive weeks. During feeding, cows were restrained at headlocks, and the mobile IRT unit was remotely operated along the feed alley at a distance of approximately 2 m. Individual cow identification was achieved via RFID, and orbital (eye region) temperature was automatically measured using a dual-lens infrared camera. Rectal temperatures were recorded concurrently for validation. An orbital temperature threshold of 37.5°C was applied for real-time health alerting.

The system achieved a 100% success rate in individual identification and orbital region recognition (n = 138 measurements). Mean orbital temperature of healthy cows was 37.0 ± 0.2 °C (n = 112), whereas cows exhibiting fever (rectal temperature 39.8 ± 0.3 °C) showed higher orbital temperatures (37.8 ± 0.3 °C; n = 26). The average acquisition time per cow was less than 5 s, enabling rapid herd-level phenotyping. These results demonstrate that mobile IRT provides a robust, non-invasive phenotyping approach for detecting thermal and health deviations associated with heat stress. The system shows strong potential for integration into precision dairy management strategies aimed at improving health monitoring, animal welfare, and resilience to heat stress.