

# Evaluation of Infrared Thermography to Identify Illness in Transition Cows

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Rectal temperature is a common method to monitor the health of transition cows; however, it requires extra time and handling of cows and has only moderate accuracy. Our objective was to evaluate infrared thermography as a tool to identify illness in transition cows. On a commercial dairy farm in Alberta, between November 2016 and July 2017, 72 cows (57% primiparous) were enrolled in the study on the day after calving until 12 days in milk. Infrared images of the eye and cheek were taken daily after the morning milking using a hand-held infrared camera (FLIR E40x; ITM Instruments Inc.), in addition to daily rectal temperatures. Images were analyzed to determine the mean and max of both the eye and cheek, as well as the combination of all eye, all cheek and all temperature measurements. Health examinations were conducted daily, and blood ketone levels were measured (FreeStyle Precision Neo™) on days 6 and 9 after calving to diagnose retained placenta, metritis, milk fever and ketosis. Blood samples taken on days 3, 6, 9 and 12 were used to measure common indicators of illness (interleukin-6, tumor-necrosis factor  $\alpha$ , serum amyloid A, and cortisol) to help identify sick cows that were missed by the physical diagnosis. For each temperature variable a threshold value was selected based on the highest Youden's index and the sensitivity (Se; identifying a sick cow as sick) and specificity (Sp; identifying a healthy cow as not sick) were determined. Overall, 26% (n = 19) of cows were diagnosed as sick and 7 additional cows had 2 or more blood indicators > 1 SD above the mean, bringing the total sick to 36%. The best performing infrared variables were mean cheek and mean of all temperature measurements. A mean cheek > 27.1°C had a Se and Sp of 66 and 53%. A mean of all temperatures > 33.6°C had a Se and Sp of 60%. In comparison, a rectal temperature > 39.5°C had a Se and Sp of 32 and 83%.

Take home message: When using a hand-held infrared camera to take images of the eye and cheek once daily, the Se and Sp were around 60%. In comparison to rectal temperature taken at the same time, infrared had an increase in Se but a decrease in Sp. This indicates a better ability to identify truly sick cows, but may misidentify healthy cows as sick, leading to overuse of antibiotics. The moderate accuracy of both rectal temperature and infrared is likely due to the general nature of transition diseases, which may or may not present with fever. This study was limited by taking infrared measurements only once per day. Based on these results, further investigation is warranted using an automated infrared camera that will take more frequent measurements and create a baseline for each cow to better identify temperature changes and more accurately identify sick cows.

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