Can thermal pixels differentiate stages of lactation compared with a conventional BCS method?

H.J. Perez Marquez*[1], A. L. Schaefer‡*, C. J. Bench*

*Department of Agricultural, Food and Nutritional Science, University of Alberta, T6G 2P5, ‡Animal Inframetrics Inc, [1]email address: perezmar@ualberta.ca

Conventional body condition scoring (BCS) is subjective, time-consuming and fail to identify thin or fat lactating cows has implications for milk yield, fertility, metabolic diseases and welfare. Radiometric infrared thermography cameras capture radiated temperature from an object and ascribe a temperature measurement for each pixel within a thermal image and have been successful in identifying physiological changes in livestock species. The objective of this proof of concept study was to investigate the use of thermal pixel analysis of the pelvic area to differentiate stage of lactation in dairy cows. We hypothesised that the number of thermal pixels (TP) will be able to identify changes in pelvic area that are indicative of lactation stage compared with a conventional visual BCS method. Twenty-five lactating Holstein dairy cows were divided into 5 groups of 5 cows each at different lactation stages (Group A: After calving, B: 30-50, C: 70-100, D: 150-180 and E: 200-230 days in milk). All cows were followed for 5 consecutive weeks. Body condition scoring was visually assessed once a week using the Wildman et al., 1982 visual method (BCS) from 1: very thin cow to 5: a severely over-conditioned. Thermal images were recorded using a hand-held camera (FLIR C3) at a resolution of 320x240 pixels with an accuracy of ± 2 % from 1.5 m above the pelvic area with the cow standing at a perpendicular angle. Thermal pixels were counted using ResearchIR (FLIR) by entering a threshold value of 18˚ C to eliminate background pixels from the pelvic thermal image. Changes in stage of lactation were used to compare with visual BCS with TP. The number of TP from the pelvic area significantly differed by stage of lactation ($P = 0.01$; A: 596.69 ± 35.38, B: 542.72 ± 35.62, C: 513.51 ± 36.45, D: 680.63 ± 34.87 and E: 654.94 ± 35.54 LSMean ± SEM) and by week ($P = 0.01$). Visual BCS were not found to differ significantly by lactation stage by week ($P = 0.1$). However, TP measurements were influenced by cow size and cow parity ($P < 0.05$) while conventional BCS were not affected by cow size and parity ($P \geq 0.05$). Based on these results, TP analysis has potential to monitor dairy cow pelvic area.

Implications: Future applications of thermal pixel analysis may also possible for monitoring subcutaneous fat in lactating dairy cows at the herd level.