Factors Impacting Ovulation Times and Temperature During Estrus and Ovulation of Holstein Dairy Cows

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The aim of this study was to determine if estrous expression, body condition or lameness impacts ovulation times or rumen-reticular temperature (RRT) around estrus or ovulation. Cows were equipped with an automated activity monitor (AAM) and enrolled onto the study when their activity crossed the alert threshold. A total of 818 episodes of estrus from 296 different cows were used for this study; a subset of 102 cows were equipped with rumen-reticular bolus thermometers where 200 estrus episodes were collected. Animals had their ovaries scanned using ultrasonography, and were gait (GS) and body condition (BCS) scored at enrolment. Ovaries were scanned twice daily to monitor for ovulation, for a maximum of 3d. Physical activity data, continuously recorded using the AAM, was used to determine estrous behaviour (peak activity and duration). The maximum change in temperature from baseline (i.e. amplitude) was calculate during estrus (MTE) and around ovulation (MTO). The AAM correctly identified 87.8% of the estrus alerts, with 12.2% false positives. Shorter ovulation times, in relation to the AAM alert, were associated with decreased peak activity and duration of estrus. Ovulation intervals of <20, 20-31, and ≥32hr had peak activity of 69.9±1.6, 80.7±1.0 and 78.4±1.9 index, and durations of 10.1±0.4, 12.9±0.3 and 13.3±0.5 hr, respectively (P<0.01). Animals with high peak activity, long duration of estrus, and lameness were 2.5, 3.3, and 1.7 times more likely to have ovulation intervals above the median length of 25hr (P<0.01). No effects of BCS on ovulation interval were found. High peak activity and long duration episodes had higher MTE than those with low peak activity (0.5±0.06 vs. 0.4±0.05 ^{0}C; P=0.02) and short duration estrus events (0.6±0.06 vs. 0.4±0.05 ^{0}C; P=0.05). The opposite was found with MTO, where long duration episodes were associated with a lower temperature amplitude than those with short duration (0.3±0.03 vs. 0.4±0.04 ^{0}C; P<0.01); there was no difference in MTO with estrus intensity. BCS affected MTE, where thin animals had a higher amplitude than animals with average and moderate BCS (0.6±0.07 vs. 0.4±0.05 vs. 0.4±0.06 ^{0}C; P=0.04); MTE was not affected by GS. BCS and GS did not affect MTO. Lastly, cows with high peak activity at estrus had higher pregnancy/AI (38.3% vs. 22.7%; P<0.01) and lower ovulation failure (3.5% vs. 11.5%; P<0.01) than low peak activity.

Implications: Estrous expression measured using an AAM has marked effects on fertility and ovulation failure and is associated with differences in ovulation times and changes in rumen-reticular temperature during estrus and near ovulation.