

Effects of Estrous Expression, Body Condition, and Lameness on Ovulation Times of Holstein Dairy Cows

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The aim of this study was to determine if estrous expression, body condition or lameness affected ovulation times in Holstein dairy cows when using an automated activity monitor (AAM). Lactating cows were equipped with a collar-mounted AAM within 10 d postpartum. Animals that were greater than 30 DIM were 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. At the time of enrolment, animals had their ovaries scanned using ultrasonography, and were gait (GS; scale:1-4) and body condition (BCS; scale 1-5) scored. Animals in estrus had their ovaries scanned twice daily to monitor for ovulation, for a maximum of 3 d. Ovulation was diagnosed by the disappearance of the dominant preovulatory follicle. Physical activity data, which was being continuously recorded using the AAM, was used to determine the behavioural expression of estrus. Estrous expression was quantified using two parameters: 1) peak activity and 2) duration of the estrus episode. Peak activity was defined as the maximum activity index during an estrus episode; the threshold activity considered an estrus event was set as an index level of 35, approximately 80% relative increase compared with baseline levels. The duration of an estrus episode was defined as the amount of time the animal spent with an index level greater than 35. Data was analyzed using logistic regression and ANOVA for repeated measures with cow as a random effect using SAS. The AAM correctly identified 87.8% of the estrus alerts, with 12.2% false positives. The timing of ovulation in relation to the AAM alert (ovulation interval) was associated with increased peak activity ($P<0.01$) and duration ($P<0.01$) of estrus. Ovulation intervals of ≤ 17 hr, 18-23hr, 24-29hr and ≥ 30 hr had peak activity of 66.0, 74.2, 81.9, and 78.9 index, and durations of 9.3, 11.5, 12.9, and 13.5hr, respectively. Animals with high peak activity, long estrus duration, and lameness were 2.5, 3.3, and 1.7 times more likely to have ovulation intervals above the median length of 25 hr ($P<0.01$). No effects of BCS on ovulation interval were found. Ovulation failure occurred in 6.7% of animals that were in estrus. Estrous expression highly impacted ovulation failure, as animals with low peak activity and short estrus duration were 3.3 and 3.0 times more likely to fail to ovulate, ($P<0.01$). BCS and GS did not affect ovulation failure. In addition, high peak activity and long estrus duration also resulted in higher pregnancy per AI (38.3% vs. 22.5% for high and low activity; 37.3% vs. 24.3% for long and short duration; $P<0.01$).

Implications: Estrous expression characteristics have the potential to better predict ovulation timing, and thus help make more effective decisions on farm.