

Estrus detection intensity and accuracy and optimal timing of insemination with automated activity monitors for dairy cows

Craig Leroy, BSc, MSc; **Stephen LeBlanc**, BSc(Agr), DVM, DVSc
Population Medicine, University of Guelph, ON Canada N1G 2W1

Introduction

The use of automated activity monitoring (AAM) systems for estrus detection is increasing rapidly in the dairy industry in North America. While there is some peer-reviewed published information about the performance of these tools for management of reproduction, large-scale field studies in commercial dairy herds are needed to inform realistic expectations of the performance of AAM systems and implementation of management practices to optimize their utility. The objectives were to assess the ability of AAM to detect estrus for first insemination, the accuracy of detection, and the optimum interval from the onset of estrus to insemination.

Materials and Methods

Four commercial farms were studied over 1 year; 2 employed the AfiAct (Afikim) system and 2 the Heatime HR (SCR Inc.) system. Cows were inseminated between 55 and 80 days-in-milk (DIM) based on AAM only, then supplemented with timed AI (TAI). Blood progesterone concentration was measured in 1,014 cows at weeks 5, 7, and 9 postpartum. Purulent vaginal discharge (PVD) was assessed at week 5 using a Metrichick device, and lameness and BCS were scored at week 7. Blood samples were collected on the day of AI from 445 AI based on AAM and 323 AI based on TAI, and from an additional 89 cows signalled in estrus by AAM but not inseminated. Onset of estrus was calculated using the same (AfiAct) or similar (for the proprietary SCR algorithm) data processing criteria as the AAM system software. Producers recorded the time of AI. The interval from onset of estrus to AI was categorized as 0 to 8, 8 to 16, or 16 to 24 h. The odds of each of the 3 outcomes of interest were analyzed with multivariable logistic regression models, controlling for the effect of herd.

Results

The prevalence of anovular condition (all 3 blood progesterone (P4) samples <1 ng/mL), PVD, BCS<2.5, and lameness (locomotion score 3 or 4 out of 5) were 9%, 14%, 9%, and 15%, respectively. Overall, AAM detected 83% of cows in estrus by 80 DIM. Cows that had 3 serum P4<1 ng/mL, had PVD, or were both lame and had BCS≤2.5 were less likely to be detected in estrus by 80 DIM (62, 68, 53%, respectively). The proportion of cows not in estrus (P4>1 ng/ml) on the day of AI was similar (P=0.35) between AAM (4±1.8%) and TAI (3±1.2%). However, 43% of cows signalled in estrus by AAM but not inseminated were not in estrus. If included with the AAM animals that were inseminated, 9% of animals signalled by AAM were not in estrus, which was greater than for TAI (P=0.02). There was no effect of AAM system on the probability of pregnancy per AI, but there was an interaction of interval with parity. For multiparous cows, the probability of pregnancy per AI was 31%, which did not differ (P=0.7) with the interval to AI. For primiparous cows, the odds of pregnancy were greater if AI occurred 0 to 8 h (49%) than 8 to 16 h (36%) or 16 to 24 h (31%) after the onset of estrus.

Significance

Automated activity monitoring can detect estrus for first AI in just over the length of 1 estrus cycle for over 80% of cows, but the remainder would likely require intervention for timely insemination. For multiparous cows, performing AI based on AAM once/day would not affect pregnancy/AI, but based on these data, AI of primiparous cows within 8 h of the onset of estrus may be advantageous.