

Rest Behaviour as a Tool for Estrous Detection: Risk Factors for Poor Expression and Associations with Ovulation and Conception Risk

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The use of sensors for activity monitoring can facilitate estrous detection and improve precision of AI timing. Our objectives were to quantify changes in rest behaviour during periods of estrus, to determine its associations with ovulation risk and pregnancy per AI (P/AI), and to identify risk factors for poor expression of estrus based on rest behaviour. Holstein cows ($n = 1,039$; 45.6 ± 10.7 kg milk/d) were fitted with AfiAct II sensors; 1,179 inseminations and estrus periods were evaluated. Rest bout frequency (BOU), daily rest time (min/d; TOTAL), and average bout duration (min/bout; AVG) were recorded. Percent changes at the day of estrus (one day before AI) and at d+1 after AI were calculated using non-estrus days (one week before AI) as reference. Thresholds for high intensity estrus were defined as a decrease greater than 25% for BOU and 22% for TOTAL. AVG did not change with estrus. An increase of 10% or more in TOTAL at d+1 after AI was defined as a large increase. At the day of estrus, BOU and TOTAL were lower than at non-estrus days by $19 \pm 34\%$ (-3 ± 5 bouts/d) and $20 \pm 30\%$ (-145 ± 190 min/d), respectively. Risk factors associated with reduced intensity were progesterone concentration at estrus (P4), season and parity. Cows with $P4 < 0.2$ ng/mL were twice as likely to have high intensity estrus (large reduction in rest time and number of bouts). High intensity estrus was also associated with greater odds of ovulation (OR = 2.7 [BOU]; 4.6 [TOTAL]). There was a tendency for an association between changes in rest behaviour at estrus and P/AI at 32 and 60 d, but parity, BCS, and season were more important predictors. Interestingly, TOTAL and AVG were greater at d +1 after AI than at non-estrus days (TOTAL: $8 \pm 30\%$; AVG: $13 \pm 36\%$). Ovulation and P/AI at 32 d were more likely for cows with large increase in TOTAL at d+1 after AI (ovulation: OR = 2.6; 92% vs. 81%; P/AI: OR = 1.5; 38% vs. 27%).

Implications: Rest behaviour has potential to be used for estrous detection and fertility prediction. The associations with ovulation and conception risk are suggestive of benefits of behavioural monitoring to reproductive efficiency. Intensity of estrous expression, similarly to detection rate, could be an important indicator of a successful reproductive management.