

Early Post-Partum Physical Activity and Estrus Expression and Their Associations with Fertility and Ovulation Rate in Lactating Dairy Cows

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The aim of this study was to evaluate the effect of early post-partum physical activity at estrus and artificial insemination (AI) on pregnancy per AI (P/AI) and ovulation rates. A total of 436 lactating Holstein cows were enrolled. Cows were monitored continuously by a leg-mounted pedometer (AfiMilk®, Afitag™). Data was recorded and retrieved at each milking (every 8 h). Ovulation was induced in cows by a timed AI protocol based on estradiol and progesterone. Body condition score (BCS; 1 to 5 scale) was measured at the time of AI and the ovaries were scanned on d 7 post-AI to check for the presence of a corpus luteum. Calving score and incidence of endometritis were recorded. An estrus event was recorded when the relative increase in activity exceeded 100% of the cow's baseline activity, within the first 30 DIM (30D) and at AI. Pregnancy diagnosis was performed 30 d after AI. Only first AI were included in the analysis. Relative increase in physical activity was (mean ± SE) 274.1±97.3% at estrus within the first 30 DIM and 494.9±159.6% at the time of AI. Low BCS (≤ 2.75) tended to affect relative increase of physical activity at both 30D ($P=0.09$) and AI ($P=0.12$). Milk production was not correlated with increased physical activity ($r=0.06$; $P=0.20$). Multiparous cows expressed lower activity than primiparous ($479.8\pm 11.3\%$ vs. $513.1\pm 12.3\%$; $P=0.04$). Cows with endometritis and difficult calving had lower physical activity at 30D compared with those that were healthy and without dystocia ($204.3\pm 21.9\%$ vs. $285.7\pm 8.9\%$; $213.8\pm 26.9\%$ vs. $282.3\pm 13.0\%$, respectively). Cows that had at least one episode of high activity at 30D had higher fertility (47.5% vs. 32.8% P/AI; $P<0.05$) and higher intensity of activity at AI ($533.1 \pm 14.8\%$ vs. $477.7 \pm 9.9\%$ relative increase; $P<0.05$). Cows with high estrous expression at AI had higher fertility (43.6% vs. 22.8% ; $P < 0.05$) and higher ovulation rates (94.8% vs. 85.7% ; $P = 0.03$). Cows that had increased activity at 30D as well as at AI had higher fertility when compared with those that did not express estrus at either (52.7% vs. 32.9% , $P<0.001$) and were more likely to ovulate (98.8% vs. 91.6% ; $P=0.01$). Greater activity at 30D and at AI improved fertility and ovulation rates.

Implications: Quantitative data from AAM can be used to identify and predict fertility measures in dairy cows. Animals with higher relative increase in activity at estrus early post-partum and at AI have higher fertility and ovulation rates.