

# Associations Between Vaginal Temperature and Induced Estrus Expression and Fertility in Lactating Holstein Cows.

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The objective of this study was to determine the effect of vaginal temperature on levels of physical activity expressed by lactating Holstein cows following induced estrus. Lactating Holstein cows ( $n = 641$ ;  $41.5 \pm 9.4$  kg milk/d) were fitted with a leg-mounted pedometer, resulting in 843 evaluated activity episodes. Vaginal temperature was monitored using thermometers attached to an intravaginal device as part of an E2/P4 timed-AI protocol (TAI), and recorded vaginal temperature every 10 min for 3 d. Environmental temperature and relative humidity (THI) were recorded using an external thermometer placed in each pen. Milk production and body condition score (BCS; 1 to 5 scale) were collected at time of thermometer insertion. Statistical analysis was performed in R Studio using ANOVA and logistic regression. Heat stress was calculated based on the percentage of time the cow spent with a vaginal temperature  $\geq 39.1^\circ\text{C}$  (PCT39), 9-11 d prior to TAI. Mean vaginal temperature was  $38.9 \pm 0.2^\circ\text{C}$ , and the mean maximum and minimum vaginal temperatures were  $39.7 \pm 0.5^\circ\text{C}$  and  $38.0 \pm 0.8^\circ\text{C}$ . Relative increase (RI) (mean  $\pm$  SE) at estrus was  $237.0 \pm 160\%$ . Animals with low BCS had a lower RI compared to cows with medium BCS ( $260.31 \pm 17.45\%$  vs.  $296.42 \pm 6.62\%$ ;  $P < 0.05$ ). Cows in early lactation showed lower RI compared to mid lactation and late lactation animals ( $265.40 \pm 9.90\%$  vs.  $288.36 \pm 11.58\%$  vs.  $295.75 \pm 11.29\%$ , respectively;  $P < 0.05$ ). Lower THI values ( $\leq 65$ ) were associated with greater RI compared to medium ( $> 65 - < 70$ ;  $P < 0.05$ ) and high conditions ( $\geq 70$ ;  $P < 0.01$ ). There was no significant effect of PCT39 ( $P < 0.79$ ) or milk production ( $P < 0.13$ ) on RI. More intense RI at estrus resulted in greater pregnancy per artificial insemination (P/AI) compared with low RI (27% vs. 20%;  $P < 0.05$ ) and no RI (27% vs. 12%;  $P < 0.01$ ). An interaction was observed between PCT39 and THI on P/AI, where a subpopulation of cows with high PCT39 had decreased P/AI under high THI conditions, but not under medium or low THI conditions (13% vs. 24% vs. 26%  $P < 0.03$ ). These results have direct management implications for Canadian producers in regions with high ambient temperatures that are managing dairy cows with low estrus expression and compromised fertility.