Associating reproductive physiology and automated monitoring technologies to predict fertility of dairy herds: I. Holstein heifers

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The display and intensity of estrus behaviour, measured by automated activity monitors, have been linked to improved fertility of dairy cows and heifers. Although, the physiological mechanism driving the association between this behavioural feature and dairy cow fertility is yet to be determined, greater concentration of the hormone progesterone (P4) before estrus was associated with improved fertility and greater intensity of estrus in lactating cows. However, the unanswered questions were: is the association between P4 and intensity of estrus the same for heifers? Would be possible to manipulate the intensity of estrus and thus fertility by controlling P4 concentrations before estrus? Additionally, we questioned: could we add different features of estrous expression to indexes of genetic selection programs used in dairy cattle operations? Two experiments were conducted aiming to evaluate the association between P4 and intensity of estrus in Holstein heifers. The first study was conducted in a crossover design using single ovulating heifers and had as a secondary objective the evaluation of ovulation timing. The second experiment was done in superovulated heifers with embryo production and quality as secondary objectives. Greater P4 concentrations before estrus was associated with greater intensity of estrus in single ovulating heifers, but no effect on ovulating timing was found. Although P4 concentrations did not associated with intensity of estrus in superovulated heifers, the number of embryos produced was shown to increase as the duration and the intensity of estrus increased. Next steps include refine estrus data to improve reproductive indexes used in genetic selection programs.
Take home message: Progesterone and intensity of estrous expression could be implemented as important markers to refine fertility traits used in genetic selection programs.

Investigating the impact of beta-hydroxybutyrate concentrations on dairy cow behaviour and productivity for cows milked in robotic milking systems

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The use of robotic milking systems is increasing exponentially worldwide. Cows are free in these systems to milk more often and typically produce higher quantities of milk. The increase in energy required to support this production level has been linked to an increase in beta-hydroxybutyrate concentrations, indictive of prevalent illnesses such as subclinical ketosis (SCK). However, current thresholds of SCK were established primarily using cows milked in conventional milking systems (tie stalls and parlours). Therefore, the objective of this study is to further explore various beta-hydroxybutyrate concentrations (BHB), within robotically milked herds, to understand the impact on milking characteristics and cow behaviour in today's modern dairy industry. A total of 430 cows across 2 commercial robotic milking herds in the Fraser Valley of British Columbia were enrolled in this study 1 week prior to dry off and followed until 60 days in milk (DIM). Blood samples were collected across the first 21 DIM, with blood analyzed cow-side for BHB. As this project is still ongoing, only preliminary results are available. Area under the curve (AUC) for each cow's BHB values throughout the first 21 DIM was calculated. For every 1 unit increase in AUC, milk yield increased by 0.9 kg/d, eating time decreased by 7.2 minutes/d, and rumination decreased by 7 minutes/d (p=0.005, p=0.02, p=0.05 respectively). The number of positive SCK tests and when they occurred was tested to determine the impact on daily milking characteristics and cow behaviour. Positive tests (BHB>1.0 mmol/L) occurring in week 3 postpartum (15-21 DIM) had the greatest impact on cow behaviour with a decrease in rumination on average by ~58 mins/d, and a decrease in eating time by ~70 mins/d (*p=0.001,* p=0.004, respectively).
Take home message: This research aims to help producers better understand the impact of BHB concentrations and SCK thresholds on the productivity, behaviour and health of their animals.