



# Research Reports

## **Progesterone and intensity of estrus are associated with fertility of dairy heifers.**

By Jessica C.S. Marques, Joyce P.O Maciel, Jose Denis-Robichaud, Rodrigo S. Conceicao, Amanda M. Bega, Sydney Moore, and Ronaldo L.A. Cerri

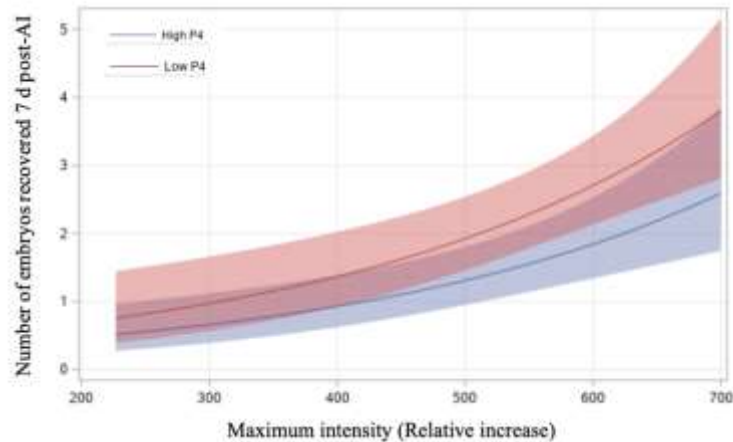
The use of sensor technologies to detect estrus (period of sexual receptivity) has increased throughout the years in dairy farms. Data generated by these wearable sensors has helped researchers to study the link between the intensity of estrus behaviour and fertility in dairy cows.

Several studies conducted by the Animal Reproduction group at The University of British Columbia demonstrated that cows displaying greater intensity of estrus (measured by wearable sensors) have improved fertility such as greater pregnancy per artificial insemination as well as lesser pregnancy losses. Similarly, another study conducted by our research group using superovulated (induced to have several ovulations) dairy heifers found that greater intensity of estrous behaviour was also associated with greater embryo production and quality. However, the unanswered question was - which physiological mechanisms are driving the intensity of estrus in dairy cows and heifers?

Recently, a study published in 2022 by our research group demonstrated that greater concentration of the hormone progesterone before estrus was associated with improved fertility and greater intensity of estrous behaviour in lactating cows. This led to studies that attempted answering the following research questions: is the association between progesterone and intensity of estrus the same for superovulated heifers as it is for lactating cows? Would be possible to manipulate the intensity of estrus and thus fertility by controlling progesterone concentrations before estrus? Evaluating this hormonal and behavioural relationship could provide supplementary information to predict and improve superovulatory responses in dairy heifers assisting in the decision-making of embryo transfer programs used in modern dairy cattle operations.

Jessica Marques, a current Ph.D. Student, and her research fellows conducted a study at The University of British Columbia's Dairy Education Research Centre evaluating the effect of progesterone concentrations during a superovulatory treatment on the intensity of estrus behaviour, ovarian responses, as well as number and quality of embryos in Holstein heifers. A total of 63 Holstein heifers were randomly assigned into two experimental groups: Low progesterone (n = 31) and High progesterone (n = 32). Heifers received a pre-synchronization protocol followed by a protocol of superovulation that included the allocated progesterone treatment. Activity was monitored continuously by an automated activity monitor, and estrus characteristics (maximum intensity and duration) were recorded. Embryo collection was performed 7 d post artificial insemination and embryos were counted and graded from good or excellent (1) to degenerated (4).

A total of 105 embryos (High progesterone: n = 42; Low progesterone: n = 63) were graded for quality. The different progesterone levels during superovulation treatment did not affect the maximum intensity or the duration of estrus in heifers. However, heifers in the high progesterone group had greater number of follicles at the time of artificial insemination, but with smaller diameters compared to heifers in the Low progesterone group. High progesterone heifers tended to have better embryo quality when compared to Low P4 heifers. However, heifers exposed to Low progesterone treatment had greater number of embryos recovered 7d post artificial insemination when compared to high progesterone. Although estrous behaviour did not relate to the quality of embryos, the maximum intensity and the duration of estrus increased the number of embryos recovered (Figure 1). These results suggested that progesterone during superovulation, and the intensity of estrus, play a role in regulating the quality and the number of embryos produced by superovulated heifers. Considering that the probability of producing pregnancies in embryo transfer programs increases as the quality of the transferred embryos increase, supplementation with progesterone before estrus might have the potential to increase pregnancy outcomes in dairy heifers.



*Figure 1: Effect plot summarizing the effect of maximum intensity of estrus on the number of embryos recovered 7 d after artificial insemination (AI), by treatment groups (High progesterone (P4) and Low P4). The maximum intensity of estrous expression was defined as the maximum relative increase in activity during an estrous episode (n = 42 heifers).*



*Jessica Marques at The University of British Columbia's Dairy Education Research Centre, in Agassiz – BC. Her research has focused on the use of progesterone and intensity of estrous expression to improve the fertility of Holstein heifers.*

For more information on this project, please contact Dr. Ronaldo Cerri ([ronaldo.cerri@ubc.ca](mailto:ronaldo.cerri@ubc.ca)). The results described in this report are based on Marques, et al. 2023. The impact of progesterone concentrations during superovulation of Holstein heifers in a randomized trial. (Submitted to Journal of Dairy Science).

## Funding

General funding during the time of this study was provided by contributions from the Resilient Dairy Genome Project (LSARP-2020 - Genome Canada; <http://www.resilientdairy.ca/funders-and-partners>) and the Natural Sciences and Engineering Research Council (grant # RGPIN-2020-05433).

## Research Reports

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