Meta-analysis of the effects of age at first calving on production outcomes, calving difficulty, and reproduction in dairy heifers

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1. ABSTRACT

This study aims to determine the effects of reducing age at first calving (**AFC**) on production and reproductive performance through meta-analytic methods. A literature search using three search engines was conducted to identify prospective studies that evaluated AFC for data extraction. Inclusion criteria included specific dairy breeds, a treatment group with an AFC below 26 mo of age, and prospective enrolment of heifers. There were few prospective studies suitable for meta-analysis, with 16 studies containing 35 appropriate experiments. There was substantial heterogeneity likely due to differences in study design and interventions used to induce an AFC difference. Outcomes were assessed using classical multilevel random effects meta-analytic models with standard mean difference, effect sizes, or risk ratios being evaluated where appropriate. Meta-regression was performed using the difference in age at first calving. There was a loss of production for first lactation milk (-2.06 L/d of earlier calving), fat (-0.12 kg/d of earlier calving), and protein (-0.08 of kg/d earlier calving) yield for heifers calving at a younger age. There were no differences in second and third lactation milk yield, calving difficulty, heifer reproductive performance, survival to calving, and survival to the end of first lactation. While the production in first lactation is decreased, this may be offset by fewer days to first calving without compromising the heifers' ability to calve, become pregnant for the first time, or survive to the end of first lactation. Given the lack of prospective studies, more randomized controlled experiments over multiple lactations, including health, production, and reproductive data, are needed to evaluate this topic further.

2. A prospective investigation into the effects of age at first calving on milk production, health, and reproduction in primiparous Holsteins on Australian Commercial Farms

From October 2023 to February 2024, heifers from commercial dairy farms in NSW and Victoria, Australia, were enrolled from 11 months of age. The heifers were weighed at enrolment with a minimum target weight of 330kg before breeding. Heifers were enrolled in age groups from 11 to 13 months and >13 months at enrolment. A group of 83 heifers was enrolled in an animal ethics exemption due to being underweight, but the farmer still wished to mate them at a younger age. Blood samples were collected randomly from 15 animals per group from the first 30 animals that moved through the crush. Tests include leptin, osteocalcin, IGF-1, IFGBP-6, protein metabolites, insulin, glucose, and NEFA.

Heifers have been tracked through herd testing and on-farm computer software. A selection of heifers was weighed a second time close to calving. Early results from the first year of the project will be presented.

Animal Care and Ethics

Animal ethics committee approval was gained through Charles Sturt University. Approval Number: A23670. One group of heifers are being followed under an animal ethics committee exemption applied to them from Charles Sturt University. Approval Protocol Number: 2024EA-02.