

Early-life growth and lactation performance as predictors of dairy cow longevity in an Australian Holstein-Friesian herd

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Dairy cow longevity is increasingly recognised as a cornerstone of sustainable and socially responsible milk production. Extending herd life improves productivity, reduces replacement costs, and enhances animal welfare outcomes. While numerous studies have examined culling risk in first lactation cows, fewer have linked preweaning performance to lifetime survival. Understanding these early predictors is essential for optimising management and breeding strategies within modern, data-driven dairy systems. To investigate associations between early-life growth traits and subsequent survival in a large commercial Holstein-Friesian herd and to identify potential preweaning indicators of longevity. Records from 14,391 cows born between 2017 and 2022 on a single Australian dairy enterprise were analysed. Variables included birth weight (BWT), weaning weight (WWT), days in milk (DIM), milk yield, birth date, and date of sale, death, or censoring. Kaplan–Meier survival curves and Cox proportional hazards models were applied to assess factors influencing the risk of removal from the herd. Cows were censored if still active at the end of the observation period. Culling risk was highest during early lactation, with a nonlinear increase from approximately 128 DIM. Both lower BWT and WWT were significantly associated with an elevated hazard of removal, suggesting that suboptimal early growth negatively impacts long-term survival. The inclusion of milk yield and DIM improved model fit, highlighting that productive performance interacts with early-life traits in shaping longevity. This study demonstrates that early-life growth metrics can serve as meaningful predictors of herd retention, reinforcing the need to prioritise calf management as part of whole-of-life sustainability strategies. Future research should integrate environmental and management variables, including nutrition, housing, reproductive performance, and heat stress, to elucidate how these interact with biological factors to determine lifetime productivity and welfare outcomes.

Keywords: longevity, weaning weight, Kaplan-Meier