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*The assessment of rising and lying down behaviours of dairy cows
in cubicle housing systems with regard to animal welfare*

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Cubicle housing is the most common housing system for dairy cows in Europe. It offers advantages in terms of management efficiency and hygiene, but cubicles can restrict cows' freedom of movement, and limit their ability to perform innate, species-specific movement patterns, particularly during transitions between standing and lying postures. My doctoral thesis investigated rising and lying down behaviours of dairy cows in cubicle housing systems, focusing on methodological innovation, housing design challenges, and practical welfare implications. The thesis consisted of three interconnected studies, each addressing critical aspects of dairy cow management.

The first study ("Towards a novel method for detecting atypical lying down and standing up behaviours in dairy cows using accelerometers and machine learning") introduced and validated an innovative methodological approach combining accelerometers with machine learning algorithms. The goal was to automate the detection of atypical rising and lying down behaviours. Accelerometers were attached to the cows' bodies to collect movement data, which were then matched with video observations. The developed models reached moderate accuracies, showing potential but not yet sufficient for practical application. Importantly, the study suggested that ethograms designed for human observers may need adaptation to improve automated detection of behaviour.

The second study ("Cubicle design and dairy cow rising and lying down behaviours in free-stalls with insufficient lunge space") examined how cubicle design affects cow behaviour on farms with limited forward lunge space. Comparisons were made between permissive cubicles with open partitions, allowing lateral space sharing, and restrictive cubicles with more extensive bar-work. Cows in permissive cubicles showed fewer difficulties when rising and lying down, with reduced hesitation and fewer atypical movements. They also lay down more often and for longer durations. These findings highlight that more permissive cubicle designs can improve cow comfort, reduce the risk of injury, and support better welfare outcomes.

The third study ("The effect of neck strap positioning relative to dairy cow body size on rising and lying down behaviours and lying cubicle hygiene") investigated how neck strap placement influences cow behaviour and cubicle hygiene. Different strap heights and distances from the curb were tested in a controlled setting. Results showed that flexible positioning of neck straps accommodates cows of varying sizes and allows natural rising and lying down movements. Atypical behaviours were generally rare, but permissive strap positioning reduced the occurrence of cows crawling backwards on their knees during rising. Moreover, well-positioned straps helped maintain bedding cleanliness.

Together, these studies demonstrate the importance of behavioural observations as indicators of cow comfort and welfare. They underline the need for cubicle designs that respect natural movement patterns, while still meeting hygiene requirements. The research provides practical recommendations for cubicle design and management, such as the use of open partitions and flexible neck strap positioning, and points to the potential of sensor-based technologies for future welfare assessment.