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Summary

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Effect of milking stall dimensions on behaviour and physiology of dairy cows during milking

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The aim of this dissertation was to study the influence of milking stall dimensions on the behaviour and physiology of dairy cows.

The first step involved an analysis of the current situation on commercial farms. Here, the dimensions (width and length) of the milking stalls, as well as the body dimensions of all dairy cows in the herd were measured by means of a previously successfully validated image-analysis method and the behaviour of ten focus animals per farm was recorded during an evening milking: Rumination, elimination, hind-leg activity and the latency to enter the parlour. A space ratio derived from rump- and milking-stall length was calculated as a measurement of the milking-stall space allowance per cow. Side-by-Side milking parlours had the smallest and Tandem parlours the largest space ratios. By tendency, more cows ruminated with increasing space ratios (odds ratio: 1.8). Furthermore, it took the cows considerably longer to enter Side-by-Side and Herringbone milking parlours than Tandem parlours. This study revealed the first indications (change in rumination occurrence) that restricted space in the milking stalls might have a negative effect on the cow comfort during milking. Based on the other variables recorded, no effects of the space ratio were detected that would indicate stress in the animals. This may be due to the fact that the space ratio for most cows was > 1.

In a second step, the importance of milking stall dimensions was investigated in an experimental milking parlour that could be flexibly remodelled in terms of size and type (Herringbone and Side-by-Side). In the first block, milking-stall dimensions for each milking-parlour type were smaller and larger than commonly found on dairy farms (‘extreme’ block). In the second block, dimensions corresponded to standard sizes found on farms, and the stall dimensions differed only slightly between ‘small’ and ‘large’ (‘standard’ block). For each experimental block, milking stalls were set up for a two-week period as large on one side of the parlour and small on the other side, after which this design was reversed for a further two weeks (so-called ‘cross-over design’). Milk-flow parameters were recorded in addition to ethological and physiological variables. Furthermore, on the last day of each phase, milk samples were taken to determine somatic cell count and milk cortisol concentration.

Particularly in the Herringbone milking parlour, the extremely small milking stalls had a negative effect on the cows’ behaviour: Latency to enter the parlour was longer, more cows had to be driven in, and more cows defecated and urinated. The cows also displayed more restlessness behaviour (increased hind-leg activity) and exhibited a higher percentage of visible eye-white. There were also more cows with bimodal milk-flow curves in small milking stalls. With the Side-to-Side milking parlour, for both the ‘extreme’ and ‘standard’ versions of the small milking stalls, entry into the parlour took longer, hind-leg activity was greater, and more cows defecated and urinated than in the large milking stalls. Despite the found effect of the milking-stall dimensions on the cows’ behaviour,

no differences were detected for heart-rate variables. Nor were there any detectable effects of milking-stall dimensions on milk yield, duration of milking, or the decline phase in the milk-flow curve. Nevertheless, more cows exhibited bimodal milk-flow curves in too-small milking stalls, which could have a negative effect on udder health in the long term.

Included in this study were some non-invasive stress indicators which have to date never or rarely been used to investigate stress during milking: visible eye-white, eye temperature, number of cows driven in, latency to enter the parlour, and number of cows ruminating.

Cows milked in extremely small milking stalls exhibited a higher percentage of eye-white. For this reason, eye parameters were examined more closely as potential non-invasive physiological stress indicators in an evaluation study. For this study, pictures and infrared images of the eyes were taken at various time points during a feeding phase (control situation) and afterwards during claw trimming in the cattle crush (stress situation), and then analysed. Heart rate, heart-rate variability and salivary cortisol concentration were determined as evidence of stress level. These parameters pointed to a significant level of stress experienced by cows in the cattle crush. By contrast, there was no situation-specific difference for visible eye white, but a slight increase in maximum eye temperature under stress was detected for Holstein cattle than for Brown Swiss.

To sum up, the results of the dairy-farm survey and of the experimental milking parlour point to small milking stalls having a negative effect on cow behaviour, and as such reducing cow comfort. In addition, more bimodality occurred in the experimental milking parlour when milking stalls were too small. Hence, it cannot be ruled out that a lack of space in the milking parlour could lead to chronic stress, which could have a negative impact on udder health. Based on the findings so far, we cannot derive size recommendations. Furthermore, more stall size effects were detected for the Herringbone than the Side-by-Side parlours, which might in part be due to parlour-specific differences. Nevertheless, the results clearly show the importance of space allowance in milking stalls for animal-friendly milking. Milking-stall design thus seems to be an important factor for cow comfort.