Are cows more likely to lie down the longer they stand?

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Introduction Information on (changes in) standing and lying behaviour can be used for oestrus detection and early diagnosis of health problems, to evaluate welfare consequences of changes in housing and management and to investigate the underlying animal motivation for these behaviours. A data set on lying and standing behaviour was collected from cows with IceTag™ sensors (IceRobotics, South Queensferry, UK) fitted to their legs. Our aims were (a) to investigate whether this behaviour was bouted, (b) to estimate bout criteria if required and (c) to test the hypotheses that (i) the probability of cows standing up would increase with lying time and (ii) the probability of cows lying down would increase with standing time.

Materials and methods Data were obtained from IceTag™ sensors fitted to 10 late-pregnant indoor-housed beef cows for periods up to 16 days. During part of the experiment, video recordings were made to validate the sensor records. The sensors produced one record per cow per min with an estimate of the percentage of standing and lying time, from which uninterrupted standing and lying episodes were calculated. The structure of standing and lying behaviour was investigated first by analysing log-survivorship plots and frequency distributions of (log-transformed) standing and lying episode lengths. The probability of cows standing up (P_{stand}) in the next 15 min at lying time t was calculated as 1 – (the number of lying bouts > t + 15 min divided by the number of lying bouts > t min). The same method on the basis of standing bout lengths was used to calculate the probability of cows lying down (P_{lie}) within 15 min. Effects of lying time on P_{stand} and of standing time on P_{lie} were estimated using linear regression. Only probabilities based on at least 100 observations were included in the regression analyses to avoid effects of data points based on few observations only.

Results A total of 10,814 lying episodes were recorded. Analyses of the (cumulative) frequency distributions of (log-transformed) lying episode lengths suggested that standing bouts were interrupted by an excessive number of short lying episodes (i.e. < 4 min). Comparison of IceTag™ records with video recordings showed that lying episodes > 4 min did correspond with lying behaviour, but episodes < 4 min did not (these tended to occur e.g. when a cow was displaced at a feeder). In contrast, short standing episodes recorded by the sensors did correspond to actual standing behaviour. Lying and standing bouts were, therefore, calculated by ignoring all lying episodes < 4 min. This decreased the number of episodes by 88%, but it had only minor effects on estimated total daily lying time (- 3%). The mean individual daily number of lying bouts ranged from 7.9 to 15.4 (mean 10.0, SE 0.7). Individual mean daily lying time varied from 10.2 to 13.0 h (mean 11.6, SE 0.33 h). The probability of cows standing up increased linearly with lying time (Fig. 1a), as hypothesized. The probability of cows lying down was, however, entirely unaffected by standing time (Fig. 1b), which contradicted our hypothesis. Disaggregation of the data in subsets showed that the absence of any effect of standing time on P_{lie} was not caused by the pooling of data obtained during the day and the night or across individuals with different behavioural strategies.

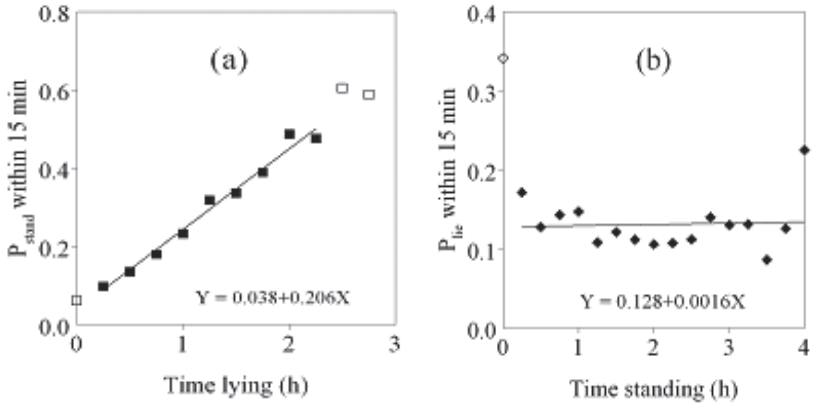

Figure 1 The probability of cows standing up (P_{stand}) within 15 min in relation to time lying (a) and the probability of cows lying down (P_{lie}) within 15 min in relation to time standing (b). Regression lines were fitted to the data indicated by the solid symbols. The regression line in graph (a) was highly significant ($R^2 = 0.98$, $P < 0.001$, RSD = 0.021). The regression line in graph (b), however, was not ($R^2 = 0.003$, $P = 0.83$, RSD = 0.033).

Conclusions Sensors can give relevant information on cows' standing and lying behaviour but the type of sensor used here recorded an excessive number of short lying episodes which must be adjusted for. Determination of a bout criterion that distinguishes between actual lying bouts and sensor settings suggesting short lying episodes but caused by other factors, such as sudden leg movements, then allows a meaningful interpretation of the data. The increase in the probability of cows standing up with lying time was as expected. Cows were, however, not more likely to lie down the longer they were standing, thereby refuting our second hypothesis. This suggests that the increase in motivation to lie down that has been observed after lying deprivation (Metz 1985; Munksgaard *et al.,* 2005) may have limited relevance for cows that are not deliberately lying-deprived.

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References

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