Using Indices of Cow Comfort to Predict Stall Use and Lameness

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Introduction

The objective of this study was to measure several indices of cow comfort for one 24- hour period in the high-group pens of a selection of Wisconsin dairy herds using either sand or rubber-crumb-mattress surface free stalls, and to determine the most appropriate time of day for measurement in terms of their ability to predict cow behavior and lameness prevalence.

Materials and Methods

Twelve Wisconsin dairy herds were selected to include six sand freestall herds and six mattress freestall herds. For the duration of one 24-hour period, the mature cow high group pen on each farm was video filmed. For each herd, the film was analyzed every hour in order to determine number of cows in the pen that were lying down, standing in the stall with all four feet, perching in the stall with the rear two feet in the alley, standing in the alley, drinking and feeding. From these data, for each hour, three cow-comfort indices were calculated, namely: the Cow Comfort Index (CCI: proportion of cows in stalls that are lying down), Stall Standing Index (SSI: proportion of cows in stalls that are standing ie. 1-CCI) and Proportion Eligible Lying or Stall Usage Index (PEL: proportion of cows not eating that are lying down). Daily times spent lying down in the stall and times spent standing in the stall were obtained for 10 cows in each herd.

Start time of the morning milking was used as a reference point to align the hourly data for each farm. Differences in the indices of cow comfort between sand and mattress herds were examined using repeated measures in the mixed procedure of SAS. $P<0.05$ was used to determine significance. PROC REG and PROC GLM in SAS were used to examine the association between indices of cow comfort recorded each hour for each herd, and, mean herd daily lying and stall standing times derived from the 10 individually tracked cows in each herd, and mean pen lameness prevalence. Optimal hourly relationship between indices and outcome variables was selected based on an optimal combination of adjusted R2 and P value. A P value of <0.002 was used to determine significance in order to reduce the chances of making an erroneous conclusion due to the multiple comparisons being made.

Results

There was a significant effect of base on CCI and SSI $(P=0.002)$ and on PEL $(P=0.003)$. Hourly effect was also significant for each variable $(P<0.001)$. More variability was observed in the CCI in mattress herds compared to sand herds, and the average over the 24-hour period was 14% lower. All indices were poor predictors of mean daily lying time at all hours of the day. There was a significant relationship between CCI/SSI and mean daily standing time in the stall at five hours and two hours before the morning milking, with the reading at two hours having the higher adjusted R2 (0.83) and P value (0.0003) combination. Base was not significant in the GLM at this time $(P=0.24)$. At two hours before the morning milking, there was a significant relationship between CCI/SSI and lameness prevalence in the pen (R2 0.89, P=0.0005), but there was also a significant effect of base $(P=0.0008)$, which complicated the relationship. SSI greater than 24% was uniformly associated with pen lameness prevalence rates greater than 20%.

Significance

Traditional indices of cow comfort do not predict mean daily lying times of individuals within the pen. However, the CCI or SSI do predict time spent standing in the stall. This suggests that these indices are actually monitoring the stall standing behavior of lame cows within the pen.

If we are to use any of these indices, we must redefine our perception of 'cow comfort', as they do not appear to predict mean daily lying time. We suggest that an absence of change in stall-use behavior in lame cows could be one definition. Stall-standing behavior is an important behavior modification associated with increased rates of lameness in compromised environments. We therefore propose the use of the SSI, taken two hours before the morning milking, as a predictor of standing behavior. An SSI greater than 25% taken at this time appears to be associated with lameness prevalence rates in excess of 20%, and could be used to trigger locomotion scoring of the herd and a more detailed investigation of lameness and free stall design.