

USING INDICES OF COW COMFORT TO PREDICT STALL USE AND LAMENESS

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Published in Proceedings of 13th International Ruminant Lameness Symposium, Maribor, Slovenia, 2004.

Introduction

Several indices of cow comfort are used on dairy farms including the Cow Comfort Index (CCI) and the Proportion Eligible Lying (PEL) or Stall Usage Index. Targets of >85% for the CCI and >75% for the PEL taken at 1h after return of the cows from the morning milking have been suggested (Overton et al., 2003), but these benchmarks have been derived from very few herds.

The objective of this study was to measure several indices of 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 the number of cows in the pen that were lying down, standing in the stall with all four feet and 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), the Stall Standing Index (SSI: proportion of cows in stalls that are standing ie. 1-CCI) and the 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. All cows in the high group pen were locomotion scored using the four point system described by Cook (2003).

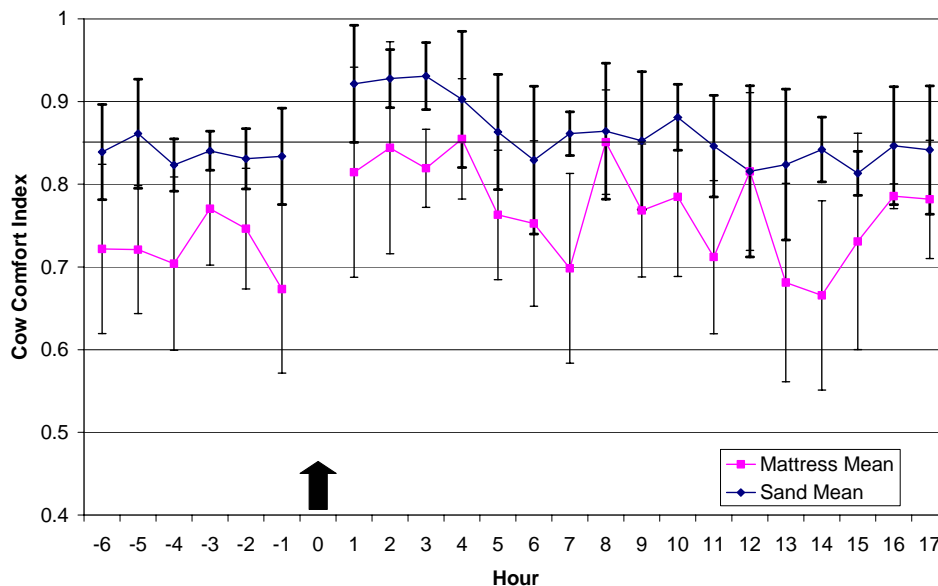
The start time of the morning milking was used as a reference point to align the hourly data for each farm. Differences in the indices of cow comfort between sand and mattress herds were examined using repeated measures in the mixed procedure of SAS. $P < 0.05$ was used to determine significance. The association between the indices of cow comfort

recorded at each hour for each herd and the mean herd daily lying and stall standing times derived from the 10 individually tracked cows in each herd and the mean pen lameness prevalence was examined using PROC REG and PROC GLM in SAS. The optimal hourly relationship between the indices and the outcome variables was selected based on an optimal combination of adjusted R^2 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 ($P=0.003$). The hourly effect was also significant for each variable ($P<0.001$) and figure 1 shows the differences observed by hour for each stall base for the CCI as an example. More variability was observed in the CCI in mattress herds compared to sand herds, and the average over the 24h period was 14% lower.

Figure 1. Mean (with one-standard deviation error bars) Cow Comfort Index (%) by Hour for Sand and Mattress herds. The bold arrow represents the time of departure for the morning milking.

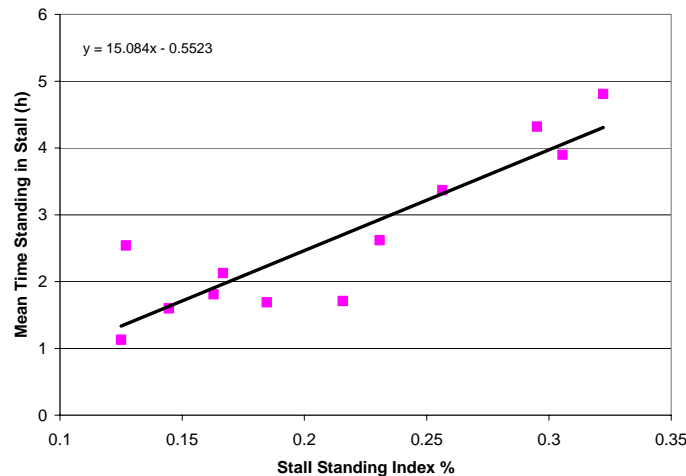


All of the indices were poor predictors of mean daily lying time at all hours of the day. There was a significant relationship between CCI/SSI and mean daily standing time in the stall at 5h and 2h before the morning milking, with the reading at 2h having the higher adjusted R^2 (0.83) and P value (0.0003) combination. Base was not significant in the GLM at this time ($P=0.24$).

At 2h before the morning milking, there was a significant relationship between CCI/SSI and lameness prevalence in the pen (R^2 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%.

Figure 2. Relationship between Stall Standing Index (%) measured 2 hours before the morning milking, and mean daily time standing in the stall (h/d) for 12 herds



Discussion

Traditional indices of cow comfort do not predict mean daily lying times of individuals within the pen, the CCI or SSI do however predict time spent standing in the stall. Cook et al., (these proceedings) have documented the increased time spent standing in the stall in lame cows in mattress facilities and the lack of this behavior change in lame cows in sand barns. 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 re-define 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 2h before the morning milking as a predictor of standing behavior. An SSI greater than 24% 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.

References

Cook, N. B. 2003. Prevalence of lameness among dairy cattle in Wisconsin as a function of housing type and stall surface. *JAVMA* 223:1324-1328.

Overton, M. W., D.A. Moore, and W.M. Sischo. 2003. Comparison of commonly used indices to evaluate dairy cattle lying behavior. Pages 125-130 *in* Proc. Dairy Housing Conf., Fort Worth, TX. Amer. Soc. Agric. Engineers, St Joseph, MI.