HOBO® Pendant™ G Acceleration Data Loggers: Adding Precision to the Assessment of Cow Comfort in Tie-Stall Operations

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Introduction

Dairy cows spend 8 to 16 hours lying down per day, and will prioritize lying over feeding if their resting behaviour is disturbed.[1] Comfortable stalls help ensure that cows rest sufficiently without reducing feed intake. Hard surface stalls with low compressibility or abrasive materials reduce lying times and increase hock injuries.[1] In tie-stall operations, surface and bedding materials can be selected to optimize health, comfort, and profitability in the herd. Studies assessing cow comfort are beginning to add quantitative evidence to surface and bedding recommendations; but information is lacking for surface choices in tie-stall operations.[1,2,3] Gathering such information by video recording technology is very time-consuming. Three Ontario producers kindly allowed us to use HOBO® Pendant™ G data loggers to generate stall usage data for three stall surface types: interlocking rubber mats (IRM), rubber filled mattresses (RFM) and Duralay roll beds (DRB). Previous studies have evaluated lying behaviour on concrete surfaces with no bedding.[2] The HOBO® data loggers are appraised informally as tools to quantify cow comfort.

Methods and Materials

Holstein cows in each herd (n_1=18; n_2=19, n_3=20) were fitted with HOBO® data loggers for 8, 8 and 7 days, respectively. The devices were placed in a cotton pouch and attached using Vetrap™ and duct tape to the outside of the right hind leg 10 in (25 cm) above the fetlock, along the metatarsus. These devices sensed and recorded the tilt of the cow's leg once per minute over the study period. The values generated by the logger correspond to three behaviours: lying right, lying left and standing. The loggers started recording in unison and were stopped upon removal.

Stall features for Herd 1 were: RFM (Pasture Mat®, ProMat Inc. Woodstock, ON) without underlays, 13 months old, 4 lbs (1.8 kg) chopped straw per stall per day, 54 in (137 cm) wide by 72 in (183 cm) long for mature cows, 50 to 55 in (127 to 140 cm) wide by 68 to 72 in (173 to 183 cm) long for Lactation 1 heifers, 40 in (102 cm) tie chain, 48 in (122 cm) high tie rail, electric trainer 48 in (122 cm) on the horizontal forward of the gutter curb, twice daily milking and feeding. Stall features for Herd 2 were: IRM (Kraiburg KSL Mats, Legend Rubber Inc. Courtland, ON), four years old, 2 lbs (0.9 kg) chopped straw per stall per day, 56 in (142 cm) wide by 72 in (183 cm) long stalls, 41 in (104 cm) long tie chain, 48 in (122 cm) high tie rail, electric trainer 48 in (122 cm) forward of the gutter curb, twice daily milking and feeding. Features of Herd 3 were: DRB (Legend Rubber Inc.), with bubble underlay, two months old, 3.8 lbs (1.7 kg) long straw bedding per stall daily, 70 in (178 cm) wide by 52.5 in (133 cm) long stalls, tie chain length of 37 in (94 cm), 47 in (119 cm) high tie rail, electric trainer 49 in (124.5 cm) forward of the gutter curb, and twice daily milking and feeding.

Results

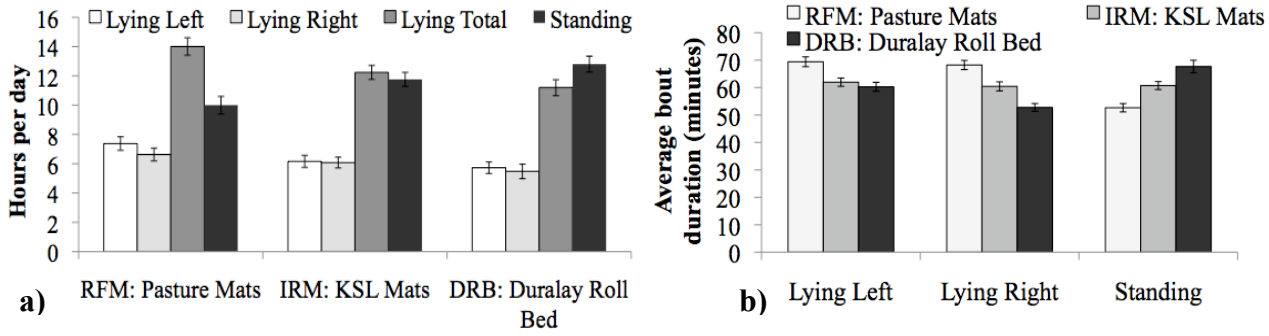

Figure 1: a) Mean hours/day spent lying and standing and b) average bout duration (in minutes) by behaviour for RFM, IRM and DRB.

Upon removal of the loggers, we noted two cows had minor hair loss due to abrasions from the device. Cows on RFM spent more time lying per day than cows on IRM or DRB (14.0 ± 0.6 hr vs. 12.2 ± 0.5 hr and 11.2 ± 0.5 hr, mean ± SE, $p < 0.05$). As well, average lying left (LL) and right (LR) bout duration was greater for cows on RFM (LL: 69.4 ± 1.8 min; LR: 68.2 ± 1.7 min) than for the other two beds (IRM: 62.0 ± 1.5, 60.4 ± 1.7 and DRB: 60.3 ± 1.6 and 52.8 ± 1.4 in minutes for LL and LR respectively, $p < 0.05$). RFM cows spent less time standing per day than IRM or DRB cows (10.0 ± 0.4 hr vs. 11.8 ± 0.6 hr and 12.8 ± 0.5 hr, $p < 0.05$). The average duration of standing bouts for DRB (67.7 ± 2.3 min) was longer than for RFM (52.7 ± 1.5 min) or IRM (60.7 ± 1.5 min) cows ($p < 0.05$). Bouts of lying left, lying right and standing per cow per day were similar at 6.4 ± 0.6, 6.0 ± 0.5, 5.7 ± 0.3 and 5.9 ± 0.5, 6.0 ± 0.7, 6.2 ± 0.8 and 11.4 ± 0.9, 11.6 ± 0.7, 11.4 ± 0.8 bouts/day for RFM, IRM and DRB respectively.

Our study was limited to three herds but we find that cows on RFM with straw spend more time resting than cows on IRM or DRB with straw. Herd 1 and 3 used about double the straw bedding per stall compared to Herd 2. Recent research showed that an extra kilogram of straw bedding resulted in only 3 min/d difference in lying times.[1] From previous studies, cows housed on RFM and IRM have increased lying times than those on concrete, but a comparison between RFM, IRM and DRB has not been published.[2,3] Greater knowledge about resting times for stall surfaces may help producers with purchasing decisions for tie-stall beds. From personal experience acquiring data from video recordings, the data loggers are our choice for cow comfort studies.

References

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