J. Dairy Sci. 99:2875–2883
http://dx.doi.org/10.3168/jds.2015-9937

Effect of sand and rubber surface on the lying behavior of lame dairy cows in hospital pens

A. S. Bak, M. S. Herskin, and M. B. Jensen[1]
Department of Animal Science, Aarhus University, AU-Foulum, Blichers Allé 20, DK-8830 Tjele, Denmark

ABSTRACT

Housing lame cows in designated hospital pens with a soft surface may lessen the pain the animals feel when lying and changing position. This study investigated the effect of the lying surface on the behavior of lame cows in hospital pens. Thirty-two lame dairy cows were kept in individual hospital pens, provided with either 30-cm deep-bedded sand or 24-mm rubber mats during 24 h in a crossover design. On each surface, the lying behavior of each cow was recorded during 18 h. On deep-bedded sand, cows lay down more and changed position more often than when housed on the rubber surface. Furthermore, a shorter duration of lying down and getting up movements and a shorter duration of lying intention movements were observed. These results suggest that lame dairy cows are more reluctant to change position on rubber compared with sand, and that sand is more comfortable to lie on. Thus, deep bedding such as sand may provide better lying comfort for lame cows than an unbedded rubber surface.
Key words: lameness, lying behavior, flooring, animal welfare

INTRODUCTION

In modern dairy production, lameness has marked negative consequences for productivity and animal welfare (Warnick et al., 2001; Vermunt, 2007; Bruijnis et al., 2010). For years, lameness has been a serious problem with no significant reduction in the reported prevalence (20–40%; Clarkson et al., 1996; Barker et al., 2010; Thomsen et al., 2012). Lame dairy cows, when compared with nonlame cows, spend more time lying (Chapinal et al., 2009; Ito et al., 2010; Thomsen et al., 2012) and have reduced competitive abilities (Galindo and Broom, 2002), which may explain their reduced time feeding (González et al., 2008; Gomez and Cook, 2010). Lame dairy cows kept in loose housing, when moved to a hospital pen, would no longer have to deal with competition and could have a more comfortable resting place to lessen their pain; both factors may contribute to a faster recovery from lameness (Weary et al., 2009). Hospital pens are typically group pens with a deep-bedded surface (Fogsgaard et al., 2012), but for hygiene reasons it may be desirable to use a rubber surface in pens used for cows with infectious diseases. In Denmark, recent legislation requires that dairy farmers must be able to house sick or injured animals in designated hospital pens with a dry and soft surface (Anonymous, 2010). A recent study showed that lame cows prefer to lie on sand compared with rubber mats (Jensen et al., 2015). However, studies examining the effect of quality of the lying surface in hospital pens on the behavior of lame cows are lacking.

Several studies have investigated how the lying surface influences behavior of clinically healthy cows, where a soft surface has been shown to increase lying time and reduce time spent standing (Tucker and Weary, 2004; Rushen et al., 2007; van Gastelen et al., 2011). In lame cows, however, only a limited number of studies have investigated this. Studies carried out in loose housing with freestalls showed increased lying time of lame cows when the stalls were deep-bedded with sand or sawdust as compared with geotextile mattresses or rubber crumb-filled mattresses (Cook et al., 2004; Gomez and Cook, 2010; Ito et al., 2010). When comparing lying behavior of healthy versus lame cows kept on geotextile mattresses or rubber crumb-filled mattresses, the lame animals lay down less than the healthy controls (Cook et al., 2004; Gomez and Cook, 2010). In addition, Hernandez-Mendo et al. (2007) reported that the gait scores of lame cows kept in freestalls with sand bedding was reduced after 4 wk on pasture, whereas no change in gait score was found in the control cows. Consequently, the lying surface of lame cows can affect their behavior as well as recovery.

Increases in measures such as duration of lying down or getting up movements, frequency of lying down interruptions, as well as frequency and duration of lying down intention movements all indicate that the cow is having problems changing positions (Lidfors, 1989;

Received June 10, 2015.
Accepted December 8, 2015.
[1]Corresponding author: MargitBak.Jensen@anis.au.dk

Müller et al., 1989; Krohn and Munksgaard, 1993). Lying time is used to evaluate the comfort of lying surfaces for cows, and when surfaces are evaluated for cow comfort and ease of changing positions, a better insight into cow welfare is gained (Krohn and Munksgaard, 1993; Tucker and Weary, 2004). The aim of the present study was to compare effects of 2 lying surfaces (deep-bedded sand versus rubber mats) on lying behavior of lame cows when housed in individual hospital pens. We hypothesized that when compared with a surface of rubber mats, a lying surface of deep-bedded sand would lead to longer lying times and increased frequency and duration of lying bouts. That cows would show increased ease of lying down and getting up movements, as indicated by shorter durations of these behavioral sequences as well as shorter durations of lying intention movements and fewer interruptions during lying down sequences.

MATERIALS AND METHODS

Animals, Housing, and Management

The experiment was carried out from September to December 2013 in the resident barn at AU-Foulum, Aarhus University, Denmark. Prior to the experiment, the cows were loose housed in a freestall barn. Freestalls were fitted with 35-mm-thick rubber mattresses (Fremtiden Staldinventar A/S, Langå, Denmark), and the alleys had a concrete slatted floor. The cows were milked twice daily in a herringbone milking parlor and fed, ad libitum, a TMR with forage-to-concentrate ratio of 60:40 (% DM basis) for lactating cows and 80:20 for dry cows. For lactating cows, the stocking density was at least 1 freestall per cow (1.15 m wide) and at least 0.55 m feeding space per cow, whereas for dry cows, it was 1 freestall per cow (1.25 m wide) and 1.10 m of feeding space per cow. Freestalls were 1.85 m in length to brisket board. None of the cows had any previous experience with sand as bedding. During the experiment, the cows were fed ad libitum a TMR (same mixture as before the experiment).

Inclusion and Exclusion Criteria

The cows were selected from the 125-cow herd. Weekly gait scoring was performed by the same trained person throughout the experiment. Once a week, all lactating cows were gait scored when returning from afternoon milking, whereas dry cows were gait scored in the dry cow pen at the same time of day. Cows with a gait score of no less than 4 on a 5-point scale, where 1 is normal gait, 4 is obviously lame, and 5 is severely lame (Thomsen et al., 2008), were superficially hoof trimmed and clinically examined in a hoof-trimming chute the next morning by the same 2 people throughout the experiment. Cows were included in the experiment if they (1) were diagnosed with a sole ulcer or white line disease (Blowey and Weaver, 2011) on one or more hooves; (2) were not diagnosed with any other clinical disease (and not treated with analgesics or any other medication); and (3) were more than ±14 d from calving. Cows diagnosed with sole hemorrhages were not included in the experiment unless they were also diagnosed with white line disease or sole ulcer. A maximum of 4 lame cows per week were included. However, if fewer than 4 lame cows per week were available, healthy and nonlame cows (gait score 1) were selected and included in the experiment to ensure a constant social environment in the barn.

Forty-two obviously or severely lame cows (gait score $\geq$4; Thomsen et al., 2008), 39 lactating and 3 dry, were included in the experiment. The lactating cows were included in another study investigating lame cows' preferences for surface and social contact (Jensen et al., 2015). In the present experiment, 10 of the 42 cows had to be excluded. This was either due to technical issues (n = 4) or due to an escape from the pen (n = 1). Finally, 5 cows fell from a gait score 4 at introduction to a score of 1 or 2 at the end of the experiment and were excluded to ensure that all experimental cows had been lame throughout the experimental period. Thus, data from 32 lame cows were included in the present data set. Of these, 8 were first-parity, 15 second-parity, and 9 third- or later-parity cows. Thirteen of the cows were in early lactation (0–120 d in milk (DIM)), 16 in late lactation (120–414 DIM), and 3 were dry. The average weight of the cows when moved to the experimental hospital pen was 634 kg (range 505–866) and the average rectal temperature on the first and second day in the experimental hospital pen was 38.3°C (range 37.7–39). None of the cows had fever (>39.5°C) during the experiment.

Experimental Design and Procedures

The cows were moved to 1 of 4 individual experimental hospital pens (Figure 1), in the morning of diagnosis and kept there for 6 d. The selected cows were listed in a random order by the person gait scoring and examined in this order. The cows that met the inclusion criteria entered pens numbers 1 to 4 in the order of clinical examination. The pens were 6 m × 9 m and contained a feed trough and 4 water cups, placed centrally in the pen. Each experimental cow had visual contact with the 3 other experimental cows of that week, unless cows were lying behind a solid separation (Figure 1). Each experimental cow could also obtain physical contact