Feeding Behaviour: Comfort at the Feed Bunk

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Introduction

Promoting feed intake by lactating dairy cattle, particularly those in early lactation, is critical in terms of improving milk production, health, and body condition of the animal (Grant and Albright, 1995). Genetic selection practices have given rise to dairy cattle that are capable of producing quantities of milk in excess of what can be maintained by nutrient intake, particularly soon after calving. Despite decades of nutritional research, we are still faced with challenges in achieving appropriate feed intake by dairy cattle. Changes in feed intake must be mediated by changes in feeding behaviour, making work on feeding behaviour a promising new approach.

Even though lactating dairy cattle are traditionally given unlimited access to feed there are several management and environmental factors that may affect the decision of whether cows will initiate or terminate a feeding event. Understanding of these factors will improve our ability to develop management practices and design environments that are conducive to maintaining optimum feeding behaviour and, in turn, nutrient intake, which is essential for lactation, prevention of disease, and cattle well-being.

Despite the importance of management and environment, very little research has been done on how to develop proper management practices and design more appropriate environments for feeding dairy cows housed in free-stall barns. In the following paper, we will summarize new work examining the effects of management and environmental changes on feeding behaviour and how we can use these results to improve cow comfort at the feed bunk.

Understanding the feeding patterns of loose-housed dairy cows

A first step in improving feeding management is to understand the feeding patterns of loose housed cows and the impact that various management factors can have on these patterns. Recently, we examined the normal feeding pattern of lactating cows housed in a free stall environment given unrestricted access to the feed bunk (DeVries et al., 2003). Cows were milked twice daily at approximately 0530 h and 1530 h. An electronic bunk monitoring system was used to monitor the presence of individual cows at the feed bunk. In this study we found that cows consumed an average of 7.3 meals per day and had an approximate daily meal time of 6 hours per day. In Figure 1 we show the 24 h diurnal pattern of bunk attendance. Clearly, the management practices of milking and delivery of fresh feed affect when cows come to the feed bunk. To determine if changes in management can change these patterns, potentially to the benefit of the cow, we also tested the cows with an alternative feeding schedule, which incorporated an increased number of feed push-ups during the early morning hours (DeVries et al., 2003). Increasing the number of times feed was pushed up resulted in small numerical changes

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in the percentage of cows feeding at different times during the day (Figure 1 vs. Figure 2). However, the management practices of milking and delivery of fresh feed had a greater impact in terms of mobilizing animals to come to the feed bunk compared to the feed push-ups.

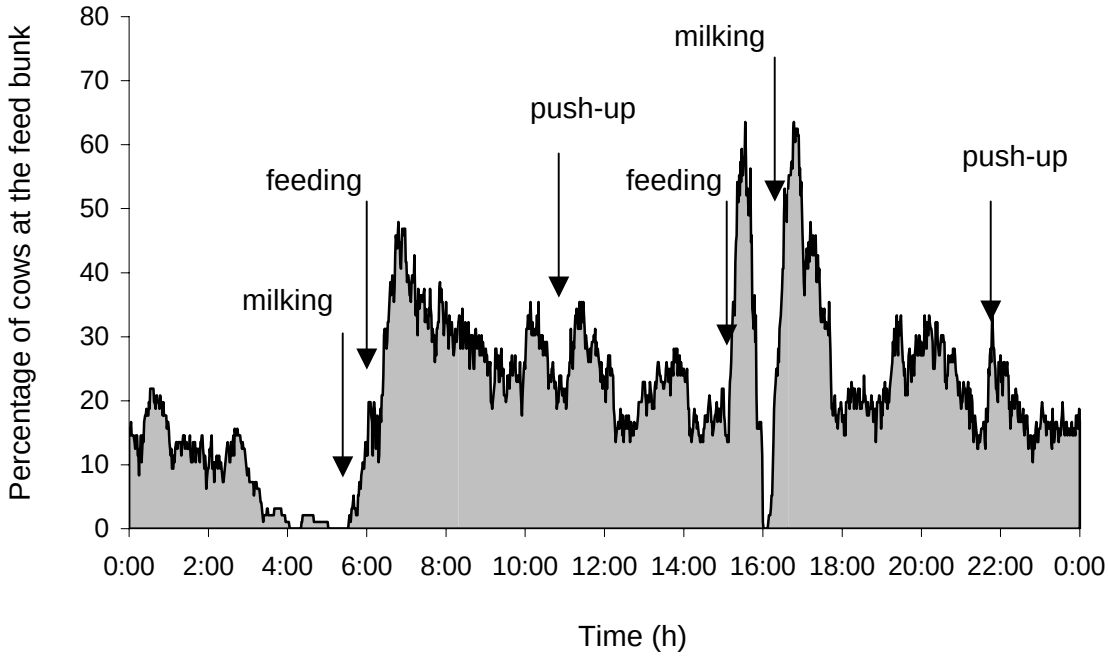

Figure 1. Feed bunk attendance during the normal feeding schedule (from DeVries et al., 2003).

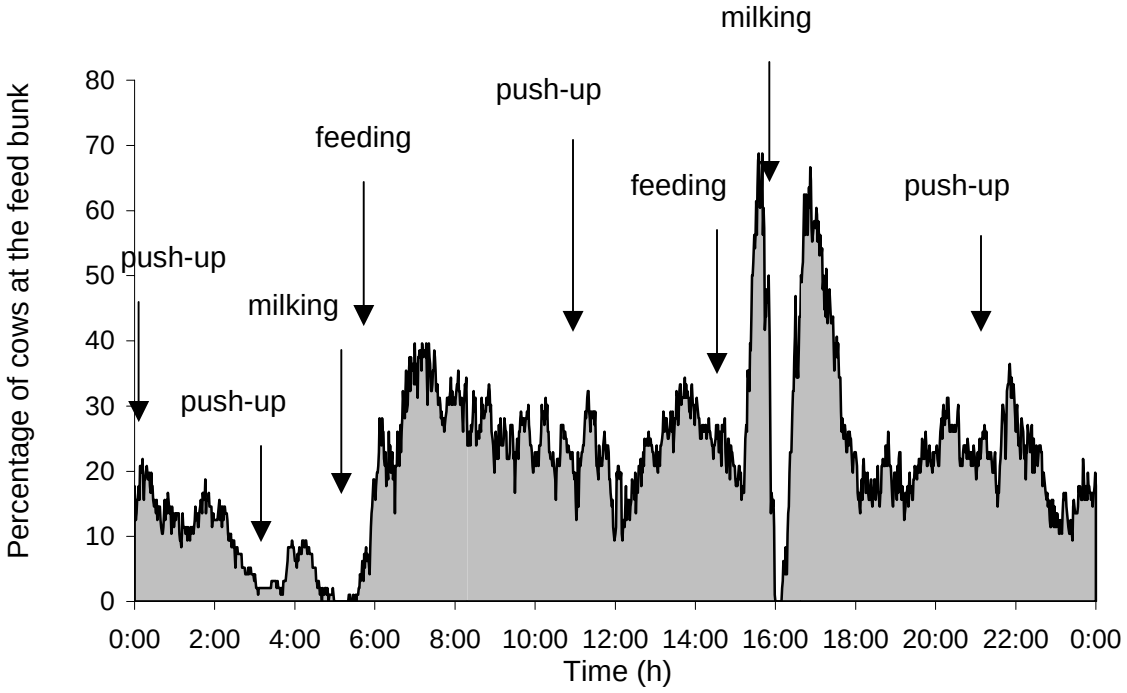

Figure 2. Feed bunk attendance during the increased push up feeding schedule (from DeVries et al., 2003).

On most commercial dairies, the management practices of milking and feeding typically occur around the same time of day. This makes it difficult to determine whether it is the act of milking or the presence of fresh feed (or both), which is acting as the primary driver stimulating cows to move to the feed bunk. Therefore, we set out in another experiment to determine whether it is the return from milking or delivery of fresh feed that has the greater ability to stimulate dairy cattle to go to the feed bunk (DeVries and von Keyserlingk submitted). We tested this objective by separating feeding and milking times, and monitoring the changes in feeding and lying behavior of group-housed cows. Forty-eight lactating Holstein cows were subjected to each of 2 treatments: 1) milking and feed delivery times coinciding, and 2) feed delivery 6 h post milking. When animals were fed 6 h post milking, they increased their total daily feeding time by 12.5%. This change was predominantly driven by a small decrease in feeding time during the first hour post-milking and a very large increase in feeding time during the first hour immediately following the delivery of fresh feed (see Figure 3). Despite the change in feeding time, the delivery of feed 6 h post milking did not change the daily lying time of the cows. These results indicate that the delivery of fresh feed has a greater impact on stimulating cows to go to and feed than does the return from milking. Also, feeding 6 h post milking increased the time spent feeding and did not affect the lying time, indicating that the cows minimized the amount of time that they spent idle waiting for feed or for access to the feed bunk.

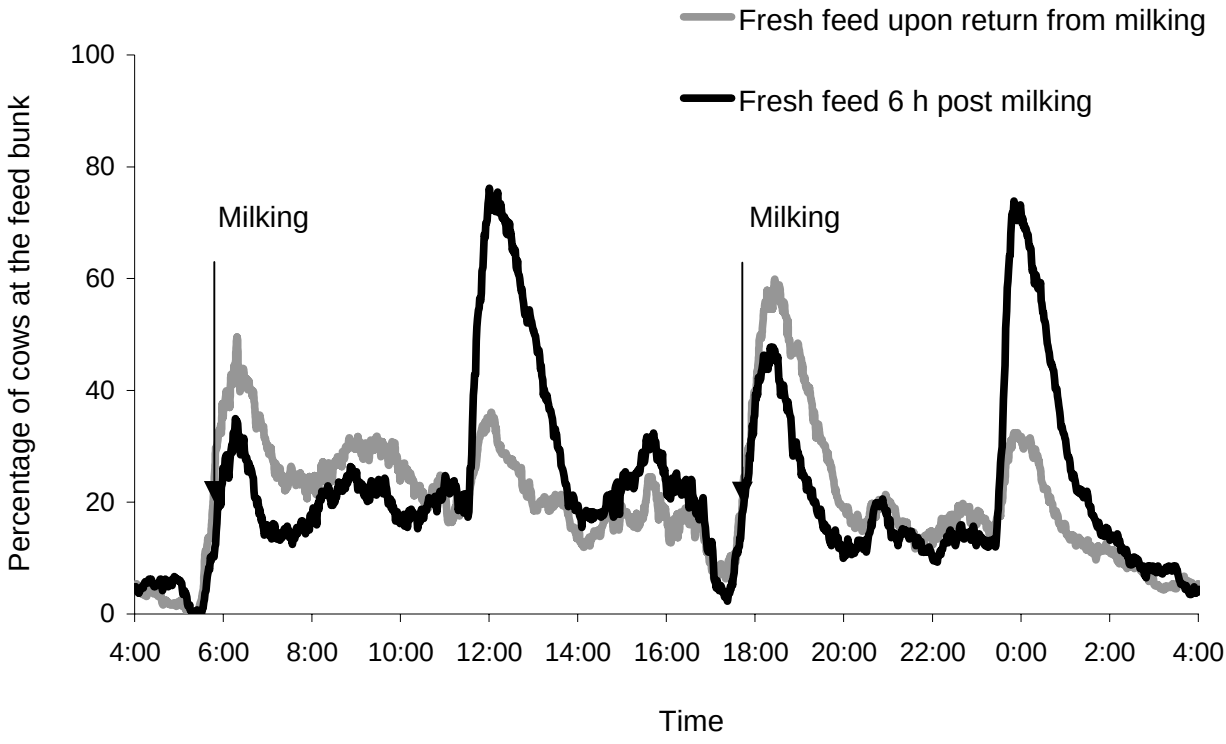

Figure 3. Feed bunk attendance when cows were provided with fresh feed upon the return from milking and when provided fresh feed 6 h post milking (from DeVries et al., in press).

Based on these results, we are focusing our new work on determining if other changes in feeding management, such as feeding frequency, increasing the time available for feeding, and minimizing the time that cows spent idle waiting for feed or for access to the feed bunk.

Reducing competition at the feed bunk

The majority of research on feeding behaviour has been completed with individually housed animals. In modern free stall dairy operations cows are group-housed, and this social environment can play a major role in the modulation of feeding behaviour. When grazing, cattle often synchronize their behavior such that many animals in the group feed, ruminate, and rest at the same times (Miller and Wood-Gush, 1991; Rook and Huckle, 1995). Curtis and Houpt (1983) reported that group-housed dairy cows housed indoors also synchronized their behaviour, particularly at feeding. They reported that when cows are fed in groups, the act of one cow moving to the feed bunk stimulates others to feed. Unfortunately, studies have indicated that the synchronization of behaviours may be reduced when cattle are housed intensively indoors (O'Connell et al., 1989; Miller and Wood-Gush, 1991). The lack of synchrony between animals housed indoors has been attributed to increased competition for resources.

Cows are social animals and form social hierarchies. When visits to the feed bunk are grouped into meals, the number of meals correlates negatively with the social dominance of the cow; namely, dominant cows have fewer meals (Olofsson, 1999). When cows are kept in individual cubicles, free from the effects of social interaction, those with higher feed intakes take fewer meals during the day. Furthermore, meal size (quantity and length), but not meal number, is positively related to milk production (Dado and Allen, 1994). These data suggest that dividing feeding behaviour into a few, long meals may be a more efficient feeding pattern than dividing it into shorter meals. This may be because fewer meals results in more sustained time for ruminating and lying down (Metz, 1975). Social behavior would seem to be one constraint in achieving this optimal feeding pattern. Reduced space availability has been shown to result in increased agnostic behaviour in cattle (Kondo et al., 1989), perhaps further limiting the ability of some cows to access feed at times when they want to.

In a recent study, we tested if increasing space availability at the feed bunk improves access to feed and reduces social competition (DeVries et al., 2004). Twenty-four lactating Holstein cows were each tested under two conditions: with 0.5 m or 1.0 m of feeding space per cow. When animals had access to more space we observed 57% fewer aggressive interactions while feeding. This reduced aggressive behaviour allowed cows to increase feeding activity throughout the day (see Figure 4). The increase in feeding activity was especially noticeable during the 90 minutes after fresh feed was provided. During this period, cows with access to more feeding space, increased time at the feeder by 24%, and this effect was strongest for subordinate cows.

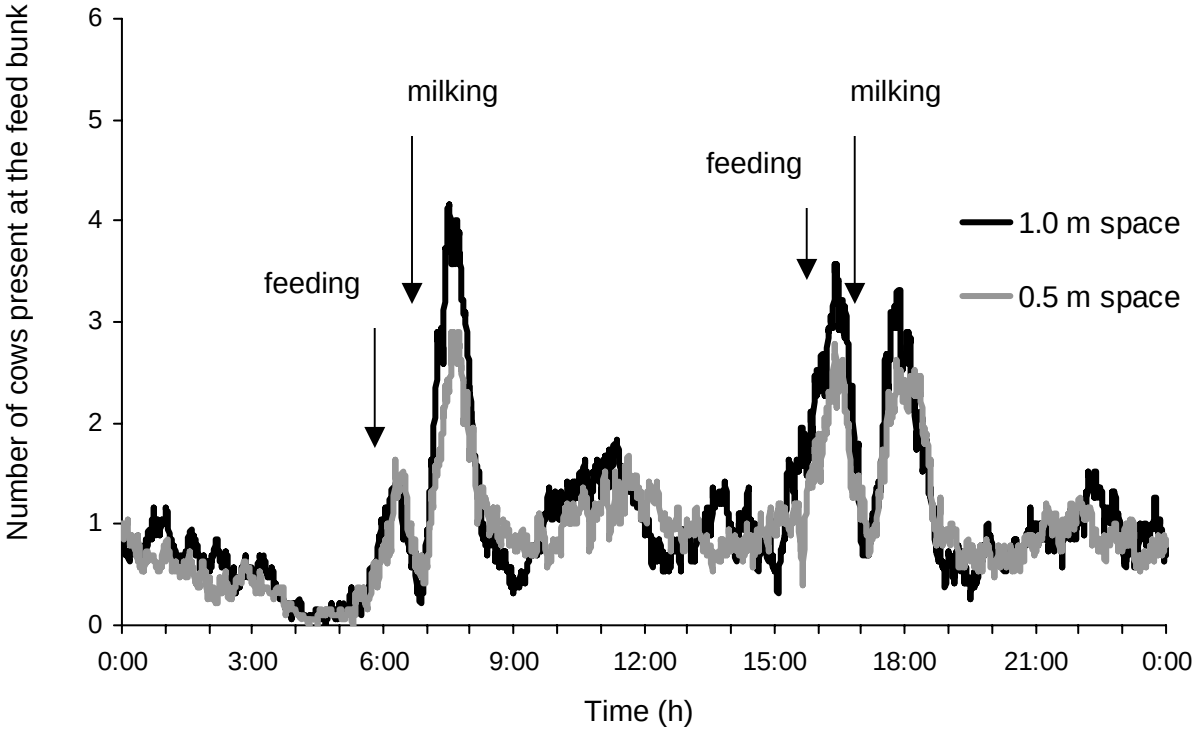

Figure 4. Feed bunk attendance with two levels of feeding space (from DeVries et al., 2004).

Improving the physical environment at the feed bunk

In addition to improving the management of feeding area to improve access to the feed, work is required to improve the physical environment. Two of the most obvious features are the surface that the cow is standing upon, and any physical barriers between the cow and the feed.

Concrete is a popular flooring surface in dairy barns due to its durability, availability, cost and ease of cleaning. Unfortunately, use of concrete flooring is known to contribute to the risk of cows developing hoof injuries and lameness. Concrete floors may also affect the comfort of cows, reducing important behaviours such as time spent eating and displays of estrus. Alternative flooring surfaces such as rubber are becoming popular with some producers, but no previous research has tested if these surfaces provide real improvements in comfort for cows. In one study, our group tested the effects of proving cows with rubber flooring to stand upon when eating (Fregonesi et al., 2004). Cows each were tested with both solid rubber flooring and grooved concrete in this area. Each group was observed for a 3-week period on each surface, and individual cow behavioral responses were recorded with time-lapse video equipment. We found that providing rubber flooring did not affect the amount of time cows spent eating. However, cows showed a slight increase in time standing without eating when they were provided the rubber surface (Figure 5). It is not known if these alternative surfaces have longer-term effects, such as reducing the risk of hoof injuries leading to lameness.

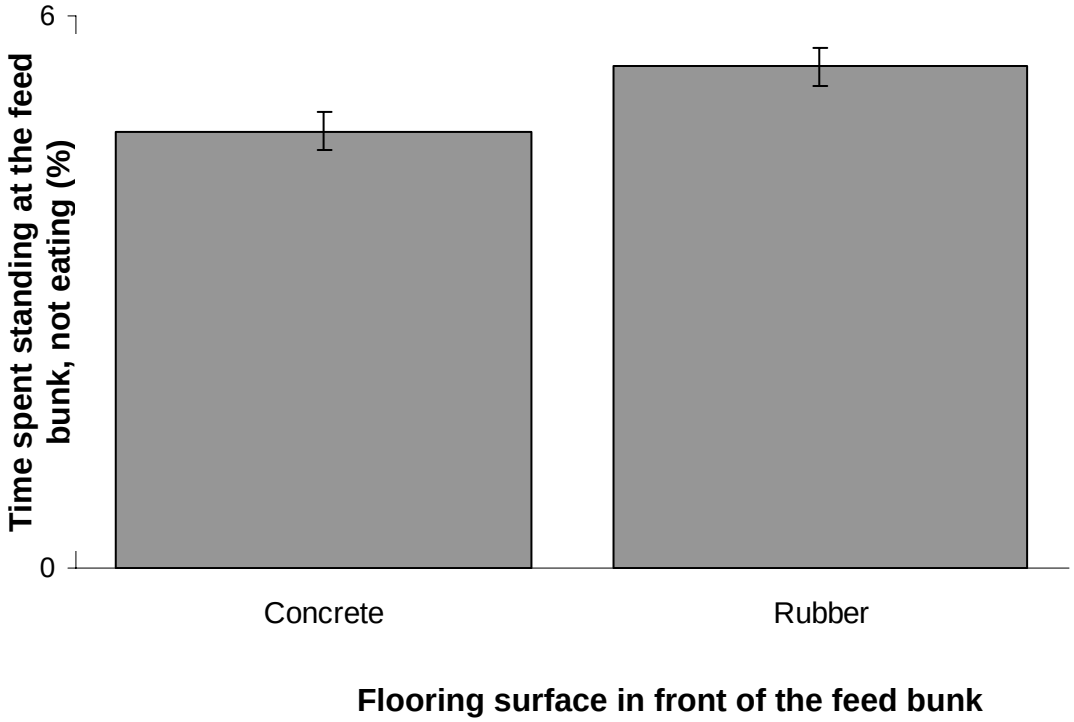

Figure 5. Percentage of time spent standing at the feed bunk without eating on two different flooring surfaces (from Fregonesi et al., 2004).

Fence line feeding, designed to allow all cows to feed at the same time, is the most common method used in free stall dairies. However, the physical barrier separating the cows from where the feed is delivered may also affect feeding behaviour. Many producers believe that a feed line barrier that provides some sort of separation between cows (e.g. head locks) will reduce competition and increase intake. Unfortunately, there is little work comparing different feed line barriers in free-stall barns. Two recent conference proceedings (e.g. Batchelder, 2000; Brouk et al., 2003) describe comparisons of post and rail feed barriers verses head-lock barriers on group feed intake and milk production. Unfortunately, it is difficult to make strong conclusions from these studies due to limited treatment replication.

In a recent experiment, we completed an experiment in which 48 cows were exposed to both post and rail feed line barriers and headlock feed line barriers (Endres et al., 2004). The objective of this study was to evaluate the effects of the two feed barrier systems on the feeding and social behavior of dairy cows. The cows were housed in 4 groups of 12 at a stocking density of 100%. The groups were assigned to one of two starting conditions: access to the feed alley via a neck rail or via headlocks.The groups were kept on one of the two conditions for 8 d, then switched to the alternative treatment for another 8 d. Scan sampling from time lapse video was used to calculate daily feeding time and the percentage of cows feeding during the 90-min following the delivery of fresh feed. Aggressive displacements from the feed bunk were scored continuously from video during these same 90-min periods. Average daily feeding time did not differ when cows

had access to feed via headlocks (271.7 ± 3.8 min d^{-1}) compared to the post and rail barrier (277.8 ± 3.8 min d^{-1}). There tended to be a greater percentage of cows present at the feed alley during the 90 min morning period when using the post and rail barrier (57.0 ± 1.5 %) compared to the headlocks (50.8 ± 1.5 %), but there was no evidence of a difference during the afternoon feeding. There was also no difference in the number of displacements performed during the 90 min after feeding when the cows had access to the feed via headlocks versus post and rail barrier (0.71 ± 0.14 and 1.10 ± 0.14 displacements per cow per post feeding period, respectively). Although the post and rail barrier may allow for greater access to feed during high use periods, these results indicate that at 100 % stocking density, the type of feed barrier has no effect on daily feeding times and incidence of competitive behavior at the feed bunk during the 90 min post feeding. New research in our group is now focusing on evaluating the effect of feed barrier type on feeding time and competitive behavior of cows when over stocked.

Conclusions

New research in the Animal Welfare Program at The University of British Columbia has focused on improving the management and physical structure of the feeding environment for dairy cows. Under current feeding management practices, cows in free stall barns exhibit a diurnal feeding pattern, which is predominantly influenced by the timing of feed delivery. Increasing the amount of feeding space per cow reduces aggressive behaviour and increasing feeding activity throughout the day, especially for subordinate cows. Access to rubber flooring at the feeder has little effect on cow behaviour. However, softer surfaces may provide longer-term benefits in terms of hoof health and lameness. Also, at a 100% stocking rate, the type of feed line barrier has no effect on daily feeding times and incidence of aggressive behavior at the feed bunk. New work is examining the effects of other management changes on cow behaviour, productivity, health and comfort at the feed bunk.

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