Oppurtunities and challenges in dairy calf housing and management for the next decade

Marina A. G. von Keyserlingk and Daniel M. Weary

Animal Welfare Program, University of British Columbia, Vancouver, BC, V6T 1Z6, Canada: E-mail: marina.vonkeyserlingk@ubc.ca

Introduction

Calf care is possibly the most challenging job on the dairy farm, in part because milk-fed calves are the animals most likely to become ill. New methods of calf rearing are becoming available that can benefit both producers and their calves, providing the potential for widespread improvements in calf care over the next decade. We predict that in the coming years producers will begin feeding dairy calves more milk than they are now commonly fed, increasingly using labour-saving milk delivery systems that facilitate more natural milk drinking behaviour. These improved feeding systems will ease the move towards group housing of calves before weaning, saving producers time and money. However, changes in feeding and housing systems pose new challenges for producers and their calves that require much innovation and research. In this presentation we will describe how new milk feeding methods promote rapid growth and more natural calf behaviour. New feeding systems facilitate keeping calves in groups, but group housing can result in increased competition and increased risk of disease transmission. Therefore, we will also discuss the challenges involved in using new feeding methods, and how to reduce these problems.

Calf Feeding

Methods of feeding calves in modern dairying differ markedly from those found in nature (von Keyserlingk and Weary, 2007), but knowing more about the natural behavior of cow-calf pairs can help us develop better ways of feeding calves (von Keyserlingk et al., 2009;
Khan et al., 2011). On many dairy farms, calves are separated from their mothers within 24h of birth and then fed milk by bucket or bottle until 4 to 12 wks of age. Separating cow and calf early is thought to allow for better supervision of colostrum, milk and solid food intake and help prevent transmission of disease. Early separation also reduced the distress response of both the cow and calf. For example, Flower and Weary (2001) examined some of the effects of the age of separation on cow and calf behaviour and found that cows and calves that were separated (14 days versus 1 day) had higher levels of activity and vocalized more often. However, the calves separated at 14 days gained 16.5 kg over this period, versus just 4.5 kg for those separated early, and the calves maintained this weight advantage even after separation from the dam. The higher growth of calves kept with the cow may have been due, at least in part, to higher milk intakes – the spread between the cow-fed and people-fed calves shows the opportunity we have for improved gains with improved feeding management of dairy calves.

In conventional management schemes, calves are normally provided milk at 10% of their body weight (~ 4 kg / day), are vulnerable to disease, often fail to gain adequate weight and can sometimes experience high levels of mortality. We have tested the effects of feeding calves ad libitum by teat (Appleby et al., 2001; Jasper and Weary, 2002). In each experiment we compared weight gain, milk intake, starter intake and number of days with diarrhoea for calves fed milk conventionally (i.e. twice daily by bucket at 10% of body weight per day) versus ad libitum from a teat. In our first experiment, we found that weight gains during the first 2 weeks after birth were less than 0.4 kg/d for the conventionally fed calves versus 0.85 kg/d for the teat-fed ones; during the next 2 weeks gains were 0.58 and 0.79 kg/d respectively (Appleby et al., 2001). In a second experiment we again found that the teat-fed calves gained weight more quickly (0.78 versus 0.48 kg/d from birth to weaning at 37 days of age) (Jasper and Weary, 2002). We also found that calves maintained their advantage in body weight after weaning. In both experiments the differences in weight gain were likely due to teat-fed calves drinking approximately twice as much milk as the calves fed conventionally. For example, the ad libitum fed calves consumed on average 8.8 litres of milk per day, compared to 4.9 litres per day for the conventionally fed calves (Jasper and Weary, 2002). Calves limit fed according to conventional practices also show behaviours indicative of chronic hunger (de Paula Vieira et al. 2008).
It is commonly thought that feeding less milk will encourage solid feed intake. Indeed, we have found that over the first 5 weeks of life, feeding calves less milk does increase starter consumption (0.17 versus 0.09 kg per day) but this practice also severely limits weight gains (Jasper and Weary, 2002; de Paula Vieria et al. 2008). Moreover, we have found that the ad libitum milk-fed calves quickly caught up to the conventionally fed calves in their intake of starter after weaning; both groups consumed on average 1.9 kg per day during the two weeks after weaning.

Improving access to milk raises practical problems, such as maintaining milk quality throughout the day, especially during warm weather. An alternate approach to continuous access is to provide unlimited availability of milk but only for a few hours each day. Previous research has found that calves provided unlimited access to milk spend just 45 minutes per day drinking milk, and that the largest meals occur just after the delivery of fresh milk (Appleby et al., 2001). In another study, we tested the effects of limited access to milk (4 h/d) versus continuous (24 h/d) access on milk intake, weight gain and behaviour of dairy calves (von Keyserlingk et al., 2004). Calves consumed as much milk in the 4 h/d treatment as they did in the 24 h/d treatment. An added advantage of the 4 h/d treatment, for some facilities at least, is that the same equipment can also be used to supply water to calves.

Much research and on-farm innovation is required to maximize the benefits of these new calf-feeding methods. In particular, little is known about how best to wean rapidly growing calves fed high milk rations. Current recommendations for weaning age and method are specific to slow growing calves fed conventionally, but new work is showing that slowly reducing milk intakes in the days before weaning can be helpful (Khan et al., 2007). In one study with calves fed up to 12 L/d (Sweeney et al., 2010), we compared calves weaned abruptly with calves weaned gradually over 4, 10, or 22 d. Calves weaned over 22 d ate the most starter, but also had the lowest weight gains before weaning. The abruptly weaned calves ate the least amount of calf starter but had the best weight gains before weaning. After weaning, calves on the 22 and 10 d treatments ate more starter and had better weight gains than calves on the more abrupt treatments. These findings suggest that weaning over 10 d is optimal. This type of gradual weaning is easily accomplished using automated calf feeders.
Group housing

For the past decades, common wisdom among North American dairy experts was that calves should be housed individually, in separate pens or hutches (e.g. Quigley, 1997). This practice was considered to maximize performance and minimize the risk of disease. Individual housing also helps avoid behavioural problems such as competition and cross-sucking.

The new calf-feeding methods described above work well for individually housed calves, but also facilitate group housing. Group housing provides more space for calves and allows for social interactions. Research and practical experience show that group rearing of calves can result in considerable benefits through reduced labour requirements for cleaning pens and feeding. One study on a commercial farm in New York State showed that calves kept in groups required one third of the labour that went into caring for the individually housed and fed calves (de Passillé et al., 2004). Calves are social animals that need exercise and keeping dairy calves in groups may provide a number of advantages to both producers and their calves. Successful adoption of group housing will mean avoiding problems such as increased disease and competition. Recent research provides some insights into how these risks can be minimized.

We evaluated the behaviour and growth rates of calves housed in pairs versus individually (Chua et al., 2002); calves gained weight steadily regardless of treatments. Interestingly, during the week of weaning (approximately 5 weeks of age), pair-housed calves continued to gain weight normally but the individually housed calves experienced a slight growth check. There were no differences between groups in the amounts of milk, starter or hay consumed, or in the incidence of scouring or other diseases. Aggressive behaviour and cross-sucking were almost never observed (less than 0.2% of time).

In a more recent study, de Paula Vieira et al. (in press) found that calves housed in pairs vocalized less during weaning than did individually housed calves. The results of this study also illustrated some longer-term costs to housing calves individually. When all calves were eventually introduced to a group pen after weaning calves that had previously been single housed took on average 50 h to begin feeding, in comparison to just 9 h for the pair-reared
calves. These results suggest that individual housing may result in at least temporary deficits in cognitive or social tasks.

Successful group rearing requires appropriate management, including feeding method and group size. Large epidemiological surveys of U.S. and Swedish dairy farms found increased mortality and disease on farms keeping calves in large groups (more than 7 or 8) (Losinger and Heinricks, 1997; Svenson et al., 2000). Thus, small groups are likely a better alternative than large ones.

Calf immunity and the design and management of the housing systems, such as its cleanliness and ventilation, likely affect disease susceptibility more than group housing per se. Our work shows that housing young dairy calves in small groups is viable in terms of calf health, performance and behaviour. New research is now required on management strategies that will help prevent disease. For now, we encourage producers to consider keeping a closed herd (i.e. no new animals entering the herd), keeping groups small and physically separated from one another (e.g. in super hutches), and managing group pens in an all-in-all-out basis.

Calves in groups sometimes compete with pen mates. In one experiment using a simple teat-feeding system, we found that group-housed calves can displace one another from the milk teat many times each day if there are not enough teats (von Keyserlingk et al., 2004). However, giving each calf access to its own teat greatly reduced these displacements. This improved access to teats resulted in longer feeding times and increased milk intakes.

Other research has focused on how computerized feeding stations can be managed to reduce competition between calves. Increasing the daily milk allowance for calves from 5 to 8 litters per day reduced by half the number of times calves visited the feeder, reducing occupancy time and displacements from the feeder, and improving the efficient use of this equipment (Jensen and Holm, 2003; de Paula Vieira et al. 2008). Our research shows that young calves can be introduced into a group with little disruption when they are trained to feed from the computerized feeding station prior to the introduction (O’Driscoll et al., 2006). Although the calves visited the feeder less frequently on the day of mixing, they were able to compensate by
increasing both the duration and amount consumed per meal, and established their pre-mixing feeding pattern after just one day.

**Conclusion**

Current research on dairy calves is paving the way for new methods of managing and housing these animals that will facilitate calf care and improve living conditions for these young animals. Calf care is arguably the most difficult job on the dairy farm. For the good calf manager, the research that we will describe provides opportunities to further improve calf care and reduce labour. However, like any new method, these are best adopted first by the best and most innovative managers. New methods require new skills and a careful eye to ensure that these are implemented in the best ways possible.

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**References**


