FOUR FALLICIES OF DAIRY CALF REARING

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ABSTRACT

In this paper I review the results from recent work at UBC that exposes four commonly held fallacies regarding how we should rear dairy calves.

Fallacy 1: Calves should be separated from the cow as soon as possible after birth. In fact, calves do very well when kept with the calves during the first few weeks after birth. Calves kept with the cow gain weight at up to 3 times the rate of conventionally reared (i.e. early-separated and fed milk at 10% body weight / day) calves.

Fallacy 2: Calves should be fed restricted amounts of milk before weaning. In fact, calves can easily consume 9 or more litres of milk a day, compared to the 4 l they get when fed conventionally. The increased milk intake much improves weight gains, with no detrimental effect on calf health or post-weaning intake of solid food.

Fallacy 3: Calves should be housed individually and preferably isolated from each other. In fact, calves can be reared successfully in small groups without stimulating cross-sucking or increasing disease.

Fallacy 4: Commonly used methods of dehorning calves are acceptable practices. In fact, typical dehorning practices have been shown to cause considerable pain. Moreover, this pain is avoidable. Alternative methods and procedures are available that can be greatly reduce the pain response.

INTRODUCTION

Rearing the pre-weaned heifer is one of the most challenging tasks on the dairy farm. Young calves are vulnerable to disease, often fail to gain weight and can sometimes experience high levels of mortality (Heinrichs et al. 1993, 1994, Place et al. 1998).

Recommendations and producer practices vary considerably in several key management areas. For example, the timing of cow-calf separation, the amount of milk that is provided, when and how solid food and water are provided, the ways calves are housed, the age and methods by which they are weaned, and the way they are dehorned. Some of these recommendations are provided in recent reviews (Brown 1998; Quigley 1997). I will briefly cover some our recent work at UBC on these topics. I hope that it will get you thinking about some of these issues in new ways. I begin by describing some work on early separation of the calf and cow and then go on to cover other recent research on calf feeding, housing and dehorning. My focus is on the well being of the calf, but factors that benefit the young replacement heifer will likely be of long-term benefit to the farm.

SEPARATION FROM THE COW

On most North American dairy farms, calves are separated from their mothers within 24 hours of birth and then fed milk by bucket or bottle until 4 to 10 weeks 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. Given that the cow and calf will be separated at some point, early separation is also thought to cause less distress to both parties. In contrast, under natural conditions cows leave their calves in groups from about 2 weeks of age and usually continue to nurse calves for more than 6 months (Phillips, 1993). In a number of organic milk production systems, the heifers suckle the dam for 4 days (Denmark) to 8 weeks (Sweden). Producers report healthier and faster growing calves and believe this management reduces the incidence of mastitis. In recent studies we have examined some of the effects of the age of separation on cow and calf behaviour and performance.

In the first experiment (Weary and Chua, 2000), calves were separated at ages that reflect ranges seen in the industry at present (6 hours, 1 day, or 4 days after birth). In the second experiment (Flower and Weary, 2001) we also looked at calves separated 14 days after birth (the time when cows leave calves in groups in the wild). In both experiments we found that the cows and calves that were separated later responded more strongly to the separation in terms of increased activity and more vocalizations. We also found that cows kept with calves yielded less milk at milking. However, this was probably due to a lack of milk ejection at milking and not to reduced milk synthesis (de Passillé et al., 1997). Consequently yields rebounded after separation such that total yield over the lactation did not differ. Perhaps most importantly, we found that calves separated at 14 days of age took advantage of the extra milk by gaining 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. In another experiment, we allowed heifers to suckle the cow twice a day for 9 weeks. These heifers gained weight at twice the rate of calves fed conventionally (1 kg/d vs. 0.5 kg/d). Again, calves maintained this weight advantage after weaning. Thus separating calves at later ages does increase their response to separation, but allows calves to grow much faster and remain healthier (Flower and Weary, 2002).

FEEDING MILK

The most dramatic finding from the cow-calf separation work is the difference in weight gains between the early separation calves and calves kept with the cow. This work shows how well calves can do in terms of weight gain, or from another perspective, how much room there is for improvement in the way we conventionally raise calves. The question then is how can we change our calf rearing methods to begin to achieve these higher gains? One method might be to keep cow and calf together for longer periods, but more research is needed to find practical ways of achieving this. The most obvious difference between conventional rearing and keeping the calf with the cow is how the calves consume their milk and the quantities they consume.

The way in which dairy calves are offered milk after separation from their mothers can have marked effects on many aspects of their behaviour, performance and welfare. The most common system is to feed them twice daily from buckets, typically with an amount equivalent to 10% of their body weight/day.

Surprisingly there has been little work on the effects of giving calves additional milk. In one recent experiment, Van Amburgh et al. (1999) were able to achieve dramatically different weight gains by feeding calves different amounts of milk by bucket, 3 times per day. These improved weight gains translated into much improved gain to feed ratios. Thus feeding larger quantities by bucket would seem to have important advantages.

Rather than providing milk from a bucket, a teat allows calves to drink in a more natural manner. In addition, calves fed from an artificial teat tend not to suck on each other or on objects, unlike calves fed from a bucket (e.g. Bøe and Havrevoll 1993; de Passillé 2001). Primarily, this increases overall feeding time, especially if a teat with a small orifice is used to reduce flow rate (Haley et al., 1998). We have found that calves fed ad libitum by nipple spend approximately 45 min per day drinking milk (Appleby et al., 2001), compared to just a few minutes per day for bucket-fed calves.

In recent experiments we have tested the effects of feeding calves ad libitum by teat (Appleby et al., 2001; Jasper and Weary, in press). In each experiment we compared weight gain, milk intake, starter intake and number of days with diarrhea 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 the first experiment we found that weight gains during the first 2 weeks of life 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. In a second experiment we again found that the teat-fed calves gained weight more quickly (0.78 versus 0.48 kg/d over from birth to weaning at day 37). 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, in the second experiment 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. Van Amburgh et al. (1999) provide some economic analysis on the beneficial effects of these improved early weight gains for the pre-weaned calf.

It is commonly thought that calves should be encouraged to increase their consumption of starter at an early age. We found that over the first 5 weeks of life, feeding calves less milk did increase starter consumption (0.17 versus 0.09 kg per day) but this practice also severely limited weight gains. Moreover, we have found that the ad libitum 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). Thus feeding restricting quantities of milk, as in conventional practice, would seem to have little merit. Dairy producers should consider increasing the quantity of milk fed to calves.

GROUP VERSUS INDIVIDUAL HOUSING

North American dairy calves are normally housed in individual pens or calf hutches until weaning, and this type of housing is often recommended (Quigley, 1997). The preference for individual rearing stems from the idea that rearing calves individually results in higher weight gains or a lower incidence of disease, and that it may reduce behavioural problems such as cross-sucking. However, calves are social animals and keeping dairy calves in groups may provide a number of advantages to both producers and their calves. For example, group rearing

allows for early social interactions that are important in the development of normal social behaviour. Group housing provides greater access to space, that together with social contact, facilitates the expression of normal behaviour. Group rearing can also reduce the labour of cleaning pens and feeding (Kung et al., 1997).

The success of a group rearing system may depend on several factors, including the feeding method and the number of animals in the group. For example, a large epidemiological survey of U.S. dairy farms found increased mortality on farms keeping calves in groups of 7 or more (Losinger and Heinricks, 1997). A recent study in Sweden (Svenson et al., 2000) found that respiratory disease was twice as high in large pens (10-20 calves) than in the small groups (3-8 calves). Thus small groups are likely a better alternative than large ones.

In one recent experiment we looked at the effect of forming the most rudimentary group possible, a pair (Chua and Weary, 2002). We fed milk ad libitum by teat to both individually-housed and pair-housed calves and found that all calves remained healthy and gained 0.8 to 0.9 kg / day before weaning. Indeed, we found no difference in weight gains between treatment groups except when calves were being weaned. During this week, the weight gains of individually-penned calves declined to just 0.5 kg / day, but the pair-housed calves continued to gain weight at pre-weaning levels. We observed no signs of disease except diarrhoea. The incidence of this condition was low and did not differ between the housing treatments.

A second recent study was conducted on a large dairy farm in New York state (de Passillé et al., 2002). Calves were either raised in groups of 8-15 animals and fed by an automated teat feeding system or were housed individually and fed by bucket. The automatic feeding system was set to feed diluted milk slowly, so that the milk meal was as long as possible. Furthermore, the feeding stall was equipped with a door behind the calf that protected the calf from being pushed out of the feeding stall. Calves could therefore suck as much as they wanted after their meal, satisfying their need to suck and reducing the chances they would suck one another (de Passille, 2001). Calves on the automated feeding system had equal gains before weaning, and better gains during the weaning, than individually housed calves. Cross-sucking was extremely low before and after weaning. Calves from both rearing systems remained healthy and there were no differences in frequency or type of heath treatments. These findings, combined with the 60% reduction in labour for feeding and cleaning and the daily reports on individual performance obtained from the computerized milk feeder, convinced the producer to adopt the group housing and automated feeding system for all his calves.

The low level of disease when calves are kept in pairs or in well-managed small groups is not surprising. Individual housing will have little effect on air-borne pathogens, and contact between calves can still occurs between adjacent pens. Thus management (e.g. cleanliness and ventilation) and calf immunity may play a more important role in disease susceptibility than housing or feeding system. The importance of these other factors may explain the variability in results of earlier studies on group housing (Maatje et al., 1993; Tomkins, 1991; Thickett et al., 1983). Our work indicates that housing young dairy calves in small groups is viable in terms of calf health, performance and behaviour.

DEHORNING

Horn buds of young dairy calves are normally removed to reduce the risk of injuries to other cattle and farm workers that can occur once horns have developed. Although necessary, this is an unpleasant procedure to perform and causes considerable pain to the calf. In this section I will review some recent work showing how the pain and stress associated with dehorning can be reduced.

The horns of calves more than 3 months of age are normally removed surgically using a number of techniques (e.g. scooping, shearing and sawing), and physiological responses indicate that these procedures are painful (Sylvester et al., 1998). It is generally recommended that dehorning be conducted when the calf is less than 2 months old. Horn buds of younger calves are typically removed using caustic paste or a hot iron, but the latter is more commonly used on dairy calves. There is good evidence that both methods are painful (Morisse et al., 1995).

Even when the procedure is carried out at an early age, hot-iron dehorning causes a pronounced behavioural response such that significant physical restraint is necessary to carry out the procedure. Increased levels of circulating "stress hormones" (corticosteroids) are commonly detected after dehorning (e.g. McMeekan et al., 1998b), although administration of a local nerve block dampens this initial increase. Local anesthetic also reduces behaviours associated with the immediate pain response (e.g. tail wagging, head movements, tripping and rearing) and those indicative of post-operative pain (head rubbing, head shaking and ear flicking) (e.g. Graf and Senn, 1999; McMeekan et al., 1999).

Although local anesthetics are effective in reducing the immediate pain after dehorning, the use of local anaesthetic alone may not be enough for at least two reasons. The first of these is that calves respond to both the pain of the procedure and to the physical restraint. Calves dehorned using a local anaesthetic still require restraint and the difference in the behavioral response between treated and untreated calves can be so subtle that it is difficult for observers to judge if nerve blockage was achieved. Calves must also be restrained while the local anaesthetic is administered, as well as during the actual dehorning. Thus calves experience the distress associated with restraint on two occasions, and still may not receive an adequate nerve block. The use of a sedative (such as xylazine) can essentially eliminate calf response to the administration of the local anaesthetic and the need for physical restraint during the entire dehorning process (Grøndahl-Nielsen et al., 1999). A sedative makes it easier to accurately deliver the nerve block, and the lack of restraint makes dehorning much easier for a single worker.

A second unsatisfactory aspect is that local anaesthetic alone does not provide adequate post-operative pain relief. The most popular local anaesthetic, lidocaine, is effective for only 2 to 3 h after administration (McMeekan et al., 1998b). Indeed, the results of recent studies indicate that local anaesthetic treated calves actually experience higher corticosteroid levels than untreated animals after the local anaesthetic loses its effectiveness (e.g. Graf and Senn, 1999; McMeekan et al., 1998a; b;). The use of non-steroidal anti-inflammatory drugs (such as ketoprofen - similar to the ibuprofen you may take for a headache), in addition to a local

anaesthetic, can keep stress hormones and behavioural responses close to baseline levels in the hours that follow dehorning (McMeekan et al., 1998b; 1999; Faulkner & Weary, 2000).

For example, in one experiment (Faulkner & Weary, 2000) we dehorned calves with a hot iron, and all calves were initially sedated with xylazine and received a lidocaine nerve block. To determine the extent of post-operative pain and how this could be treated half of the calves were also given ketoprofen in their milk meals. We found that calves treated with ketoprofen showed little head shaking, ear flicking and head rubbing after hot-iron dehorning, but calves that received no ketoprofen showed much higher frequencies of these pain-related behaviors (remember that all animals received the sedative and nerve block). The magnitude of this effect varied with time after dehorning. Calves treated with ketoprofen showed almost no head shaking throughout the 24 hours following dehorning. Calves that did not receive the ketoprofen were frequently observed head shaking, with response peaking 6 hours after dehorning.

We therefore recommend that dairy producers, in consultation with their veterinarians, consider a combination of treatments for calves being dehorned. The use of a sedative allows for careful administration of the local anaesthetic, with no response by the calf. The combination of sedative and local anaesthetic allows for dehorning with no immediate pain response. The combination of sedative, local anaesthetic and a non-steroidal anti-inflammatory drug reduces the response to the pain both during dehorning and in the hours that follow.

CONCLUSIONS

New research may help us to rethink certain existing practices. For example, keeping the calf together with the cow for a longer period illustrates how well calves can do and how much room we have for improving the ways we rear calves. When calves are given the chance to drink more milk, either from the cow or from an artificial teat, they show impressive weight gains that persist after weaning. Feeding calves by teat facilitates keeping calves in small groups, a practice that may have advantages for both the calf and the producer. The pain and distress of dehorning can be much reduced using medications available from your veterinarian.

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