

# Alternative weaning strategies to diminish acute distress during weaning and separation from the dam after prolonged suckling

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## Abstract

Prolonged suckling allows the dam to perform behaviours associated with maternal care. These behaviours allow the cow to bond with her calf and to provide it with nourishment. However, this maternal bonding process has practical challenges at the time the farmers want the calves to be weaned and separated from their dam as both the dam and calf often show a pronounced behavioural response. By means of on-farm research we have identified characteristics signalling emotional distress resulting from weaning and separation and investigated practical management strategies to reduce weaning- and separation-induced distress. These include social buffering at the time of weaning, postponement of separation after weaning by the use of nose-flaps, and gradual weaning and separation by means of fence line contact. Compared to abrupt weaning and separation after a prolonged suckling period, the investigated strategies significantly reduced distress vocalisations, stereotypy's and replacement behaviour and prevented weight loss of the calves.

## Introduction

The major stressors in conventional calf rearing during weaning are the transition from a mainly milk-based diet to a solid diet and a change in physical and social environment as the calves are often moved to a different pen (Weary et al. 2008). Although prolonged suckling has several benefits on health, production and behavioural development of calves, prolonged suckling adds separation from the dam or foster cow as a stressor, which has been shown to be more than just milk and suckling deprivation (Veissier and le Neindre, 1989; Newberry and Swanson, 2008). Weaning and separation after prolonged suckling is most straightforwardly achieved by removing the calf from the dam or foster cow (abrupt weaning) and placing it in a different barn, either socially or individually housed. When the calf stays on the farm, the distance between the calf barn and dairy herd usually allows auditory signals to be exchanged between mother and calf, while visual and tactile communication is impaired. Behavioural changes upon abrupt weaning in calves generally include an increased frequency of standing, walking and vocalizing and less lying down, feeding and ruminating during the first days (Solano et al. 2007; Enríquez et al. 2010).

Alternative weaning methods that minimize distress after prolonged suckling make the application of prolonged suckling as a calf rearing system more feasible. The aim of this study is to investigate and compare the immediate behavioural response to different types of weaning and separation from the dam after prolonged suckling. The main question is whether gradual weaning and two-step nose-flap weaning lessen distress compared to abrupt weaning. Under the hypothesis that separate stressors are potentially less stressful, it is expected that both nose-flap and gradual weaning lessen the behavioural response to weaning and separation.

## Material and Methods

### *Animals, housing and care*

The study was conducted on two organic dairy farms in the Netherlands. The cows were kept on straw in a deep litter housing system combined with a slatted floor behind the feeding rack. Both farms had around 50 dairy cows, either dehorned (farm 1) or horned (farm 2), that were crossbreeds of Holstein-Friesian with either Maas-Rijn-IJssel (farm 1) or Friesian cattle (farm 2).

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Both herds had permanent access to pasture in spring and summer and *ad libitum* roughage was provided every morning. Cows were milked twice daily, also when nursing a calf.

Cows calved throughout the year. Calving took place in a separate area in the same barn, so that animals still had visual and possible tactile contact with their herd. Calves remained with their dam in the herd until they left the farm at the age of 2 to 4 weeks, or, in case of replacement heifer calves, until weaning off milk at around 3 months of age. Calves moved freely in the herd or pasture and had *ad libitum* access to their dam, water and roughage. Once (partially) separated from their dam and herd, calves had *ad libitum* access to water and roughage and were fed a limited amount of concentrate.

### *Treatments*

Treatments for all calves comprised both weaning and separation, in which weaning refers to the cessation of milk intake by the calf and separation to the removal from the dam in such a way that tactile and visual communication is impaired.

#### *Abrupt weaning and separation*

At farm 1, six calves were abruptly weaned and separated from their dams at 10 weeks of age. They were housed in a different barn at the farm, either individual or social (two calves in one pen; 3.3 × 4 m of which 7.6 m<sup>2</sup> slatted floor and 5.6 m<sup>2</sup> with straw bedding). Tactile and visual communication was possible with calves in the adjacent pen.

#### *Gradual weaning and separation (fence-line)*

At farm 2, five calves were subjected to a gradual weaning treatment in which weaning was achieved in three stages. At around 10 weeks of age, the calves were placed in a pen within the cow barn with one or two other calves (stage 1; 3.5 × 3.5 m deep litter). Contact with the dam, including suckling, was possible when the dam stood parallel to the fence. After two weeks, the fence was barred during the day for a period of two weeks to prevent diurnal suckling (stage 2), after this the fence was permanently barred (stage 3). At this point weaning was complete, but calves remained in the pen for two to three more weeks before they were separated from the dam and introduced into a heifer calf group in a separate barn (stage 4; 8 × 8 m of which 34 m<sup>2</sup> slatted and 30 m<sup>2</sup> concrete with 5-10 calves in total).

#### *Abrupt weaning and gradual separation (nose-flap)*

The farmer at farm 1 was willing to adapt a different weaning and separation strategy because of the calves' overt signs of discomfort and stunted growth at abrupt weaning. Consequently, as a preliminary study, two calves at farm 1 were weaned by means of a nose-flap (QuietWean nose-flap, JDA Livestock Innovations) at 10 weeks of age (stage 1). They remained in the herd for two weeks before separation (stage 2). Housing of the calves is described under 'abrupt weaning'.

#### *Behavioural observations, handling and measuring breast circumference*

Calves were observed in the herd a day before treatment started (day -1), at the day treatment started (day 0 respective to initiation of treatment) and on the three consecutive days (days 1, 2 and 3), as well as a week after initiation of treatment (day 7). In case of gradual and nose-flap weaning, calves were also observed when a new stage of weaning and separation from the dam initiated (day 0 respective to stage 1/ stage 2/ weaning/ separation), as well as the three consecutive days and one week after initiation of a new stage of treatment (days 1, 2, 3 and 7).

Animals were observed from 10.00 to 14.00. This period was chosen because it is a relatively quiet time on both farms, with no feeding or milking activities. One-zero focal sampling was used to record the occurrence of the different behaviours (table 1; ethogram derived from Loberg et al. 2008 and Enríquez et al. 2010) in 48 intervals of 5 minutes. The following behavioural elements were scored; Lying, eating and ruminating are traditional comfort behavioural indicators (Price et al. 2003; Hernández et al. 2006) as well as play (Haupt and Wolski, 1982), while excessive moving, standing, vocalizations and head out of the pen are thought to indicate distress and perhaps willingness to reunite with the dam (Loberg et al. 2008; Enríquez et al. 2010). As weaned calves suddenly do not have milk as their primary source of energy and

water, it is crucial that water intake is adequate and food intake starts soon upon weaning, while the calves have no prior experience with concentrate (Weary et al. 2008). The possible onset of abnormal oral activities such as cross-sucking, tongue rolling and excessive exploring and grooming are thought to reflect reduced welfare. Restlessness can also be reflected in an increased number of transitions between behavioural activities such as lying and standing (Munksgaard and Simonsen, 1996).

On the day that the treatment or a new stage of the treatment initiated, as well as on the observation days a week after such a change, the heart girth of the calves was measured as an indication for their weight (Heinrichs et al. 1992).

## **Results**

### *Pre-weaning behaviour*

Calves spent most of the observation period lying calm with other individuals, as often with cows as with other calves. Ruminating, autogrooming and moving either slow or fast was observed in about 30 per cent of the intervals.

Ten out of thirteen calves suckled their dam during the observation period, the duration of which varied from 1 to 4 intervals. Furthermore, all calves were observed eating some type of roughage, which could be grass, hay or straw, during on average 9 intervals. None of the calves had access to concentrate at this point. Only one calf has been observed to drink water on the pre-weaning day and she drank from a puddle in the field, not a drinker.

One calf was observed to cross-suck an object in one interval and performed tongue rolling in three intervals prior to weaning, while no such abnormal behaviours were observed in the 12 other calves. No pacing has been seen, nor any cross-sucking on other calves or cows.

### *Comparison of the different weaning methods*

The behavioural change in response to any stage of weaning and separation was most intense in the abrupt weaning treatment. Abruptly weaned calves peaked in the number of transitions, the frequency of alertness and abnormal behaviours, as well as both the amount of intervals in which vocalizations were emitted and the total amount of vocalizations per observation period. Abruptly weaned and separated calves also ate hay less frequently after weaning and separation than the gradually weaned calves.

A clear exception to the more restless pattern as shown by abruptly weaned and separated calves was the lower frequency of escape attempts compared to the frequency of escape attempts of gradual weaned calves when they were housed in the pen next to the dairy herd. This frequency peaked at about three times the intensity observed in abrupt weaning. A possible explanation for this is that the restless dam and her udder as external stimuli are likely to add greatly to the internal motivation to reunite and to feed and suckle. This explanation seems legitimate, since both head out and pacing behaviour were decreased to a minimum on day 1, when most calves had already been observed to suckle their dam.

Unsuccessful suckling attempts were also observed in the first stage of nose-flap weaning (also described in Enríquez et al. 2010). However, it seems that the abrupt inability to suckle causes less frustration than complete abrupt weaning and separation from the dam as shown in less distress signs. Calves that were gradual weaned often lied, ate and ruminated in the company of their dam.

Upon initiation of treatment, most calves in the abrupt weaning treatment had a decreased breast circumference and none had a positive difference, while both nose-flap weaned calves had an increased breast circumference. The difference was not directional in gradual weaning. Breast circumference did not change much a week after separation for both nose-flap and gradual weaned calves. Interestingly, all calves had at all times a larger breast circumference than they were supposed to be on optimal growth schemes used in artificial rearing (Sprayfo, 2012).

## **Discussion**

This study investigated the immediate behavioural response to abrupt weaning, gradual weaning and nose-flap weaning with the hypothesis that the latter two methods are less stressful than abrupt weaning and separation.

The overall impact of weaning is thought to be composed of cessation of milk supply and severing the mother-young bond (Newberry and Swanson, 2008; Weary et al. 2008). Vocalizations have been found to be related to milk consumption and occur more often after milk deprivation in newborn and 5-week-old calves (Thomas et al. 2001). Moreover, vocalizations that occurred before feeding in conventionally reared calves (receiving 10% of their body weight in milk per day) seemed not to occur in calves receiving two times that amount of milk, suggesting that milk supply plays a role (Khan et al. 2007). In the nose-flap treatment and gradual weaning treatment, weaning and separation occurred at two different moments. This creates the opportunity to discuss the effect of weaning and of separation separately.

### *Weaning*

Gradually and nose-flap weaned calves were weaned without much of a behavioural response compared to the abrupt weaned and separated calves who performed distress behaviours like excessive standing, moving, alertness, transitions and vocalizations. This difference in coping might suggest that weaning in itself apparently is not necessarily a stressor threatening biological functioning, and does not necessarily evoke a disproportionate increase in standing, moving, transitions, alertness and vocalizations, as is supported by other studies on alternative weaning methods (Hayley et al. 2005; Loberg et al. 2008).

### *Separation*

Being separated from the dam in nose-flap weaning did not lead to the increase in moving, standing, vocalizations and alertness that are thought to reflect the motivation to reunite with the dam (Enríquez et al. 2010). Gradually weaned calves did move a lot upon separation, but this was most likely due to dominance interactions, as standing, vocalizations and alertness were not affected. This suggests that reuniting with the dam is less important when the calf is nutritionally independent, or at least that the separation is experienced as less stressful than it seems after abrupt weaning. However, as with abrupt weaning, abnormal behaviour was observed in the days following separation in the nose-flap treatment, as well as an increase in autogrooming. Apart from suckling, the calf and cow also exchanged affiliative behaviours, mostly grooming or being in each other's proximity. The calf might compensate for not being mothered by increasing its autogrooming frequency.

Another possibility is that the change in housing causes unrest, or that the confounding factor of individual housing leads to this increased grooming frequency, as gradually weaned calves that were housed socially after separation did not increase grooming behaviour. This is also confirmed in other studies in which pair-housing prevented the impaired growth (Chua et al. 2002; Bach et al. 2010) and lessened the behavioural response (De Paula Vieira et al. 2010) that singly housed calves experienced after weaning, suggesting that the experienced distress due to weaning is less intense in socially housed calves.

### **General conclusions on prolonged suckling and subsequent weaning methods**

During prolonged suckling, calves behaved like they were expected based on the behavioural patterns of (semi-)wild herds. They were observed in the presence of other calves as often as with cows, while cows were far more abundant, and were often found in calf groups, as well as cared for by their dam. Only one calf was observed to display abnormal behaviour before weaning, while cross-sucking commonly occurs in hand-reared dairy calves while they are still fed milk (Lidfors, 1993; Fröberg and Lidfors, 2009). All calves observed had a larger breast circumference than they were supposed to have according to optimal growth schemes used in artificial rearing (Sprayfo, 2012). Concluding that good biological functioning as well as a normal social development seemed to be facilitated by prolonged suckling. Gradual weaning as well as nose-flap weaning appeared to lessen the distress upon weaning and separation from the dam. However, in practice, the gradual weaning as it was applied on this farm is quite a burdensome alternative for the farmer, as the fence needs to be barred and opened up daily, and requires an additional pen to be present adjacent to the herd. Nose-flap weaning, on the other hand, seemed to diminish distress even more in this preliminary study, and is much easier to apply. The nose-flap itself is cheap, easily fitted into the calves' muzzle and removed again after separation. This alternative will be further investigated.

### **Tackling future challenges**

Organic livestock farmers try to ensure better animal welfare by taking animals' natural behaviours and needs into account (IFOAM, 2010; von Borell and Sørensen, 2004). However, the rearing of dairy calves is a practice that is often in contrast to the philosophy of organic farming. Dairy calves are separated from their dam directly after birth or within three days after birth, after which they are bucket fed until weaning and housed in such a way that contact with animals of different age groups is little (LBI, 2011; Wagenaar and Langhout, 2007). This 'artificial' rearing contrasts with natural rearing in several aspects (von Keyserlingk and Weary, 2007). For example, while natural weaning in cattle occurs at the age of 6-14 months (Phillips, 1993 as cited in Flower and Weary, 2001; Reinhardt and Reinhardt, 1981 as cited in Enríquez, 2010), milk supply to dairy calves is often stopped at or before they are three months old. Despite the supposedly well-balanced feeding after weaning and the supposedly smaller risk of disease transmission, mortality amongst calves is high. A report by the Flemish government (2009) reports about 12% mortality from calves born alive until first calving; a recent UK survey reports mortality rates of 13-16% (Brickwell and Wathes, 2011). Calf welfare is likely to be reduced, as is reflected in both the reduced growth and high mortality (biological functioning) and the occurrence of abnormal cross-sucking behaviour (affective states).

As an alternative for the conventional rearing practices, prolonged suckling should be integrated in dairy production systems. Animal welfare and animal health can be improved as prolonged suckling bears a closer resemblance to natural calf rearing than artificial calf rearing, as calves are raised in their natural social environment and dams can express their maternal behaviours. Dams can lick and nurse their calves, while calves can suckle their dam and socially learn adequate behaviour. According to the natural living approach, better welfare may therefore be expected for both calf and cow.

*Secondly*, prolonged suckling appears to have positive effects on the health and physical development of the calf (biological functioning approach). Calves in a prolonged suckling treatment had a lower disease incidence and mortality than artificially reared calves (Boonbrahm *et al.*, 2004). Diarrhoea, a major cause of death in calves, was found to cause fewer problems in suckling systems than in artificial rearing (Wagenaar and Langhout, 2007). In addition, calves grow faster and mature well-balanced and naturally when they are allowed to suckle (Bar-Peled *et al.*, 1997; Flower and Weary, 2001; Grøndahl *et al.*, 2007; Metz, 1987; Roth *et al.*, 2009) and cows that suckled as a calf have been reported to have a higher average weight gain until conception, an earlier age of conception and a tendency to have a higher milk production during their first lactation (Bar-Peled *et al.*, 1997).

*Thirdly*, artificial rearing induce negative affective states that can be averted by prolonged suckling (feelings approach). Separation from the mother has a serious impact on an individual's development due to the lack of a mother-young bond that normally encompasses food and protection, social learning and exchange of affiliative behaviours (Newberry and Swanson, 2008; Mogi *et al.*, 2011). Suckled calves have been reported to be more social than individually housed calves at 6 weeks of age (Flower and Weary, 2001) and later in life when being reintroduced in the herd, as well as higher up the hierarchy (le Neindre and Sourd, 1984) and showing more adequate maternal behaviour (le Neindre, 1989).

In The Netherlands 30 farmers have successfully applied a prolonged suckling system with an average calf mortality of 7%. A third of these farmers also don't use antibiotics at all.

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