Mindful Pain Management: Addressing Both Visible and Unseen Pain in Dairy Cows

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Take Home Messages

- Unaddressed pain in dairy cows and calves can negatively impact animal welfare, productivity, and societal trust of the dairy industry.
- Not all painful experiences are the same for dairy cattle. Pain intensity can range from none to severe and its duration can be acute to chronic. The impact on dairy cattle becomes more negative as duration and intensity of pain increase.
- Behaviour can be used as indicators of pain including pain-specific behaviour, changes in normal behaviour, and avoidance of pain.
- Some painful situations aren't easily visible to dairy handlers but are still important to the cow.
- Pain can be well-managed through considerate management and appropriate administration of pain control.

Introduction

At some point in their lives, dairy cattle will experience pain regardless of management. Pain is unavoidable, even if it is minimal, such as from an injection or blood draw. While pain is inherently negative, it can be minimized so that animal welfare is not compromised. The keys to limiting pain are recognizing it and being proactive about managing it.

Pain is defined as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" by the International Association for the Study of Pain (Raja et al., 2020). We gauge the magnitude of pain by considering the duration and intensity (Figure 1). Dairy cow welfare becomes increasingly compromised as pain becomes more severe and lasts longer (i.e., chronic). For example, udder engorgement can be uncomfortable but is quickly relieved by milking, whereas broken tails, which are a result of broken ligaments and joint dislocation, may take months to heal causing more severe pain to cows (Laven and Jermy, 2020).

In this paper, I will provide an overview of on the impact of pain to the sustainability of the dairy industry, ways to recognize pain, and opportunities to reduce pain experienced by cows. While there are many points throughout the life cycle when cows experience pain, we have many tools to address it.

Consequences of Dairy Cow and Calf Pain

Animal Welfare

There are three commonly used facets to assess animal welfare: 1) health, injury, and disease, 2) the ability to perform natural behaviours and 3) mental and emotional states (Fraser et al.,1997). Depending on the nature of the painful experience, one of more of these categories can be negatively impacted (Figure 2).

Figure 1. Pain is affected by both its duration and intensity. Negative effects of pain vary based on both factors but pain has more negative impacts as one or both factors increase.

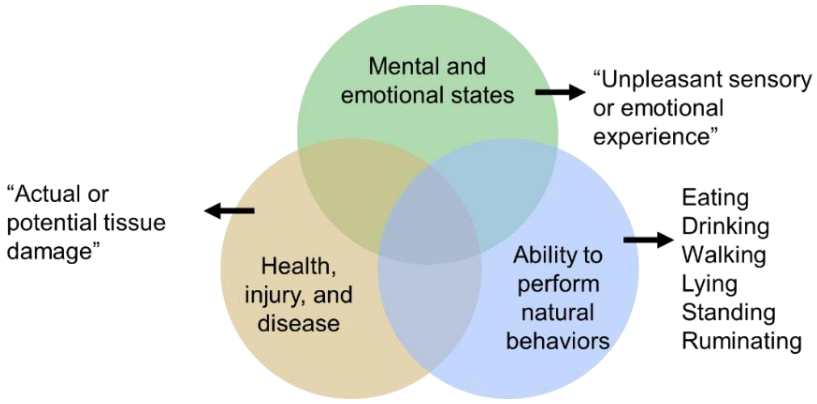

Figure 2. Pain can negatively affect welfare within each facet of the Three Circles of Animal Welfare model (Fraser et al., 1997). One or more of the facets may be affected at a time depending on the pain-causing stimulus.

Impacts of pain on health, injury, and disease are likely the easiest to observe. Visible wounds are a clear injury that would result in pain and likely are one of the easiest painful experiences to identify. These injuries might include wounds from surgery, disbudding, or broken tails. Mastitis may be another example. Cows with clinical mastitis have visible signs of pain including red, inflamed quarters that are hot to the touch because of inflammation caused by an intramammary infection. Further, cows with mastitis can withstand more pressure applied to the udder when they are given pain control (Fitzpatrick et al., 2013), indicating that mastitis is indeed painful.

In addition to biological functioning, it is also possible that pain will limit dairy cows' ability to perform natural behaviours. Some of these behaviours might include reduced drinking that can result in dehydration and/or reduced milk production, reduced eating that can lead to metabolic diseases, decreased rumination, reductions in estrus behaviours like mounting, and changes in locomotor behaviours such as standing, lying, and walking. For example, lame cows eat less and spend less time eating than non-lame cows (Thorup et al., 2016). Additionally, severely lame cows spend more time lying and have longer lying durations that non-lame cows (Ito et al., 2010). One of the positives of the alterations in behaviours caused by pain is that it can be used to identify cows that need attention. Wearable sensors for cows show differences in rumination patterns, physical activity, and lying time for cows with mastitis, metritis, and metabolic disorders including displaced abomasum, clinical ketosis, and indigestion (Rial et al., 2023a,b).

Perhaps more difficult to see, but not less important, is the impact of pain on the mental and emotional states of dairy cattle. A study performed by Neave et al. (2013) found that calves were less optimistic about receiving a milk reward when provided an ambiguous cue after disbudding than before disbudding. The results from this study suggest that calves have negative emotional states associated with pain from disbudding.

Impacts of Pain on Production

In addition to the negative impact on dairy cattle welfare, pain can also compromise production. I will use lameness as an example of pain because it is widely accepted as a painful condition within the dairy industry. Puerto et al. (2021) performed a 15-year study that included 120 herds to determine if lameness impacted milk production. This study found that lame cows produced between 800 to 1,300 kg less milk within a single lactation than non-lame cows. Another study that investigated if reproduction was affected by lameness found that cows with dermatitis, sole ulcers, and white line disease had a longer calving to first service interval than non-lame cows. Additionally, cows with sole ulcers and white line disease had greater days open than non-lame cows (Charfeddine and Pérez-Cabal, 2017).

The exact mechanism by which milk yield and reproductive outcomes were affected by lameness in the previously described studies is unclear. Lame cows may alter their feed consumption and nutrients are redirected to areas of injury when inflammation is present (reviewed by Horst et al., 2021). Other painful conditions in addition to lameness may have negative impacts on production and should be monitored by dairy producers for the specific impacts within their herd.

Societal Trust of the Dairy Industry

There has been increasing concern expressed by the public about the quality of life for farm animals (Robbins et al., 2016). The public has an expectation for dairy cattle to have good welfare. It can be predicted that fewer and properly managed painful experiences would fit within societal expectations for good dairy cattle welfare. Painful experiences, such as disbudding and lameness, are highly visual and be easily identified by individuals without industry knowledge. It is possible that if the public becomes aware of the certain painful experiences for dairy cattle, the dairy industry is at risk of losing public trust. Reputational damage of agricultural industries can lead to increased scrutiny of animal management and a push to influence change from public stakeholders. Changes in marketing of animal products and legislation have been observed in other industries. For example, in the last decade, there has been a shift from battery cage to cage-free eggs and gestation stalls to social housing of sows. To maintain the social license to produce, dairy producers must continue their commitment to limiting painful procedures when possible and properly managing pain when it occurs.

▪ How to Recognize Pain

As caretakers of animals, we have the responsibility to recognize when dairy cattle are in pain. Some painful experiences are obvious, such as broken bones and cuts. However, other occurrences of pain are less obvious, and we must rely on changes in behaviour to identify if cattle are in pain. Behavioural indicators of pain include pain specific behaviours, changes in normal behaviours, and avoidance of pain. These changes in behaviour may occur together or in isolation.

Pain-specific behaviours in dairy cattle can include postural changes, vocalization, reaction to palpation, and procedure or location specific pain. A less obvious example of pain in dairy cattle is clinical metritis, which is characterized by fever and purulent discharge. Dairy cattle with metritis also have a greater response to rectal palpation with and without uterine palpation as shown by a higher back arch compared with that in healthy cows (Stojkov et al., 2015). The increased response of cows with metritis to palpation is an example of a pain specific behaviour.

We can also observe deviations from normal behaviour for dairy cows or calves that are in pain. For example, calves that are disbudded without pain control perform more pain behaviours after disbudding

than calves disbudded with pain control, demonstrating that proper pain control reduces pain experiences by calves. An avoidance of pain is also an indicator of pain. Cows with mastitis can withstand more pressure applied to their udder when they have been given a non-steroidal anti-inflammatory drug (Fitzpatrick et al., 2013). One potential on-farm example of avoidance of udder pain is when cows with clinical mastitis react to the handling of teats in the milking parlour. Moreover, lameness scoring is based on the avoidance of pain. When a cow avoids putting pressure on a painful limb, we can observe it by changes in posture and how quickly the cow picks up her sore limb causing changes in gait.

There are multiple changes in behaviour when pain occurs that can be identified by dairy cattle handlers and/or with the addition of precision livestock technology that provides a detailed summary of behaviour. Using cues provided by dairy cattle, we can apply techniques to reduce pain that have been investigated in research and developed with on-farm protocols.

▪ Seeing Invisible Pain

Some of the painful events described in this paper are clear, such as severe lameness or broken tails, but others are commonly out of sight for animal managers. It is very important we understand that pain that may be out of sight for us is not out of mind for the cow. Cows described in this section will be those that typically receive less attention than lactating cows and preweaned calves. Specifically, I will focus on cull cows after they leave the dairy.

Approximately 30% of dairy cows are removed from the herd each year in Canada (AAFC, 2023). According to Agriculture and Agri-Food Canada (AAFC), the most common reasons for removing cows from the herd (i.e., culling) were reproduction, mastitis, and low milk production. Feet and leg problems, sickness, and injury were also common reasons for culling cows. Once cows leave the dairy, they are no longer in the custody of dairy producers and can change possession multiple times including with livestock transporters, livestock assembly yards, one or more sales through livestock auctions, and the slaughter plant. In settings where cows are not being observed by consistent handlers, it can be easy for cow pain and discomfort to go unnoticed. Further, reasons for culling associated with poor welfare can be exacerbated once cows leave the farm.

From the time a cow leaves the dairy to the time she arrives at the slaughter plant, she will experience many changes in management that can compromise her welfare. After leaving the dairy, cull cows are not milked again, do not have access to feed, have limited access to water, have limited abilities to lie down, can experience thermal stress, and are likely mixed with unfamiliar animals (personal experience). Each of these experiences are stressful for dairy cattle but some can lead to pain or discomfort.

A recent study in Western Canada found that it took between less than 1 day to 16 days for cows to reach slaughter after leaving the dairy (Stojkov et al., 2020). Only 5% of cows in the study were slaughtered less than 1 day after leaving the farm and it took most cows between 1 to 5 days from the time of leaving the dairy until slaughter. In the interim, cows spent time at livestock auctions, assembly yards, in transportation, and at holding facilities at abattoirs. Cows had reduced body condition, and udder engorgement and inflammation increased substantially from the time of assessment at farms to that at abattoirs. Older cows were more likely to develop severe lameness by the time of arrival at abattoirs.

Cull cows are in variable condition at livestock auctions and slaughter plants. At a livestock auction in British Columbia, 10% of cows were emaciated, 10% had an engorged udder, 3% had a swollen or inflamed udder, 47% were lame (7% severely lame), and 6% had another defect such as a swollen joint or pneumonia (Stojkov et al., 2020). A study in the United States also found that many cows were in poor condition at slaughterhouses. Many cows were emaciated (9%), lame (23%), or had a defect (43%) (Harris et al., 2017).

Challenges leading to poor fitness for transportation, including engorged udders, lameness, and reduced body condition, can vary between discomfort to severe pain for dairy cattle. Many cows are culled during the middle of their lactation when milk production is still high. Further, many cows are still producing large amounts of milk in late lactation. Udder inflammation and engorgement caused by milk accumulation in the

udder from not being milked increases intramammary pressure resulting in tissue damage, discomfort, and pain (Franchi et al., 2022). As previously discussed, lameness is visibly painful for cows as they avoid putting weight on sore limbs(s). Finally, while hunger may not be acutely painful, it is still a negative experience for cows that can increase in severity as time without feed increases. A study that deprived cows of feed for up to nine hours found that lactating and dry cows worked harder to access feed as the time without feed increased (Schütz et al., 2006). It is not clear how hungry cows are after nine hours without feed, but it may be severe considering that cows may not be slaughtered until many days after leaving the dairy.

While dairy producers and on-farm caretakers do not have control over the fate of cull cows after leaving the dairy, there are some solutions we can use to minimize pain and distress of cows after they leave the dairy. Some of these solutions are described in the next section.

▪ Proactive Pain Management

To manage pain in dairy cattle, it first needs to be recognized. An appropriate assessment of pain needs to be performed for each painful experience. Many studies have documented pain experienced by animals at different pain points including castration, disbudding, and lameness.

Pain can be minimized by avoiding the painful experience all together, providing pain reducing drugs, and improving the environment. Solutions to avoiding pain can be simple. For example, to limit the worsening of cull cow condition, cows can be maintained on the dairy farm until they have a better fitness for transport. This may be achieved by allowing cows to recover from lameness or mastitis or increasing body condition prior to shipping. Another management practice to avoid discomfort for dairy cows is by reducing the daily milking frequency or feeding a lower energy diet to cows in the weeks prior to dry-off to avoid udder engorgement after milking is ceased for dry cows (Franchi et al., 2022).

Appropriate pain control medications are also available to help limit pain when it can't be avoided through management. Possible drugs for dairy cattle include analgesics to reduce the perception of pain, anesthetics for local pain elimination, and sedatives to alter the level of consciousness. Each of these drugs can be used on their own or in combination when appropriate. The effectiveness of pain control can be determined by assessing the signs of pain including changes in normal behaviour, avoidance of pain, and pain specific behaviours. If measures applied to control pain appear to be ineffective, we can try multiple solutions to determine what is most effective.

▪ Conclusion

Dairy cattle will experience discomfort or pain at some point in their lives. While pain is associated with a negative sensory or emotional response, the degree to which a cow's welfare will be impacted is affected by pain intensity and duration. Behavioural observations are important to identifying when cows are in pain. However, we might miss indicators of pain if cows are not closely observed or are only observed briefly. We need to be considerate that dairy animals may be in pain even if we do not observe it. For cattle in visible pain, we can use tools to treat them and reduce the negative effect but for less observed animals, we need to be forward thinking and use proactive management strategies. Addressing pain is important to production but it is also critical to animal welfare, which plays an important role in making sure the dairy industry is sustainable.

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