Emerging topics in dairy cattle welfare: Perspective for progressive practitioners

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Abstract

Since cattle were domesticated thousands of years ago, production practices and cattle care have continued to evolve, improve, and progress. What is emerging, is the ethical concerns of society for how the global dairy industry cares for cattle, our scientific understanding of the impact of production practices on the cattle as well as science that provides a better understanding of the needs of the cattle in our care, and practices that help to best meet those needs. These factors create an opportunity for the industry to make production decisions that benefit the dairy, consumers of dairy products, and most importantly the cattle in our care. Veterinarians, as trusted experts in the care of cattle by both producers and consumers, can provide a key link in opening the discussions on welfare topics with producers and helping to illuminate these animal care opportunities at the production level. This presentation will highlight several of these "emerging" topics and provide discussion of the mutual benefits that can be realized by proactively addressing those areas, in order to help bovine veterinarians successfully facilitate those conversations.

Key words: dairy welfare, ethics, veterinarians

Introduction

While welfare is certainly not a new term or concept, it can be a difficult term to define. The American Veterinary Medical Association (AVMA) describes welfare as "An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well-nourished, safe, able to express innate behavior, and if it is not suffering from unpleasant states such as pain, fear, and distress".[5] Since cattle were domesticated, the methods we have used to keep cattle healthy, comfortable, and well-nourished has continuously evolved as has cattle's contribution to society and civilization. This evolution has predominantly been driven by a growing understanding of the needs of cattle through continued research and expansion of the body of scientific literature. Traditionally, this progress has been motivated significantly by the overarching goals of both producers and production medicine to increase productivity and profitability of cattle production systems. Over the past decades, globally consumers of dairy products, and society as a whole, have entered into the discussion of the ethics of production practices. Though the input of society into animal care practices is more recent, the other factors driving change in animal care, namely a better understand of the needs of cattle and how to meet them, still exist just as they have for thousands of years. Although external factors can make both producers and practitioners feel more isolated and removed from animal care decisions, that does not need to be the case! Improved animal care can still benefit productivity and profitability, and indeed many of the topics discussed will have significant benefit to production and production medicine beyond the benefit to the cattle in our care. The veterinarian, as a trusted expert in animal care by both consumers and producers alike, must and should be leading the discussions in how to advance care practices, along with an obligation to help dairy clients stay apprised of the changing science of dairy cattle care and the welfare topics of discourse within the global dairy supply chain.

Colostrum and Additional Colostrum Feedings

Despite our best efforts, failure of passive transfer (FPT) is still an issue for many dairy calves, and especially anecdotally bull calves. Beam 2009 found "the estimated prevalence of FPT in US dairy heifer calves was 19.2%."[7] More recently, in a 2017 study in a cohort of 18 Canadian dairies, and using a cut point for FPT of <5.2 g/dL, the average farm FPT rate was 16%. As part of that trial, participating farms were provided a single benchmarking report that outlined their failure of passive transfer results, their average daily gain numbers, and then compared those results to the other 17 participants' results. Having seen a single report, all 18 dairies agreed to a second round of the study, and 11 of the 18 herds made at least 1 change to their colostrum management. This resulted in the FPT rate of those 11 dairies falling from 21% +/- 10 to 11% +/-10.[4] Another lesson here beyond the colostrum science is that benchmarking can be a highly effective tool to motivate change and engage dairy producers. Clinics and practitioners can harness this to both improve animal care outcomes while also creating value for producers.

At the same time, we are learning that there is so much more value to colostrum than simply the antibodies it carries, and providing additional colostrum to calves can enhance the future life and production potential of that calf.

- "Factors other than immunoglobulins in colostrum modify feed intake, feed efficiency and growth of calves and can enhance the effect of early life nutrient status."[26]

- "A management suggestion to make best use of the factors the dam is trying to supply the calf would be to feed first milking colostrum to the calf immediately, then feed colostrum from milkings 2 through 4 (day 1 and 2 of lactation) to the calves over the first 4 days."[27]
- Calves fed colostrum for the first 4 days of life had enhanced oral glucose uptake, and thus improved glucose status, compared to milk replacer-fed calves. Calves fed milk replacer for the first 4 days following an initial feeding of colostrum showed elevated amino acid degradation.[23]
- Both colostrum and a 1:1 mix of colostrum and whole milk had improved small intestine development compared to whole milk for the first 3 days of life, following an initial colostrum feeding.[19]

Yet, many dairies will sell additional colostrum rather than feed it to calves. As of the drafting of this paper, colostrum in the US was being sold from dairies for prices at or around $70/cwt. Considering the additional benefits of colostrum and the added nutrient value, there are potential ethical considerations, if not future production considerations, to selling rather than feeding this colostrum.

Pair and Group Raising of Calves

Housing of dairy calves in North America has predominantly been in individual calf pens or hutches. This housing choice evolved as a means of limiting disease spread, allowing for some additional level of individual care, while at the same time improving in part the ease of finding sick calves. There is mounting evidence that raising calves in pairs or groups offers benefits to development of social skills and cognition of calves.

- Early paired calves (6d +/- 3d) showed significantly higher starter grain intake and higher average daily gains to 10 weeks of age than late-paired or individually raised calves. "Social housing soon after birth can increase weight gains and solid feed intake."[11]
- Individually housed calves are more fearful of unfamiliar calves than pair-raised calves. "Increasing the level of social contact in the home environment made calves less fearful in novel social and environmental situations"[14]
- "Increased reactivity to novel environments" is a long-term effect on calves of conventional raising (social isolation plus restricted milk intake).[8]

Despite potential costs to alter calf housing, these findings should be highly motivating to the industry. Many of our disease and welfare challenges in calves, heifers, and lactating cows are related to changing social dynamics and eventually entry into the milking string. It is possible increased socialization of calves early in life may play a part in easing some of these issues.

Volume of Milk Fed to Calves

It is hard to argue that we have not traditionally underfed dairy calves compared to what they could or would consume if we compare them to say, beef calves. The adage of 4 quarts of 20:20 milk replacer a day simply does not provide the necessary nutrient requirements. This is partially due to calves and youngstock being viewed more as a cost center of the dairy, and less as a future opportunity of the dairy. Unfortunately, thin calves are still an all-too-common outcome of welfare audits, especially in times of changing weather or other challenges calves may face. In truth, calves are both a cost center and an opportunity to enhance the future of the dairy, and both factors need consideration.

- "As an industry and as nutritionists, we need to talk about metabolizable energy and protein intake and status relative to maintenance and stop talking about cups, quarts, gallons, buckets and bottles of dry-matter, milk, milk replacer, etc. The calf has discrete nutrient requirements not related to dry-matter and liquid volume measurements."[26]
- Calves fed ad libitum milk replacer, compared to those fed 6L (1.59 gal) of 12.5% solids milk replacer per day, developed a small intestine that was 3 meters (9.8 ft) longer at 80 days of age. Additionally, the ad libitum group had increased villus circumference, cut surface, and height in the duodenum, proximal jejunum, and ileum.[15]
- Calves fed over 3.8L (1 US Gal) per day on milk, under 21 days of age, decreased the hazard of BRD by 92%. "Such a decrease in BRD hazard may be an indication that feeding calves less than 3.8 L (1 US Gal) per day may not fulfill their nutrient requirements for metabolic growth, and immune system function."[13]
- "…for every kilogram of preweaning ADG, first-lactation milk yield increased by 3417.2 lb (1,550 kg). Furthermore, the meta-analysis yielded an odds ratio of 2.09 (P = 0.001) indicating that calves fed for greater preweaning ADG were 2 times more likely to have greater milk yield in the first lactation."[22]
- "…the milk yield response due to greater nutrient intake from milk or milk replacer was approximately 4 times the average lactation response due to selection for milk yield."[21]

Lameness

Lameness is a monumental animal health and wellbeing concern on North American dairies. According to Dr. Nigel Cook in a 2019 Bovine Veterinarian article, "worldwide about 23% of dairy cattle experience lameness issues"[10] The changes in gait and weight distribution we see that are used to diagnose lameness are a direct result of the pain lameness causes. Any painful condition, such as lameness, that

also affects such a high proportion of the cattle population is obviously a large welfare concern. Lameness also happens to be a monumental economic issue for dairies as well, meaning lameness on dairies is another area of welfare that all parties should be motivated to address. According to the Dairyland Initiative's Lifestep Module:

- "Most studies suggest a loss of milk production due to lameness of the order of ~ 3 lb (~1.4 kg) milk per cow per day or 900 lb (~408.2 kg) per lactation, but losses due to foot rot and sole ulcers are most severe (~2,000 lb; 907.2 kg), while losses due to digital dermatitis can be much less severe (0 lb)."[12]
- "In herds that control lameness, milk production increases at a herd level frequently exceed 2,000 lb (907.2 kg) per cow per lactation."[12]
- "Individual estimates for a case of lameness can be as much as $500 per case, while less severe cases can be $100 or less per case."[12]

Similarly:

- Liang et al in a model of the costs of disease found that "the total lameness costs were $185.10 ± 64.46 and $333.17 ± 68.76 per case for primiparous and multiparous cows, respectively."[16]
- Cha et al, 2010 found, the average cost per lameness case (US$) was $216 for sole ulcers, $133 for digital dermatitis, and $121 for foot rot.[9]

Clearly, addressing lameness is a large welfare and financial opportunity for the global dairy industry. Potential lameness prevention strategies may include improving flooring conditions by resurfacing where concrete has aged and aggregate is exposed, proper concrete grooving and strategic use of rubber in parlor and transfer areas, increasing cows' lying time through improved cow comfort, and ensuring cows spend less than 45 minutes per milking shift standing in the parlor or holding area. While some of these solutions may require some capital investment or facility changes, placing more emphasis, effort, and training into finding and diagnosing lame animals sooner, along with better training on how to perform proper maintenance foot trims, has very little up-front cost and offers significant welfare and productivity reward.

Dehorning and the use of Polled Genetics

Cattle evolved horns as a means of potential defense from predators, and the reality is for the safety of people and for that of other cattle we need the cows not to have horns. No matter what procedure we as veterinarians may elect to recommend to remove the horns, all are known to cause pain to the cattle and all require the input of labor from the dairy farm itself or in the form of their veterinarian. Unlike our colleagues in beef production, dairy breeds have been very slow to adapt to use of polled genetics. Yet removing the need to disbud or dehorn cattle not only saves on labor, but would remove an entire stressful handling event for the cattle as well. Some of the reluctance of producers toward use of polled genetics stems from concerns over the lower genetic merit of polled bulls at stud as well as challenges managing inbreeding. Despite those concerns, the situation is of course dynamic, and the considerations of 10 years ago are evolving.

- Of the Holstein bull population at major North American companies, about 4% are polled, with heterozygous (Pp) bulls making up 3% and homozygous (PP) bulls making up 1%.[a]
- The top 10 Pp polled bulls average $744 Net Merit $ (NM$), while the top 10 PP bulls average $532 NM$. For comparison, the top 10 horned bulls average $882 NM$.[a]
- The top yearling polled bull in the US (Mendel-P) is $943 NM$, which is the highest NM$ bull his age or older - even beating out the horned bulls.[a]

Polled genetics, especially those heterozygous polled bulls, have made significant genetic progress. Especially for herds that may use genomic sires in their breeding program, choosing polled no longer necessarily means sacrificing production traits. Of course, the Mendelian genetics of the polled trait remain unchanged, and using nothing but Pp bulls will never lead to a fully polled herd. Despite this, it is possible to include polled genetics within a dairy's genetic plan in order to actively begin increasing the polled gene frequency within their herd and the breed responsibly over time.

Pain Mitigation

The commitment to relief of pain and suffering is central to both the practice of veterinary medicine as well as being a core tenet of animal welfare. In their guidelines on disbudding and dehorning, the American Association of Bovine Practitioners (AABP) states that "pain management be considered the standard of care for all dehorning and disbudding procedures".[2] The AABP's guidelines on castration similarly acknowledge "All mechanical and chemical methods of castration are painful", that "Use of a local anesthetic immediately prior to castration mitigates the immediate pain associated with the procedure" and that "Nonsteroidal anti-inflammatory drugs (NSAIDS) can be used to effectively mitigate the post-procedural pain of castration".[1] Yet, even for routine procedures such as disbudding and castration, there are many reasons cited for not utilizing pain management including lack of labeled pain management options, concerns with the use of extra label drug use and the associated risk of residues, added cost, and lastly inconvenience/added labor. While there is some truth to all these concerns, most if not all can be overcome if we and our clients are motivated to do so.

There are also ways to mitigate pain beyond use of drugs to do so. Performing procedures at the earliest possible age, with the least traumatic manner, and with proper restraint can help limit pain caused. It is also important to recognize that the most effective means of pain management is simply avoiding the practice or procedure if possible. Choices such

as use of polled genetics along with choices to discontinue elective (if not required by law) procedures such as branding not only avoid causing pain, but also mitigate any potential concerns with use of Extra Label Drug Use (ELDU) drug options for pain management. Perhaps most importantly, these choices also remove the labor cost to perform the procedure along with the stress of the procedure on the animal. In the case of branding, studies have shown hot iron-branded tissue to be more painful than unbranded tissue for up to 71 d post branding.[25] Veterinarians, even with ELDU pain management, will be very unlikely to be able to successfully mitigate that pain for that duration. It is also reasonable to question the ethics of performing other elective procedures such as teat removal, either for mastitis treatment/part of the process of "3-teating" the cow, or for removal of supernumerary teats for cosmetic purposes.

Finally, dairy cattle may benefit from pain management, in situations we had not previously used pain management as standard of care.

- Use of meloxicam, in conjunction with antimicrobial therapy, for mild to moderate cases of clinical mastitis, resulted in a higher probability of bacteriological cure, an increased probability of conception to first artificial insemination, fewer artificial inseminations, and a greater proportion of cows pregnant by 120 d in milk.[17]
- Calves receiving a single injection of meloxicam at the onset of diarrhea had improved appetite and performance compared with placebo calves. These calves were more likely to consume their entire daily milk allowance, began consuming starter ration earlier and at a greater rate, consumed more water, gained BW at a faster rate, and tended to wean earlier than diarrhea calves not receiving pain management.[24]
- In a study involving 20 predominantly Holstein herds in Canada evaluating administration of a single dose of oral meloxicam at time of calving, "Relative to untreated controls, meloxicam-treated cows produced 1.4 lb (0.64 kg)/d (SE = 0.29. P = 0.03) more milk over the first 3 test days (90 to 120 d in lactation), had 0.75 times the odds of subclinical mastitis at first test (SE = 0.08, P = 0.01), and were culled or died at 0.46 times the rate (SE = 0.16, P = 0.03) before 60 days-in-milk."[20]
- In a study evaluating administration of aspirin at parturition, animals receiving aspirin produced more milk in the first 30 DIM, more milk over the first 5 DHIA test days, and had lower first test day SCC.[6]

Additional Dairy Welfare topics Veterinarians and Producers should be aware of:

1. **Tie Stall Housing:** tie-stall housing is still used on a large percentage of dairies in North America. The main welfare concerns are with restriction of normal behaviors and lack of freedom of movement. National Milk Producers Federation's Farmer's Assuring Responsible Management (F.A.R.M) Program convened a task force to review the pertinent research on the topic.[18] You can access their white paper here: https://nationaldairyfarm.com/wp-content/uploads/2019/03/Tie-Stall-Paper.pdf
2. **Cow-calf Separation:** although some dairy herds globally leave the calf with the cow, in typical North American dairies this is not practical. The primary welfare concern is the inability of the calf and cow to bond, potential short- and long-term effects on both the dam and the calf as well as the ethics associated with separation. It should be noted, however, that research does support that stress of separation is higher after cow and calf have bonded.[29] This is an area to follow the research, and one that will have significant future discussion among those engaged in dairy welfare. Currently there is not an acceptable and workable solution readily available to the global dairy industry. Stay tuned!
3. **Fitness for Transport:** globally many of the major dairy producing countries have established firm criteria for what animals can and cannot be transported, as well as criteria for transporting calves and duration of time animals may be transported. A good example of this is New Zealand, where the government has helped to launch a Fitness for Transport App for Google Play® and for iPhone® users to help guide decisions at the producer level. Australia and the European Union have also devoted significant resources to this topic. Compromised animals will experience additional stress with trailering, and ethically although it may be possible for an animal to enter the supply chain, transporting (especially for significant distances) sick, lame or injured cattle is not in the best interests of the animal. The North American dairy industry needs to carefully evaluate our practices related to transport as well as culling decisions and their timeliness at the dairy farm level.
4. **Pasture Access:** in research, cows have shown a high degree of motivation to gain access to pasture, where they were willing to push a significant weight that was similar to what they were willing to push to access fresh feed after milking, in order to gain access to pasture.[28] Cattle evolved as grazers and developed behaviors around grazing that are unable to be expressed in confinement housing. Further, grass and soft dirt provide much more give and cushion than concrete. While most people enjoy seeing cows out on fresh grass, multiple potential issues can make this anywhere from challenging to impractical for existing conventional dairies. These

potential issues include concerns with design and siting/locating of current dairy facilities, climactic and seasonal concerns, as well as size and scale of larger dairies. Dairies considering new facilities could be very proactive to consider the possibility of this in the future when making the decisions on location and layouts.

5. **Euthanasia:** both the AVMA and AABP revised their euthanasia guidelines in the past 12 months. Veterinarians and producers alike should review the guidelines and ensure that their own procedures align with them. When it comes to techniques, although we as practitioners pride ourselves in clinical experience and judgement, not adhering strictly to the approved primary and secondary methods presents huge risk to our clients and most importantly to the animal. As a profession, we can greatly aid cattle welfare by helping client dairies assess prognosis and empowering them and their employees to feel they can make the decision to euthanize confidently. Once the decision is made, there is an obligation to the animal to act in a timely manner, within 4 hours, to provide the relief of suffering.[3]
6. **Down Cows:** although down cows are certainly not an emerging issue, they continue to be an ongoing welfare concern and challenge. As an industry, we need to ensure we are always being realistic with our prognosis for down animals and honest about our abilities to provide supportive care to down animals. Lastly, movement of down cows continues to be a welfare risk area. The use of hip clamps, from a welfare perspective, present a significant risk for misuse either by using them to move or drag a cow or by being applied inappropriately. Even when hip clamps are used properly, there is often extensive trauma to the hip, especially with repeated uses. Dairies and practitioners should look at alternatives for lifting cattle, such as slings, and ensure that movement of down animals is only performed with either an appropriately sized sled or loader bucket.

Dairy producers and veterinarians alike have a long history of advancing the care of dairy cattle. The current opportunity before us is to use the emerging science and understand the changing global dairy welfare dynamics to make proactive changes to the care of dairy cattle. Despite concerns of producers about the ramifications of society having input into production practices on privately owned dairies, there are plenty of areas where there is mutual common ground. As veterinarians, being leaders in this discussion will allow the profession to maintain its position as "experts in animal care", to meet the obligations of our professional oath, and increase the credibility of our clients and the dairy industry as a whole. In the end, as it turns out, welfare is as simple as doing what is right for the animal in front of us!

Endnote

[a] Direct Communication with geneticists at Genus PLC/ABS Global

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