

## **Male dairy calf welfare: A Canadian perspective on challenges and potential solutions**

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**Abstract** – Male dairy calf welfare is a key issue in the Canadian cattle industry. The welfare of male dairy calves can be explored through the aspects of health and biological functioning, affective states, and natural living. Presently, the main welfare issues associated with the production of male dairy calves include morbidity and mortality, colostrum and feeding management, transportation, isolation, castration and disbudding, and euthanasia. Opportunities to improve male dairy calf welfare include improving accepted industry practices, enhancing education and compliance with industry codes of practice, and increasing veterinarian involvement in on-farm animal welfare. The benefits of improving male dairy calf welfare include maintenance of the cattle industry's social license and improved producer mental health and occupational satisfaction. The main barriers to improving male dairy calf welfare are economics and cultural attitudes within the industry towards male dairy calves.

**Résumé** – **Bien-être des veaux laitiers mâles : une perspective canadienne sur les défis et les solutions potentielles.** Le bien-être des veaux laitiers mâles est un enjeu clé dans l'industrie bovine canadienne. Le bien-être des veaux laitiers mâles peut être exploré à travers les aspects de la santé et du fonctionnement biologique, des états affectifs et de la vie naturelle. Actuellement, les principaux problèmes de bien-être associés à la production de veaux laitiers mâles comprennent la morbidité et la mortalité, la gestion du colostrum et de l'alimentation, le transport, l'isolement, la castration et l'ébourgeonnage, et l'euthanasie. Les possibilités d'améliorer le bien-être des veaux laitiers mâles comprennent l'amélioration des pratiques industrielles acceptées, l'amélioration de l'éducation et de la conformité aux codes de pratique de l'industrie, et l'augmentation de la participation des vétérinaires au bien-être des animaux à la ferme. Les avantages de l'amélioration du bien-être des veaux laitiers mâles comprennent le maintien de la licence sociale de l'industrie bovine et l'amélioration de la santé mentale et de la satisfaction professionnelle des producteurs. Les principaux obstacles à l'amélioration du bien-être des veaux laitiers mâles sont les attitudes économiques et culturelles au sein de l'industrie envers les veaux laitiers mâles.

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### **Introduction**

**A**n emerging welfare issue in the dairy industry is the management of male calves. Male calves are of less value to the dairy industry than female calves, as the latter are primarily raised as future replacement milking cows. Despite this low value, large numbers of male dairy calf births are presently

unavoidable. Approximately 470 000 male dairy calves are produced in Canada each year (1). As 211 000 of those calves are slaughtered for veal, it is estimated that the remaining 259 000 enter the dairy-beef industry (2). As a by-product of the dairy industry, male calves can be subjected to practices that undermine their welfare. Although similar welfare challenges exist for surplus female dairy calves, most surplus calves are still male, and as such, this review will focus on male dairy calves.

To critically evaluate animal welfare from a scientific perspective, a framework recognizing that animal welfare exists as basic health and biological functioning, affective states, and natural living can be used (3). Pursuit of only 1 aspect of animal welfare, while disregarding the others, can lead to animal suffering (3). Through the lens of each aspect, a critical analysis of the literature related to male dairy calf welfare is covered in this review. Specifically, this narrative review will focus on the aspects of the production life cycle that are current welfare threats to male dairy calves in Canada. These include morbidity and mortality, colostrum and feeding management, transportation, isolation, castration and disbudding, and euthanasia. This review will also

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briefly explore opportunities that exist in improving male dairy calf welfare and barriers to improving male dairy calf welfare on Canadian farms.

### Morbidity and mortality

Morbidity and mortality are major issues for the calf-rearing industries (4) and contribute to poor welfare in both male and female calves. Morbidity negatively impacts welfare through the suppression of biological function and the introduction of noxious stimuli that contribute to negative affective states. Furthermore, sickness behavior that occurs because of disease highlights that disease itself negatively influences the affective state. These behavioral changes include increased sleeping time, decreased feeding, social isolation, and reduced learning capacity (5). Sick male dairy calves spend less time feeding, moving, and lying; even a mild respiratory infection negatively impacts grooming and social activities (6). As grooming and social activities are indicative of the absence of negative affective states, a reduction in these behaviors suggests that the disease process, even when mild, generates negative impacts on calf affective state. Disease resulting in mortality, either unassisted or from euthanasia, is a welfare concern based on the magnitude of suffering experienced.

Male calves raised for veal production experience a relatively high morbidity and mortality rate. Infection with enteric disease-causing pathogens has been reported to occur at a high prevalence in male dairy calves raised for veal in Ontario (7). In that study, over a 4-month study period, 85.8% of calves tested positive for bovine coronavirus, 94.2% tested positive for bovine rotavirus A, 1.5% tested positive for bovine rotavirus B, and 57.4% tested positive for *Cryptosporidium parvum*. Calves that tested positive for these enteric pathogens had an increased proportion of days with severe diarrhea and a reduction in weight gain compared to calves without diarrhea.

In Ontario, researchers have reported mortality risks for veal calves arriving at veal farms ranging from 4.0 to 9.6%, with a disproportionately higher mortality rate in the first 21 d after arrival to a commercial rearing facility (8–9). Dehydration, an abnormal navel, low body weight, and the presence of a sunken flank were reported to be associated with mortality within the first 21 d after arrival (8). As high prevalence of disease in male dairy calves may negatively impact biological functioning and resultant affective state, stakeholders should strive to reduce disease prevalence. In general, morbidity events in male dairy calves are related to a handful of key events and management practices within the neonatal phase: colostrum and milk feeding, vaccination, and transportation (8–9,10). Thus, morbidity and mortality in male dairy calves may be prevented or mitigated with improvements to management practices.

### Colostrum and feeding management

Colostrum management is considered the most important management factor in determining calf health and survival (11). Depriving male dairy calves of good-quality colostrum contributes to poor welfare through suppressed biological function and the related negative affective states associated with disease onset. The Code of Practice for the Handling and Care of Dairy

Cattle requires that dairy calves must receive at least 4 L of good quality colostrum within 12 h after birth (12). It is worth noting that the 13-year-old Code of Practice for the Handling and Care of Dairy Cattle is currently under revision, and therefore its requirements and recommendations may change soon. Despite this, Renaud et al (13) reported that failed transfer of passive immunity occurred in 24% of calves sampled from 109 dairy farms in Ontario. In this study, there was no difference in the occurrence of failed transfer of passive immunity between male or female calves, indicating that there is opportunity for improvement of colostrum management in all calves. However, 25% of the farms sampled in this study reported managing colostrum differently for male calves than that for female calves. These differences included using a different colostrum source, using a poorer source of colostrum, feeding a smaller quantity of colostrum, delays between birth and feeding, and generally focusing less on colostrum management (13). Fecteau et al (14) also reported discrepant care on Quebec farms where male calves did receive colostrum, the colostrum was more likely to have higher bacterial counts than that fed to female calves. Seemingly, further research is needed to understand barriers to adoption of best practices associated with colostrum management on-farm.

Calf body weight upon arrival to veal farms in Ontario has been associated with mortality and may be an indicator of previous nutrition and age at arrival (4). Malnutrition suppresses lymphocyte function and reduces the effectiveness of the immune system in neonatal calves (15). Adequate caloric intake is also essential for thermoregulation, which can be a challenge for poorly insulated neonatal calves, especially during transit in cold months when they are prone to heat loss. Therefore, it is noteworthy that Renaud et al (8) reported a high proportion of emaciated calves (18%) upon arrival to a veal farm in Ontario. As low calf body weight and the presence of a sunken flank were associated with higher mortality risks for calves arriving at veal farms (4,8), enhancing the nutrition of male calves on the farm of origin could contribute to decreased morbidity and mortality later in life.

In addition, the method in which milk is fed, as well as the amount, may impact affective states of calves. Calves are highly motivated to suck, and deprivation of this natural feeding behavior has been suggested to result in frustration and lack of satiety and have possible negative impacts on digestive function (16). Therefore, feeding milk to calves in pails, rather than through teat feeding systems, could negatively impact all 3 aspects of calf welfare. Overall, suboptimal colostrum and feeding management for male calves appears to present both acute and chronic welfare challenges for male dairy calves in Canada.

### Transportation

Transportation challenges optimal biological function and introduces negative affective states like hunger, distress, and fatigue in calves. In Canada, most male dairy calves are sold for veal or dairy beef production and must be transported either directly to a veal farm or to a sales barn before being transported once again to their final destination. In recent research it was demonstrated that short-distance transportation, as brief as 2 h in duration, increases plasma cortisol and inflammatory cytokines

in male dairy calves (17). Serum creatine kinase concentrations, indicative of muscle damage and exhaustion, were increased in 3- to 10-day-old calves that were transported for 12 h, both immediately after transportation and after a 12-hour recovery period (18). This study also reported that physiological and behavioral responses, such as time spent lying down, associated with transportation differs with calf age, although it is unclear how these differences affect calves' abilities to cope with the stressors of transportation. Thus, transportation may impact natural behaviors and affective states differently in calves, depending on their age and physical maturity.

Long-distance transport induces fasting that requires calves to mobilize energy reserves and can cause calves to become hypoglycemic and may result in hunger and fatigue (19). As such, in the Code of Practice for the Care and Handling of Farm Animals Transportation Review of Scientific Research on Priority Welfare Issues (20), it was concluded that young, unweaned calves are at greater risk of experiencing disease and hypoglycemia, and more susceptible to cold stress during transport than adult cattle. Renaud et al (10) reported that most male dairy calves are sold within 2 wk after birth and, therefore, are considerably vulnerable to these negative effects of transportation. Despite the inferred negative effects of transportation on biological function, experts lack a clear consensus of how to improve calf welfare during transportation. Further research is needed to define effects of transportation more clearly on affective states and natural behavior in young calves.

Transportation of calves may also increase morbidity and mortality risk in comparison to calves that are continuously reared on their farm of origin. In Ontario, arrival to veal farms in summer months and winter months, compared to spring and fall months, and also being lighter weight, has been associated with greater risk of mortality within the first 21 d after arrival (4,8). These findings can be partially attributed to the physiological stress that transportation imposes on calves, especially during thermal extremes. In addition, Renaud et al (8) reported that drover-derived calves had a lower mortality hazard within the first 21 d after arrival, which the authors attributed to their greater body weight, but could also be related to less time spent in transit than calves purchased from sales barns. Furthermore, calves derived from sales barns had a higher mortality hazard beyond 21 d after arrival (8), suggesting that transportation stress imposes long-term effects on welfare. Although it appears that transportation impacts biological functioning, and likely affective states of calves, more research is needed to better understand the long-term consequences of transportation stress.

### Isolation

Isolation of male dairy calves contributes to poor welfare by impacting all 3 aspects of animal welfare science. In natural, feral herd conditions, calves live in social groups and would experience frequent social interactions with other conspecifics (21). Renaud et al (9) reported that male dairy calves in Ontario were more likely to be housed individually than female dairy calves on their farm of origin. Male calves that are then raised for veal or dairy beef may continue to be reared individually, or alterna-

tively, placed into groups. The proposed benefits of individually housing calves, including primarily reduction in disease transmission and more individualized nutrition [reviewed by Costa et al (22)], have been recently challenged. Social isolation of calves does not align with the natural behavior of a herd species, and research supports those calves that have an innate need for social contact (23). Housing calves in groups can be beneficial for the animals' affective states and may satisfy natural herd behaviors that calves are highly motivated to perform [reviewed by Costa et al (22)]. Pair-housing both male and female calves has been associated with improved performance parameters and increased play behavior (24). Furthermore, play behavior in calves reduces negative affective states and is generally accepted as an indicator of good welfare (25); this may be an important component of natural living.

The welfare-related drawbacks of keeping calves in isolation is greater than the understood benefits. Historically, arguments for individual housing of calves were based on the premises of disease control. A recent study by Medrano-Galarza et al (26) reported that introducing dairy calves to group housing at < 24 h of age increased the risk of severe diarrhea in comparison to calves grouped at 5 d of age. Therefore, early group housing of calves may still contribute to the incidence of certain diseases. Group housing appears to also have mixed implications for affective states in calves. Abdelfattah et al (27) reported that calves grouped at earlier ages spend a larger proportion of their time playing in comparison to calves grouped at older ages. However, Jensen (28) reported that 6-day-old calves had more difficulty competing for access to milk than 14-day-old calves when introduced into groups of 16 to 24 calves. This would suggest that on the other end of the spectrum, housing calves in large groups may impose limitations to optimal welfare for calves, due to competition pressures and other negative social interactions (e.g., due to stocking density at each resource and the spread in age of the calves in the pen). Although practically implementing group housing to minimize adverse effects on welfare is still being investigated, recent research predominantly supports that isolation limits natural living and contributes to negative affective states. When taken together, this body of evidence indicates that housing calves individually is detrimental to welfare.

### Disbudding and castration

Disbudding and castration are painful, non-health-related procedures that are specific to production needs and diminish male dairy calf welfare both during and following the events. Disbudding and castration are not practiced in the veal industry but are practiced in the dairy-beef industry and can negatively impact welfare by subjecting calves to distress and substantial pain if appropriate pain management techniques are not used. In relation to natural living, castration and disbudding are alterations of the animal's morphology, and as painful procedures, affect natural behavior in calves such as lying behavior and play (29,30). The Code of Practice for the Handling and Care of Veal Cattle (31), which also encompasses the starting part of production for dairy-beef, states that all methods of castration, disbudding, and dehorning are painful at any age.

Scientific evidence concurs that disbudding leads to severe pain in calves (32). In addition to causing pain, disbudding also induces a negative affective state comparable to pessimism in calves. Neave et al (33) observed a negative cognitive bias in calves after hot-iron cautery disbudding. Cognitive bias refers to the systematic pattern of deviation from normal or rational judgement, in which illogical inferences about situations are made. A significant negative cognitive bias to an ambiguous stimulus after disbudding suggests that the process induces a state of negative expectation or pessimism in calves. Furthermore, Mintline et al (30) reported that dairy calves disbudded with pain mitigation, a nonsteroidal anti-inflammatory drug (NSAID) and local anesthetic, displayed more play behavior than did calves disbudded without pain mitigation, indicating that the calves who experienced more pain surrounding disbudding had a more negative affective state than the calves which had their pain mitigated. In summary, the pain associated with disbudding induces a negative affective state when tested with complex cognitive measures.

Much like disbudding, castration contributes to reduced welfare by impacting all 3 animal welfare science aspects. Neurohormonal and electroencephalographic indicators demonstrate that castration in calves is a painful and stressful event (34). Studies on the pain response to castration in beef cattle further support that castration without the use of pain mitigation induces a negative affective state in calves (29). Increased displays of behavior indicative of pain following the procedure have been reported more frequently in castrated than non-castrated calves (29).

For these reasons, multimodal pain management is needed for castration and disbudding to effectively mitigate acute and chronic pain, and to address more than just 1 of the underlying pain mechanisms. Suggested multimodal pain management in disbudding includes local anesthetic and nonsteroidal anti-inflammatory drugs (NSAID) (35). Local anesthetics effectively mitigate nociceptive pain, like the pain that occurs during horn bud removal in dairy calves (32), or during skin incision and spermatic cord severing in castration, whereas NSAIDs block the production of inflammatory mediators (36). Non-steroidal anti-inflammatory drug (NSAID) administration at the time of band castration was able to reduce the display of painful behaviors for up to 3 d after the procedure (37). However, the pain related to band castration is chronic, and limited research suggests that the most painful time during band castration is 3 to 4 wk following band application, highlighting the need for long-lasting pain management strategies in these calves (38).

Another method of reducing stress and pain associated with disbudding and castration is the use of sedation. Pieler et al (39) reported that xylazine sedation combined with local anesthesia mitigated the painful effects of castration in 1.5- to 2-month-old dairy calves. In that study, there was no appreciable increase in behavioral indicators of pain in the medicated castrated groups compared to the non-castrated controls (39). Reedman et al (40) reported that calves given a sedative before cautery disbudding, in addition to local anesthesia and an NSAID, responded less to painful stimuli during and following the disbudding procedure. These researchers also reported

a higher rate of play behavior in calves given sedation before disbudding compared to calves given only a local anesthetic and NSAID (40). In summary, disbudding and castration are painful physical alterations of male dairy calves requiring pain mitigation to reduce the negative affective states associated with the procedures.

## Euthanasia

Although euthanasia ultimately relieves an animal of suffering, the method of euthanasia and its effectiveness dictates the pain and distress a calf may experience during the procedure. Euthanasia, meaning “good death,” is intended to be performed in a way that eliminates or minimizes stress or pain associated with the procedure (41). Euthanasia should render calves insensible either before or during the procedure that stops cardiovascular and respiratory functions (41). Acceptable methods of euthanasia of calves are barbiturate overdose, gunshot, and captive bolt with a secondary step, such as pithing, exsanguination, or potassium chloride and magnesium sulfate administration (41). In Canada, 5% of Canadian dairy producer respondents reported euthanizing at least 1 male calf at birth in the last 12 mo, with 34% reporting the use of blunt force trauma as a euthanasia method (10). Blunt force trauma is considered an unacceptable form of euthanasia for calves, as their skulls are too hard to facilitate destruction of brain tissue that would lead to immediate unconsciousness and death, and results in delayed loss of consciousness and suffering (41). Inappropriate euthanasia methods, like blunt force trauma, fail to eliminate or mitigate pain and distress associated with euthanasia by prolonging consciousness, and are a grave welfare concern. Educating dairy producers on appropriate euthanasia methods, how to perform those methods, and why inappropriate euthanasia methods are welfare concerns are all relatively realistic steps that can be taken to improve male dairy calf welfare. Support from commodity groups and governmental organizations in these education efforts is key. Likewise, veterinarians have a role in ensuring that producers have an on-farm euthanasia protocol and understand how to appropriately euthanize their calves. Although not entirely a welfare issue, euthanasia of healthy male dairy calves at birth is an ethical issue, and one which the public is likely to oppose. The Canadian dairy industry is encouraged to develop proactive initiatives regarding the fate of male dairy calves.

## Further opportunities for improving welfare of male calves on Canadian dairy farms

Although the factors influencing male dairy calf welfare are complex, there are opportunities for improving calf welfare in Canada. Improving male dairy calf welfare is advantageous from a basic production viewpoint. Negative affective states, such as stress and pain, contribute to elevated cortisol production (17). Improving calf welfare contributes to decreased cortisol production, thus supporting stronger immunity and improving production efficiency.

In addition to improving management in those areas already discussed, there are other opportunities to improve male dairy calf welfare. One approach comes through application of the

Canadian Codes of Practice for Care and Handling of Farm Animals. As previously mentioned, The Code of Practice for the Handling and Care of Dairy Cattle (12), The Code of Practice for the Handling and Care of Farm Animals Transportation (20), and The Code of Practice for the Handling and Care of Veal Cattle (31) outline required and recommended best practices associated with handling and raising male dairy calves. Producer familiarity with The Code of Practice for the Handling and Care of Dairy Cattle has been associated with better male calf care on farm of origin (10). Thus, targeted education of producers on the codes of practice may be part of the solution to improve male dairy calf welfare. Beyond education, on-farm auditing through the proAction program, a national quality assurance program implemented by Dairy Farmers of Canada, would be a method of identifying non-compliance to industry-set animal welfare requirements (42). Creating more proAction requirements needed to obtain program compliance that are specific to calf health and welfare may make male calf welfare a greater priority for the industry. Implementing auditing programs in other areas of livestock production is generally accepted as a successful strategy of improving and standardizing farm animal welfare (43). Although not as well-validated, increasing the severity of the penalties for non-compliance to quality assurance programs and codes of practices may also serve to increase the standards of welfare on farms. Furthermore, Codes of Practice should be regularly updated to reflect the ever-evolving knowledge of calf welfare on farms, as a 13-year interval between codes may not be the most conducive to promoting ongoing improvements on farms.

Another approach to optimizing male dairy calf welfare is to use veterinarians as a catalyst for improvement. For instance, Renaud et al (9) indicated that dairy farms with higher mortality risks reported having herd veterinarians that inquired less frequently about calf health and performance. Winder et al (44) reported that Ontario dairy farms with regular herd veterinarian visits were more likely to use pain relief during dehorning and cited their veterinarian as an influential to that pain relief use. Herd veterinarians can begin honest conversations with producers about welfare challenges presented from an affective state and natural living point of view. In Ontario, producers report that most herd veterinarians do not regularly and actively inquire about calf health (8). Interestingly, a recent Canadian survey revealed that veterinarians are concerned about male calf management and see an increasingly relevant role as educators of clients to improve calf welfare (45). However, communication between veterinarians and producers is complex, and as such, veterinarians may not always take advantage of opportunities to discuss calf health and welfare with producers, and producers may not initiate the discussion, even if they desire to have these conversations.

In Canada, the general public is progressively more concerned about farm animal welfare and production practices (46). The dairy industry benefits from recognizing and responding to consumer concerns about animal welfare, as it allows the industry to maintain the social license to produce milk. The industry is encouraged to address concerns raised by consumers and industry experts and make welfare-related changes proactively.

As previously discussed, enhancing disease prevention strategies in male dairy calves is an important first step in improving male dairy calf welfare.

Improving male calf welfare also has tangible benefits for improving producer well-being. Productive farms practicing good animal welfare are generally associated with positive producer well-being (47). To illustrate this, King et al (48) reported in a recent study that lower producer stress and anxiety were associated with lower prevalence of severe lameness on Ontario dairy farms. Improving male dairy calf welfare, therefore, could increase producer and veterinarian job satisfaction, relieve producers of negative perceptions from the general public, and reduce some of the financial costs associated with disease treatment, calf mortality, and low calf prices.

### **Barriers to improving welfare of male calves on Canadian dairy farms**

It would be naïve to ignore the systemic barriers that limit the improvement of male dairy calf welfare. Arguably, most dairy producers in Canada see themselves in the business of selling milk. They and may unconsciously place less value on male calves, and thus be less motivated to find sustainable solutions. In situations in which profit margins are not large, and the costs of feed and labor associated with caring for male calves is greater than the sale price, producers will be less motivated or unable to provide optimal care to their male calves. As Canada's dairy industry is a supply managed sector, the cost of production is regularly assessed, and farmers are guaranteed a price for the sale of milk above the cost of production. As such, it could be argued that the cost of providing male dairy calves with a reasonably good life could be included into the cost of production formula. However, as supply management of the dairy industry does not secure better veal or beef prices, the economic incentive to improve male dairy calf welfare may still be lacking for many dairy producers. Indeed, a recent focus group of Ontario dairy farmers reported that the economic cost of providing good neonatal calf care for male dairy calves as either a motivator or a barrier to good care, depending on how producers marketed their male calves (49).

Production costs may also vary by region, depending on physical resources. For example, male calves born on farms in the Atlantic provinces, where facilities that raise and market veal or dairy beef are scarce, are more likely to be euthanized at birth (10). Furthermore, vaccination and feeding practices of male calves also vary across Canada by region, which could be explained by differences in access to and strength of markets that purchase male calves across the country (10). In Ontario, calves sold with a higher standardized price per pound had a lower mortality risk within the first 21 d of arriving to a veal facility (4). Although a higher price for calves does not directly equate to better welfare for male calves, it suggests that there is an incentive for producers to invest in male calf health and welfare as they may be financially compensated.

Another equally relevant barrier to improving male dairy calf welfare is the cultural attitudes within the dairy community towards male calf welfare. An animal that has intrinsic value will motivate producers to provide a good quality of life. Wilson

et al (49) reported that Ontario dairy producers cited social norms, intrinsic pride, and a perceived obligation to provide good calf care as motivators for calf care. Those researchers reported that although economic barriers existed for providing calf care, producers were still motivated to provide adequate care for male dairy calves. Similarly, recognizing that welfare encompasses more than just production performance and health, and valuing affective states and components of natural living as fundamental pieces of welfare are necessary to change the culture of male calf care in the dairy industry. Although disease is considered a main welfare concern to Canadian producers, perspectives on the natural living component of welfare is not well-characterized in Canada (50). As members of the animal agriculture industry, producers and veterinarians are obligated to provide food animals an acceptable quality of life.

## Conclusion

Male dairy calf welfare can be viewed as a synthesis of health and biological functioning, affective state, and natural living. In Canada, the areas of greatest concern for male dairy calf welfare are morbidity and mortality, colostrum and feeding management, transportation, isolation, castration and disbudding, and euthanasia. Opportunities exist for veterinarians and codes of practice to improve management of male dairy calves on farms and could contribute to improving public perception of the dairy industry and improve producer well-being. Major barriers to improving male dairy calf welfare include economic constraints and cultural attitudes towards improved animal welfare. Where welfare issues exist in the male dairy calf industry, solutions also exist. Reframing the issues surrounding male dairy calf welfare as an opportunity, as well as a challenge for the dairy and livestock industries, encourages the exploration of new solutions, the enhancement of public perception, and improvement of animal and human well-being. CvJ

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## Answers to Quiz Corner

### Corrigé du test éclair

1. E) This is a microcytic and hypochromic anemia.  
E) Il s'agit d'une anémie microcytaire et hypochrome.
2. C) Image resolution will increase, but depth penetration will decrease when switching to a higher frequency transducer.  
C) La résolution de l'image augmentera mais la profondeur de pénétration diminuera lors du changement pour un transducteur à plus haute fréquence.
3. D) Cysticercosis is caused by ingesting the pork tapeworm, *T. solium*. *T. saginata*, the beef tapeworm, only rarely causes cysticercosis.  
D) La cysticercose est causée par l'ingestion du ténia du porc, *T. solium*. *T. saginata*, le ténia du bœuf, cause rarement la cysticercose.
4. A) Hyponatremia, hyperkalemia, and mild hypercalcemia are usually present. The sodium:potassium ratio is usually less than 23, and mild hypercalcemia is typically present.  
A) Une hyponatrémie, une hyperkaliémie et une hypercalcémie légère sont habituellement observées. En général, le rapport sodium:potassium est de moins de 23 et une hypercalcémie légère est présente.
5. A) Horses from 6 months to 2 years of age are most susceptible to strangles.  
A) Les chevaux âgés de 6 mois à 2 ans sont les plus sensibles à la gourme.