

## **DAIRY COW WELFARE & UDDER HEALTH**

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### **Introduction**

Maintaining consumers trust is essential to ensure the future of the dairy industry. Production of high quality milk from healthy, well cared for animals is the goal of most dairy farmers. However, as fewer and fewer consumers are familiar with dairy farming, they have become more skeptical about the ability of farmers to properly care for farm animals. Public attention about the welfare of dairy cows has included concerns about animal health, prevalence of lameness, handling of non-ambulatory cows, animal handling and the impact of housing on cow health and longevity. Additional welfare concerns often include the use of management practices such as tail docking and mitigation of pain. The purpose of this paper is to review the impact of mastitis and practices associated with mastitis control on dairy cow welfare.

### **Morbidity, Mortality and Involuntary Culling**

The occurrence of disease directly reduces animal welfare and mastitis is by far the most common disease of dairy cattle. Virtually every dairy farm has cows that develop mastitis. On most herds, subclinical mastitis typically affects about 20-25% of lactating cows. Of about 3,000 dairy herds using a DHI service in Wisconsin, in January 2015, the percent of cows with SCC >200,000 cells/mL were 23.1%, 19.2%, 18.5%, 17.6% and 18.8% for herdsizes of <100 cows, 100-250, 251-500, 501-1000 and >1,000 cows, respectively. About half of the subclinical cases persistent and become chronic infections, thus increasing the risk of involuntary culling. Clinical mastitis also affects a large proportion of cows and the US National Animal Health Monitoring Service, reported that about 18.2% of all dairy cows were treated for this disorder (USDA, 2008). Researchers who prospectively collect more in-depth data typically report even greater rates of mastitis. In a study of 52 Wisconsin dairy herds, approximately 40 mastitis treatments per 100 cows per year were administered in contrast to 13 treatments per 100 cows per year for reproductive disorders, and 2-5% treatments per 100 cows per year for respiratory disease, foot problems and digestive disorders. The occurrence of mastitis increases the risk of other disorders further reducing dairy cow welfare. Cows that develop both subclinical and clinical mastitis are at increased risk of infertility. In a recent study, the odds of conception were reduced by 40% for cows that experienced chronic clinical mastitis around the time of 1<sup>st</sup> breeding (Fuenzalida et al., 2015) thus increasing the risk of involuntary culling.

The consequences of mastitis often result in increased risk of involuntary culling and in some instance increased risk of death. In contrast to voluntary culling (when a cow leaves the herd because a replacement is available), involuntary culling is defined as a cow that leaves the herd due to health, disease or decreased reproductive performance. In the United States, 24% of cows were culled from their herd for reasons other than death (USDA, 2008). Of these animals approximately 50% were culled for either reproductive problems or mastitis related issues (USDA, 2008). Mastitis is second only to injury and lameness as a cause of adult cow mortality (Garry, F., 2011). While most mastitis does not cause severe illness, the frequency of occurrence of mastitis results in mastitis accounting for about 17% of all adult cow mortality (Garry, 2011). Increased bulk tank SCC has also been identified as a risk factor for increased herd level mortality rates (Thomsen and Houe, 2006) Thus, the adoption of management practices that reduce the incidence of mastitis can have a considerable impact on improving adult cow welfare.

### **Impact of Mastitis on Cow Behavior and Pain.**

Freedom from discomfort is one of the 5 freedoms that are used to define animal welfare (<http://www.fawc.org.uk/freedoms.htm>). Pain is defined as “an unpleasant sensory and emotional experience that is associated with tissue damage.” Assessment of pain in cattle is difficult and is usually based on observation of changes in behavior. In dairy cattle, obvious symptoms of pain include depressed appearance, reduced milk yield, weight loss and abnormal posture (Leslie and Petersson-Wolfe, 2012). These symptoms are often used as part of the case definition for severe cases of mastitis that are accompanied by systemic symptoms (Oliveira et al., 2013). However, most cases of mastitis do not cause this level of disease and detection of subacute pain in cattle is difficult as they are stoic animals that do not typically tend to display painful behaviors. Several indicators of pain such as altered stance, increased heart rate, and increased respiratory rates have been observed in cattle that experience moderate cases of clinical mastitis. Mastitis that was experimentally induced using *E coli*, resulted in reduced feeding times, increased time standing idle, reduced frequency of self-grooming and decreased rumination (Fogsgaard et al., 2012). Cows that develop naturally occurring clinical mastitis have also been shown to exhibit typical signs of sickness behavior such as alterations in lying time, feeding time and more restlessness (Fogsgaard, et al., 2015, Medrano-Galarza et al., 2012). Most farmers and veterinarians agree that severe mastitis is clearly painful, however this form of the disease occurs only in about 15% of cases. The occurrence and degree of pain caused by the more common presentations of the disease (subclinical or mild cases) has not been well defined. The effect of painful diseases can be mitigated by use of nonsteroidal anti-inflammatories. Animal handlers should be trained to recognize subtle changes in cow behavior that may be indicative of pain associated with mastitis. As methods to recognize pain in cattle are improved, it is likely that treatment of pain associated with mastitis will become a more common practice.

### **Impact of Housing on Mastitis and Animal Welfare.**

Assuring the welfare of cattle should be the primary goal when designing and managing facilities used for housing and milking dairy cows. There are several important aspects of animal housing that directly influence both the occurrence of mastitis and the welfare of the cows. The design of stalls is clearly related to incidence of teat injuries (Regula et al., 2004) which are painful and contribute to increased risk of mastitis and culling. Teat injuries occur more commonly when animals are housed in tie stalls and have limited access to pastures. Teat injuries also occur more frequently when animals are housed in stalls that are not of sufficient size. Overcrowding contributes to increased stress and a minimum of 10m<sup>2</sup> of dry resting space per cow should be provided in group housing areas.

Manure handling, type of bedding and maintenance of cow beds all have major impact on exposure to mastitis pathogens. As farms have grown and management has intensified a variety of bedding materials are used. These bedding materials support different populations of bacteria resulting in exposure of teats to a greater variety of potential mastitis pathogens. The amount of moisture and bacteria that are present in cow bedding are especially important (Hogan et al., 1989). Organic bedding materials tend to support more bacterial growth as compared to inorganic bedding materials and a linear relationship between the number of Gram-negative bacteria in bedding and the occurrence of clinical mastitis has been demonstrated (Hogan et al., 1989).

Exposure to manure-based bedding materials is likely to increase as larger farms adopt the use of anaerobic digesters to meet local environmental restrictions regarding processing of manure. Before using manure-based bedding, the potentially negative welfare aspects of using this bedding should be considered by farm managers. The use of digester solids for cow bedding results in direct exposure of teats to bacteria found in the nutrient rich organic matter and can result in a large diversity of pathogens causing subclinical and clinical mastitis. A study that included large Wisconsin dairy farms (average

herd size of >800 cows) demonstrated that the rolling herd average (RHA) of herds that used manure based bedding (n = 25) was 1,152 kg less than the RHA of herds using sand bedding (n = 156) (Rowbotham and Ruegg, 2015 submitted). Much of the difference in productivity was likely related to the occurrence of mastitis. The bulk tank SCC was 198,000 and 248,000 cells/mL for sand bedded and manure-based bedded herds, respectively, indicating a greater prevalence of subclinical mastitis for herds using manure-based bedding. Increased clinical mastitis was also apparent as the proportion of cows with daily milk discarded was 1.6% for herds using sand versus 2.4% for herds using manure-based bedding. The chronicity of mastitis was also markedly worse for herds using manure-based bedding as herds using manure-based bedding contained about 6.3% of cows with non-functional quarters as compared to 4.5% of cows for herds using sand. Overall, it was apparent that the use of digester based manure products has the potential to reduce animal welfare through increased incidence and prevalence of mastitis. Both the social and economic consequences of using this type of bedding should be considered and weighted against perceived environmental benefits.

### **Dairy Cow Hygiene**

Animal hygiene is considered to be an indicator of welfare of dairy cows and measurements of udder and leg hygiene are frequently included in welfare auditing and assessment programs (Bergman et al., 2014). Several studies have demonstrated that dirty cows are at greater risk for developing diseases such as mastitis. A number of scoring systems are used for assessing hygiene, but most scoring systems use a scale of 1 (indicating very clean) to 4 (indicating very dirty). An udder hygiene scoring system (scoring chart available at: <http://milkquality.wisc.edu/wp-content/uploads/2011/09/udder-hygiene-scoring-chart.pdf>) was used to repeatedly score 1250 dairy cows located on 8 Wisconsin dairy farms (Schreiner and Ruegg, 2003). Cows were categorized as “clean” (UHS of 1 or 2) or “dirty” (UHS of 3 or 4). About 20% of the cows received scores categorized as “dirty.” Somatic cell counts and the rate of intramammary infection were both higher for animals categorized as “dirty.” Significantly more environmental and contagious mastitis pathogens were recovered from milk samples obtained from cows with dirty udders as compared to cows with clean udders. Hygiene scores of udders should be routinely performed as a quality control measure just as body condition scores are performed to monitor nutritional management. Udders become dirty as a consequence of a number of management decisions that adversely affect animal welfare. Risk factors for “dirty udders” were evaluated on 79 commercial Wisconsin dairy farms (Salgado and Ruegg, data unpublished). The farms included 11,200 lactating cows housed in both freestalls (n = 51 herds) and tie stall barns (n = 28). There was no difference in the proportion of clean UHS (77%) based on type of facility. For animals housed in tie stalls, the risk of dirty udders was increased 1.5 times when stalls were cleaned <2x/day, 4.5 times when stall beds were dirty, and >10 times when a large proportion of the cows had loose manure. For animals housed in freestalls, the risk of dirty udders was increased 1.8 times when organic bedding materials were changed less frequently than daily, 4x when stall beds were dirty, >10 times when a large proportion of the cows had loose manure, 2.5 times when cows had access to outdoors and >10 times as barns were increasingly overstocked. This data reinforces the role of facility management and cow comfort in ensuring animal welfare.

### **Tail Docking**

Removal of the lower portion of the tail is commonly referred to as “tail docking”. Use of tail docking as a routine dairy farm management tool apparently originated in New Zealand, however the practice is no longer popular there and the use of tail docking seems to be declining throughout the world. Many farmers and consultants perceive that tail docking results in improvements in animal cleanliness and udder health but there is no scientific evidence to support that perception and unnecessary mutilation of animals is commonly considered by animal welfare advocates as a serious animal welfare issue. There is considerable evidence that tail docking does not improve animal hygiene nor reduce the

incidence of mastitis. Tucker et al. (2001) evaluated the effect of tail docking on cow cleanliness and SCC in a single herd, housed in freestalls, over an 8-wk period. Tails were either docked or left intact. Cleanliness scores (using a 4 pt scale) were recorded for available animals on a weekly basis. The researchers did not find any differences in cleanliness scores for any of the measured areas between docked and intact animals. No differences in SCC or udder cleanliness were identified and the authors concluded that there was “little merit to adopting” tail docking. A study with more animals and for a longer duration was conducted to determine the effect of tail docking on SCC, intramammary infection and udder and leg cleanliness in eight commercial dairy herds housed in freestalls (Schreiner and Ruegg, 2002). Lactating dairy cows (n = 1,250) on 8 dairy herds were either docked or served as a control cow. Milk samples, somatic cell counts and hygiene scores were collected for eight to nine months. The prevalence of intramammary infection was determined for each of the five occasions when milk samples were obtained. Udder and leg cleanliness were assessed during milk sample collection using a standardized scoring method. At the end of the study about 12 of cows had been culled in the both groups. There were no differences in SCC or udder and leg hygiene scores based on the use of tail docking. The rate of subclinical mastitis caused by contagious, environmental or minor mastitis pathogens was not affected by tail docking. This study did not identify differences in udder or leg hygiene or milk quality that could be attributed to tail docking. A number of countries and some U.S. states have prohibited tail docking, and the American veterinary medical associations has a policy statements that opposes the practice of tail docking for routine management of dairy cattle. The policy statement of the American Association of Bovine Practitioners indicates that scientific evidence to support tail docking is lacking and recommends that “if it is deemed necessary for proper care and management of production animals in certain conditions, veterinarians should counsel clients on proper procedures, benefits, and risks. While removal of the tail may facilitate the process of attaching milking units (in some types of parlors), there is no evidence that it reduces mastitis and it simply cannot be recommended.

### **Animal Handling**

Freedom from fear is one of the five freedoms and an important aspect of ensuring animal welfare. Adult cows have considerable interaction with humans during the process of milking and interactions between workers and cows can influence cow welfare. Researchers have indicated that cows that are exposed to an aversive handler during milking had indications of reduced welfare including increased residual milk, increased heart rate and increased restlessness. Hemsworth et al. (2000) conducted a study of workers on 66 Australian dairy farms and demonstrated that the attitude of the farm workers influenced the behavior of cows during milking. Cows that were exposed to negative behavior of the farm workers, had increased movement and kicking during milking and produced less milk. A training program for farm workers was able to positively influence the behavior of the farm workers and improved interactions with cows. After the training program was completed, cows had reduce flight zones (indicating more acceptance of the people) and produced more milk (Hemsworth et al., 2002). Standard operating procedures that mandate gentle care of cows should be in place on all farms and be reinforced by frequent employee training of farm workers.

### **Conclusions**

Many management practices can increase the occurrence of mastitis and result in negative influences on dairy cow welfare. Practices that results in decreased incidence of mastitis will generally result in improved animal welfare and decreased overall mortality. Consistent training of animal handlers should be performed to ensure that animals are handled appropriately and that subtle behavioral changes that indicate pain are rapidly detected. The use of non-steroidal anti-inflammatories to reduce pain is recommended for severe cases of mastitis and should be considered if cows exhibit sickness behaviors. Assessment of udder hygiene should be performed routinely and animal facilities should be

modified to provide sufficient space that meets the behavioral needs of cows. The risks and welfare consequences of using manure-based bedding materials should be recognized.

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