Prevention of clinical and subclinical mastitis

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Mastitis is considered the most important and challenging dairy cattle disease, with huge financial impacts. Economic consequences of clinical or subclinical mastitis include loss of milk production, loss of milk sales, lower price for high somatic cell count (SCC) milk, increased culling rates and cost for veterinary treatments. A holistic mastitis control and prevention programme, with expert advice and guidance, is strongly recommended.

What is mastitis?

Mastitis is an inflammation of the udder usually caused by the invasion of bacteria through the teat canal. Mastitis can also be attributed to mycoplasmal, fungal or algal infections, mechanical trauma (such as teat injuries), thermal trauma and toxins. The inflammation consists of white blood cells (leukocytes, or somatic cells) that are released into the mammary gland in response to the invasion, where there is a local battle. These bacteria multiply and produce toxins that cause injury to milk-secreting tissue and various ducts throughout the mammary gland. The white blood cells also release toxins, engulf bacteria and cause a temporary local destruction of the tissues. The elevated SCC is a measure of the degree of inflammation in the udder.

Alternatives to antimicrobials

Most antibiotics used in dairy herds are related to udder health, of which a large proportion are dry-cow products. Since the conventional antibiotic treatments of mastitis are of increasing concern due to the global emergence of multiple antibiotic-resistant bacteria, the focus on preventive strategies is of uttermost importance. The preventive blanket dry cow therapy, to treat all teats on all cows, can no longer be considered prudent use. Successfully managing udder health should aim to minimize antimicrobial use. A study in Belgium indicated that herds participating in a veterinary herd health management program and herds selectively drying off cows used fewer antimicrobials compared to herds not participating in such a program or applying blanket dry-cow therapy [1]. There are good screening tools available that perform real-time diagnostics to use a selective dry cow therapy, where only high-risk quarters are ultimately dry-cow treated. Internal teat sealants are a good alternative for antibiotics to prevent low SCC cows from becoming infected during the dry period [2-4]. Alternatives to internal sealants are external teat dips, which protect against new infection by covering the teat end with a disinfectant; however, these need to be reapplied frequently. Genetic selection for mastitis resistance is included in many breeding programs; however, only a small part of the solution for good udder health is found in the breeding programs [4]. Development of vaccines to prevent or control mastitis is an important goal. Good progress has been made for coliform mastitis control through mutant gram-negative vaccines. Development of an effective *Staphylococcus aureus* vaccine is an ongoing research objective.

A multifactorial disease

Mastitis is a multifactorial disease, which means there are multiple factors that contribute to mastitis and high SCC (subclinical mastitis), including milking procedure, immune status, nutrition,

environmental and housing conditions, management systems, genetics and heifer rearing. Mastitis-causing bacteria can be simply classified into two categories, as either contagious or environmental. The primary habitat of bacteria that cause contagious mastitis is on the udder and in teat lesions. These bacteria have poor survival in the environment when not associated with the skin or in the gland. Contagious mastitis is the type of mastitis in chronic or subclinical mastitis. The infection is transmitted at milking by the washcloth, the milker's hands and the milking machine. The major organisms causing contagious mastitis are *Streptococcus agalactiae*, *Staphylococcus aureus* or *Mycoplasma*.

Environmental mastitis has become more prevalent as we have successfully employed good milking hygiene to reduce the contagious mastitis. Bacteria that cause environmental mastitis are mainly found in the environment, such as faeces, bedding, soli or water. Udders can become infected at milking time or between milking times. The major organisms that cause environmental mastitis include the coliform bacteria, the environmental streptococcal species and the *Pseudomonas* species. It is imperative to know the source of the infection and how the infection was spread to infect the new cows. A control program identifies the bacteria involved in order to decide the most appropriate and cost-effective measures to reduce mastitis.

Heifer mastitis

Heifers are definitely at high risk of mastitis, and infections of the mammary quarter have been shown to range between 29–75% prepartum and 12–46% at parturition [5;6]. Generally, the bacteria that are involved in heifer intramammary infections or mastitis are the same ones as those that cause infections in the older cows, with coagulase-negative staphylococci (CNS) followed by coagulase-positive staphylococci (CPS) and environmental mastitis pathogens being the most prevalent. The presence of CNS infections in heifers at parturition may be associated with lower risk of clinical mastitis and higher milk production during lactation [7]. However, certain CNS species may be more pathogenic and cause long-term infections [8], thus emphasizing the need to be part of an udder health program that includes heifers pre-calving. Some of the risk factors for heifer mastitis have been milk somatic cell counts greater than 200,000 at calving and stress associated with moving prior to calving. Heifer udder health programs include avoidance of cross-suckling among young heifers, not feeding waste/hospital milk to heifers (unless pasteurized), fly control, optimal nutrition and managing heifers as a separate group from older cows. Furthermore, application of external and internal teat sealants, teat antiseptics, and implementation of hygiene control and comfort measures, especially around calving, can decrease the risk of heifer mastitis [9;10]

Good milking hygiene and udder hygiene

Well-documented management measures to reduce clinical mastitis include good udder hygiene and milking routines. Poor udder hygiene is associated with increasing somatic cell counts and clinical mastitis. It has been shown that improving the environment of the cow and heifer, including cubicles, pastures and calving pens, can reduce clinical mastitis [11]. If cows are consistently entering the milking parlour with dirty udders and teats, then the housing and management systems need to be improved. Mechanical removal of dirt/contamination on teats while minimizing the use of water in the milking parlour is important. Use individual paper towels or reusable clean cloth towels for every cow to clean and dry teats, with one towel per cow used prior to attaching the unit. Proven germicidal teat disinfectants reduce bacterial contamination of teat ends, and using sprays — or, preferably, dips — can reduce clinical mastitis in lactating dairy animals. These may be used in heifers prior to calving to reduce heifer mastitis. Forestripping is important to consistently check the milk of each quarter and facilitate milk let down, and after the forestripping, another teat dip can be applied. The milking unit should be properly attached, adjusted and removed to minimize air admission, and

removing the claw from one quarter while the others are still milking should be avoided, as this can cause air to leak into the claw, impacting the other attached teats.

Enhancing udder immunity

The animal's udder defence involves immediately eliminating invading disease-causing bacteria by white blood cells, releasing inflammatory substances and causing the migration of white blood cells to the infected udder [12]. Therefore, an important component of a mastitis control program is to enhance immunity, which can be achieved through improved nutrition, vaccination and the removal of potential immune suppressors.

Nutritional factors associated with udder health

Nutrition, including adequate nutrients, macro and micro-minerals, and vitamins, is very important for optimal immunity and is therefore important for good udder health in heifers and cows [13]. Selenium works in synergy with vitamin E to improve the ability of white blood cells to engulf and destroy bacteria. The ability of white blood cells to multiply and migrate to the site of infection or inflammation may also be improved in animals with higher selenium/vitamin E status. Several studies have shown a significant reduction in the incidence and duration of mastitis in dairy cows after they were supplemented with selenium and/or vitamin E [14]. Copper is another micro-mineral that has been shown to reduce the severity of coliform mastitis and enhance milk production in cows challenged with *E. coli*. Zinc is required for keratin formation, and zinc methionine supplementation has been shown to increase teat canal keratin and reduce SCC. The organic forms of minerals, such as Bioplex® and Sel-Plex®, are better absorbed, stored and utilised by the heifer/cow and are thus better able to meet the higher nutrient needs of modern dairy cows. Sub-optimal concentrations of vitamin A and β-carotene have also been shown to result in more severe mastitis.

Subclinical ketosis

Heifers and cows in negative energy balance are at a higher risk of ketosis, and clinical ketosis is associated with a two-fold increase in the risk of clinical mastitis [15]. In heifers and cows with ketosis (subclinical or clinical), the white blood cells have a reduced ability to engulf and kill bacteria, and the white blood cells at the site of infection also produce less signalling chemicals to attract other leukocytes to the site of inflammation [12]. Therefore, an essential component of an udder health programme is to minimize the levels of subclinical ketosis in the herd, including assuring that the heifers/cows are not over-conditioned pre-calving and optimizing transition feeding.

Mycotoxins can increase SCC

Mycotoxins are secondary metabolites of moulds that are an increasing challenge worldwide. Dairy cows may be exposed to multiple mycotoxins in silages from both pre- and post-harvest contamination. Mycotoxins impact productivity and health through their toxic immune-suppressing effects, but many times they may not be recognized due to the subtle signs, which have numerous symptoms. Mycotoxins such as aflatoxins, type A and B trichothecenes, fumonisins, *Aspergillus*, *Penicillium* and ergot alkaloids have been associated with reduced milk production and elevated somatic cell counts [16]. Therefore, it is important to evaluate the mycotoxins risks in the feed and to include a good broad-spectrum mycotoxin binder such as Mycosorb®.

The Alltech Mastitis and SCC Control Guidelines

The Alltech Mastitis and SCC Control Plan can help farmers mitigate issues associated with mastitis and high SCC. This plan includes key areas of management that can be implemented and used as part of any mastitis control program. The Alltech plan further puts focus on enhancing immunity in order

to reduce the somatic cell counts associated with subclinical mastitis and thereby offers a sustainable and cost-effective preventive program that will optimize production.

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