

Key Mastitis Control Points for Best Milk Quality

*Dr. Luciana Bignardi da Costa, and Dr. Gustavo Schuenemann,
Department of Veterinary Preventive Medicine,
The Ohio State University*

Mastitis is the most common and costly disease affecting dairy cows, ranking within the top two reasons for early removal of cows within US dairy herds. This disease affects cow welfare and causes significant economic losses through decreased milk yield, reduced milk quality, early removal of cows from the milking herd, and increased treatments costs. Mastitis is caused by several pathogens which lead to mammary gland inflammation with the subsequent increase of somatic cell counts in milk. **Somatic cell count (SCC) and standard plate count (SPC)** are mandated by the federal Grade “A” Pasteurized Milk Ordinance (PMO), which specifies safety standards of Grade “A” milk. The quality of processed dairy products and fluid milk is greatly affected by the initial quality of the raw milk harvested at the farm level. Therefore, listed below are key points expanded from the National Mastitis Council control program to improve milk quality at the herd level:

Point #1: Establishment of goals for udder health.

The most important part of your mastitis control program is setting goals for udder health and milk quality (Tables 1 and 2).

- Milk from uninfected mammary glands contains less than 100,000 somatic cells per mL. Research studies have shown that milk SCC of equal or more than 200,000 per mL is associated with an inflammatory response due to an infected or recovering mammary quarter, and that milk has reduced manufacturing quality properties.
- The PMO requires the SPC to be less than 100,000 cfu/mL for Grade A farms and to be less than 300,000 cfu/mL for manufacturing grade milk. However, for being a critical control point for milk quality, some milk purchasers are more rigorous than the official regulations. Thus, realistic a goal for SPC can be set at <5,000 cfu/mL and usually a count of >10,000 cfu/mL is indicative of a problem.
- The Preliminary Incubation Count (PIC) or PI counts recommended values are <10,000 cfu/mL but up to 20,000 cfu/mL is considered acceptable. Values higher than 50,000 cfu/mL suggest potential problems with cleaning and sanitation of the milking machine, poor pre-milking preparation (washing the teats with water, not using teat predip, and dirty teats) all known risk factors for mastitis.
- The laboratory pasteurized count (LPC) is usually performed to distinguish organisms that survive pasteurization. High LPC numbers can be associated with improper sanitizing practices, unclean equipment, high water-hardness score, high alkalinity of alkaline detergent wash, or problems with cooling system/ plate cooler. The LPC values should be below 100 cfu/mL and values >200 cfu/mL are considered high.
- Coliforms are fecal bacteria that are also commonly found in the environment. Thus, coliform count (CC) is an indication of the efficiency of procedures, such as cow’s milking preparation and cleanliness of the cows’ environment. The coliform count should be less than 10 cfu/mL. Coliform counts >50/ml suggest manure and soil on the teats, and counts higher than 100 cfu/mL usually indicate poor milking practices, dirty equipment, contaminated water, and/or cows presenting coliform cases of mastitis.

Table 1. Criteria for bulk tank parameters.

Parameter	Low	Medium	High
Bulk tank SCC (cells/mL)	<200,000	200,000-400,000	>400,000
Standard Plate Count (SPC; cfu/mL)	<5,000	5,000-10,000	>10,000
Preliminary Incubation Count (PIC; cfu/mL)	<10,000	10,000-20,000	>20,000
Lab Pasteurized Count (LPC; cfu/mL)	<100	100-200	>200
Coliform Count (cfu/mL)	<50	50-100	>100

Source: Oliver SP, Dairexnet, 2019

Table 2 -Sources of Microbial Contamination as Detected by Bacteriological Procedures

Procedure	Natural Flora	Mastitis	Dirty Cows	Dirty Equipment	Poor Cooling
SPC>10,000 cfu/mL	Not Likely	Possible	Possible	Possible*	Possible
SPC>100,000 cfu/mL	Not Likely	Possible	Not Likely	Possible*	Possible*
LPC>200-300 cfu/mL	Not Likely	Not Likely	Possible	Possible*	Not Likely
PIC High vs SPC	Not Likely	Not Likely	Possible	Possible*	Possible*
SPC High/No Increase in PIC	Not Likely	Possible*	Not Likely	Not Likely But Possible	Not Likely
CC High	Not Likely	Possible	Possible	Possible	Not Likely

* A more likely source

Source: Murphy, SC. NMC Regional Meeting Proceedings, 1997

Point #2: Maintenance of clean and comfortable environment.

The principles of best animal welfare are directly associated with cleanliness of housing and cow comfort (<https://www.dwcouncil.org/node/4006>).

- Keep bedding area dry and clean. Review frequently your bedding and grooming protocol, ensure appropriate ventilation, and avoid frequent social changes within transition cows (e.g. move groups of cows once per week)
- A compacted bedding surface negatively affects laying time of cows. Dairy cows have strong behavioral need to rest, and this has a priority over dry matter intake, regardless of feed availability at the feed bunk.
- Ensure adequate stocking density, feed availability within reach of cows, and water availability for pre- and postpartum cows. Transition cows should be less than 100% capacity relative to stalls available (1 stall per cow or less) and have a linear feed bank space of 30 inches per cow.
- Water should not accumulate in alley ways and/or bedding area. A clogged flush line or leaky roof will flood alleys or add water to bedding surfaces, which in turn significantly increases the risk for environmental mastitis and lower milk quality.
- Think about cow comfort as a hotel which could range from 1 to 5 stars in terms of comfortable amenities. For a given cow, the difference in terms of consistent lying time (hours/day) is that the best dairy farm provides 2 to 2.5 hours per day more lying time

compared with the average farm. For every 3 minutes of lost rest, the cow will sacrifice 1 minute of dry matter intake (DMI). Therefore, poor cow comfort will likely reduce eating to 40 to 50 minutes per day or a drop of 3.3 to 4.4 lb/day of DMI.

- Milk is 87% water and without sufficient water intake, milk production will suffer. An adequate ingestion of fresh, clean water promotes normal rumen function, high feed intake, digestion, and nutrient absorption - maximize water intake and you will maximize feed intake and consequently milk production.
- To improve mammary gland health: (1) Feed and manage dry and prepartum cows to maintain proper body condition and avoid a drop in feed intake prepartum and excessive body condition score (BCS) loss early lactation, (2) Proper mineral nutrition of prepartum cows to prevent hypocalcemia, and (3) formulate a diet considering your water quality (bacteria and mineral contribution) to feed adequate, but not excessive amounts of trace minerals and vitamins (selenium and vitamin E are critical for the immune system).

Point #3: Proper milking procedures.

- Allow milk to let-down properly by providing good practices on handling animals with care to the milking parlor and maintaining a calm (no yelling is necessary) and comfortable holding pen.
- Strip 4-5 squirts of milk from each quarter before preparing the cow. Do a strip cup test routinely to identify the cases of mastitis at an early stage. Perform stripping correctly, avoiding spreading the milk skirts in other directions than the strip cup or floor.
- Pre-dip teats with an effective germicide (iodine, chlorine dioxide, hydrogen peroxide, lactic acid, glycolic acid, or chlorhexidine) and allow 30 seconds contact time.
- Dry teats thoroughly using individual paper towels or cloths.
- After preparation starts, one should wait approximately 60-90 sec before attaching the unit that should be properly aligned on the udder.
- Post milking teat disinfection remains a foundation for the prevention of contagious mastitis. The effectiveness of the various products offered is well documented in the scientific literature.
- Discard teat dip contaminated with manure or dirt- it has lost its efficiency.
- Milk last or segregate those cows with contagious mastitis (e.g., *Staphylococcus aureus* infections).

Point #4: Proper maintenance and use of milking equipment.

- With greater farm size, more herds are milking 3 – 4 times /day and adopting the use of robotic milking, thus the milking machine remains an important way of transferring contagious bacteria from infected to non-infected cows, particularly considering that more cows will be milked in the same milking unit.
- Proper maintenance of milking equipment will assure proper vacuum to be applied to the teats, causing no damage to the cow's teat-ends.
- Make sure the cooling tank and any part or connection in the whole milk handling chain is cleaned. Water heating capacity must meet the requirements from the cleaning procedure.

Point #5: Good record keeping.

- When treatment is needed, record the necessary information, such as cow identification, drugs used, start of treatment day, dose, route of administration or how the drug was given

(e.g. oral, injection, intramammary), name of the person who gave the drug, length of the treatment, withdrawal period, and results of culture, stripping and/or CMT.

- To evaluate the effectiveness of your mastitis control during the dry period and to make decisions regarding mastitis prevention, it is important to record how many cows are infected and how many are not infected at dry-off and then compare those numbers after freshening.

Point #6: Appropriate management of clinical mastitis during lactation.

- About 50 to 80% of clinical cases of mastitis may not benefit from an antibiotic treatment labeled for intramammary administration. If the pathogen is known and susceptible, an antibiotic is indicated BUT CANNOT be the ONLY approach to overcome limitations with environment and/or management. Note that dehydration and pain management should be top priorities for severe cases of mastitis.
- Does antibiotic treatment increase her chance of cure? The short answer is “yes” but only for susceptible pathogens.
- How long should I treat? Follow the label and your vet’s recommendations. Duration of 2 days should work, but some cases may require an extended therapy of 5-7 days. Extending duration may reduce clinical failure but may have no effect on cure rate, SCC, or new intramammary infection.
- Will she get better on her own? “No” for contagious pathogens or toxic cases, but “yes” for minor pathogens. A milk culture will be needed to identify the pathogen(s) causing the infection. On most farms, mild and moderate cases of mastitis will resolve within 4-6 days, regardless of treatment.
- With the increased concern nowadays about the misuse of antibiotics in livestock, it is recommended to treat cases of clinical mastitis only after the identification of the causing organisms. This practice will not only reduce antibiotic usage, but also reduce the volume of milk withheld from the bulk tank because of antibiotic withdrawal.

Point #7: Effective dry cow therapy.

- Mastitis disease is related to three major steps: 1) teat-end exposure to pathogens (**environment**), 2) pathogens entering the mammary gland (**open teat-end**); and 3) the ability of the pathogens to survive the host defenses and to invade the mammary gland epithelium (**colonization**).
- Proper dry cow management is extremely important in maintaining and improving udder health, milk yield and milk quality.
- Over 95% of new dry period infections occur in quarters with open teat canals.
- Over 50% of clinical mastitis cases caused by environmental pathogens occurring in early lactation were acquired during the dry period.
- High milk producing cows are very susceptible to new intramammary infections in the beginning and the end of the dry period (around calving).
- In high milk producing dairy cows, reducing milk yield a week prior to dry-off (offering the dry cow ration would reduce milk yield by ~60% or milking 1x per day would reduce milk yield by ~40%) significantly enhances teat canal closure and formation of the keratin plug. It has been shown that lactating cows with >36 lb/day during the last week of lactation were over 7 times more likely to be infected at calving compared with lactating cows milking ≤24 lb/day.

- New research showed that prepartum cows benefited by administering the mastitis vaccine at 28 days prior to parturition (dpp) followed by pen change with acidogenic diet at 21 dpp (greater serum glucose, ~46% reduction in subclinical hypocalcemia [from 31.9 to 17.3%], and 19% more colostral IgG at calving) compared to cows vaccinated plus pen change at 21 dpp.
- Dairy cows confirmed with twin pregnancies almost always experience short gestation length and more hypocalcemia at calving. The transfer of IgG from blood into the mammary gland (colostrum and milk) is an active process that requires energy and calcium. Plan to vaccinate and move cows into the prepartum pen at least 7 days earlier than typically planned for cows confirmed with twin pregnancies.
- The usage of an intramammary antibiotic is indicated if a cow has a persistent infection from her previous lactation, while a proper application of a teat sealant aims to prevent new infections. Follow the label indications for safe and correct use.

Point #8: Biosecurity for contagious pathogens and marketing of chronically infected cows.

- Biosecurity refers to not just the management practices that reduce the chances of introduction of infectious diseases onto the farm (by animals or people) but also practices that prevents the spread of infectious disease on farms.
- Keep the herd as closed as possible. If you purchase animals into your herd: 1) Ask for the somatic cell count information on milking cows and check the cow's history on contagious mastitis in current and/or previous lactations; 2) Look for other health events; 3) When possible, test all purchased cattle for infection not just restricted to mastitis causing organisms, such as *Staphylococcus aureus*, *Streptococcus agalactiae* and *Mycoplasma bovis*, but others diseases such as BVD and Bovine leukosis; and 4) Immunization history.

Point #9: Regular monitoring of udder health status.

- Be enrolled in a system that provides you with individual SCC, such as DHIA. If not possible, perform regularly CMT tests to screen for clinical cases of mastitis.
- Assess the success of your treatment protocols. Successful treatment could be defined based on: 1) Cure rate (return to normal appearance of milk, duration of milk discard or days in hospital pen) and/or 2) Bacteriological cure (absence of causative bacteria in follow up culture).
- Work with your veterinarian on monitoring goals for SCC and clinical cases of mastitis.

Point #10: Periodic review of the mastitis control program.

- Meet regularly with your veterinarian to review and discuss the points listed above to improve, adjust, or change your milk quality program. Small changes can lead to bigger benefits for the cow's udder health and profitability of your farm.

An ounce of prevention is worth a pound of cure! There is no magic bullet to solve milk quality issues at the farm level, and proactive management practices matter when it comes to controlling mastitis. How to remain competitive is the “big” question. Considering this 10-point mastitis control program, along with genetic selection of animals for improved udder health, can improve milk quality and reduce antimicrobial use at the herd level. Please share this discussion with your veterinarian and nutritionist. These little details make the difference at the end of the day!