Impact of Heat Stress in mammary gland development and health in dairy cows

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What is heat stress?

It occurs when an environment impacts the ability of a cow to get rid of body heat. Lactating cows thermoneutral zone is from -15°C to 25°C[1], indicating that mature cows can handle lower temperatures better than higher temperatures.

How can you best estimate the impact of "heat" on your cows?

A combination between environmental temperature and humidity known as temperature-humidity index (THI) is one of the best tools to reflect the true impact of the environmental on the cow[1]. Other ways to measure "heat" are:

- Rectal or vaginal temperatures. Commonly used in controlled studies.
- Respiration rate. Observe flank movements—values greater than 60 breaths per minute (bpm) a threshold of heat stress[1].

Heat stress impacts on mammary gland development

Cows need to be raised in an environment where temperatures are within their thermoneutral zones to achieve their maximal genetic potential. Failures to establish adequate environmental temperatures can dramatically alter behavior, health, and productivity of cows.

When cows are exposed to non-cooled environments, mammary epithelial cells do not proliferate well leading to lower milk production[2]. In heifers born to cows experiencing late-gestation heat stress, milk production potential is also reduced[2]. So not only is the cow effected by heat stress, but her calf also stands to lose genetic potential for milk yield by being exposed to heat stress in utero. Future milk production is negatively affected by heat stress because mammary growth is impaired; thus, it is imperative to provide heat abatement strategies to improve farm profitability.

Heat stress impacts on mammary gland function

Heat stress may negatively affect the process of involution during the dry period due to endocrinological changes—reduced estrogen and increased prolactin. We know that during earlier steps of involution many immune cells are active in the mammary gland to prepare mammary tissue for the next lactation. Successful immune function is very important to protect the mammary gland during lactating and non-lactating period.

Some negative impacts of heat stress[2] are:
- Decreased milk production in subsequent lactation
- Increased bulk milk SCC

It is important to emphasize that heat stress is not the only factors that can negatively impact milk production and SCC during the warm season but other factors, including reproductive strategies, herd and nutritional management can impact productivity on a dairy.

Heat stress and intramammary infections

Incidence rates of mastitis can increase during the warm season. Heat stress poses a negative effect on udder health as it causes reductions in immune competence of lactating and dry cows[1]. Immune suppression can last for a long period during the productive life of a cow and can have a detrimental impact on how cows respond to pathogen exposure. All these factors contribute to increase the probability of intramammary infections, and to decrease milk quality. Along with putting in place heat abatement strategies on your herd, you need to reduce the exposure to mastitis-causing pathogens at the teat end. To reduce risk of mastitis follow the [National Mastitis Council Recommended Mastitis Control Program](#).

During warm months, *Trueperella pyogenes* is one bacterium that can cause summer mastitis occurring mainly in pastured cows and this infection is associated with a flie—*Hydrotaea irritans*. Amongs some clinical symptoms are swollen and painfulquarter and/or teat, and systemic signs including fever, being off-feed, depression, and even death. Something characteristic about this type of mastitis are purulent lesions in quarters, and fetid and purulent milk[3]. Incidence of this type of mastitis can be exacerbated if farmers do not implement measures to abate heat. To prevent and control these cases, farmers need to talk to their herd veterinarians to establish appropriate mastitis treatment protocols, dry cow therapy protocols, and [implement protocols to reduce exposure to flies](#).

Heat stress abatement

Some strategies[1] to reduce negative impacts of heat stress on lactating and dry cattle are:
- Provide shade for cows housed on pasture or in an open lot. Minimum of 19 ft^2 of space for each cow.
- Active cooling. Combination of soaking cows with water and then using fans. Repeat this process throghouth the day.

- Active cooling. Use water to carry heat from the air as misted water evaporates, and use this approach combined with fans.

Remember to locate cooling in areas where cows will concentrate, for example, holding pens, feeding line in free stall barns. It is very important that water on the cows evaporates by the time the lie on their beds as we do not want water to be transferred to beds, thus potentiate bacterial growth and exposure.

Footnotes

[1] G. Dahl. 2018. Impact and mitigation of heat stress for mastitis control. Vet Clin Food Anim 34: 473-478.

[2] S. Tao, R. M. Orellana, X. Weng, T. N. Marins, G. E. Dahl, and J. K. Bernard. 2017. Symposium review: The influences of heat stress on bovine mammary gland function. J Dairy Sci 101:5642-5654

[3] M. Rzewuska, E. Kwiecien, D, Chrobak-Chmiel, M Kizerwetter-Swida, I. Stefanska, and M. Gierynska. 2019. Pathogenicity and virulence of *Trueperella pyogenes*: A review. Int. J. Mol. Sci. 20:2737.

References
- National Mastitis Council Recommended Mastitis Control Program. https://manitowoc.extension.wisc.edu/files/2011/10/NMC-Mastitis-Control-Program1.pdf
- Summer mastitis-the warmer months https://dairy.ahdb.org.uk/technical-information/animal-health-welfare/mastitis/working-arena-prevention-of-infection/summer-mastitis-the-warmer-months/#.Xwc_0ud7k2w