

Texas Dairy Matters

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Non-antibiotic management of mastitis in dairy cattle

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Mastitis is a common and costly disease affecting dairy cattle worldwide. It is characterized by inflammation of the mammary gland, typically caused by bacterial infection. Mastitis is typically managed on dairy herds with intramammary antibiotics. However, not all mastitis events respond to treatment with antibiotics, depending on the pathogen associated with the disease event and cow level factors. In addition, prudent and appropriate use of antibiotics is an essential step in achieving antimicrobial stewardship in dairy farms. In some management systems such as organic systems, the use of antibiotics is restricted (USDA, 2017). This presents the need to explore options to manage mastitis without the use of antibiotics.

In this article, we discuss some strategies currently being evaluated by our group to manage mastitis events.

A) Acoustic pulse technology:

Acoustic pulse technology, APT, has emerged as a promising non-antibiotic therapy for managing mastitis in dairy cattle. Specifically adapted for treating mastitis, APT uses repeated projectile collisions with an anvil connected to the treatment head. These collisions generate low-incidence shockwaves or acoustic pulses that are transferred non-invasively to the affected mammary gland tissues. Similarly to ultrasound therapy, ATP uses sound waves to deliver energy. However, APT delivers lower-frequency sound waves that can penetrate deeper into tissues compared to ultrasound therapy. The therapeutic effects of APT include promoting

recovery, reducing inflammation and potentially improving blood flow and immune responses (Leitner et al., 2021). Recent studies have shown positive outcomes, such as increased recovery rates, reduced culling and additional milk yield in APT-treated cows compared to controls (Blum et al., 2023). This innovative approach offers an alternative to antibiotics, contributing to udder health and overall dairy cow welfare.

B) Cold laser therapy:

Cold laser therapy, also known as low-level laser therapy, has been explored as a potential non-antibiotic treatment for mastitis in dairy cattle. Cold laser therapy is currently used by many veterinarians as an alternative therapy approach to manage inflammation in small and large animals, including horses. This technology works on the principle of “photobiomodulation,” which refers to a therapeutic technique that uses light energy to stimulate cellular processes. In the context of dairy cattle, photobiomodulation has gained attention for its potential benefits in various aspects of herd health and productivity. There are reports of this technology uses to promote wound healing and tissue repair. Photobiomodulation can accelerate wound healing and tissue repair by promoting cellular metabolism and enhancing blood flow. The technology can also help with pain management as the anti-inflammatory effects of photobiomodulation can help alleviate pain and discomfort. It has particularly been useful for managing conditions like lameness or joint inflammation (Gard et al., 2017).

Photobiomodulation has been explored as an adjunctive therapy for mastitis treatment. By reducing inflammation and promoting immune responses, it may aid in faster recovery. Light-emitting diodes, LEDs, or lasers are used to deliver specific wavelengths of light to targeted areas for a specific duration. Treatment protocols vary, but sessions are typically short and non-invasive. Although research is ongoing by our group, the results have indicated potential benefits. In a separate study, the laser irradiation resulted in a 16.6% increase in recovery, indicated by regression of signs of inflammation and a decrease in the somatic cell counts. Supportive treatment with laser irradiation increased recovery rates by 24.2% (Malinowski, et al., 2019). However, further studies are needed to establish its efficacy by evaluating optimal duration and wavelength combination for mastitis and somatic cell count management.

C) Plant molecule-based compounds:

One of the new tools for mastitis management that is getting attention is called antibiofilm compounds derived from plant molecule-based compounds. Mastitis-causing bacteria form and maintain biofilm through the process of quorum sensing. Bacteria produce biofilms as a survival strategy, especially in challenging environments. Biofilm protects the bacteria as a shield preventing immune cells from directly reaching the bacteria. The plant-based molecules use quorum sensing science to disrupt communication between selected mastitis-causing bacteria (Herrema et al., 2023). The components can block bacterial communication and influence their behavior such as biofilm formation. This process is called quorum quenching or quorum sensing inhibiting. In bacteria, the formation of biofilms is controlled by the quorum sensing, QS, signaling genes and their products. Various inhibitors/compounds can disturb the QS signaling cascade and are used as an alternative therapy to optimize biofilm-related challenges. Reducing

bacterial QS signaling by proprietarily selected plant molecules is possible because they possess inhibitory activity against bacterial and fungal biofilms. There are claims this technology promotes overall herd health and longevity of cows.

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