

Texas Dairy Matters

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INFLAMMATION

Definition, implications and control

Jennifer A. Spencer, Ph.D. and Juan Piñeiro, DVM, Ph.D.

Extension Dairy Specialist. Department of Animal Sciences

Texas A&M AgriLife Extension Service. The Texas A&M University System

Guest Author: Sarah Capik, DVM, Ph.D.

Assistant Professor. Texas A&M AgriLife Research, Texas A&M University System,

Amarillo, Texas. Department of Veterinary Pathobiology, College of Veterinary

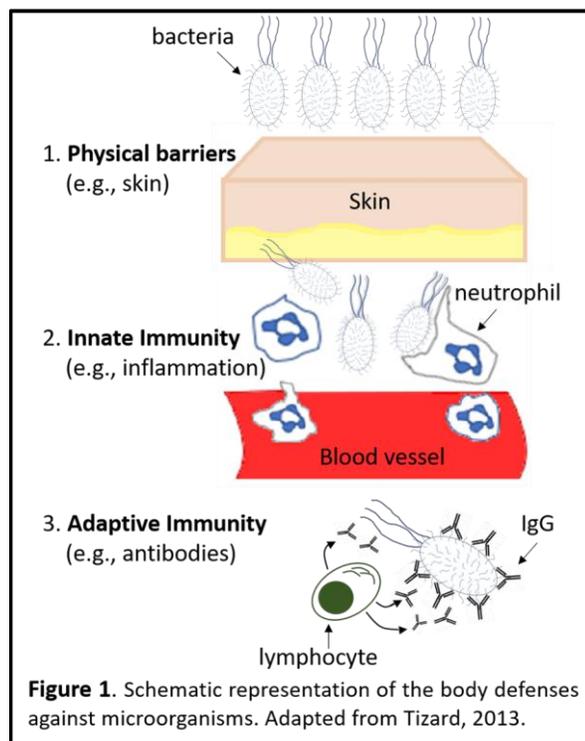
Medicine and Biomedical Sciences, Texas A&M University, College Station, Texas.

Understanding inflammation, why and when it occurs, allows us to know the benefits of controlling its effects. A few benefits include pain mitigation and maintaining cattle welfare. Let's start by defining inflammation and the immune system.

What is the immune system?

The body's defenses to illnesses, infection, or injury are known collectively as the immune system. The immune system is composed of:

- 1) Physical barriers (e.g., skin).
- 2) The innate immune system (acts within seconds after a stimulus). For example, inflammation.
- 3) The adaptive immune system (acts days after a stimulus). For example, antibodies (as the ones you produce when you get a vaccine).



What is inflammation?

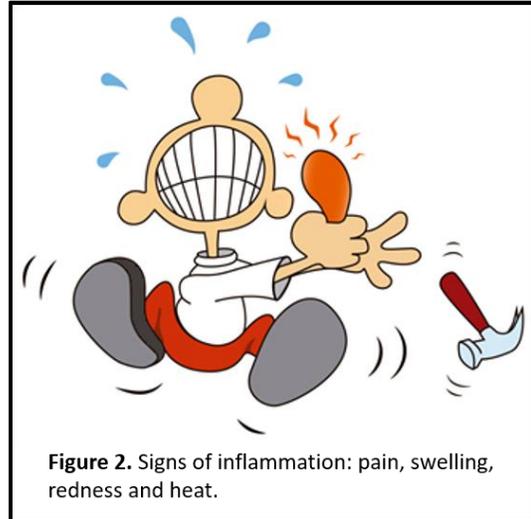
The immune system is constantly exposed to germs (e.g., bacteria, virus), and physical and chemical challenges. When pathogens defeat the physical barriers there is a response from the immune system (Figure 1).

Inflammation is a complex response from the immune system to a stimulus. The stimulus signals white blood cells (WBC). In turn, WBC act with other cells and substances produced in the body to protect and repair any damage.

Which are the signs of inflammation?

If you have ever smashed your finger with a hammer, you have experienced the signs of inflammation:

- 1) Pain
- 2) Redness
- 3) Swelling
- 4) Heat
- 5) Loss of function (in some cases)



Local and systemic effects of inflammation

Inflammation could be local, as in the example in Figure 2. However, sometimes it can also affect the whole body (systemic response). For instance, let's imagine bacteria invading and infecting our body. This would first result in an immune response to control the infection locally. Eventually, if this infection is not locally controlled and enough "chemical messengers" are produced, a systemic response occurs.

These chemicals would reach the liver and change protein production to proteins that will aid the immune response. Positive acute phase proteins (APPs) increase during inflammation and destroy or inhibit bacteria growth, regulate blood coagulation, etc. In addition, other chemicals released during inflammation can reach the brain and result in fever. As you may have experienced, fever could result in increased body temperature, reduced appetite and dullness. Although a fever can be quite uncomfortable, the purpose is to slow the spread of germs and allow the immune system to fight an infection more efficiently.

If inflammation (usually) protects the body, why would we intervene?

It is important to control inflammation to manage pain and maintain welfare of cattle. Some practices that help to control pain and promote animal welfare include the use of non-steroidal anti-inflammatory drugs (NSAIDs).

Pain management may increase the performance of cattle by mitigating pain and increasing feed intake. However, controlling inflammation has benefits in cattle performance that go beyond pain mitigation. Inflammation poses a high metabolic demand to the body. Energy and nutrients are used for the activation and migration of WBC to the site of injury, production of proteins, fever, etc. In turn, this will shift the energy usage from growth or production to fighting an infection. As a result, cattle may have lower milk yield and impaired reproductive performance. In fact, the activation of the immune system could decrease milk yield by 80% (Kvidera et al., 2017). Therefore, by controlling inflammation, we are not only mitigating pain, but also decreasing the impact of other detrimental effects on cattle performance.

While inflammation is part of body's defenses, in some cases we should control it. However, the response to infection might be diminished with the use of NSAIDs. Therefore, if inflammation is caused by germs, judicious use of antimicrobials combined with NSAIDs may be necessary. Thoughtful use of antimicrobials would address the infection, while NSAIDs would reduce pain and fever.

Remember to:

- 1) Always consult with your veterinarian to determine which drugs should be used for different procedures or diseases.
- 2) Follow the directions on the label and withdrawal times.
- 3) Regularly train employees to properly administer all drugs.

References

Kvidera, S. K., E. A. Horst, M. Abuajamieh, E. J. Mayorga, M. V. Sanz Fernandez, and L. H. Baumgard. 2017. Glucose requirements of an activated immune system in lactating Holstein cows. *J. Dairy Sci.* 100:2360–2374.

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