Dairy Research Summary

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Prevalence of Digital Dermatitis in Canadian Dairy Cattle Classified as High, Average, or Low Antibody- and Cell-Mediated Immune Responders

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Why is this important?

Lameness is one of the most costly and serious animal welfare concerns affecting the Canadian dairy industry, as it has been associated with many issues, including reduced milk yield and lower fertility. It is estimated that 20-35% of Canadian dairy cattle are lame, with the most common lesion being digital dermatitis at an incidence rate of 15% of all lesions. Digital dermatitis is an infectious hoof lesion that typically affects the skin at the base of the hoof heel. It is highly contagious and caused by bacteria found in damp and dirty conditions, such as manure slurry. The Canadian dairy industry has made great efforts in recent years to implement preventative measures, including foot baths and treating lesions with antibiotics during trimming. Despite these efforts, this disorder remains prevalent.

Studies have shown that cattle classified as high immune responders have a lower incidence of mastitis, metritis, ketosis, displaced abomasum, and retained placenta. There are two types of immune responses: cell-mediated (which predominantly protects against viruses) and antibody-mediated (which primarily protects against bacteria). Although genetic selection for resistance against specific pathogens may be done, it is not considered ideal, as selection for resistance against one pathogen may cause susceptibility to others. Therefore, it is more beneficial to select for high immune responders that demonstrate an overall greater ability to respond to a wide array of pathogens. The objective of this study was to evaluate the prevalence of digital dermatitis in Canadian dairy cattle classified as high, average, and low immune responders.

What did we do?

A total of 329 cattle from 5 commercial dairy farms in Ontario were evaluated for immune response using a patented test protocol that involved collection of blood samples, injection of cattle with known antigens, and a series of subsequent laboratory tests. Hoof health data were collected by the farms' hoof trimmer, using Hoof Supervisor software, from December 2011 to November 2013. Digital dermatitis was assessed as either present or not present at each trim event for each cow.

What did we find?

Overall prevalence of digital dermatitis in the study was 34%. Results for the prevalence of digital dermatitis in animals ranked as high, average, and low for antibody-mediated (Figure 1) and cell-mediated (Figure 2) immune response are shown below.

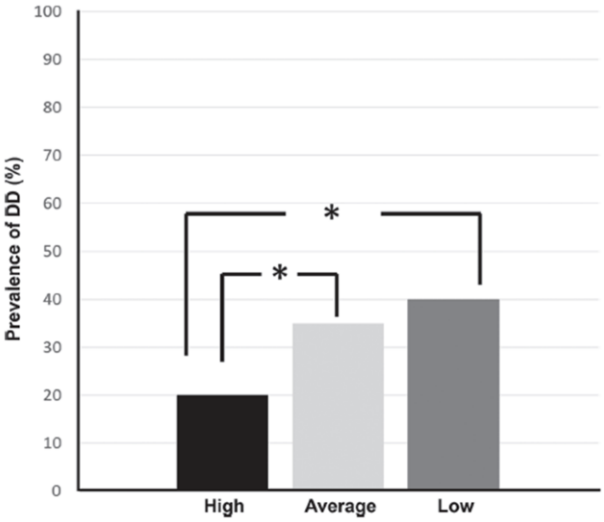

Figure 1. Prevalence of digital dermatitis in cattle ranked as high, average, and low for antibody-mediated immune response.

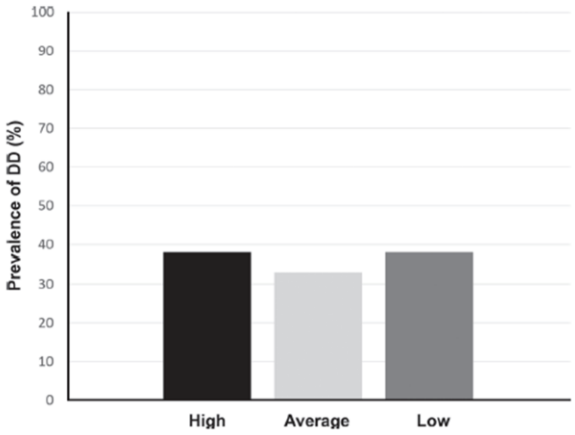

Figure 2. Prevalence of digital dermatitis in cattle ranked as high, average, and low for cell-mediated immune response.

High antibody responders had significantly lower prevalence of digital dermatitis compared with average and low antibody responders (Figure 1). There were no significant differences observed between high, average, and low cell-mediated immune responders for prevalence of digital dermatitis.

What does it mean?

Antibody responses are typically associated with an animal's defense against extracellular (outside of the cell) pathogens, including bacteria. Therefore, it makes sense that antibody responses would play an important role in defending the animal against bacterial pathogens that cause digital dermatitis. Interestingly, these results were also seen in a study examining mastitis, which is another disease typically caused by extracellular bacterial pathogens.

Alternatively, cell-mediated immune response is typically associated with an animal's defense against intracellular (within the cell) pathogens, usually viruses. Since the primary pathogen involved in digital dermatitis is extracellular, it is logical that no significant difference was seen in cell-mediated immune responder cows.

It is important to note that these two immune response systems work together to control infectious disease. As noted early, selecting for overall immune response is preferable to selecting for response to a single pathogen. Therefore, selecting for animals with both high cell-mediated and antibody-mediated immune response will not only improve disease occurrence but may also decrease the prevalence of infectious hoof lesions, resulting in overall improved welfare and economic gain.

Summary Points

- High antibody responders were less affected by digital dermatitis
- Selecting for overall high immune response animals will result in decreased disease in a herd

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