

Diagnosing and Monitoring Ketosis in Dairy Herds



By: Donna Amaral-Phillips, Ph.D.

Ketosis is the most common metabolic disease in early lactation dairy cows. This disease results from the cow's inability to adapt to the large energy demands caused by the synthesis of milk in early lactation. In the [DAIReXNET webinar entitled "Diagnosing and Monitoring Ketosis in Dairy Herds"](#), Dr. Gary Oetzel from the University of Wisconsin-Madison Veterinary School discussed the impact of this disease on performance and how to detect cows with ketosis using cow-side or on-farm tests. A summation of his major take home messages is included in this article.

- Dr. Oetzel equated the energy needs of an early lactation dairy cow to a person running 2 marathons daily. Thus, dairy cows require a tremendous amount of energy to support themselves and milk production. Ketosis results from the inability of a cow to adapt to the large demand for energy needed to support lactation. Essentially, a cow is not able to adapt quickly enough to the negative energy balance with increased feed intake and consequently, she mobilizes body fat to try and meet the energy demand. Mobilized fat overwhelms the metabolic processes in the liver and results in ketones accumulating in the blood. These ketones can be detected in blood, urine, or milk. A case of ketosis generally lasts for 5 days.
- If one collected blood samples from very early lactation cows 2 to 3 times weekly, US dairy herds would see an average incidence rate for ketosis of 20 to 60%. To detect if ketosis is a problem, herds should measure BHBA (beta hydroxybutyrate- one of the ketones) concentrations in the blood. Cows are classified as being ketotic when their blood concentration of BHBA is equal to or greater than 1.2 mmol/L. Clinical signs may be seen when the blood concentration is above 3.0 mmol/L. However, clinical signs in cows often are hard to detect. BHBA concentrations in fresh cows should be measured several times yearly as BHBA concentrations can change over time.
- Cows with elevated ketones (BHBA) do have lower performance. Specifically, milk production has been shown to decrease by 3 to 7% with high producing cows possibly being even greater. Ketotic cows are 3 to 19 times at a greater risk for a displaced abomasum, and have 3 times greater chance of being culled in the first 30 days after calving. Ketotic cows also are 1.2 to 1.7 times less likely to conceive at first breeding, but use of synchronization protocols may help decrease this effect.
- Many different types of cow-side tests exist for measuring the concentration of ketones in urine, milk, and blood. With a cow-side test, the key is to detect cows which have ketosis, but also to not classify cows as negative which do indeed have ketosis. Treatment is inexpensive and early detection results in early treatment with a quicker recovery and improved milk production. From his field experience, Dr. Oetzel's first recommendation for a cow-side test was the blood test, Abbott Precision Xtra™. Blood is collected from the tail vein using a 22 to 25 gauge single-use needle attached to a 1 to 3 ml syringe and a drop of whole blood is placed on the test strip. The strip is then

placed in the hand-held reader which then displays the concentration of BHBA. The drawbacks of this test are the current high cost and decreased availability of test strips. Test strips are only available through human medicine not animal medicine suppliers, thus the high cost and lower availability. Hopefully, this will be resolved within the next year and additional cow-side blood tests will come on the market that have been validated for use in dairy cows. He did not recommend using a urine test (Ketostix®) because a low percent of cows urinate on demand or the milk test using nitroprusside reaction (usually a powder) since it misses 2/3rd of cows that are positive. Ketotest™, measures milk BHBA and is better than other milk tests but still misses on average 15-20% of ketotic cows.

- Dr. Oetzel also discussed the use of DHI- based ketosis testing using either milk components (fat and protein) or milk ketones. Cows with ketosis do have a higher milk fat and lower milk protein. Milk fat to protein ratios greater than or equal to 1.4 are suggestive of ketosis. At this time, milk fat to protein ratios should be used to see if the herd has a problem and not to detect individual cows with ketosis since a lot of false positives (cows identified as ketotic but are not ketotic since blood ketones are not elevated) exist with this approach. Dr. Oetzel also discussed another study using milk ketones measured by a DHI testing lab. He concluded that additional research is needed before milk ketones (KetoMonitor) can be used to detect individual cows with ketosis. Again, this method may work to detect herd problems but not individual cows with ketosis at this time. He noted that dairy breed may also influence the interpretation of the results.
 - In another webinar review, we will look at different treatment options that Dr. McArt from Cornell University presented in the companion webinar.