Bio Vet Innovator Magazine

Volume 1 (Issue 6) December 2024

OPEN ACCESS

Popular Article

Recent Trends in Diagnosis and Management of Ketosis in Dairy Animals with Special Reference Towards Blood Metabolites

Ritu Mahala[1], Rahul Krishaniya[2], Amita[3] and Ravindra Pal Mandar[4]

1PhD Scholar, Department of Veterinary Medicine, College of Veterinary and Animal Science, Bikaner-334001 (Rajasthan), India
2Assistant professor, Department of Veterinary Physiology, Shekhawati Veterinary College, Sikar-332406 (Rajasthan), India
3PhD Scholar, Department of Veterinary Public Health and Epidemiology, College of Veterinary and Animal Science, Bikaner-334001 (Rajasthan), India
4Assistant professor, Department of Veterinary Pharmacology and Toxicology, Mahatma Jyotiba Fule College of Veterinary and Animal science, Chomu, Jaipur-303702 (Rajasthan), India
***Corresponding Author:** ritumahala96@gmail.com
DOI: https://doi.org/10.5281/zenodo.14602809

Received: December 29, 2024
Published: December 31, 2024

Abstract:

Ketosis is a common metabolic disorder in dairy cows, especially during early lactation. Recent advances focus on using blood metabolites like beta-hydroxybutyrate (BHB) and non-esterified fatty acids (NEFA) for early diagnosis, enabling timely intervention to prevent severe cases. Portable on-farm testing devices now allow rapid assessment of these markers, improving management strategies. Nutritional interventions, such as glucogenic supplements and rumen-protected nutrients, are increasingly tailored based on metabolite levels, reducing ketosis risk and enhancing herd health. This targeted approach to ketosis management represents a significant step forward in dairy production.

Keywords: Ketosis, BHB and NEFA

Introduction:

Recent trends in the diagnosis and management of ketosis in dairy animals have increasingly focused on using blood metabolites to provide a more accurate, early diagnosis and effective management protocols. The early detection of ketosis—especially in its subclinical form—has become a priority for managing herd health, as early intervention can prevent progression to clinical ketosis, improve productivity, and enhance reproductive performance.

Here's an in-depth look at current advancements in diagnosing and managing ketosis in dairy animals with a focus on blood metabolites:

1. Blood Metabolites as Diagnostic Biomarkers: Blood metabolites are central to diagnosing ketosis

because they reflect energy imbalances and metabolic adaptations to lactation stress, particularly in the early postpartum period. The main metabolites used in the diagnosis of ketosis are beta-hydroxybutyrate (BHB) and non-esterified fatty acids (NEFA).

(i) Beta-Hydroxybutyrate (BHB): BHB is a ketone body produced when cows mobilize body fat for energy due to insufficient dietary intake of glucose precursors. Elevated blood BHB levels are a direct indicator of subclinical ketosis. For instance, levels between 1.2 to 1.4 mmol/L in blood are typically indicative of subclinical ketosis, while levels above 3.0 mmol/L can indicate clinical ketosis.

Recent studies show that measuring BHB is highly reliable and is now routinely used in both on-farm testing and laboratory assays. Handheld devices allow rapid BHB testing in a cost-effective manner, and this advancement enables timely intervention before the condition worsens. According to McArt et al. (2012), regular monitoring of BHB levels in early lactation reduces the risk of clinical cases by allowing preventive measures.

(ii) Non-Esterified Fatty Acids (NEFA): NEFA levels indicate the extent of fat mobilization due to negative energy balance. Higher NEFA levels, especially prepartum (>0.3 mEq/L), are predictive of postpartum ketosis risk. Testing NEFA levels in late gestation can help identify cows at risk of ketosis even before clinical signs appear, allowing for preventive nutritional adjustments. Chapinal et al. (2012) found that elevated NEFA levels in the prepartum period are strongly associated with metabolic disorders, including ketosis, after calving.

(iii) Glucose and Insulin Levels: While not as widely used as BHB and NEFA, glucose and insulin measurements can provide additional insights into energy metabolism and potential ketosis development. Cows with low blood glucose levels, combined with elevated BHB and NEFA, are at higher risk for severe ketosis and liver damage.

(iv) Liver Enzymes: High levels of liver enzymes such as aspartate aminotransferase (AST) and gamma-glutamyl transferase (GGT) can signal liver stress or damage due to fatty liver disease, which often coexists with ketosis. Monitoring these enzymes alongside blood metabolites can help differentiate ketosis from other liver-related metabolic disorders.

2. On-Farm Diagnostic Tools and Monitoring Protocols:

Advancements in portable and cost-effective testing devices have made it feasible to monitor ketosis in real-time on dairy farms:

(i) Handheld Ketone Meters: Devices like the Precision Xtra meter allow for immediate

on-farm BHB measurement, giving farmers a practical tool for routine screening. Studies by Oetzel (2017) highlight that on-farm monitoring of BHB levels can lead to earlier intervention and reduced reliance on costly treatments.

(ii) Automated Monitoring Systems: Some farms are now using automated blood sampling and analysis systems integrated with herd management software, allowing seamless tracking of NEFA and BHB levels during high-risk periods.

3. Management Strategies Based on Blood Metabolite Monitoring:

Management strategies have evolved to include preventive nutritional and medical interventions based on the blood metabolite profile of the cows:

(i) Targeted Nutrition: Adjusting the diet based on prepartum NEFA and postpartum BHB measurements allows for more targeted nutrition. High-energy, glucogenic diets can help at-risk cows meet energy demands without excessive body fat mobilization, while rumen-protected choline and methionine support liver health and reduce fat accumulation. In addition, feeding propylene glycol can help increase blood glucose and reduce ketone production in cows with elevated BHB levels.

(ii) Strategic Supplementation: Supplementation of compounds like monensin has been shown to decrease ketosis risk by modulating rumen fermentation and increasing glucose availability. According to Duffield *et al.* (2009), monensin supplementation in dairy cattle reduced BHB levels and decreased the incidence of ketosis in early lactation cows.

(iii) Herd Management and Culling Decisions: Regular testing and recording of BHB and NEFA levels allow herd managers to make informed culling decisions, focusing on breeding cows with better metabolic efficiency and resilience to ketosis. These data also support long-term breeding programs aimed at reducing ketosis susceptibility in future generations.

Conclusion:

In conclusion, monitoring blood metabolites like BHB and NEFA has become crucial for early ketosis detection and management in dairy cattle. These advancements allow for timely, targeted interventions that reduce ketosis incidence and improve herd health. This approach marks a progressive shift towards more proactive and precise dairy management practices.

References:

Chapinal, N., Carson, M. E., Duffield, T. F., Capel, M., Godden, S., Overton, M., Santos, J. E. P., & LeBlanc, S. J. (2012). The association of serum metabolites in the transition period with milk production and

early-lactation reproductive performance. Journal of Dairy Science, 95(3), 1301-1309. This research emphasizes the predictive value of NEFA and BHB levels for ketosis and related metabolic diseases.

Duffield, T. F., Rabiee, A. R., & Lean, I. J. (2009). A meta-analysis of the impact of monensin in lactating dairy cattle. Journal of Dairy Science, 92(4), 1623-1629. This meta-analysis confirms the efficacy of monensin in reducing ketosis incidence and supporting energy metabolism.

McArt, J. A. A., Nydam, D. V., & Oetzel, G. R. (2012). Epidemiology of subclinical ketosis in early lactation dairy cattle. Journal of Dairy Science, 95(9), 5056-5066. This study highlights the importance of monitoring BHB levels to prevent clinical ketosis and improve overall health.

Oetzel, G. R. (2017). Monitoring and testing dairy herds for metabolic disease. Veterinary Clinics of North America: Food Animal Practice, 33(2), 227-250. Oetzel's work discusses the role of regular BHB testing in managing ketosis and preventing metabolic disorders.

Citation: Ritu Mahala, Rahul Krishaniya, Amita and Ravindra Pal Mandar. (2025). Recent Trends in Diagnosis and Management of Ketosis in Dairy Animals with Special Reference Towards Blood Metabolites. In Bio vet innovator magazine (Vol. 1, Issue 6, pp. 39–42). Bio vet innovator magazine. https://doi.org/10.5281/zenodo.14602809