Understanding the Role of Branched-Chain Volatile Fatty Acids in Enhancing Dairy Cow Nutrition and Performance

A new invited review in Applied Animal Science synthesizes our current understanding of the mechanisms by which isoacids can improve nutrition, milk yield, and production efficiency.

Champaign, IL, August 5, 2024—Branched-chain volatile fatty acids have long been known to be beneficial for the ruminal bacteria that aid digestion, dairy cow nutrition, and milk production. However, the exact mechanisms are still a focus of dairy research. A new review article published in Applied Animal Science sheds light on how these acids benefit lactating dairy cows. David K. Beede, PhD, Editor in Chief of the journals, explained, “This excellent invited review addresses our current understanding of the mechanisms by which branched-chain volatile fatty acids, historically termed isoacids, can improve fiber digestibility, rumen microbial protein production, milk yield, and production efficiency of lactating dairy cows.”

Reviewing the latest peer-reviewed research literature on the topic, the article delves into the complex interplay between branched-chain volatile fatty acids and rumen microbes, the powerhouses that break down fiber in a cow’s digestive system. The authors explain the metabolism of isoacids, highlighting the importance of providing the right balance of branched-chain volatile fatty acids—isovaleric acid, 2-methylbutyric acid, and isobutyric acid—to optimize this microbial activity.

“Traditionally, all three branched-chain volatile fatty acids were included in supplements, but the recent research shows that isovaleric acid doesn’t appear necessary in corn silage-based diets,” explains lead author Jeff Firkins, PhD (Department of Animal Sciences, The Ohio State University, Columbus, OH, USA). “The precursor of isovalerate is the amino acid leucine, which is already high in corn protein, and often isobutyric acids can act as a substitute for some rumen bacterial strains.”
A new review article synthesizes our understanding of the function of branched-chain volatile fatty acids and paves the way for more targeted dietary strategies to optimize rumen health, milk production, and overall dairy cow performance (Credit: J. Firkins).

The review also confirms that feeding branched-chain volatile fatty acids improves the ability of a cow to degrade fiber. “This improved fiber digestibility, typically by 3% to 5%, leads to an increase of acetate, which the research suggests increases milk fat production,” said Firkins.

This effect is especially true for multiparous cows (those that have given birth more than once), whereas primiparous cows experiencing the postpartum period for the first time are still growing. “This means they are going to respond to branched-chain volatile fatty acid supplementation not with increased milk production, but with growth and weight gain,” said Firkins.

This improved fiber digestion paves the way for increased efficiency and milk production, depending on the cow’s unique nutritional needs. For cows in mid to late lactation, it allows them to produce the same amount of milk with slightly lower dry matter intake. For cows in early lactation with greater metabolic demand, it helps them increase dry matter intake and boosts their milk production.

Overall, the research shows that “milk production efficiency goes up 5% to 10% when cows are receiving an optimum dose of branched-chain volatile fatty acids, along with adequate supply of rumen-degradable protein,” noted Firkins.

Although further research is needed to refine isoacid recommendations for different dietary scenarios, this new understanding of the function of branched-chain volatile fatty acids paves the way for more targeted dietary strategies to optimize rumen health, milk production, and overall dairy cow performance.

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Notes for editors


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