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C HOLINE and methionine both play essential roles in mammalian metabolism. Choline is a quasi-vitamin that has a variety of functions, including as the predominant phospholipid contained in the membranes of all cells in the body (as phosphatidylcholine), a component of the neurotransmitter acetylcholine and as a direct precursor to betaine (Goselink et al., 2013). Furthermore, choline deficiency in monogastric species results classically to fatty liver development, among other symptoms.

Methionine is an essential amino acid and building block for protein and typically can constitute 5 to 7% of the two most limiting amino acids for the production of milk protein in lactating dairy cows. Methionine can contribute to biosynthesis of phosphorylcholine through its role as a methyl donor. In a study conducted a number of years ago using lactating cows and radio-labeled choline and methionine to determine the kinetics and interconversions between the two compounds, 6% of the choline pool was derived from methionine (Emmanuel and Kennedy, 1984). Choline and methionine together have been the focus of a number of transition cow studies over the past 15 years and have demonstrated positive effects on cow productivity during early lactation.

Given the interrelationships described above, questions have been asked regarding the potential substitution of methionine for choline or if supplemental choline is needed at all by dairy cows. Given the similarity of choline and methionine, either of these nutrients has distinct effects on the transition cow.

**Transition cow research**

Piepenbrink and Overton (2003) determined that cows fed rumen-protected choline (RPC) during the prepartum period and on through early lactation tended to have increased fat-corrected milk yields (average response of 5.3 lb. per day) compared to control cows. Feeding both HMBi and 9.5 lb. more per day for cows fed RPC. In this study, HMB supplementation increased milk yield compared to the one described above for cows fed RPC. Furthermore, there are several studies among these that clearly demonstrate improved liver metabolism.

Cows fed methionine had large increases in milk yield compared to controls — 5.3 lb. more per day for HMBi and 9.5 lb. more per day for RPM. However, effects of the two sources of methionine on blood NEFAs and BHBA and free triglyceride content were not significant. Interestingly, cows fed supplemental methionine had greater phagocytosis in blood neutrophils harvested at 21 days of parturition, suggesting improved immune function.

**Summary, conclusions**

In summary, research during the past 15 years has highlighted the roles for both choline and methionine in transition cow nutrition. However, there are several important considerations. The number of studies from which to draw both production and metabolism results and the consistency of production responses among these studies are much greater for choline than for methionine. Furthermore, there are several studies among these that clearly demonstrate improved liver metabolism and decreased triglyceride accumulation in cows fed choline and methionine. These biological mechanisms are consistent with the classical choline deficiency symptom of fatty liver that has been well-illustrated in monogastric species.

The research currently available for supplementation of methionine sources to transition cows suggests the potential for production responses as well; however, the mechanism of response does not appear to relate to liver metabolism and perhaps relates to either immune function or methionine’s role as a potentially limiting amino acid during the transition period and early lactation.

**References**


