The Nutritional CONSULTANT'S DIGEST Volume 13

Choose Fat Wisely for Optimum Nutrient Digestibility

Fat supplements are commonly used in dairy cow diets to help meet energy needs. Recent research reports yield new information on the effects of fat supplementation on nutrient digestibility.[1,2,5,7] Factors influencing nutrient digestibility include DMI, the fat supplement's chemical structure, rate of passage through the rumen, and digestion rates for the various dietary components.

Dry Matter Intake

There is an inverse relationship between nutrient digestibility and dry matter intake: as DMI increases, nutrient digestibility decreases.[6] Harvatine and Allen[2] determined that feeding 2.5% Calcium Soaps of Fatty Acids (CSFA) decreased DMI compared to feeding a control diet, a diet containing similar levels of prilled hydrogenated free fatty acids (FFA–Energy Booster 100®), and a 50:50 combination of CSFA and Energy Booster 100.

CSFA also depressed DMI compared to feeding hydrogenated palm oil (HPO) in a study by Weiss and Wyatt.[7] They concluded that differences in nutrient digestibility were likely due to differences in DMI levels. Cows fed CSFA had a lower DMI with increased nutrient digestibility compared to cows fed HPO; however, the increased nutrient digestibility was not enough to overcome the depression in DMI due to CSFA supplementation. The result? A numerically lower energy intake for CSFA-fed cows compared to cows fed HPO.

Chemical Structure

Weiss and Wyatt[7] also determined that the source of fat had greater impact than supplementation level on nutrient digestibility. Diets containing HPO had lower digestibilities of dry matter (DM), organic matter (OM), neutral detergent fiber (NDF) and fatty acids (FA) compared to diets containing CSFA. Hydrogenated triglycerides like HPO have high melting points which lower their digestibility.

Differences sometimes observed in individual fatty acid digestibility are of questionable significance. Bauman[1] and colleagues concluded that the rumen's lipid outflow is predominantly free fatty acids and differences in the digestibility of these individual fatty acids in the small intestine are negligible. Harvatine and Allen[4] documented that CSFA failed to protect polyunsaturated fatty acids (PUFAs) from rumen biohydrogenation. Thus, the composition of fatty acids absorbed in the small intestine is similar to the composition of fatty acids leaving the rumen.[1] A high percentage of these fatty acids are stearic (C18:0), an endpoint for completely biohydrogenated PUFAs.

Rate of Passage and Dietary Component Digestion Rates

Harvatine and Allen[3] determined that increasing the saturation level of fat supplements decreased ruminal digestibility of DM and OM; however, they observed no differences in total tract digestibility of DM and OM. The decrease in ruminal digestibility was due mainly to a reduction in ruminal NDF digestibility caused by a decrease in the rate of digestion and an increase in the rate of passage—both responses likely related to the higher DMI for cows fed Energy Booster-100.[2] Interestingly, total tract digest-ibility of NDF did not differ among treatments. The lack of dif-ferences in total tract nutrient digestibility, despite varying levels of saturation, was due to compensatory post-ruminal digestion.

Fat *Fast* Facts

- There are differences in the effects of the fat source on location of nutrient digestibility; however, these differences are of very little consequence. Of greater consequence is the effect of the fat supplement on depressing DMI.
- When selecting a fat supplement, choose one that will not depress DMI.
- Energy Booster 100 does not depress DMI.

[1]Bauman, D.E., J.W. Perfield II, M.J. de Veth, and A.L. Lock. 2003. New perspectives on lipid digestion and metabolism in ruminants. Proc. Cornell Nutr. Conf, p. 175.

[2]Harvatine, K.J. and M.S. Allen. 2004a. Effect of rumen-protected fatty acid saturation on feed intake and feeding and chewing behaviour of lactating dairy cows. J. Dairy Sci. 87 (suppl. 1) Abstr. W95, p. 336.

[3]Harvatine, K.J. and M.S. Allen. 2004b. Effects of rumen-protected fatty acid saturation on feed intake and feeding and chewing behavior of lactating dairy cows. J. Dairy Sci. 87 (suppl. 1). Abstr. 629, p. 309.

[4]Harvatine, K.J. and M.S. Allen. 2004c. Kinetic model of rumen biohydro-genation: effect of rumen-protected fatty acid saturation on fractional rate of biohydrogenation and duodenal fatty acid flow in lactating dairy cows. J. Dairy Sci. 87 (suppl. 1). Abstr. 628, p. 308.

[5]Loften, J.R. and S.G. Cornelius. 2004. Review: Responses of Supplementary Dry Rumen Inert Fat Sources in Lactating Dairy Cow Diets. The Professional Animal Scientist. 20: (In press).

[6]National Research Council. 2001. Nutrient requirements of dairy cattle. 7th rev. ed. Natl. Acad, Sci., Washington, DC.

[7]Weiss, W.P. and D.J. Wyatt. 2004.Digestible Energy Values of Diets with Different Fat Supplements when Fed to Lactating Dairy Cows. J. Dairy Sci. 87:1446–1454.

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