

Improving fatty acid digestibility in dairy cows

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Supplemental fat fed to dairy cattle increases the energy density of the diet with the intention of increasing milk yield, milk component yield, and/or body tissue reserves. For fat supplementation to have these intended results, the fatty acids (FA) contained have to be digested. FA digestion primarily occurs in the small intestine, after considerable modification of the profile (changing from more unsaturated to more saturated) and form (changing from more esterified to more non-esterified) occurring in the rumen. In the duodenum, low pH and the addition of bile increases the solubility of the FA, leading to micelle formation. In order to aid micelle formation, some research has focused on supplementing lysolecithin or the precursor lecithin, viewing this as potentially limiting FA digestion. Thus far, there is limited evidence that supplementing either lysolecithin or lecithin aids in FA digestibility. Oleic acid (C18:1) may also aid in micelle formation and has shown to increase stearic acid (C18:0) digestibility. Due to the rather extensive biohydrogenation in the rumen, stearic acid is typically the most abundant FA reaching the duodenum with lesser amounts of oleic acid present. Recent work evaluating the digestibility of individual FA, as well as their effects on the digestibility of other FA, has revealed that that long chain saturated FA have more neutral to negative effects on FA digestibility while, unsaturated FA, specifically oleic acid (C18:1), likely increase FA digestibility. Supplementing calcium salts with elevated concentrations of oleic acid improved FA digestibility compared to supplements that contain more saturated fatty acids. The improvements in FA digestibility with the increased inclusion of oleic acid, is likely the result of that FA increasing emulsification and micelle formation, that is required for FA absorption. In addition to commercially available fat products, the availability of soybeans with increased oleic acid concentrations may also present an opportunity to increase the amount of oleic acid that reaches the duodenum and thus potentially improve FA digestibility. In addition to FA profile, the source and amount of dietary fat influences FA digestibility. Fat sources such as calcium salts and vegetable oils tend to have greater FA digestibility compared to the FA contained in sources like whole seeds. Due to the limited digestion of FA in the rumen, total dietary intake of FA is positively correlated to duodenal flow of FA. As duodenal flow of FA increases, total FA digestibility is reduced, this is especially true for the stearic acid which shows a greater reduction in digestibility as more FA reaches the duodenum than other FA. Recognizing that individual FA have different bioactive properties and impacts on FA digestibility has led to supplementation of blends of supplemental fat products as well as new product development to optimize the FA profile and therefore the biological responses observed. The amount of fat supplemented, the form of the fat, and the FA profile reaching the duodenum all impact the digestibility of individual FA. Although fat makes up a small portion of the dairy diet, maximizing the amount of FA digested increases digestible energy as well as the increasing the specific FA available for these bioactive processes.