Can palmitic acid improve milkfat and milk yield?

by Alvaro Garcia

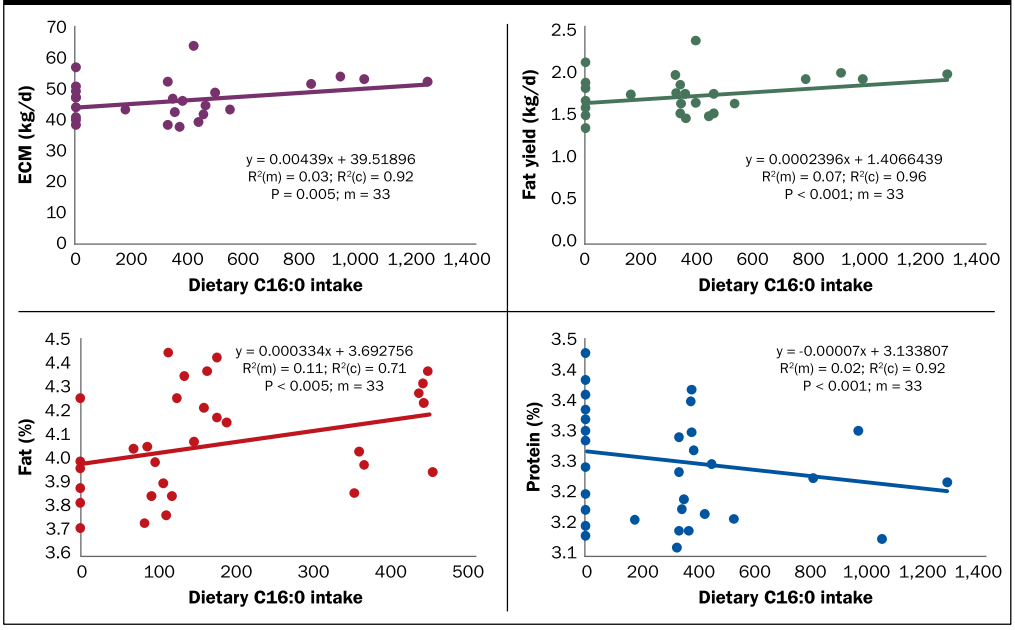
CONSUMER demand of milkfat for both butter and cheese is the reason over 90% of U.S. milk production now falls under multiple component pricing mechanisms. As a result, dairy producers and their nutritionists prioritize genetic and nutritional strategies that enhance milkfat.

The primary precursor for fatty acid synthesis in the mammary gland is acetate, and secondarily beta-hydroxybutyrate, resulting in fatty acids of 4 to 14 carbons and some with 16 carbons. The rest of the fatty acids with 16 carbons and all those with 18 carbons or more derive from circulating fatty acids from dietary fats or body fat reserves. The use of fat supplements to improve the energy density of the diet is common practice among nutritionists. It is important, however, to use the right lipids in the diet since those that have unsaturated fatty acids may reduce milkfat.

Most fat supplements are based on palmitic acid, a 16-carbon saturated fatty acid. Its inclusion rate depends on the requirements of the group of cows, but it is usually between 0.5% and 2.5% of the ration dry matter. Individual fatty acids, however, can have different effects, with considerable research being placed on palmitic because of its reduced interference with fiber digestibility.

In 2021, researchers from Penn State fed fat supplements to lactating dairy cows based on palmitic or oleic acids and their blends. The rate of supplementation was 1.5% of the diet dry matter for all three treatments. Supplementing with palmitic acid improved milkfat yield compared to stearic acid, but the blend of both increased energy-corrected milk without affecting intake.

The effects of palmitic acid intake on performance



Researchers at Dellait conducted a meta-analysis to evaluate the effects of palmitic acid intake on lactating cow performance. The authors looked at 11 experiments from 2007 to 2019 where fat supplements enriched with palmitic acid were fed. These supplements were added daily to the diets at rates between 0% and 0.6% of the dry matter for a daily intake up to 1,248 grams.

Raising palmitic acid in the diet up to 1,248 grams per day improved both energy-corrected milk and milkfat yield. Interestingly, milk protein fell as dietary palmitic acid went up. It is possible this effect was the result of nonrumen-fermentable energy from fat, replacing rumen-fermentable energy from carbohydrates, thus reducing available microbial and metabolizable protein.

Researchers at Virginia Tech confirmed in 2022 that milkfat was positively correlated with forage and negatively correlated with starch in the diet. Daily intake of the unsaturated linoleic acid was more negatively correlated with milkfat than with any other fatty acid.

The best variables to predict milkfat concentration were days in milk; fatty acid-free dry matter intake; forage; starch; daily intake of linoleic acid; linolenic acid; and absorbed methionine, histidine, and tryptophan.

The effect of these last three amino acids is mediated through an enzyme (kinase) that regulates the metabolism of fatty acids and triglycerides. Results of this work showed that even though linoleic acid is still the best predictor of milkfat concentration in dairy cows, daily intake of palmitic acid (C16) was the best predictor of milkfat yield. Interestingly, the daily intake of linolenic acid resulted in positive responses in both milkfat concentration and yield, suggesting this fatty acid was seemingly not only not inhibitory, but possibly slightly deficient.

The reduction in milk protein with palmitic acid supplementation needs consideration, particularly in markets that base milk pricing on milk protein. According to researchers at the University of Illinois, despite the reduction in milk protein concentration, the gain in milk yield by feeding supplementary palmitic acid offsets the reduced concentration of protein in milk. In this same experiment, dietary fat tended to raise the body condition score during Weeks 4 to 25 and increased body condition score, which is another positive aspect to consider, particularly in primiparous cows.

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