

TECHNICAL BULLETIN

DAIRY



A NOVEL INDICATOR OF MILK COMPONENTS: DE NOVO FATTY ACID LEVEL PREDICTS MILK FAT AND PROTEIN CONTENT

Introduction

Milk fatty acid composition information could be useful for predicting milk component production. A recent research project led by Dr. David Barbano and Dr. Tom Overton from Cornell University analyzed large amounts of milk samples, and they found some interesting correlations between *De Novo* fatty acid composition and milk fat and protein content. This finding can help us design feeding and management strategies to increase milk component yields and dairy profitability.

What is *De Novo* fatty acid?

De Novo is a Latin expression meaning “from the beginning”. With typical chain length from C4:0 to C14:0, *De Novo* fatty acids are synthesized within the mammary gland from substrates like butyrate and acetate, which are produced in the rumen by forage fermentation (**Figure 1**).

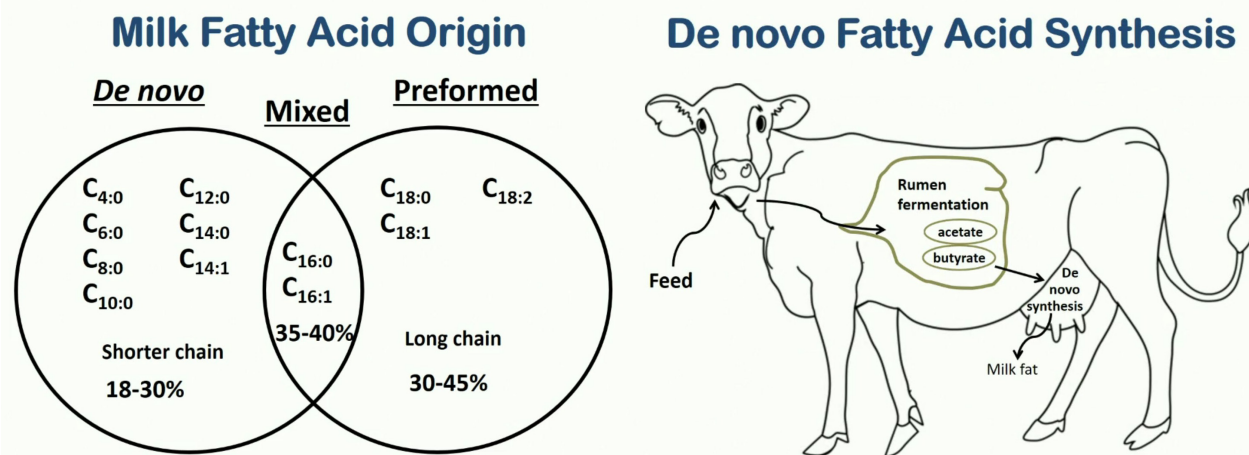


Figure 1: *De Novo* fatty acid synthesis

Positive correlation between *De Novo* fatty acid level and milk components

The research team evaluated bulk tank milk average from 430 farms located in Vermont and New York State, and tested samples 3 to 20 times per month per farm over 15 months for fat, protein, lactose, and fatty acid composition. They found a positive correlation between increasing bulk tank fat and protein tests with increasing *De Novo* fatty acid content in milk (**Figure 2**).

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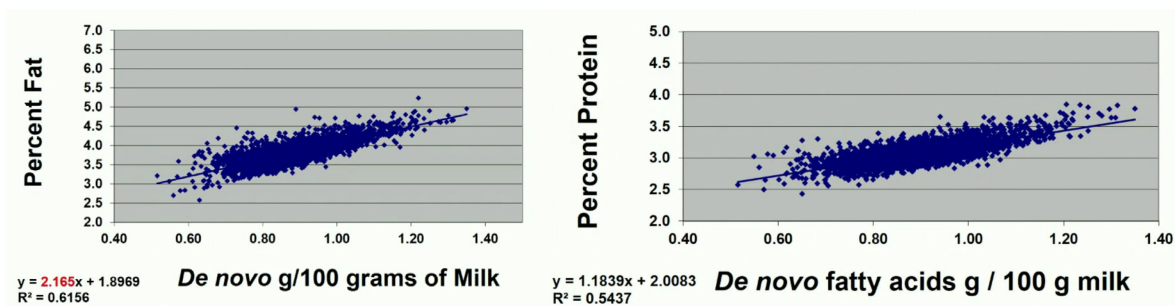


Figure 2: Correlation between *De Novo* fatty acid content and bulk tank fat and protein percent.

Why was there a strong positive correlation between *De Novo* fatty acids and milk components? Perhaps the relationship between *De Novo* fatty acids and milk protein content is even more intriguing. Protein is synthesized within the mammary tissue from amino acids. When rumen function and fermentation of digestible carbohydrates is working well, the rumen microflora biomass (i.e., essential amino acids) and ruminal VFA (i.e., butyrate, acetate, and propionate) should be maximized. According to the Cornell researchers, *De Novo* fatty acid output might be an indicator of both excellent production of ruminal VFA and microbial amino acids biomass providing a rich source of substrates in support of milk component synthesis.

To further explore if feeding and farm management practices that produce greater amounts of *De Novo* fatty acids can help increase milk fat and protein output, the Cornell team studied 20 Holstein farms that had a wide range of *De Novo* fatty acid concentration. They found that during the 15-month period of study, the 10 low *De Novo* herds averaged 3.62 % fat and 2.99 % protein, while the 10 high *De Novo* herds averaged 3.92 % fat and 3.09 % protein, respectively. The low and high *De Novo* herds had 24 vs 26% *De Novo* fatty acids as a percent of total fatty acids, respectively. What are the factors related to *De Novo* fatty acid percent differences in those farms? Interestingly, more feed bunk space, less pen stocking density, lower dietary fat content, and higher dietary physically effective NDF were all related to higher *De Novo* and higher fat and protein tests.

Can feeding QLF sugar supplements increase *De Novo* fatty acid production?

Here are several reasons why feeding QLF supplements may help increase the production of *De Novo* fatty acids and milk components. **First**, by feeding QLF supplements, sugar fermentation in the rumen produces butyrate, which provides substrates for *De Novo* fatty acids and milk component synthesis. Furthermore, butyrate increases blood flow of ruminal epithelium and enhances the absorption of all VFA. **Second**, feeding QLF supplements improves forage fermentation and NDF digestibility, which increase ruminal acetate supply for *De Novo* fatty acids and milk component yields. A recent meta-analysis by several scientists found that when total dietary sugar is between 6.75 to 7.5% dry matter in the ration, cows had the best NDF digestibility and milk response. In another word, cows should be fed between 1.5 and 2.0 lb. of added sugar to optimize NDF digestibility, which is equal to 4 to 5 lb. of QLF products. **Third**, feeding QLF supplements is in line with the concept of feeding a high forage diet and better rumen health, which creates a proper ruminal environment for *De Novo* fatty acid synthesis.

Summary

De Novo fatty acid production has a strong positive correlation with the contents of milk fat and protein. The level of *De Novo* fatty acid seems to be an indicator of rumen health and proper rumen function. Feeding and farm management strategies that produce an increase in synthesis of *De Novo* fatty acids can help increase milk fat and protein output and dairy profitability. By feeding QLF sugar supplements, cows have increased ruminal butyrate and acetate production, which provide substrates for *De Novo* fatty acid and milk component synthesis. Increased milk fat and protein production will improve dairy profitability.