

# DAIRY SOLUTIONS

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E-Newsletter

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## Enhancing herd profitability through the evaluation of milk fatty acids

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Producing more milkfat and protein is a sure way to enhance herd profitability. And, the best way to increase milkfat and protein is to enhance rumen fermentation. Over the past year, a group of scientists led by Dr. Dave Barbano of Cornell University have been studying the link between on-farm management, nutrition and milk composition with a focus on bulk tank sampling.

This test is derived from a series of bulk tank samples that are taken on-farm and immediately shipped to a lab for milk fatty acid composition. The test is conducted by an infrared (mid-FTIR) milk analysis machine, which provides levels of de novo, mixed origin and preformed fatty acids (grams of fatty acids per 100 grams of milk) of that specific bulk tank sample.

### De novo fatty acids and rumen fermentation

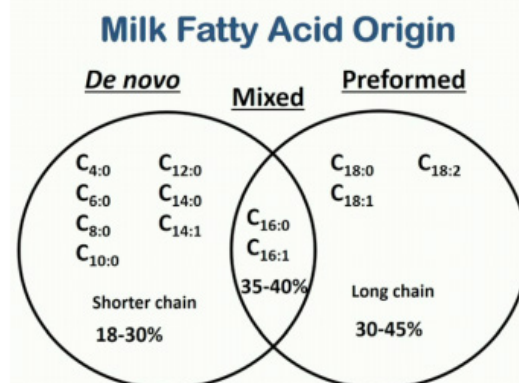
De novo is a Latin expression meaning “from the beginning.” De novo fatty acids are the short chain fatty acids (C4 to C14) that comprise 20–30 percent of total milk fatty acids. These fatty acids are derived from acetate and butyrate precursors that are produced in the rumen by forage fermentation (Figure 1.). There are also preformed, long-chain fatty acids (C18:0, C18:1 and C18:3), which make up about 35 to 40 percent of total fatty acids, and the mixed group of fatty acids (C16’s) which comprise the remaining 35 percent of milk fatty acids. University research has shown that the percentage of milk de novo fatty acids is positively correlated with the percentage of fat and true protein in the milk. Continuing research is being conducted with the goal of determining the optimal relationship among these three groups for peak milk component output.

The de novo fatty acids are important for two reasons: first, de novo fatty acid levels reflect rumen function, primarily fiber fermentation, which produces the acetate and butyrate needed as building blocks for short-chain de novo fatty acids. Second, milk fat and protein yields are two key areas of focus for dairy profitability, with pounds of components per day positively related to net milk income over feed costs. In addition, rumen conditions that enhance microbial fermentation should stimulate microbial protein production, thereby increasing milk protein content. Higher de novo fatty acids in the milk reflect healthier rumen conditions.

### Rumen pH and milk fatty acids

It is commonly known that nutritional factors, such as fat percentage in the diet and its composition, may influence milk fermentable carbohydrates and forage particle size. Rumen pH has an incredibly large impact on fiber fermentation because nutrient factors such as too much fermentable starch in the rumen will lower pH and decrease both rate and extent of fiber digestion. Poor feeding management can influence rumen pH, subsequent fiber digestion and microbial protein production.

Figure 1.



Source: Barbano, D.M., Dann, H.M., Grant, R.J., and Mellili, C. 2017. Field testing of fatty acid metrics for herd management. Presentation. St. Cloud, MN: 22 August 2017.

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## Improving rumen pH and maximizing de novo fatty acid synthesis

Below are some tips to improve de novo fatty acid content and produce higher milk fat and true protein content:

- **Don't overstock.** Herds with higher de novo synthesis are 10 times more likely to have feed bunk space of at least 18 inches per cow and are five times more likely to have stall stocking density less than or equal to 110 percent. The relationship between stocking density and de novo fatty acid content in milk makes sense given that overstocking increases feeding rate and aggression at the feed bunk, depresses rumination and increases risk for lower rumen pH. In addition, some research shows that overstocking has a greater impact on rumen pH than does physically effective neutral detergent fiber (peNDF).
- **Feed more frequently.** High de novo free-stall farms are five times more likely to feed twice a day, which presumably results in better rumen conditions for microbial fermentation. For tie-stall farms, high de novo farms are 11 times more likely to feed at least five times per day. Overall, greater frequency of feeding enhances milk components and the de novo fatty acids, which reflect rumen pH.
- **Feed fat properly and meet fiber requirements.** From a nutritional standpoint, low de novo herds typically have diets with higher dietary fat content. These herds are also three-and-a-half times more likely to have a total mixed ration (TMR) containing greater than three-and-a-half percent ether extract. We still need to learn more about the composition of dietary fat and how it contributes to lower de novo fatty acid synthesis, but it is apparent that feeding more fat is a risk factor for reducing de novo milk fatty acids. Feeding too much unsaturated fat will depress rumen fiber fermentation.
- **Excellent fermentation of forage is needed.** A high level/output of de novo fatty acids in the milk indicates that the rumen fermentation is working very well and that high levels of acetate, propionate and butyrate are being produced in the rumen. Excellent fermentation of forage produces a larger microbial biomass in the rumen and provides more essential amino acids in support of milk protein synthesis.

De novo fatty acid measurement in milk is an excellent tool to evaluate the effectiveness of rumen fermentation and forage digestion.

Dr. Dave Barbano suggests the parameters for bulk tank fatty acid testing analysis:

### If you would like a fat test greater than 3.75 percent fat in the bulk tank with a Holstein herd, then:

- De novo fatty acids needs to be greater than 0.85 grams per 100 grams milk
- Mix origin fatty acids needs to be greater than 1.40 grams per 100 grams milk
- De novo and mixed fatty acids needs to be greater than 2.25 grams per 100 grams milk
- Double bonds per fatty acid in milk fat needs to be less than 0.31. As double bonds per fatty acid increase in milkfat, the output of de novo fatty acids decreases.

In conclusion, de novo fatty acid production has a strong positive correlation with the content of milk fat and protein. The level of de novo fatty acids 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, protein output and dairy profitability.

For more information on fatty acid metrics or the milk sampling process, contact a member of the Hubbard Dairy Tech Team or reach out to the Stearns DHIA Laboratory at 1-800-369-2697.

