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A Tool for the Near Future: the Milk Fatty Acid Profile

Milk fatty acid profile adds precision to total fat, and reveals a great deal about what is really going on in a cow. In the near future, it will be possible to monitor the fatty acid profile in both the bulk tank and in individual cow milk. But what does this new information bring, and how will it be used?

WHERE DO MILK FATTY ACIDS COME FROM?

While milk fat comprises more than 400 fatty acids, the 12 main ones originate from three different sources (Figure 1).

1 *DE NOVO* FATTY ACIDS: These are short-chain fatty acids (less than 16 carbons) and they represent 18 to 30% of the fatty acids found in milk fat. *De novo* synthesis takes place in the mammary gland, where fatty acids are produced from acetate and butyrate, that result from ruminal fermentation.

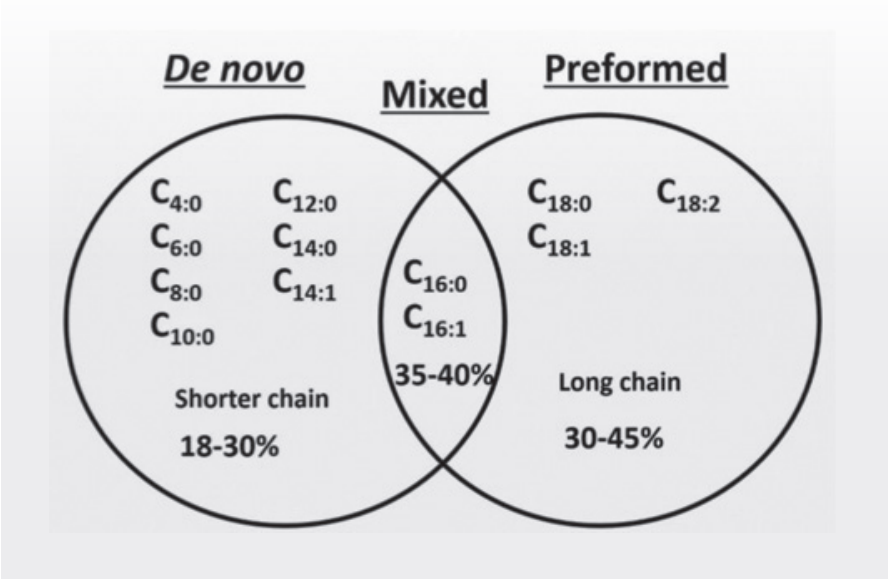
2 PREFORMED FATTY ACIDS: These fatty acids come from feed, are synthesized by microorganisms in the rumen, or result from the mobilization of the cow's body fat reserves (particularly important in early lactation). Preformed fatty acids make up 30 to 45% of milk fat.

3 THE MIXED FATTY ACIDS: They represent 35 to 40 % of the fatty acids contained in milk fat. These include fatty acids of 16 carbons, of which approximately half are from *de novo* origin, and the other half are preformed. Mixed and preformed fatty acids derived from feed transit through the digestive tract, are released in the bloodstream and then absorbed by the mammary gland, before being secreted into milk.

HOW ARE FATTY ACIDS ANALYZED?

The traditional method for analyzing the fatty acids contained in milk is gas chromatography. This type of analysis costs $150 per sample and takes about 4 h. At

FIGURE 1: FATTY ACIDS BY ORIGIN



Valacta, the fatty acid content can now be analyzed by infrared spectroscopy, at the same time as the standard milk components (fat, protein, lactose...). This testing method is faster (6 s per sample, or up to 600 samples per hour), and costs less than the gas chromatography analyses conducted in research stations.

WHAT ARE THE FACTORS THAT INFLUENCE THE FATTY ACID CONTENT OF MILK?

One of the major challenges of using the milk fatty acid profile is the need to consider all of the factors that cause it to vary. Among those that have been shown to have the greatest impact on the profile are genetics, breed, stage of lactation, ambient temperature, rumen conditions (pH), amount of concentrates fed, metabolic status, feeding management, and cow comfort.

HOW CAN THIS DATA BE USED?

Analysis of the fatty acid profile of milk will provide a more precise interpretation than fat alone. For example, in the case of a herd with slightly low fat levels, a profile analysis will show if the problem is due to a low concentration of *de novo* fatty acids (pointing to a lack of precursors, fibre that is less digestible than indicated on paper, low rumen pH) or to a low proportion of preformed fatty acids (indicating lean cows that have depleted their body fat reserves). Another example: an undetected change in forage could lead to a slight weight loss in cows if it were less digestible. If the fatty acid profile was monitored in the bulk tank every other day, an increase in preformed fatty acids could serve as a warning for the producer and the nutritionist, and it would be noticeable before the fat test begins to drop.

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The analysis of milk fatty acid profile could also be used to more precisely assess the effectiveness and profitability of changes in feeding strategy or the addition of some specific additives.

Finally, more on an individual cow basis, it will likely be possible to establish a link between the milk fatty acid profile and ruminal pH, and then use a milk sample to find out what is going on in the rumen in order to maximise performances.

CONFIRMED PRACTICAL APPLICATIONS

The few studies that have been conducted to date on the fatty acid profile of commercial herds have yielded extremely interesting findings. A recent study conducted in the United States (Woolpert et al., 2017) showed that dairy herds with a high level of *de novo* fatty acids also had higher milk component levels than herds that had a low level of *de novo* fatty acids. Moreover, the study demonstrated that cow comfort and feed management have a significant impact on the milk fatty acid profile. In fact, herds with high levels of *de novo* fatty acids were 10 times more likely to have access to adequate feed bunk space (>18 in./head), and 5 times more likely to have a stall occupancy rate below 110%. Likewise, the managers of these herds feed the ration at least twice per day, effective fibre content of the total ration was higher (≥ 21% ADF), while total fat level was lower (≤ 3.5%).

THE PASSION TO DO MORE... TO IMPROVE THE HEALTH AND PERFORMANCE OF OUR COWS

Once benchmarks have been established Quebec farms, the fatty acid profile will make it possible to assess and improve feeding and herd management strategies to maximize cow health and milk production. The fatty acid profile is an additional tool that will enable producers and advisors to do more – because milk is our passion!