Analyses of Free Fatty Acids in Milk

- Used extensively in Norway on single cow/goat level as well as on herd level

In Norway free fatty acids has routinely been analyzed with FTIR on payment samples as well as on single cow and goat samples for 8-10 years now. A part from replacing organoleptic tests in Norway, it is also widely used to monitor correct feeding and energy supply to the animals and the parameter has also been used when improving taste and coagulation properties of especially goat milk.

This article is based on an interview with Liv Sølverud from TINE Dairies who is responsible for part of the Norwegian advisory service to dairy cow and goat farmers as well as she is involved in the analyses done in the laboratories.

Veterinarian Liv Sølverud
FFA analyses replaced traditional organoleptic test 8-10 years ago

8-10 years ago when the labs in Norway started analyzing all samples, payment as well as single animal samples, on the new MilkoScan FT6000, extensive tests were carried out in order to see to which extent the free fatty acid calibration could be used to improve the quality of Norwegian milk.

This resulted in replacing the traditional, very tedious and labor intensive organoleptic test with the new much quicker analyses on FT6000. A sufficient share of the samples with off-flavor were caught by the use of the FFA calibration so today the only “organoleptic test carried out routinely is carried out by the truck driver. He is obliged to do a sensory test before loading and taste the milk before unloading. For this purpose a pasteurizer is used to create one small for the entire truckload. If the truck driver identifies off flavor a full organoleptic test will be carried out on all bulk samples belonging to this truck to identify from which farm the off flavor sample comes.

FFA analyses can be used to test failures in milking procedures

It is well known that to rough mechanical treatment of milk during milking or transportation, especially if combined with low hygiene, will cause an increase in the level of free fatty acids in milk. It will damage the membrane of the fat globules so the lipase(s) can attack the triglycerides. Therefore FFA analyses are used in a number of countries, and in Norway too, to detect if there are failures in the procedures on the farm which will lead to reduced shelf life of the milk as well as off flavor. The experience is that very often, when FFA is high, then there is a technical problem on the farm and once corrected, the FFA level will be back on a normal level again.

FFA analyses are made on herd and single cow level

If a technical problem cannot be found, it can also be the feeding which causes the elevated FFA level. To put focus on this aspect, FFA has also been analyzed on milk recording samples for many years. Experience is that if the energy supply is too low or too high, - for various reasons then FFA levels will increase. Therefore adequate energy
supply, adequate body condition, - and hence body condition scoring of the herd are seen as good tools for fighting high FFA levels too! To detect this problem it is obvious that analyses on single cow samples will be a big help to the farmers as well as to the consultant. Another observation from the field in Norway is that sick animals, - especially if mastitis but also other diseases frequently results in elevated levels of FFA. One explanation when talking mastitis, may be that the synthesis in the alveolus is disturbed, - but for other diseases it may also be caused by a decreased feed uptake, - which may again result in a negative energy balance.

**FFA and transportation over long distances**

Though distances can be very big between farm and laboratory, samples for payment analyses are transported under cooled conditions and usually reach the lab within 36 hours and here analyzed the same day. So her experience is that no significant changes occur during transportation. However, for milk recording samples, the age of the sample may be up to 4 or even 5 days, - and though preserved with bronopole, this challenges the value of an FFA analysis on the samples. Here Liv Sølverød argues that if the level of FFA is low when starting out, then it stays rather stable on a low level, - whereas a higher level will be unstable and increase during transportation. This may not be easy to explain all farmers, but as these samples are not used for payment but for management purposes this is not a big issue! And we do experience that the individual FFA analyses really are useful information doing advisory service on nutrition, both for cows and goats, Liv Sølverud argues.

**FFA used in a breeding program for goats**

Cheese from goats is an important part of dairy products in Norway. However, until recently there have been quite some challenges with some of the milk from Norwegian goats which had quite a bad taste and very bad coagulation properties. During a research project it was found that this was caused by some of the goats having very high FFA levels in the milk and also bad coagulation properties.

A breeding program was made, - semen from French goat was imported and the goats with high content of FFA in the milk were culled. At the same time corrective measures have been made on feeding in order to avoid under- and over feeding during lactation.
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Now, 6 years later, the taste of goat milk and goat cheese in Norway has improved significantly, and analyses of FFA in the milk was an important parameter in the program. Both the quality of the cheeses as well the taste of the cheeses, has improved. And so has the shelf life as well as the taste of the goat milk.

Whereas the frequency for analyzing FFA in goat milk usually is 3-5 times per year, it is 6-8 times per year for cows, - though the farmers do have the possibility to influence the frequency. On bulk samples the FFA is analyzed 2 times per month but in 2014 this will increase to times per month.