

## Within and across breeds differences in fatty acids profiles of milk and milk fat

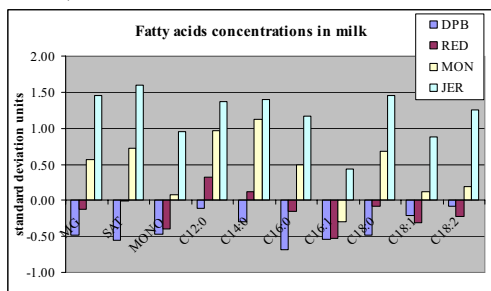
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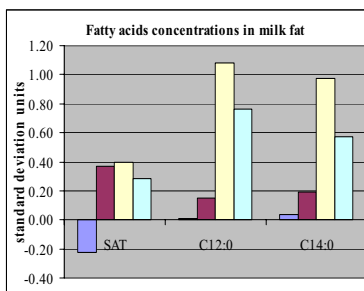
**Introduction** Many studies were already focussing on ways to improve the nutritional quality of milk fat. The most popular way to improve nutritional quality is by feed supplementation; however these methods present certain disadvantages. Most important is that this improvement is not sustainable. If the supplementation stops, the nutritional quality disappears. A genetic improvement however is complementary to feeding and has the additional advantage to create additional value for the animals through selection. However studying the genetics of nutritional quality of milk fat requires a lot of data. The objectives of this study were to use medium infrared spectrometry to get this data and, by using these predicted quantities of fatty acids in milk and milk fat, to study the differences in fatty acids profiles of milk within and across breeds.

**Materials and methods** After a phase of calibration, the composition of fatty acids in milk and milk fat were estimated by medium infrared spectrometry. A total of 600 milk samples produced at different test-days by 275 cows from 5 different breeds (Dual Purpose Belgian Blue (DPB), Holstein-Friesian (HOL), Jersey (JER), Montbeliarde (MON) and non-Holstein Red and White (RED) were analysed. The differences in fatty acids profiles of milk and milk fat and in delta-9 desaturase activity (C14:1/C14:0, C16:1/C16:0, C18:1/C18:0) within and across breeds were modelled. The following single trait mixed model was used:  $y = X\beta + Zu + e$  where  $y$  is the vector of the analysed trait (fat, fatty acids contents in milk or milk fat or the delta-9 desaturase activity indicator traits),  $\beta$  is the vector of fixed herd\*test date, number of lactation, stage of lactation and regressions on breed composition effects as a lot of animals were crossbred, when fatty acids contents in milk fat were analyzed a regression on milk fat percentage was added;  $u$  is the vector of random repetition on animal effect;  $X$  and  $Z$  are incidence matrices. Animals were considered unrelated as tests using the relationship matrix and separated genetic and permanent environmental effects did not converge. Computations were done with SAS PROC MIXED, and variance components were estimated using REML. Results for regression on breed composition were reported compared to the reference Holstein breed. In order to allow comparisons across traits, differences were expressed on a standardized scale by dividing them by the total standard deviation obtained as the square root of the sum of the animal and residual variances. Animal repeatabilities reflecting the degree of within breed differences were estimated from the ratio between animal and total variances.

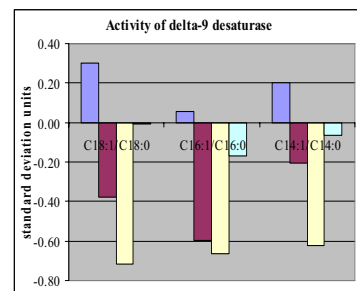
**Results** By comparing total milk fat with fatty acids on a standardized scale one notices that the values obtained were not constant. For example, DPB had the lowest concentration in milk fat, however results were clearly lowest for saturated and monoinsaturated fatty acids in milk. Also the concentrations in C18:1 and C18:2 9-cis, 12-cis obtained were not the lowest concentrations for these fatty acids (Figure 1). Therefore, the proportion of insaturated fatty acids in milk fat might be high. In fact, the fat of DPB contained the lowest proportion in saturated fatty acids (SAT) (Figure 2). These observations might be explained by the higher activity of delta-9 desaturase for this breed (Figure 3). Similarly, the fat of RED and MON contained a high proportion of SAT. This might be explained by a low delta-9 activity. Few publications have compared the fatty acids compositions for milk produced by different breeds. A publication indicates that the proportion of SAT in JER milk fat was higher than the one produced by the HOL animals (Palmquist *et al.*, 1992), a result that our results confirmed.



**Figure 1** Differences in fatty acids composition in milk (standardized units) compared to Holsteins.



**Figure 2** Differences in fatty acids profiles in milk fat (standardized units) compared to Holsteins.



**Figure 3** Differences in activity of delta-9 desaturase (standardized units) compared to Holsteins.

To estimate the differences within breed, the repeatabilities for all studied traits were estimated and the obtained results were high with values between 43 and 61 %. Future studies should show if this is also an indication for reasonable high heritabilities.

**Conclusion** The differences in fatty acids profiles of milk across the selected breeds have been shown by this research. It might suggest the possibility to obtain milk products with differentiated nutritional quality by the choice of breed. By the estimated repeatabilities, the differences within breed have also been shown. These might suggest a high heritability for each component of fatty acids profile and allow their genetic improvement.

### Reference

Palmquist, D.L., Beaulieu, A.D. 1992. Difference between Jersey and Holstein cows in milk fat composition, *J. Dairy Sci.* **75** (Suppl. 1):292 (Abstr.).