Validation of equations to predict milk fatty acids in commercial Irish cows

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Introduction

Milk fat of dairy cows typically contains 70% saturated fatty acids (SAT) and 30% unsaturated fatty acids (UNSAT). Large variation in this 70:30 ratio exists (Mc Parland and Berry, 2010). Because of the prohibitive costs of measuring fatty acids (FA) in milk, routine estimates of the ratio of SAT to UNSAT in commercial cows are not freely available. Recently equations were developed to accurately predict the level of FA in milk from mid-infrared spectroscopy (MIR) using data from commercial cows in Belgium and Luxembourg as well as cows from research herds in Scotland and Moorepark (Soyeurt *et al*., 2010). The objective of this study was to validate the accuracy of the developed prediction equations on a random sample of commercial cows from the Irish national herd.

Materials and Methods

Milk samples (n=143) were obtained from the Dairygold Cooperative Society Limited during June 2010. Dairygold operate a commercial milk recording service, and the milk samples obtained were from a random selection of cows representative of several herds within the Munster region of Ireland. All milk samples were analysed using a MIR spectrometer (FOSS Milkoscan FT6000). The resulting MIR spectrum obtained for each milk sample represented the absorption of light through the milk sample at 1,060 different wavelengths. Following MIR analysis, FA content of each milk sample was determined using gas chromatography, the gold standard method of determining the FA in milk. Results from the gas chromatography were considered the "true" measure of FA in the milk. The prediction equations developed by Soyeurt *et al*. (2010) were used to predict the level of 15 individual FA and 13 groups of FA (Table 1) in each milk sample. Product moment correlations and the bias between the true value for each FA and corresponding predicted values were undertaken.

Results and Discussion

The mean fat percent across all 143 milk samples was 3.93%, while the mean proportion of SAT and UNSAT in the milk fat was 66% and 34%, respectively. These results are similar to those previously presented from an Irish research herd (Mc Parland and Berry, 2010) and are more favourable than results shown for Dutch Holstein-Friesians (Stoop *et al*., 2009). Mean proportion of SCFA, MCFA and LCFA in milk fat were 9% 49% and 42% respectively.

All correlations between the true and predicted values of individual FA were moderate to strong and ranged from 0.54 (C18:2*cis*9*cis*12) to 0.97 (C8:0, C10:0) for individual FA. The mean correlation coefficient between true and predicted values of individual FA was 0.82. Correlations between true and predicted values of grouped FA were slightly stronger than the correlations for individual FA, and ranged from 0.63 to 0.99 (Table 1). The mean bias across all FA was -0.01 and ranged from -0.10 where FA were over-predicted (C18:1*cis*9), to 0.05 (SAT), where FA were under-predicted. The more abundant FA in milk generally had stronger correlations between true and predicted values, since the ability of the MIR to predict components in milk increases as the concentration of the component in the milk increases (Soyeurt *et al*., 2006).

Table 1. Correlation coefficient (r) between true and predicted levels of fatty acids or groups of fatty acids in milk

Fatty Acid	r	Fatty Acid Group	r
C4:0	0.91	C18:1 trans	0.77
C6:0	0.96	C18:1 cis	0.88
C8:0	0.97	C18:2	0.67
C10:0	0.97	Omega-3	0.63
C12:0	0.96	Omega-6	0.69
C14:0	0.96	Saturated	0.99
C14:1	0.72	Monounsaturated	0.95
C16:0	0.95	Polyunsaturated	0.83
C16:1 *c*[1]	0.62	Unsaturated	0.95
C17:0	0.85	Short chain	0.97
C18:0	0.84	Medium chain	0.98
C18:1 *c*9	0.87	Long chain	0.95
C18:2 *c*9, *c*12	0.54	Branched	0.76
C18:3 *c*9, *c*12, *c*15	0.59		
C18:2 *c*9,*t*11[2]	0.59		

[1] *c* = cis; [2] *t* = trans

Conclusions

Strong correlations between true and predicted values of individual FA and groups of FA indicate that the equations developed to predict milk FA are suitable for use on Irish commercial cows. The use of MIR technology to predict FA in milk allows for a quick and inexpensive method of determining the FA in milk at no extra cost over and above routine milk recording.

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References

Mc Parland, S. & Berry, D. P. 2010. In: Proceedings of the Teagasc National Dairy Conference. p.64-71

Soyeurt, H., Dardenne, P., Dehareng, F., Lognay, G., Veselko, D., Marlier, M., Bertozzi, C., Mayeres, P., & Gengler, N. (2006). *J. Dairy Sci. 89:3690-3695*

Soyeurt, H., Dehareng, F., Gengler, N., Mc Parland, S., Wall, E., Berry, D.P., Coffey, M.P. & Dardenne, P. (2010). *J. Dairy Sci. (In Press)*

Stoop, W.M., Bovenhuis, H., Heck, J.M.L. & van Arendonk, J.A.M. (2009). *J. Dairy Sci. 92:1469-1478*