003

Persistency of the effect of dietary milled rapeseeds on the milk fatty acid composition of lactating cows fed maize silage-based diets

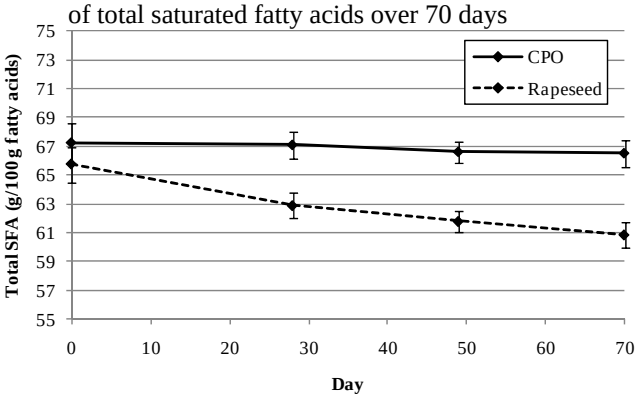
K E Kliem[1], K J Shingfield[2], A K Jones[1], D I Givens[1]
[1]University of Reading, Reading, United Kingdom, [2]MTT Agrifood Research Finland, Jokioinen, Finland
Email: k.e.kliem@reading.ac.uk

Introduction Including oilseeds in the dairy cow diet is an effective strategy to reduce milk fat saturated fatty acid (SFA) concentrations (Givens and Shingfield, 2006). However the rumen ecosystem requires time to adapt to dietary change. Time dependent changes in rumen fermentation and biohydrogenation of unsaturated fatty acids would be expected to alter both the supply of fatty acid precursors for de novo synthesis and long chain fatty acids available at the mammary gland. Most studies examining the impact of rapeseed supplements on milk fat composition have been conducted over relatively short periods. However, maintaining any favourable changes in milk fatty acid profile over an extended period is critical for commercial production of modified milk and milk products. Recent research (Givens *et al*., 2009) concluded that a mixture of milled rapeseeds and wheat was an effective supplement for lowering milk SFA content whilst minimising adverse effects on intake, rumen function and milk yield. The objective of this study was to assess the persistency of changes in milk fatty acid composition due to milled rapeseeds, over a 10-week period.

Material and methods Thirty multiparous, Holstein-Friesian cows (mean yield 40.8 litres/day, mean 79 days into lactation) blocked according to milk yield one week before the start of the study and randomly allocated to one of two dietary treatments according to a repeated measures randomised block design. Treatments fed over 70 days were a control diet (CPO) containing 41 g/kg dry matter (DM) calcium salts of palm oil distillate (Megalac®, Volac International Ltd., Royston, UK), or the same basal diet with Megalac® being replaced by 47 g/kg DM lipid derived from rapeseed milled with wheat. Diets were fed as a total mixed ration (TMR) with a 50:50 forage:concentrate ratio (DM basis) with the forage proportion consisting of 3:1 mixture of maize silage:grass silage. Daily DM intake and milk yield were recorded throughout the experiment. Milk samples collected on days 0, 28, 49 and 70 were submitted for fat, crude protein, lactose and fatty acid composition (Kliem *et al*., 2008). Data were analysed by ANOVA for repeated measures using the Mixed Models procedure of SAS, with a model that included fixed effects of treatment, day and treatment x day interactions and random effect of block. To assess persistency, changes in response to each treatment between days 28 and 70 were compared.

Results There was no effect (P>0.05) of treatment on DM intake, milk yield or milk composition. However milk yield decreased (P<0.001) over time for both diets, and DM intake and milk composition varied (P<0.05) over time. Replacing CPO with a rapeseed supplement enhanced (P<0.05) 10:0, 12:0, 14:0 and 18:0 and decreased (P<0.01) 4:0 and 16:0 concentrations leading to an overall reduction in total SFA content (Figure 1). The effect of milled rapeseed on total SFA was persistent over 70 days, with no difference (P>0.05) between days 28 and 70 for the CPO diet but a further reduction (P<0.05) between days 28 and 70 for the rapeseed diet. Rapeseed inclusion also enhanced (P<0.001) milk *cis*-MUFA content compared with the CPO diet, mainly due to increases in *cis*-9 18:1 concentrations. The increase in *cis*-MUFA due to rapeseed supplementation was found to persist (P<0.05) over the 70-day period. Concentrations of total *trans*-MUFA in milk fat were higher (P<0.01) in milk from the rapeseed-fed cows compared with the CPO diet, mainly due to enhanced concentration of *trans*-11 18:1. Effects of milled rapeseeds in the diet on milk *trans*-MUFA were maintained until the end of the 70 day study for the rapeseed diet. Total conjugated linoleic acid (CLA) concentration in milk fat was also greater (P<0.01) following rapeseed supplementation compared with CPO, an increase which persisted for 70 days, although the concentration of non-conjugated 18:2 isomers was lower (P<0.001) in milk from cows supplemented with rapeseeds.

Figure 1. Mean effect (n=15 per treatment) of rapeseed supplementation on milk fat concentration of total saturated fatty acids over 70 days



Conclusions Supplementing dairy cow diets with milled rapeseed resulted in a significant decrease in milk fat SFA (mainly 16:0) concentration, which was persistent for 70 days. The decrease can be attributed to both partial replacement of the CPO supplement (which has a high 16:0 content) with rapeseed lipids, but also inhibition of mammary de novo synthesis of 16:0 by long chain MUFA and PUFA from rapeseed. The enhanced effect of rapeseed supplementation after 70 days for total SFA and total *trans*-MUFA may reflect time dependent changes in rumen and mammary gland metabolism of fatty acids with advancing lactation.

Acknowledgements The authors gratefully acknowledge funding from the EU Framework 6 programme (LIPGENE)

References Givens, D. I., Shingfield, K. J. 2006. In Improving the Fat Content of Foods (Woodhead Publishing) 252-280.
Givens, D. I., Kliem, K. E., Humphries, D. J., Shingfield, K. J., Morgan, R. 2009. Animal 3, 1067-1074.
Kliem, K. E., Morgan, R., Humphries, D. J., Shingfield, K. J., Givens, D. I. 2008. Animal 2, 1850-1858.