

## Effects of feeding *Chrysanthemum coronarium* flowers to lactating dairy cows on milk fatty acid composition

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**Introduction** The presence of *Chrysanthemum coronarium* plants at 34% of pasture dry matter (DM) consumed by sheep increased milk fat *cis*-9, *trans*-11 conjugated linoleic acid (CLA) concentration (Cabiddu *et al.*, 2006). This was associated with an increase in milk fat *trans*-11 18:1 concentration, suggesting effects on rumen biohydrogenation. The *Chrysanthemum coronarium* plant is rich in 18:2 n-6 and 18:3 n-3 compared with other *Chrysanthemum* species (Cabiddu *et al.*, 2006), but other factors may be involved (e.g. coronaric acid; Earle, 1970). The objective of the present study was to determine the effect of feeding dehydrated *Chrysanthemum coronarium* flowers on milk fatty acid composition in dairy cows fed a typical commercial ration based on conserved forages.

**Materials and methods** Six multiparous lactating Holstein-Friesian cows averaging 39.5 litres milk/d at the start of the study were used in a simple cross-over design experiment with 2 treatments and 21 day periods that were separated by a 14 day 'washout' period. Treatments were a control diet (Con) and the same diet with dried, ground *Chrysanthemum coronarium* flowers added at 5% of ration DM (Chr), diluting other ingredients. The Con diet was a total-mixed ration containing on a DM basis: 24.5% grass silage, 18.5% maize silage, 4% grass hay, and 53% concentrate blend with minerals. Measurements of DM intake and milk yield and composition were obtained in the last week of each period. Data were statistically analyzed using Mixed Models procedures and a model testing fixed effects of diet and period and random effects of cow.

**Results** Fatty acid analysis indicated little difference between the diets fed, with the Con and Chr diets containing 8.4 and 8.0 g/kg DM 18:2 n-6 and 2.9 and 2.7 g/kg DM 18:3 n-3, respectively. Feed DM intakes increased ( $P < 0.04$ ) when Chr was fed (Table 1), in part due to a higher concentration of crude protein and lower concentration of neutral detergent fibre in the Chr diet. There was no effect on milk yield, milk fat concentration, or milk component yield, but milk protein concentration was higher when Chr was fed (29.8 vs 30.9 g/kg;  $P < 0.05$ ). Feeding Chr had little effect on milk saturated fatty acid (SFA) concentration (Table 1) apart from increases ( $P < 0.05$ ) in 4:0 and 6:0 and a tendency for a decrease ( $P < 0.10$ ) in 18:0. The concentration of milk fat *trans*-monounsaturated fatty acids (MUFA) increased ( $P < 0.05$ ) after feeding Chr (Table 1), mainly due to tendencies for increases ( $P < 0.09$ ) in concentrations of specific *trans*-18:1 isomers (6-8, 10, 12, 13-14 and 16 18:1, data not shown), but there was no difference in *trans*-11 18:1 concentration. Likewise there was no difference ( $P > 0.05$ ) between treatments in total and *cis*-9, *trans*-11 CLA concentration (Table 1). However, increases ( $P < 0.01$ ) in milk fat concentration of other CLA isomers were observed (e.g. 17.7 vs 27.6 mg *trans*-11, *trans*-13 CLA/100 g fatty acids and 7.4 vs 12.4 mg *trans*-12, *trans*-14 CLA/100 g fatty acids) when Chr was fed.

**Table 1** Effects of feeding diets containing 5 % *Chrysanthemum coronarium* flowers on feed intake, milk yield, and milk fatty acid composition (g/100 g fatty acids) in lactating dairy cows.

	Con	Chr	s.e.	P<
DM intake, kg/d	20.3	21.3	0.75	0.036
Milk yield, kg/d	33.3	33.9	0.99	0.630
Σ SFA	71.6	71.8	0.57	0.489
Σ <i>trans</i> MUFA	3.69	3.97	0.162	0.042
Σ <i>trans</i> 18:1	3.13	3.41	0.146	0.048
<i>trans</i> -11 C18:1	0.69	0.67	0.050	0.240
Σ CLA	0.52	0.55	0.030	0.127
<i>cis</i> -9, <i>trans</i> -11 CLA	0.37	0.38	0.027	0.602

**Conclusions** The results of the present study demonstrate that feeding dried *Chrysanthemum coronarium* flowers at 5% of ration DM (> 1 kg/d) had some effects on *trans*-monoene fatty acid concentrations in milk fat suggesting that rumen biohydrogenation had been modified, but in contrast to previous studies in grazing sheep, consumption of *Chrysanthemum coronarium* had no effect on milk fat *cis*-9, *trans*-11 CLA or *trans*-11 18:1 content. This may reflect the lower inclusion level in the present study, differences in the composition of the *Chrysanthemum* consumed, variations in the rumen environment and dynamics between cattle and sheep, or differences in the basal diets. Palatability was not a problem and in fact intake was increased by 1 kg of DM daily when dried *Chrysanthemum* flowers were added to the ration fed to these lactating dairy cows, and milk protein concentration was increased.

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### References

- Cabiddu, A., M. Addis, G. Pinna, S. Spada, M. Fiori, M. Sitzia, A. Pirisi, G. Piredda, G. Molle. 2006. The inclusion of a daisy plant (*Chrysanthemum coronarium*) in dairy sheep diet. 1: Effect on milk and cheese fatty acid composition with particular reference to C18:2 *cis*-9, *trans*-11. *Livestock Science* 101, 57-67.
- Earle, F. R. 1970. Epoxy oils from plant seeds. *Journal of the American Oil Chemists' Society* 47, 510-513.