

Rumen biohydrogenation-derived fatty acids in milk fat from grazing dairy cows supplemented with rapeseed, sunflower, or linseed oils.

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Abstract

The effects of supplementation with rapeseed, sunflower, and linseed oils (0.5 kg/d; good sources of oleic, linoleic, and linolenic acids, respectively) on milk responses and milk fat fatty acid (FA) profile, with special emphasis on rumen-derived biohydrogenation intermediates (BI), were evaluated in a replicated 4 x 4 Latin square study using 16 grazing dairy cows. The dietary treatments were 1) control diet: 20-h access to grazing pasture supplemented with 5 kg/d of corn-based concentrate mixture (96% corn; CC); 2) RO diet: 20-h access to grazing supplemented with 4.5 kg/d of CC and 0.5 kg of rapeseed oil; 3) SO diet: 20-h access to grazing supplemented with 4.5 kg/d of CC and 0.5 kg of sunflower oil; and 4) LO diet: 20-h access to grazing supplemented with 4.5 kg/d of CC and 0.5 kg of linseed oil. Milk fatty acids were converted to methyl esters and analyzed by gas-liquid chromatography and silver-ion HPLC. Dietary treatments had no effect on milk production or on milk protein content and milk protein production. Supplementation with rapeseed and sunflower oils lowered milk fat content and milk fat production, but linseed oil had no effect. Inclusion of dietary vegetable oils promoted lower concentrations of short-chain (including 4:0) and medium-chain FA (including odd- and branched-chain FA) and 18:3n-3, and higher concentrations of C(18) FA (including stearic and oleic acids). The BI concentration was higher with the dietary inclusion of vegetable oils, although the magnitude of the concentration and its pattern differed between oils. The RO treatment resulted in moderate increases in BI, including trans 18:1 isomers and 18:2 trans-7,cis-9, but failed to increase 18:1 trans-11 and 18:2 cis-9,trans-11. Sunflower oil supplementation resulted in the highest concentrations of the 18:1 trans-10, 18:1 cis-12, and 18:2 trans-10,trans-12 isomers. Concentrations of 18:1 trans-11 and 18:2 cis-9,trans-11 were higher than with the control and RO treatments but were similar to the LO treatment. Concentration of BI in milk fat was maximal with LO, having the highest concentrations of some 18:1 isomers (i.e., trans-13/14, trans-15, cis-15, cis-16), most of the nonconjugated 18:2 isomers (i.e., trans-11,trans-15, trans-11,cis-15, cis-9,cis-15, and cis-12,cis-15), and conjugated 18:2 isomers (i.e., trans-11,cis-13, cis-12,trans-14, trans-11,trans-13, trans-12,trans-14, and trans-9,trans-11), and all conjugated 18:3 isomers. The LO treatment induced the highest amount and diversity of BI without decreasing milk fat concentration, as the RO and SO treatments had, suggesting that the BI associated with 18:3n-3 intake may not be the major contributors to inhibition of mammary milk fat synthesis.