Effects of Feeding Camelina Meal on Milk Production and Composition in Lactating Holstein Cows

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Meal from Camelina sativa is potentially available from the oil and biofuel industry as a protein source rich in alpha linolenic acid (18:3n3) for the dairy cow. Currently the FDA restricts feeding of camelina meal to lactating cows based on glucosinolates present in the meal and potential transfer of their metabolites, isothiocyanates and/or nitriles, into milk. The objective of this work was to determine the effects of feeding camelina meal to Holstein cows on milk production, composition, content of glucosinolates and metabolites as well as thyroid hormone concentrations of serum. Cows (n=15) were randomly assigned to diets after blocking for parity and milk production. Camelina meal replaced canola meal at 0, 50, and 100% so rations contained 0, 7 and 14% of the diet DM as camelina meal. Total mixed rations were formulated to meet NRC requirements for cows producing 35 kg of milk per day. Cows were fed individually in tie stalls for 6 wk. Milk production was recorded daily to provide a weekly mean for d 35-42 and composition was tested on d 41 and 42 of feeding. Results were compared using Tukey's test. Milk production (30.5, 32.1 and 29.3 kg/d for 0, 7 and 14% camelina, respectively; SEM = 1.6) and milk protein percentage (3.2, 3.0 and 2.8% for 0, 7 and 14% camelina, respectively; SEM = 0.07) were unaffected ($P > 0.05$) by diet. Milk fat percent was lower ($P < 0.05$) in milk from cows fed 14% camelina meal compared to the other diets (3.8, 3.6 and 3.3% for 0, 7, and 14% camelina, respectively; SEM = 0.09). Camelina meal at 14% of diet DM reduced ($P < 0.05$) milk fat concentrations of 18:0 (10.8, 12.0 and 7.9 wt% fatty acid methyl esters (FAME) for 0, 7 and 14% camelina, respectively; SEM = 0.55), but increased ($P < 0.05$) 18:3n3 (0.1, 0.5 and 0.8 wt% FAME for 0, 7 and 14% camelina, respectively; SEM = 0.08), total 18:1 trans isomers (2.6, 3.5 and 6.8 wt% FAME for 0, 7 and 14% camelina, respectively; SEM = 0.56) and 18:2 cis9 trans11 conjugated linoleic acid (0.9, 1.1 and 2.3 wt% FAME for 0, 7 and 14% camelina, respectively; SEM = 0.20), relative to other diets. Camelina meal had no effect ($P > 0.05$) on 12:0, 14:0, 18:1 cis9 and 18:2n6 concentrations in milk fat. Milk samples from d 41 and 42 of feeding were also analyzed for glucosinolate and metabolite content via HPLC, LC-MS, GC and GC-MS. No glucosinolates or metabolites were detected in milk from cows fed 0, 7 and 14% camelina to the lowest detection limits. Blood samples were collected on d 42 of feeding with serum analyzed for thyroid stimulating hormone (TSH), triiodothyronine (T3) and thyroxine (T4) to consider possible effects of glucosinolates on metabolism. Concentrations of TSH (1.32, 1.30 and 1.31 ng/ml; SEM = 0.03), T3 (2.70, 3.33 and 1.72 ng/ml; SEM = 0.35) and T4 (103, 117 and 105 ng/ml; SEM = 3.46) for 0, 7 and 14% camelina, respectively, were not affected ($P > 0.05$) by diet. In conclusion, camelina meal supported milk production similar to canola meal without transfer of glucosinolates or their metabolites into milk as confirmed by a lack of effect on thyroid hormones and chemical analysis. Camelina meal also enhanced the unsaturated portion of the milk fatty acid profile which could potentially offer a healthier alternative for consumers.

Keywords: camelina, glucosinolates, Holstein cows, milk fat, milk yield, thyroid