Fatty acid composition of milk from Holstein cows fed fish oil, canola oil, or their combination in early lactation

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Introduction Supplementing the diet of cows with long chain unsaturated lipid decreased the medium chain fatty acids (10:0, 12:0, and 14:0) and increased the 18:0 and 18:1 content of milk fat with the greatest decrease when a high linoleic acid source was fed. Fish oil which contains relatively high concentrations of two polyunsaturated fatty acids of the n-3 family: eicosapentaenoic acid (EPA, C20:5) and docosahexaenoic acid (DHA, C22:6), is an effective means of increasing milk fat CLA content, due to an inhibition of *trans* C18:1 reduction in the rumen that results in an increased supply of *trans*-11 C18:1 available for endogenous conversion in the mammary gland. The combination of marine lipids with plant oils is an established strategy for increasing milk fat CLA content (Palmquist and Griinari, 2006). Lipids from canola seeds contain about 6% C16:0 and as high as 58% *ci*s-C18:1, which have potentially interesting characteristics to change fatty acids profile of milk fat. Our objective was to evaluate the effects of feeding fish oil and canola oil separately and in combination on the fatty acid profile of milk fat and on the yield and composition of milk from dairy.

Material and methods Eight multiparous early lactation Holstein cows (42±12 DIM, 40±6 kg daily milk yield) were fed a total mixed ration supplemented with either 0% oil (Control), 2% canola oil (CO), 2% fish oil (FO), or 1% canola oil + 1% fish oil (COFO), according to a double 4 × 4 Latin square design. Oils were added at a level of about 2% of dietary DM, resulting in a dietary ether extract content of 4.7%. Milk samples were collected at the regular milking time over a 48-h period at the last two days of each period and stored at -20°C until analysis for fatty acid composition using gas liquid chromatography (GC Younglin Acme 6000 column bpx70 100*0.25*250 micron SGE company. Using hexane, milk lipid extracted, then following extraction fatty acid methyl esters were synthesised using methanolic sodium. Methyl esters of fatty acids were analyzed by gas chromatography equipped with a flamed ionized detector and silica capillary column [30 m × 0.32 (internal diameter) with 0.25-µm film thickness] with hydrogen gas as the carrier gas. Data were analyzed as a replicated 4×4 Latin square using generalized linear model (PROC GLM, SAS Inst, Inc., Cary, NC).

Results The proportions of *trans* 18:1, *cis*-11 18:1, *trans*-10,cis-12 18:2, *cis*-9,*trans*-11 18:2 (CLA), 18:3, 20:5(EPA) and 22:6 (DHA) were affected significantly by oil supplemented diets (Table1, P<0.05).

Table 1 Milk fatty acid content in cows fed control, fish oil (FO), fish oil with canola oil (FOCO), or canola oil (CO) diet

Fatty Acids (g/100g fatty acids)	Treatments[1]				SE	p Value
	Control	FO	FOCO	CO		
18:1 *trans*	0.38[a]	1.57[b]	0.57[a]	0.58[a]	0.05	0.001
18:1 *cis*-9	22.2	23.53	22.75	25.53	1.06	0.22
18:1 *cis*-11	0.78[a]	0.84[a]	1.81[b]	1.12[b]	0.08	0.006
18:2 *trans*-9, *trans*-12	0.25	0.27	0.29	0.26	0.04	0.93
18:2 *cis*-9, *cis*-12	2.56	2.74	2.98	2.84	0.06	0.11
18:2 *trans*-10, *cis*-12	0.05[a]	0.3[b]	0.15[a]	0.06[a]	0.02	0.03
18:2 *cis*-9, *trans*-11 CLA	0.47[a]	1.05[b]	1.26[b]	0.88[ab]	0.09	0.03
18:3	0.44[a]	0.69[b]	0.60[b]	0.48[a]	0.01	0.009
20:5 EPA	0.05[a]	0.26[b]	0.17[b]	0.04[a]	0.001	0.03
22:6 DHA	0.04[a]	0.28[b]	0.14[b]	0.06[a]	0.01	0.04

Conclusion Milk fatty acid profile was significantly affected by diet containing fish oil and canola oil. AbuGhazaleh *et al* (2003) reported that the concentrations of cis-9, *trans*-11 CLA in milk fat increased when cows were fed the high oleic and high linoleic sunflower seed with fish oil. The results of the current experiment reveal that combining fish oil with canola oil positively improves fatty acid composition of milk fat.

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https://doi.org/10.1017/S2040470010004334 Published online by Cambridge University Press