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# Differential transport of *trans* fatty acids by bovine plasma lipoprotein fractions: 2. Fish oil and partially hydrogenated vegetable oil

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**Introduction** Fish oil (FO) either alone or in combination with vegetable oils results in increased concentrations of *trans* fatty acids (tFA) in duodenal fluid and milk fat. Our previous study demonstrated that infusion of partially hydrogenated vegetable oil (PHVO) or soya oil (SO) increased the tFA content of both HDL- and LDL- lipoprotein fractions, but responses varied according to fatty acid source. Because FO has a greater effect on rumen tFA yield than SO, we hypothesized that differences in blood FA profiles would be observed, particularly in 18:1 *trans* isomers. The objective of this study was to determine the effects of infusing oils that induce different concentrations of tFA, and to elucidate further which lipoprotein fractions are involved in tFA transport.

**Materials and methods** Two non-lactating Holstein cows (Live weight 778 ± 88 kg), each fitted with a rumen cannula, were used in a 2 x 3 Cross over design with 3 d infusion periods followed by 4 d washout interval between treatments to minimize carryover effects. Cows were fed on grass hay (7 kg/d) and concentrate (based on barley, sugar beet and wheat; 2 kg/d) and treated with bolus ruminal infusions of: 1) SO (control; 250 ml/d in 500 ml/d of skim milk; SM); 2) FO (Salmon oil: 250 g/d in 500 ml/d of SM) and 3) FO+PHVO (125 + 125 g/d, in 500 ml/d of SM). Blood samples were obtained prior to each infusion (0 h) and 1 and 3 h after infusion. Plasma was ultracentrifuged at 39,000 x *g* for 16 h (to separate VLDL-cholesterol fraction) and a further 20 h (to separate LDL- and HDL-cholesterol fractions) at 12ºC using a Beckman XL-70 ultracentrifuge. Fatty acid profiles of plasma and lipoprotein fractions were determined by gas chromatography. Data were analysed by repeated measures ANOVA to study effects of treatment, period, sampling day within period and infusion time within sampling day. Results presented are least-square means for each treatment because there was no interaction between treatment and period, day or time.

**Results** Compared with control, FO and FO+PHVO reduced ($P$<0.05) concentrations of saturated FA in plasma. Compared with control and FO+PHVO, FO reduced ($P$<0.05) concentrations of saturated FA in VLDL. Compared with control and FO, FO+PHVO resulted in higher ($P$<0.05) concentrations of monounsaturated FA in plasma and lipoprotein fractions. Compared with control and FO+PHVO, FO resulted in higher ($P$<0.05) concentrations of PUFA in plasma (Figure 1). Compared with control and FO+PHVO, FO resulted in higher ($P$<0.05) concentrations of VA in VLDL. Compared with control and FO, FO+PHVO increased ($P$<0.05) HDL concentrations of 18:1 *trans*-9 and *trans*-10, LDL concentration of 18:1 *trans*-9, and VLDL concentrations of 18:1 *trans*-5, *trans*-9 and *trans*-12 (Figure 2).

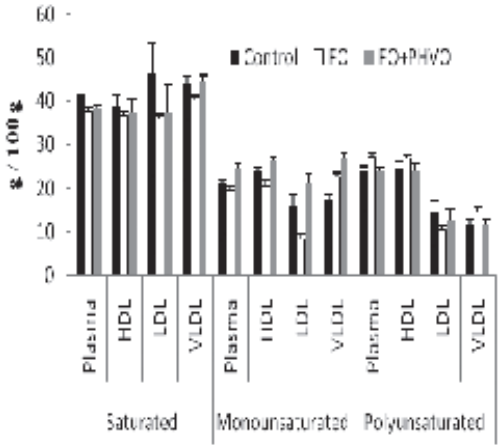


**Figure 1** Treatment effects on major fatty acid classes in plasma and lipoprotein fractions

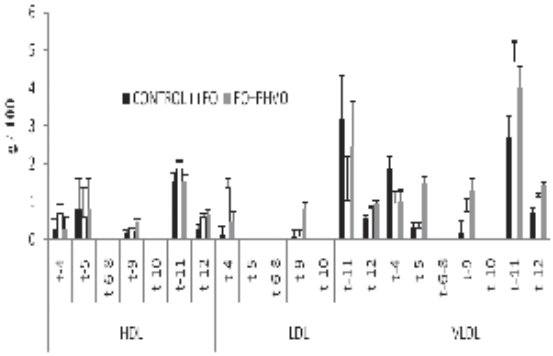


**Figure 2** Concentrations of 18:1 *trans* isomers in lipoprotein fractions

**Conclusions** Dietary lipid source influenced FA profiles of plasma, HDL, LDL and VLDL. Fish oil is rich in PUFA, which increase VA after ruminal biohydrogenation; PHVO contains a mixture of tFA isomers, which are not changed during rumen passage. The results showed that dietary lipid source influences tFA concentrations of plasma and lipoprotein fractions. This study suggests that the VLDL-cholesterol fraction is more responsive to supply of tFA. VLDL-cholesterol fraction appears to be the major fraction involved in transportation of tFA.

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