Effect of Emulsification on the Lymphatic Absorption of Alpha Linolenic Acid in Rats Fed Linseed Oil

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For several years, there has been a growing body of evidence on the implication of n-3 fatty acids, particularly polyunsaturated fatty acid (PUFA), on cardiovascular, inflammatory, neurodegenerative disease and cancer prevention. In order to increase PUFA bioavailability, we investigated the potential use of emulsified linseed oil for α linolenic acid (ALA) supply.

Emulsions based on linseed oil (47 wt% of ALA) and stabilized with soy lecithin were first characterized *in vitro* in gastrointestinal-like conditions. Large pH variations from 1.5 (stomach) to 7.4 (intestine) at the physiological temperature (37°C) induced an instantaneous oil globule coalescence, partially reversible under stirring when the external medium was further neutralized. Lipid oxidation measured by the amount of propanal (as a secondary oxidation product of n-3 PUFA) at 37°C during 48 hours showed that the emulsified state prevented ALA from oxidation compared with linseed oil in bulk phase. Lipid solubilization by bile salts (after lipase and phospholipase hydrolysis) was favoured by preliminary oil emulsification presumably due to the presence of lysophospholipids issued from lecithin hydrolysis.

We, then, compared the *in vivo* absorption of ALA in thoracic lymph duct-cannulated rats, after intragastric feeding of linseed oil emulsified or not. The kinetics study showed that emulsification favored ALA recovery in lymph: maximum ALA absorption in rats was significantly higher with emulsion (110% $\pm$ 4, at 2 hours) than with bulk linseed oil (93% $\pm$ 3, at 3 hours). These results could be correlated, at least partly, with the *in vitro* emulsion behavior especially the composition of lipid-bile salt mixed micelles. Moreover, the existence of a preformed interface in the case of emulsion might favor the hydrolysis step of interfacial enzymes such as pancreatic lipase and phospholipase A2. As a whole, this study pointed out that linseed oil emulsions could constitute an attractive material for the development of oral PUFA supplements with an increased bioavailability.