Synthesis of Structured Triacylglycerols Rich in Alpha Linolenic Acid for the Study of their Metabolic Fate in Rats

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Polyunsaturated fatty acids (PUFA) are known to play a major role on cardiovascular and inflammatory disease prevention. However, their *in vivo* metabolic fate is still under study, especially the question relative to the bioavailability and the influence of the tryacylglycerol (TG) structure. In this context, structured TG with α linolenic acid (ALA, 18:3 ω3) esterified either at the external or at the internal positions of the glycerol backbone were synthesized and given to thoracic lymph duct-cannulated rats to quantify ALA absorption. The main interest of this approach was to give TG containing ALA at only one specific position compared with studies using mixtures.

The synthesis of pure symmetrical and unsymmetrical TG was performed in three steps from glycerol. First, glycerol was transformed, in the presence of benzaldehyde, into a mixture of 2-Phenyl-[1,3]dioxan-5-ol and (2-Phenyl-[1,3]dioxolan-4-yl)methanol. The resulting mixture of alcohols was esterified with ALA, using dicyclohexylcarbodiimide as coupling agent and N,N-dimethylaminopyridine as catalyst. Acylated species were isolated with 96% yield. Then, one-pot, the ketal functions were removed and the resulting free alcohols esterified either with heptadecanoic acid (17:0) or oleic acid (18:1). TGs were recovered with moderate yields from the dioxan. From dioxolan, reaction proceeded with very good yields.

The bioavailability of ALA was tested in vivo in thoracic lymph duct-cannulated rats, after intragastric feeding of oil containing ALA esterified either at the internal position or at the external position. Heptadecanoic acid was used as a tracer to quantify ALA absorption since it represented only 0.3% of endogenous lymphatic fatty acids. The results showed that the two mixtures were absorbed with equal efficiency (100%). Thus, pure structured TG constituted a pertinent model system to study the metabolic fate of ALA.