**In vitro Lipolysis and in vivo Absorption of Omega-3 Polyunsaturated Fatty Acids According to their Chemical Form**

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**Context**

Omega-3 long chain-polyunsaturated fatty acids (n-3 LC-PUFA), such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are associated with health benefits. However, recent epidemiological studies have highlighted an insufficient consumption of n-3 PUFA in western countries, suggesting the necessity to improve n-3 PUFA bioavailability without increasing total lipid intake. Among factors influencing the fatty acid (FA) bioavailability, the chemical form of lipids, *i.e.* phospholipids (PL) or triglycerides (TG) is of major concern. In order to study the impact of the chemical form of lipids (TG vs PL) on EPA and DHA bioavailability, 3 different formulations were investigated in terms of their *in vitro* digestion and *in vivo* bioavailability in rats.

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### 1. Study design

3 formulations were designed to provide similar FA composition but different chemical structure: n-3 LC-PUFA were esterified either on TG, alone (TG n-3) or in combination with soya lecithin (TG n-3 + sup PL), or on PL alone (PL n-3).

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### 2.1. In vitro lipolysis

- **Gastric phase**: no lipolysis observed under rat lingual lipase with LC-PUFA
- **Intestinal phase**: Rapid increase of lipolysis level for TG n-3 and PL n-3
- Lower lipolysis when soya PL were added to TG n-3 (TG n-3 + sup PL)

- **Equivalent in vitro intestinal digestion of lipids regardless of the chemical form of n-3 LC-PUFA (PL vs TG)**

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### 2.2. In vivo absorption

**Absorption efficiency of n-3 LC-PUFA**

- EPA and DHA levels in total lymph lipids

**Incorporation of n-3 LC-PUFA into lymph lipids**

- EPA and DHA incorporation into lymph PL and TG

**Impact of the chemical form of n-3 LC-PUFA on lymph TG and PL structure**

**Conclusion**

*In vitro* digestion and *in vivo* absorption of EPA and DHA were similar regardless of the chemical form of n-3 LC-PUFA. Thus, marine PL were as well digested and absorbed as marine TG. Even if the incorporation of n-3 LC-PUFA into lymph lipids was not affected, their re-synthesis was modified. Indeed, according to their lipid form of intake (PL vs TG), differences in their absorption chemical form (FFA for marine PL or 2-MG for marine TG) led to different biosynthesis pathways. Thus, the consumption of n-3 LC-PUFA as PL led to an enrichment in EPA and DHA of the external positions of lymph TG. Impact on n-3 LC-PUFA post-intestinal bioavailability, tissue accretion and their bioactivity need to be confirmed.