

PhD offer

Physicochemical properties and bioaccessibility of omega-3 fatty acids of galactolipids from various vegetal sources

Context

Dietary consumption of omega 3 polyunsaturated fatty acids (n-3 PUFAs) is correlated to myriad of health benefits, in particular a diminution of risk of cardiovascular disease. However, majority of the global population has very low to low levels of blood eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) highlighting the absolute necessity of increasing the intake of these essential fatty acids. The traditional sources of n-3 PUFAs are fish oil. Nevertheless, the combination of the fishery overexploitation and the constant increase of worldwide population urge to find more sustainable food sources of n-3 PUFAs.

Glycolipids are omnipresent in the vegetal kingdom and carry up to 80% of plant fatty acids. Moreover, they are also the principal carrier of plant n-3 PUFAs, including alpha linolenic acid (ALA), EPA and DHA. As a consequence, they could be viable sources of n-3 PUFAs as alternatives to fish oils especially in the context of urgent calls for 2030 - 17 Sustainable Development Goals adopted by all United Nations Member States (<https://sdgs.un.org/goals>).

Concerning the metabolic aspects, the digestion of n-3 PUFA glycolipids remains mostly unknown. Indeed, the latest reviews only reported information on the bioavailability of n-3 PUFAs from phospholipid, triglyceride or ethyl ester forms.

Objectives

The gastrointestinal digestion of n-3 PUFA galactolipids could depend on the nature of the polar head carriers (monogalactosyldiacylglycerol, MGDG or digalactosyldiacylglycerol, DGDG) or the fatty acid chain length (ALA, EPA or DHA). The project will investigate both aspects using biophysical *in-vitro* and *in-vivo* models. The doctoral work includes the extraction and isolation of large quantities of n-3 PUFA galactolipids from terrestrial plant and microalgal sources, the studies of their interfacial behaviors, their *in-vitro* lipolysis and micellization (bioaccessibility) as well as their postprandial bioavailability in the rat. The vegetal sources are chosen based on their distinct n-3 PUFA profiles. Comparisons will be made with phospholipid and triglyceride forms. These studies will clarify the relationship between the physicochemical properties of galactolipids and their metabolic efficacy in terms of ALA, EPA and DHA provision.

Biochemical and biophysical works will be done at ISD laboratory (BIA, Biopolymères Interactions Assemblages), Nantes, INRAE. An *in-vivo* study will be done by a trained technician at the laboratory CarMen (Cardiovasculaire Métabolisme diabétologie et Nutrition) during the PhD period.

The findings of this project are of paramount importance in terms of nutrition, environment and commercial perspectives. Firstly, they are a key element to evaluate the health potential of n-3 PUFAs carried by glycolipids. Secondly, they will contribute to demonstrate the interest of exploitation of terrestrial and marine plants of low environmental impacts. Thirdly, they could stimulate economic interests for emergent industrial sectors (<https://www.veillecep.fr/2023/04/la-production-dalgues-en-europe-un-secteur-en-devenir/>).

Keywords

Omega 3, galactolipids, bioaccessibility, gastrointestinal digestion, microalgae

Academic supervision

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Thesis co-supervisor: Ha Phuong TA (haphuong.ta@inrae.fr) (BIA, INRAE, Nantes)

Required profile and selection criteria

- A MSc/Master 2 in chemistry, physical chemistry, biophysics or food science
- Autonomy, organization, planning and time-management skills
- Strong interest in bench work at analytical and preparative scale
- Experience in communicating science in English is highly appreciated (writing scientific papers, presenting results at international conferences)

Contract and application procedure

- Fully funded PhD for three years (2023-2026). The PhD student will be registered as a doctorate student at the doctoral school VAAME (Végétal, Animal, Aliment, Mer, Environnement), University of Nantes.
- Expected starting date: October 1st, 2023.

How to apply

Application should be submitted by email to both supervisors before 25th June 2023. The application should include 1) a curriculum vitae, 2) a cover letter, 3) transcripts of records for at least the final year of master and 4) names and contact details of at least two references.