

Microalgal Derivatives as Nutraceutical Supplements for Chemoprevention

Doctor of Philosophy in Life and Biomolecular Science

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ABSTRACT

Microalgae are mostly photosynthetic and unicellular organisms, being increasingly important given their biotechnological potential e.g., for human health or environmental sustainability. My Ph.D work is a contribution to this relevant field of research especially focusing on the human health outputs of microalgal biomass. The general aim of my three years-study was to explore at different levels the microalgal interests as chemopreventive tools to be further used in food complements, nutraceuticals or feed. My work presents an explorative study with on the one hand a bioprospecting analysis and on the other hand a deeper *in vitro* functional analysis of the chemopreventive assessment of the biomass/compounds on targeted human cell lines. Different extents of the bioprospecting survey were implemented comparing (i) the *in vitro* protective abilities of different carotenoids, (ii) four microalgal species, as well as (iii) contrasted biological or light conditions for cultivating microalgae. The microalgal models used in my thesis were: the two centric diatoms *Skeletonema marinoi* and *Cyclotella cryptica*, the eustigmatophyta *Nannochloropsis oceanica* and marine cyanophyta *Spirulina subsalsa*. Functional investigation was developed for the bioactivity assessment of the microalgal biomass through a combination of *in vitro* cell biology, molecular investigation and gene expression involved in cell death or more generally in immunologic responses. The cell lines selected in my work belonged to a large panel of normal or cancer cell lines corresponding to different organs (e.g., prostate, pancreas, lung). Another strength of my study is represented by the detailed illustration of the so-called bioactive capacity of the biomass, which is a combination of the bioactivity analysis with antioxidant activities and the comprehensive biochemical assessment with analysis of carotenoids, vitamins, polyphenols, together with the total proteins, lipids, carbohydrates, phytosterols, phenolic compounds and flavonoids.

Results indicated that the carotenoid diatoxanthin (typically found in diatoms) exhibited outstanding antioxidant, anti-inflammatory, and anti-angiogenic activities, thus resulting in great anticancer or antiviral properties. All the microalgal models that I studied during my work displayed strong human health benefits (anti-proliferative, anti-inflammatory, or anti-angiogenic) as characterized by *in vitro* bioactivity assessments.