

Abstract

In recent decades, growing scientific attention has focused on the role of food-derived bioactive compounds in maintaining health and preventing disease. Beyond their nutritional value, many natural food components exert specific biological activities that modulate key molecular pathways involved in chronic disorders.

These compounds, defined as nutraceuticals, represent a bridge between nutrition and pharmacology, as they combine dietary origin with measurable therapeutic potential.

This evolving perspective has shifted research interest toward the identification and characterization of novel nutraceuticals, particularly those derived from biodiversity-rich environments such as the Mediterranean basin.

The Mediterranean area, recognized as one of the world's most important biodiversity hotspots, represents an exceptional reservoir of structurally diverse bioactive molecules, derived predominantly from plants and traditional agri-food products that reflect the region's rich agricultural heritage.

The preservation and scientific valorization of this biodiversity are therefore essential not only from an ecological standpoint, but also as a strategic approach to discovering innovative health-promoting compounds.

Unlike conventional pharmacological therapies, which often act on single molecular targets and may cause adverse effects, nutraceuticals generally exert multi-targeted actions with a favorable safety profile. Their regular inclusion in the diet represents a proactive and sustainable preventive strategy, and growing evidence supports their role not only in disease prevention but also in modulating disease progression.

Chronic disorders, including cancer, intestinal inflammatory diseases (IBD), metabolic and hepatic dysfunctions, neurodegenerative conditions, and ultraviolet (UV)-induced skin damage, share complex and interconnected pathogenic mechanisms. These include oxidative stress, endoplasmic reticulum (ER) stress, mitochondrial dysfunction, altered redox homeostasis, and impaired cellular signaling pathways. The multifactorial nature of these conditions often limits the effectiveness of single-target therapies, highlighting the need for multifunctional bioactive compounds capable of modulating multiple pathways simultaneously.

Based on these premises, the present doctoral project aims to isolate, characterize, and biologically evaluate new phytocomplexes derived from traditional Mediterranean products and novel food sources. Through integrated *in vitro* and *in vivo* experimental models, this research seeks to elucidate the biochemical mechanisms underlying their protective and modulatory effects.

The ultimate objective is to contribute to the development of innovative nutraceutical strategies that support disease prevention and health promotion through a biodiversity-driven and mechanistically grounded approach.