Development of a Fermented Food with Antihypertensive and Immunomodulatory Potential

[1]Fabio Angelini, [1]Beatrice Pizzelli, [2]Giacomo Mantegazza, [1]Elena Pierallini, [3]Robin Duncan, [1]Simone Guglielmetti

f.angelini7@campus.unimib.it

[1] µBEAT Lab, Department of Biotechnology and biosciences (BtBs), University of Milan-Bicocca (Italy)

[2] Laboratory of Food Systems Biotechnology, Department of Health Sciences and Technology, ETH Zürich, Zürich, Switzerland

[3] Department of Food, Environmental and nutritional Science (DEFENS), University of Milan (Italy)

Keywords: Lactic Acid Bacteria, Indoles, Hypertension, Immunomodulation, Aminoacids, Nuts, Fermentation

Hypertension is a multifactorial condition strongly linked to chronic inflammation and endothelial dysfunction. Recent studies highlight how microbial metabolites derived from aromatic amino acids can modulate immune pathways associated with vascular inflammation. Building on this evidence, this project aims to develop a nut-based fermented food enriched in tryptophan-derived indoles and designed to support antihypertensive and immunomodulatory functions. A broad panel of lactic acid bacteria (LAB), isolated from different food matrices, was screened for their ability to convert tryptophan into indole derivatives. Strain growth, acidification profiles and viability were evaluated across multiple nut-based formulations, while indole production was quantified via LC/MS. These trials highlighted clear metabolic variability among strains, with several isolates showing consistent indole accumulation and good compatibility with the selected matrices. Ongoing work focuses on refining the most promising strain-matrix combinations and characterizing the presence of additional bioactive components, including potential ACE-inhibitory peptides. The biological activity of the enriched formulations will be assessed through in vitro cell lines models of endothelial function and cytokine modulation, followed by immunological assays to evaluate their influence on Th17/Treg balance. In the final phase, in vivo studies in hypertensive mice will explore the antihypertensive and immunomodulatory potential of the optimized product. Overall, this study outlines a multidisciplinary strategy integrating microbial metabolism, functional food design and immunometabolic readouts to develop innovative fermented formulations targeting inflammation-associated hypertension.