EVANGELIA KEREZOUDI obtained her Bachelor of Science in Nutrition and Dietetics from Harokopio University of Athens in 2018, followed by a Master of Science in Applied Nutrition and Dietetics – Molecular Nutrition from the same institution in 2020. Since then, she has been pursuing a PhD at the Nutrition-Gut-Brain Interactions Research Centre (NGBI) in the School of Medical Sciences at Örebro University.

This thesis investigates how dietary fibres influence intestinal barrier function and immune regulation, with a particular focus on β-glucans and rhamnogalacturonan-I (RG-I). The intestinal barrier plays a crucial role in gut homeostasis, serving as both a protective shield against external threats and a selective gateway for nutrient absorption. Its integrity is regulated by a finely orchestrated network of epithelial junctions, microbial communities and immune mediators, yet the mechanisms through which dietary fibres modulate this balance remain only partially understood.

To address this gap, this research employs a multi-layered experimental approach, integrating *in vitro* models, the *ex vivo* Ussing chamber method with human colonic tissue and a human dietary intervention. By examining how β-glucans and RG-I affect intestinal permeability, immune signalling and microbial metabolism, this thesis elucidates key mechanisms through which these fibres contribute to gut health. The findings demonstrate ability of these fibres to reinforce barrier integrity, counteract permeability disruptions induced by inflammation and bile acids, selectively shape microbial ecosystems and regulate immune responses. These results highlight the distinct bioactive properties of β-glucans and RG-I, positioning them as regulators of gut health beyond their conventional prebiotic role.

By moving beyond a microbiota-centred perspective, this thesis establishes a broader, systems-based framework for understanding dietary fibre functionality. The findings underscore the need for precision nutrition strategies that optimise fibre selection based on specific physiological outcomes rather than generalised microbiome alterations. Through this integrative perspective, the research advances the field of dietary interventions for gut health, immune modulation and metabolic stability, contributing to the development of next-generation functional food solutions.

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