

PhD: Food Science 40th Cycle

Title: Bioactive Compounds Obtained from the Fermentation of Agro-food Waste and Clinical Trials for the Evaluation of Beneficial Effects

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Objectives of the research project and interdisciplinary collaborations:

The food industry generates tons of production waste annually, leading to significant disposal costs. The valorization of waste products, with their reuse in other production processes, will mitigate the need for industrial waste disposal and reduce the use of new raw materials, ultimately promoting the development and enhancement of "secondary raw materials." The use of agri-food sector waste as a substrate for fermentation and the production of bioactive compounds is an insufficiently explored, but very promising field. The formation of bioactive compounds such as monacolin K and GABA through fermentation is an interesting process involving the action of specific microorganisms on organic substrates like agri-food waste. Fermentation is a versatile and old technique that allows the production of valuable bioactive compounds such as monacolin K and GABA, or other bioactive compounds that have beneficial effects on human health.

The objective of this PhD project is to obtain bioactive substances through the fermentation of waste, and subsequently extraction through green techniques, and formulation of dietary supplements through encapsulation, testing their effectiveness through a clinical trial. This clinical trial will be conducted with rigorous methodological control and ethical management of participants to ensure that the results are valid and applicable to the general population. Through a metabolomic investigation it is possible to obtain valuable information on the metabolic changes associated with the use of supplements, contributing to the understanding of human metabolism and therapeutic strategies.

Innovation and originality of the project in relation to the state of the art:

Currently, some bioactive compounds such as Monacolin K are produced through the fermentation of red yeast rice with environmental impacts that can be assessed along the entire production chain, from rice cultivation to fermentation, and distribution of the final product. Rice cultivation requires large areas of agricultural land, which can contribute to deforestation and the loss of natural habitats. Rice is a crop that requires large amounts of water for growth, often cultivated in flooded fields. This can lead to high water consumption and competition for local water resources. The use of pesticides and chemical fertilizers can lead to groundwater contamination, soil degradation, and reduced local biodiversity. The production of rice and the fermentation process generate organic waste that must be managed sustainably to avoid soil and water contamination. The use of agri-food sector waste as fermentation substrates contributes to the sustainable production of these bioactive substances within a circular economy strategy.

Grant availability:

- Research agreement with companies following a MISE project totaling approximately 50,000 euros
- PRIN project 000001_PRIN_PNRR_2022_T_CIRILLO_001_001€ totaling 113.375,00

Collaborations with foreign institutions:

Aristotle University of Thessaloniki - Department of Food Science and Technology, Faculty of Agriculture, Forestry and Natural Environment, School of Agriculture.