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MICROBIAL BIODIVERSITY AS A NEW GREEN AND SUSTAINABLE SOLUTION TO ENHANCE FOOD SAFETY & REDUCE AGRI-FOOD WASTES IN THE NEXUS APPROACH

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The actual global population growth drove energy and food resources towards an ever-stronger pressure. In recent years, an always increasing amount of **food wastes**, also related to **microbial spoilage**, resulted in a loss of food quality and microbiological safety. A strategy to reduce this safety concern and the corresponding food loss is represented by Nexus approach, that promotes the reduction in food waste and the optimisation of the production yields by using energy in a sustainable way. Moreover, the widespread consumers demand for natural and innovative foods directed the research towards the study of **new green and sustainable solutions**, such as **bio-preservation** and **bio-protection**.

Given these considerations, the three years of my PhD thesis were focused on the study and development of innovative strategies to improve the quality and microbiological safety and extend the shelf-life of fresh or fermented products. Moreover, this research project was part of the **PRIMA project**, financed in the frame of Section 2 - 2019, titled [BioProMedFood](#), that intended to provide **innovative low-cost solutions for local food chains** and promote **environmental sustainability of food productions**.

To achieve these goals, bio-active natural compounds, obtained from plant by-products or unconventional matrices (*i.e.*, brown algae), and bio-protective cultures, isolated from traditional naturally fermented sausages, were used for the valorisation of **Mediterranean biodiversity**.

Bio-active compounds were employed for their strong antimicrobial and antioxidant activities, while the mitigation of microbial spoilage and safety concerns was achieved by using **lactic acid bacteria** strains, due to their competition with spontaneous microbiota and foodborne pathogens and their ability to produce specific antimicrobial metabolites. Several spontaneous fermented sausages, collected from Italy, Slovenia, Spain, and Croatia, were used as a source of isolation of these autochthonous strains, representing an important cultural heritage of microbial biodiversity linked to the origin area.

The core of the project was represented by their screening for safety and technological features to select the best candidates to be applied in real food systems to achieve safety and food quality and to preserve product peculiarity. In fact, the typical characteristics of the traditional products can be impoverished by the application in the meat industry of commercial lactic acid bacteria strains as starter cultures, due to their limited number and standardised applications.

Thus, to guarantee food safety and environmental sustainability of agri-food systems, different **possible solutions** are available, such as the valorisation of traditional foods, with the aim to find new bio-protective or functional strains, and, on the other hand, the use of unconventional matrices and by-products as a source of bio-active compounds to reduce food wastes. These two strategies could be applied, also in combination, in food industry to maximise the bio-protective effects and **extend shelf-life of perishable foods**, maintaining their peculiar nutritional and organoleptic properties and reducing microbiological risks.

