Impact of "eco-friendly" formulation and production on the nutritional value of foods

in connection with Spoke 3: *Green manufacturing for a sustainable economy* (leader UNIBO) of the project ECOSYSTEM FOR SUSTAINABLE TRANSITION IN EMILIA-ROMAGNA

Research project

The agri-food sector is the number one driving force behind Italian industry. Compared to the contraction seen in two longstanding sectors of its manufacturing industry – fashion (-4.6%) and the automotive sector (-4.4%) – the latest report issued by Coldiretti, the Italian national farming federation, has announced an increase of 3% in the agri-food sector, based on ISTAT national statistics. Food has become Italy's main source of wealth thanks to its extensive agri-food supply chain, which stretches from fields to shelves to catering businesses and is worth €538 billion, the equivalent of 25% of the country's GDP, employing 3.8 million people. In particular, Emilia Romagna is a region rich in unique and inimitable food and wine traditions, forged by the encounter between quality, know-how and territory. The various agri-food sectors represent 12.5% of total exports from Emilia-Romagna.

Unfortunately, food production has a large environmental impact in several ways

- Food production accounts for over a quarter (26%) of global greenhouse gas emissions.[1]
- Half of the world's habitable land is used for agriculture.
- 70% of global freshwater withdrawals are used for agriculture[2].
- 78% of global ocean and freshwater eutrophication is caused by agriculture.[3]
- 94% of non-human mammal biomass is livestock. This means livestock outweigh wild mammals by a factor of 15-to-1.[4]
- 71% of bird biomass is poultry livestock. This means livestock outweigh wild mammals by a factor of more than 3-to-1.[5]

Tackling what we eat, and how we produce our food, plays a key role in tackling climate change, reducing water stress and pollution, restoring lands back to forests or grasslands, and protecting the world's wildlife.

"Eat local" is a common recommendation to reduce the carbon footprint of your diet. But, it's often a misguided one. Transport tends to be a small part of a food's carbon footprint. Globally, transport accounts for just 5% of food system emissions. Most of food's emissions come from land use change and emissions from their production on the farm. Thus, a most proper approach to the problem would be to innovate the food sector implementing and consolidating a green manufacturing environment oriented towards a sustainable and circular economy. As sustainable innovation is stimulated, it

becomes important to verify the nutritional value of the resulting foods as it is known that variations in formulation and processing can affect the quality of the final products. The ecological transition of the food sector is in fact fundamental both for the environment and for the consumer as long as the nutritional value of the food products is not compromised.

The purpose of this project is to evaluate the protein and lipid digestibility of food products that are made according to sustainability and circular economy criteria, and to compare the results obtained with the benchmarks. The nutritional value of a food is closely related to the digestibility of its proteins and lipids in the gastrointestinal tract as the extent of release of proteins and lipids from the food matrix and their hydrolysis during digestion determine the amount of end products (amino acids, small peptides and fatty acids) which are present in assimilable form for absorption.

The project will consider already commercialized foods or foods produced on a laboratory/pilot scale, all sharing "green economy" characteristics in formulation, production or packaging. Food samples will undergo *in vitro* static digestion according to the INFOGEST protocol. Total lipids will be extracted from not digested and digested foods and methyl esterified. The content and qualitative profile of fatty acid methyl esters (FAMEs) will be analysed by gas-chromatography, and their relative release evaluated. The entity of protein hydrolysis after in vitro digestion and the amino acid profile of digestate will be assessed by spectrophotometric, chromatographic and 1H Nuclear Magnetic Resonance (NMR) spectroscopy techniques. The above-described analysis will be also performed on traditional commercial benchmarks that will be used for comparison.

Activity plan

The activity plan of the project will be based on the following points:

- Selection of "eco-friendly" food products for analyses;

- Set up of the *in vitro* digestion system based on the foods to be analysed;

- Set up of detection methods;

- Evaluation of lipolysis after digestion in "eco-friendly" foods and corresponding benchmarks;

- Evaluation of protein hydrolysis after digestion in "eco-friendly" foods and corresponding benchmarks;

- Evaluation of amino acid profile after digestion in "eco-friendly" foods and corresponding benchmarks;

- Assessment of the nutritional value of "eco-friendly" foods compared to corresponding benchmarks.