**Driving pea and whey protein hydrolysis towards the development of hybrid beverages with improved foamability**

G Di Filippo1, N Innocente1, S Melchior2 and S Calligaris1

*1* *Department of Agricultural, Food, Environmental and Animal Sciences, University of Udine, Italy*

*2 Department of Human Sciences and Promotion of the Quality of Life, San Raffaele University, Rome, Italy*

The development of hybrid foods, in which animal proteins are partially substituted with plant proteins, represents a cutting-edge approach to intensify the utilisation of alternative proteins while limiting the use of animal ones. This approach leverages the strengths of both protein sources representing a strategy to improve the functionality of entirely plant-based food systems and to reduce the environmental footprint of those formulated with animal proteins1. Furthermore, these binary systems could also improve sensory and nutritional aspects, catering for the dietary preferences of health-conscious and/or flexitarian consumers, who seek to decrease animal protein intake without eliminating it2.

The design of hybrid foods is challenging, particularly because the limited technological properties and undesirable sensory attributes of plant proteins hinder their application as hydrocolloids in food products. Targeted modifications are necessary to unlock the full potential of plant proteins and maximise their functionality. Breaking proteins into fragments of different dimensions through enzymatic hydrolysis offers a promising strategy to steer protein functionalities allowing the development of functional and sustainable food products.

The present study aimed to optimise the enzymatic hydrolysis process to obtain hydrolysates of whey proteins (WPH) and pea proteins (PPH) which were then combined to formulate a hybrid beverage with enhanced foaming capacity. To this aim, proteins were hydrolysed by using Alcalase 2.4L at increasing hydrolysis degree. The samples exhibiting optimal foamability were selected to prepare WPH/PPH blends at different ratios (0:100; 25:75; 50:50; 75:25; 100:0). Foaming ability and stability measurements indicated that the 50:50 ratio exhibited the highest foaming properties. Subsequent analyses were conducted to characterise the interfacial and microstructural properties of the foam, aiming to elucidate the interactions between WPH and PPH within the hybrid system. A tensiometer was employed to measure interfacial tension, providing insights into the surface properties of the foam. Additionally, scanning electron microscopy (SEM) and confocal laser scanning microscopy (CLSM) were utilised to examine foam morphology at microstructural levels.

This work highlights the potential of enzymatic hydrolysis as a tool to steer the functional properties of proteins and the successful strategy of blending animal and plant protein sources for a foaming beverage formulation. By analysing the interactions between WPH and PPH, we aimed to deeply understand the combined and synergistic behaviour in product development.

*References:*

1 Silva, T. H. B., Baptista, D. P., Silva, K. K. D. P. E., Marfil, P. H. M. and Gigante, M. L. (2024). Hybrid high‐protein yogurt made with partial replacement of milk proteins by pea proteins. *International Journal of Food Science & Technology*, 59, 8806-8815.

2 Grasberger, K. F., Gregersen, S. B., Jensen, H. B., Sanggaard, K. W. and Corredig, M. (2021). Plant-dairy protein blends: Gelation behaviour in a filled particle matrix. *Food Structure*, 29, 100198.