Perspectives of protein bio-encapsulation to tailor its digestion kinetics in plant-based drinks

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Plant-based drinks are commonly emulsified systems containing purified macronutrients from plant origin. These drinks are nowadays greatly consumed because people are more aware of the impact of food on health, animal welfare, and the environment. The utilization of pea protein in these products is growing due to its high nutritional value, low allergenicity, and availability. Importantly, the macronutrient structure and accessibility significantly influence the digestive functionality of these drinks. In this regard, the goal of this project was to design plant-based drinks containing protein in two forms: dispersed and bio-encapsulated and at different ratios. The drinks were prepared by combining two independent streams: (i) basic drinks, containing dispersed protein from pea protein isolate (PPI), and high oleic acid sunflower oil (HOSFO), and (ii) individual pea cell (IPC) suspensions, containing bio-encapsulated protein. For all drinks, their overall composition was 5% HOSFO, 6% protein, 1% soy lecithin, and 88% water (w/w). The ratio of protein derived from IPC and PPI was modified, yet, the total protein content was kept constant (6%). All drinks were digested to study the impact of the protein structural organisation on proteolysis kinetics, as well as on the digestion kinetics of co-ingested lipids and starch (if present). The results showed that increasing the IPC content (5% versus 15%) significantly decreased the extent of protein (75% versus 68%, respectively) as well as starch (63% versus 47%) small intestinal digestion after 120 min. Moreover, drinks having a greater extent of proteolysis presented a greater extent of amylolysis. Finally, higher IPC content (15% versus 5%) presented a lower extent of gastric lipolysis (44% versus 56%) which was leveled out during the small intestinal phase (>80%).
Our findings confirmed that combining dispersed and bio-encapsulated protein, is an interesting approach to modulate macronutrient digestion kinetics. Increasing the content of bio-encapsulated protein in this particular case, resulted in a lower susceptibility of substrates to enzymatic breakdown. This might be a promising strategy in the design and formulation of liquid food products with slow/low macronutrient digestion for satiety effects and weight control purposes in tailored populations.