Research Abstract

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Topic: Protein folding, structure and function

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Structural shielding and functional preservation of bioactive peptides within self-assembled plant-protein nanocarriers.

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Rationale: Maintaining the structural integrity and conformational stability of bioactive peptides is a prerequisite for preserving their functional performance against proteolytic and environmental challenges. Within the 4EU+ BIOnanoDELY project, we develop plant-protein-based nanocarriers to encapsulate peptides derived from two legume protein sources: (i) β-vignin from cowpea (*Vigna unguiculata*), a 7S vicilin-type storage globulin hydrolyzed by pancreatin to mimic gastrointestinal digestion, and (ii) antifungal peptides from soybean (*Glycine max*) okara, a protein-rich by-product.
Methods: Peptides released by enzymatic hydrolysis are structurally flexible and highly susceptible to degradation during their delivery, which can compromise their bioactivity. Self-assembled nanoparticles of zein (maize prolamin) or pea seed globulins are biopolymeric matrices able to encapsulate peptides, are produced via anti-solvent precipitation and evaluated for encapsulation performance and structural stability providing structural shielding and enhancing resistance to proteolytic and environmental stress by modulating protein-peptide interactions.
Results: Functional outcomes develop along two complementary axes: for β-vignin-derived peptides, resistance to digestion and intestinal bioaccessibility to be evaluated using the standardized INFOGEST model and Caco-2 cells; for okara-derived peptides, antifungal efficacy of encapsulated formulations tested on relevant fungal strains.

Conclusions: By elucidating the relationship between protein–peptide interactions within these plant-based nanoparticles and their structural integrity, this work aims to establish a bio-derived delivery platform that links molecular structure and functional performance, while contributing to sustainable use of plant proteins within the agro-food system.
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