Association of endogenous phospholipids with pea globulins: effect on their structure and functionality

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While extraction methods aim to enrich plant protein fractions, residual lipids often persist. Phospholipids, with their amphiphilic nature and high surface activity, have the potential to significantly alter protein–protein and protein–interface interactions, and yet their contribution to protein structure and functionality remains poorly defined.
In this study, we report the role of endogenous phospholipids on pea globulins (legumin and vicilin) structure, solubility, heat stability and foaming properties. Globulins were extracted from both defatted and non-defatted pea protein concentrates and further fractionated by selective pH precipitation with borate buffer. Lipid analysis revealed that non-defatted globulins still contained ~7% lipids, predominantly phospholipids, with higher levels detected in the legumin-rich fraction than in vicilin.
Structural characterization using synchrotron radiation circular dichroism, nano-differential scanning calorimetry and small angle X-ray scattering showed that legumin had higher α-helical content and greater thermal stability than vicilin, regardless of lipid content. Furthermore, both legumin and vicilin showed monomers dissociation and unfolding with heating, before the formation of heat-induced aggregates, with no difference between the proteins extracted from defatted flour, compared to the non-defatted proteins. In spite of the identical structural features of proteins, the presence of the endogenous phospholipids reduced protein solubility, affected interfacial adsorption properties and impaired foaming performance. These results demonstrate that lipids are co-extracted with legumin and influence their interfacial behavior. By disentangling the effects of endogenous phospholipids from intrinsic protein properties, this study highlights the significant impact of co-extracted lipids on pea protein functionality. These findings underscore the importance of considering lipid–protein interactions when designing plant protein ingredients for targeted applications.

Keywords:
Pea protein; Legumin; Vicilin; Phospholipids; Lipid–protein interactions; Interfacial functionality

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