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Unlocking the biophysical properties of rapeseed storage proteins: tailoring innovative strategies for sustainable protein production

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Background:

Providing sustainable and nutritious food protein sources for a growing global population that is projected to reach 9.7 billion by 2050 is a significant challenge, especially given the predicted doubling of protein demand. Animal-based foods produce more greenhouse gases than plant-based foods, making it imperative to minimize the carbon footprint and bridge the protein gap. To address this challenge, the SEEDFOOD project aims to develop food products using seed proteins that have improved nutritional quality and functionality. Rapeseed, with its high protein content and excellent balance of essential amino acids, shows great promise as a protein crop. Due to its large-scale production, it could be a game changer in the shift from animal- to plant-based proteins.

Objective:

Rapeseed's two major storage proteins, cruciferin and napin, have distinct molecular properties and exhibit contrasting behaviours instead of complementary ones, hindering the creation of desired functionalities. To address this issue, our goal is to purify and conduct further studies on the biophysical properties of these proteins as well as understanding the varying characteristics of the different isoforms of these proteins.

Methods:

The presented study focusses on investigating the effect of different extraction and post-extraction treatments on purified cruciferins and napins. The biophysical properties of these proteins are examined using techniques such as high-performance liquid chromatography (HPLC), liquid chromatography-mass spectrometry (LC-MS), dynamic light scattering (DLS), static light scattering (SLS), and nano-differential scanning fluorimetry (Nano-DSF).

Results:

Preliminary results have shown that destabilizing effects of cruciferins and napins vary in response to changes in pH, salt concentration, treatment for the removal of phenolic compounds, and drying of the protein isolates. Further investigations into these findings will be presented at the conference.

Conclusions:

Rapeseed storage proteins exhibit varied responses to treatments applied during the processes of extraction, purification, and protein processing. As a result, it is essential to understand the effects of different treatments on the functionality of individual proteins. By doing so, we can tailor new methods with the end-use of the proteins in mind. This understanding will enable us to design innovative strategies that preserve and enhance the functional properties of the proteins, ultimately leading to the production of high-quality protein products that meet the demands of consumers while contributing to sustainable food production.