Effect of high pressure of homogenization in the functional and rheological properties of chickpea flour: focus on the behavior of starch and protein fractions

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Due to increasing global population and environmental concerns, the food system is partially replacing animal-based proteins with plant-based ones, as functional food ingredients or for producing meat analogues. However, their performances are often inferior to the animal ones. Emerging non-thermal technologies can be exploited with the aim of improving their functional properties by physico-chemical and structural modifications, opening a completely new scenario in their utilization as ingredients in the food sector.

The aim of this work was to investigate the effects of a non-thermal treatment, such as high pressure homogenization (HPH), on the functional and physicochemical properties of chickpea flour, focusing on the two main fractions, starch and protein. Whole chickpea flour was suspended in distilled water (1:3 ratio) and treated at different pressures (30, 60, 90 and 120 MPa) in a GEA Lab Homogenizer. After treatment, the samples were freeze-dried and sieved (<150μm) for further analysis. To assess the effects of the treatments, the functional (swelling/solubility index, oil/water adsorption, foaming/emulsion capacity and stability) and the rheological (pasting curves, frequency sweeps) properties of the whole flour were evaluated, while the specific effects on starch were studied based on the reducing sugars and the degree of damaged starch. Finally, the effects on the protein fraction were evaluated by solubility and absorption at 280 nm.

After treatment, the swelling index and water absorption increased significantly, especially for the 30 and 60 MPa treatments, while the oil absorption capacity and solubility index increased proportionally to the treatment pressure, peaking at 120 MPa. The pasting behaviour of the sample showed a significant decrease in peak and final viscosity, pasting temperature and holding strength for pressure higher than 60 MPa, while a slight improvement in peak temperature and final viscosity was observed when treated at 30 MPa compared to the untreated sample. These effects were attributed to changes in the starch and protein fraction of the flour, confirming the potentiality of HPH to generate ingredients with tailored functional properties.