
Extruded fava bean ingredients for dairy product application

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There is a growing demand from food sector for highly functional pulses-based ingredients. The functional and nutritional properties of pulses may be improved by processing using extrusion in order to create a wide variety of end-use properties. High protein content (32.5%) and well-balanced amino-acid composition make fava bean (FB) suitable for novel food ingredients. In this context, our objectives are to tailor functional and nutritional properties of FB ingredients using extrusion, and to elaborate innovative yoghurts analogs enriched with extruded FB ingredients. For this purpose, fava bean flour (FBF), starch concentrate (FBS) and protein concentrate (FBP) were processed by twin-screw extrusion for a large interval of specific mechanical energy (SME=100-3000kJ/kg). The pasting properties of extruded ingredients were evaluated by their viscoamylograms, and their emulsifying properties were assessed through oil-to-water emulsion droplet size. The protein digestibility was evaluated using a standardized in vitro static protocol (INFOGEST). Results showed that FBF and FBS ingredients extruded at a low SME presented the highest hot (500-700 mPa.s, respectively) and cold (1600-2000 mPa.s, respectively) paste viscosities, likely due to limited starch degradation. FBF and FBP display the lowest emulsion droplets size (13-40 μm respectively, vs $\sim 100 \mu\text{m}$ for FBS) due to their high protein content (33-68%, respectively), which makes them suitable as surfactants. Smaller the size of emulsion droplets, better the emulsifying properties. Extrusion increased the protein hydrolysis degree of ingredients during digestion, likely because of the inactivation of anti-nutritional factors, like trypsin inhibitors. Owing to its promising functional properties, the extruded FBF was selected to make yoghurts analogs. The FBF was blended with different proportions of classical yoghurt ingredients (cow-based skim milk and cream). A concentration of dairy (33 g/L) and fava (17 g/L) proteins of 50 g/L in yoghurt was found to be optimum for obtaining desirable texture: firm and adhesive (penetrometry), smooth and absence of grating sensation (sensory perception). The presence of a sufficient amount of starch (23 g/L), brought by FBF, is essential for the gel formation, before phase separation. These results highlight the technological and nutritional potentials of extruded FB ingredients. Digestibility properties of novel yoghurts will be investigated further.