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Title:

Exploring ultrasonication as a strategy for the sustainable improvement of fava bean protein functional and structural properties

Authors & affiliations:

Name and surname *Institution/ Department, University, Country*

Kinza Mukhtar, Chemical Engineering, University of New South Wales, Australia

Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word ONLY (place names excluded). No full stop at the end.
2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Fava bean protein isolate (FBPI) is a promising alternative protein source due to its high nutritional value and environmental sustainability. However, its limited solubility and functional properties restrict its broader use in food applications. This study explored the effect of low-intensity ultrasonication (LIUS) at 4% and 6% amplitude for (1–15 minutes) on the functional and structural characteristics of FBPI. The functional and structural differences were compared with other plant protein isolates, including pea, soy, and rice. Ultrasonication significantly improved FBPI solubility from 40% (control) to 92 %, especially at (3–5 minutes). Particle size was reduced, and more uniform dispersions were observed, indicating disaggregation of protein clusters. Emulsion stability index (ESI) increased from (19.5±0.62 to 39.1±18) minutes, while emulsifying activity index (EAI) remained unchanged. Surface hydrophobicity (Ho) increased markedly, suggesting partial unfolding and exposure of hydrophobic residues. Structural analysis using FTIR and microfluidic modulation spectroscopy technology showed a high beta sheet content in the native state of fava bean protein and an increase in β-sheets of all proteins on ultrasonication, indicating conformational changes. Intrinsic fluorescence intensity changed after sonication, confirming tertiary structure disruption.