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Title:

Influence of extrusion on fibrous structure, texture and digestibility of plant-based meat alternatives with faba bean protein and brewers' spent grain

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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

Replicating the fibrous texture and nutritional value of animal meat remains one of the greatest challenges in plant-based food innovation. This study investigated how extrusion parameters can be optimised to produce plant-based meat alternatives (PBMAs) from faba bean protein and brewers' spent grain (BSG), an upcycled brewing by-product, with the aim of achieving both meat-like structure and digestibility.

Formulations were processed under varying extrusion temperatures (130–160 °C) and screw speeds (100–300 rpm). Structural and textural properties were characterised through visual observation, scanning electron microscopy, cutting strength, and texture profile analysis. Digestive behaviour was evaluated in a dynamic in vitro gastrointestinal system, tracking gastric emptying, particle size, protein hydrolysis, and amino acid release.

Elevated extrusion temperatures and screw speeds promoted protein realignment, yielding well-defined fibrous layers that closely resembled chicken breast. Textural attributes, including hardness and chewiness, improved under these optimised conditions. Importantly, optimising fibrous structure did not compromise nutritional performance: PBMAs achieved protein digestibility and amino acid profiles comparable to chicken meat, directly challenging the perception that plant proteins are nutritionally inferior in terms of digestibility.

By combining a high-quality plant protein (faba bean) with an upcycled ingredient (BSG), this work demonstrates a clean-label, cost-competitive, and scalable pathway to next-generation PBMAs. The results emphasise how extrusion can be strategically applied to engineer fibrous microstructures that deliver both sensory quality and nutritional performance, advancing the design of sustainable foods that meet consumer and industry expectations.