

Development and Validation of Alternative Protein Product Portfolios: Technological, Nutritional and Sensory Assessment of 63 Pilot-Scale Food Prototypes



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The transition towards sustainable food systems requires alternative protein ingredients capable of delivering nutritional value, consumer acceptance, and industrial feasibility across multiple food applications. This study presents the development and characterization of 63 pilot-scale food prototypes formulated with 11 alternative protein ingredients within the LIKE-A-PRO project. Products were distributed across four categories: powdered food supplements, meat and fish analogues, hybrid meat products, and convenience foods. A broad range of processing technologies, including high-moisture extrusion, dry extrusion, gel extrusion, 3D printing, conventional meat processing and powder agglomeration, were successfully applied.

Comprehensive characterization included physicochemical properties, nutritional composition, amino acid profiles, microbiological safety, shelf-life stability and sensory performance. Many prototypes achieved nutritional claims such as high protein, high fibre, low sugar and omega-3 source. Microbiological quality was generally satisfactory, while sensory evaluation enabled identification of the most promising formulations for each product category. Fava bean, pea, microbial proteins and fungal-lentil ingredients showed particularly strong performance across multiple applications. The results demonstrate the technological versatility of alternative proteins and their integration into diverse food matrices without compromising product quality. This work provides a validated framework for industrial scale-up and supports the development of commercially viable, sustainable protein-based foods.

Recommendation: Before starting product development with alternative proteins, evaluate the functionality of different protein sources within the target food matrix rather than selecting ingredients based only on their nutritional profile.