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Functional and sustainable food innovation: incorporation of insect hydrolysates in tuna pâté

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Abstract:

The growing demand for alternative protein sources has led to an increased interest in insect-derived proteins due to their sustainability, high nutritional value, and functional properties. Many insect species contain approximately 60% protein and are recognized as a good source of other important nutrients, such as iron, zinc and calcium. Insect protein hydrolysates have demonstrated promising bioactive properties, including antioxidant, anti-hypertensive and anti-inflammatory effects, making them suitable for incorporation into food products. This study explores the development of a novel tuna pâté enriched with insect protein hydrolysate, aiming to enhance its protein content and assess its potential health benefits, as well as its behavior throughout gastrointestinal digestion.

The pâté was formulated using fresh tuna, dried tomatoes and the hydrolysate, in proportions that ensured an appealing texture and flavor for consumer acceptance. The insect hydrolysate used in this study contained 57.1% protein, with a significant proportion of low molecular-weight peptides: 47.35% within the 1–3 kDa range and 45.85% below 1 kDa. The incorporation of this hydrolysate into the pâté formulation is expected to improve not only its protein profile but also its bioactive properties, given that the hydrolysate exhibited antioxidant, anti-inflammatory, anti-obesity and anti-hypertensive activities. To evaluate the true potential of the pâté, protein stability and bioavailability after ingestion must be assessed. For this purpose, an *in vitro* gastrointestinal (GIT) tract digestion simulation was performed, following the standardized static digestion model of the INFOGEST 2.0 protocol. Post-digestion characterization included protein quantification to determine the impact of digestion on protein content and structure. Additionally, the bioactive properties of the digested product were evaluated, including antioxidant, antihypertensive, and antidiabetic activities, to assess its potential functional benefits.

This study contributes to the advancement of novel protein-rich foods, demonstrating that insect hydrolysates can be used to enrich food formulations, not only enhancing their protein content but also providing new properties that may align with EFSA health claims, contributing to the development of new functional foods. Additionally, insects serve as a sustainable protein source, addressing the global demand for alternative proteins and supporting sustainable development goals by potentially reducing the reliance on traditional protein sources. However, despite being consumed in several countries, insect-based products face acceptance challenges in Western markets due to consumer stigma. Therefore, it is necessary to overcome these barriers by increasing awareness and highlighting the nutritional and environmental benefits of insect proteins. Future work will focus on sensory analysis with a consumer panel to validate the acceptability of this innovative formulation, as well as on developing effective communication strategies to improve consumer acceptance of the product.

Keywords: Sustainability; INFOGEST; Bioactivities; Peptides; New-Food