

International FoodTec Conference

Shaping the Future
of Sustainable
Food Ecosystems



1st Edition '25

Interreg



Cofinanciado por
la Unión Europea
Cofinanciado pela
União Europeia

España - Portugal



Net4food

RED DE INVESTIGACIÓN E INNOVACIÓN
PARA EL SECTOR ALIMENTARIO

BOOK OF ABSTRACTS

-  Challenges and Opportunities in the Food System of the Transborder Region
-  Innovation, Technology, and Food Security in a Changing Global Landscape
-  Nutrition and Consumer Trends: Enhancing the Value of Endogenous Resources
-  Quality, Food Safety, and Environmental Responsibility
-  Marketing, Digitalization, and the Future of the Food Sector
-  Strategic Developments in the Net4Food Project

27th to 29th of October 2025

Bragança 2025

TECHNICAL DATA

Title

International FoodTec Conference – *Shaping the Future of Sustainable Food Ecosystems*

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ISBN

978-972-745-362-7

Edition

Instituto Politécnico de Bragança

Campus de Santa Apolónia,

5300-253, Bragança, Portugal

URL

<https://iftc.morecolab.pt/>

P3 | INNOVATIVE ALGAE-BASED MEATBALLS: NUTRITIONAL PROFILING AND FOOD SAFETY AS PILLARS OF SUSTAINABLE PRODUCT DEVELOPMENT

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Seaweed have gained increasing attention in the context of sustainable and health-promoting food innovation, particularly due to their rich micronutrient profile, including iodine, a nutrient of public health concern in many populations. This study aimed to develop and characterize innovative meatballs enriched with two edible seaweeds (*Undaria pinnatifida* and *Himanthalia elongata*), improving their nutritional profile while responding to consumer demand for functional and environmentally responsible food options. The formulations were designed to be commercialized raw and ready-to-cook. Therefore, a nutritional characterization of the raw products was conducted, while microbiological safety and sensory acceptability were assessed after preparation using two common culinary methods, roasting and sautéing, as proposed usage suggestions.

Proximate composition (moisture, protein, fat, ash, and dietary fibre) and other components (fatty acids and salt) were determined through standard chemical analysis, while iodine content was estimated based on ingredient composition. The energy value and available carbohydrates were calculated. Both seaweed-based formulations presented low energy (111 kcal/100g), low fat (≈ 2.6 g/100g), and high protein content (≈ 19 g/100g), with unsaturated fatty acids predominating. Dietary fibre values ranged from 1.65g to 1.92g/100g, and salt levels remained under 0.3g/100g. Notably, the wakame-based version provided substantially higher iodine levels (103.3 μ g/100g) compared to the sea spaghetti version (25.1 μ g/100g), enhancing its nutritional relevance.

Microbiological analysis of the cooked samples showed compliance with food safety standards, with pathogens such as *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli*, and *Clostridium perfringens* all below detection limits (<10 CFU/g). Total aerobic mesophilic counts ranged from 7.0×10^3 to 8.9×10^4 CFU/g; one sample with sautéed *Himanthalia elongata* showed elevated counts, highlighting the importance of handling and storage practices. Yeasts and molds were within acceptable thresholds across all samples. In sensory trials, the sautéed sea spaghetti and roasted wakame variants were the most appreciated by consumers, while the sautéed wakame and roasted sea spaghetti were less well received. These results underline the importance of preparation methods in shaping sensory perception and consumer acceptance.

This study demonstrates the feasibility of incorporating edible seaweed into meatballs, offering nutritionally rich, safe, and sensory-pleasing products. The use of seaweed, particularly wakame, presents a promising opportunity for iodine fortification, aligning food innovation with both public health goals and sustainability priorities.