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# FROM TUNISIAN CEREALS TO FUNCTIONAL NUTRITION: SUPPORTING CHILDREN WITH AUTISM

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## 1.CONTEXT OF THE STUDY

In Tunisia, Autism Spectrum Disorder (ASD) is estimated to affect approximately 200,000 individuals according to institutional reports, although official and comprehensive national epidemiological data remain limited and incomplete. Despite this relatively high estimated prevalence, nutritional management strategies remain underdeveloped and insufficiently tailored to the specific needs of this population.

In particular, there is a notable lack of functional foods designed to address the gastrointestinal disorders, dietary restrictions, and sensory sensitivities commonly observed in children with ASD. The availability of specialized food products, especially gluten-free or reduced-gluten options, remains limited in the Tunisian market. As a result, families often rely on imported products that are expensive and not always adapted to local dietary habits and cultural preferences.

This situation highlights the need for innovative, accessible, and culturally appropriate nutritional solutions. It is within this context that our approach is positioned, aiming to valorize Tunisian cereals in the development of functional foods that may improve digestive comfort, nutritional intake, and ultimately the quality of life of children with ASD.

## 1. R&D METHODOLOGY

This study focused on the development and optimization of a gluten-free bread for individuals with autism spectrum disorder (ASD).

A mixture design of experiments (DOE) was implemented using Minitab to evaluate 13 formulations based on rice, oat, and lentil flours, while all other ingredients were kept constant to ensure experimental reliability.

Standardized processing conditions were applied for all trials, including controlled sourdough fermentation and baking.

## 3.ENSURE THE QUALITY

Quality assurance was achieved through the use of standardized raw materials, controlled processing conditions, and reproducible experimental procedures.

All formulations were produced under identical conditions, and evaluated using physicochemical analyses including texture, color, density, moisture content, and baking loss to ensure objective comparison and reliable selection of the optimal formulation.

## 4.CONVIVIAL MEAL

Beyond nutritional optimization, the developed bread was designed to support sensory acceptability and ease of consumption in daily life.

The formulation aims to improve palatability, digestive comfort, and dietary adherence, contributing to a more inclusive and enjoyable eating experience for children with ASD.

## 5. CONCLUSIONS & PERSPECTIVES

This study highlights the potential of Tunisian cereal-based ingredients in the development of functional gluten-free bread adapted to individuals with ASD.

The optimized formulations showed promising technological and nutritional properties. Future work should include extended sensory evaluation, nutritional bioavailability studies, and clinical validation to assess the impact on health and quality of life.

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# FISH-FREE SIYADIYEH- A PLANT-BASED ADAPTATION FOR FISH-ALLERGIC CONSUMERS

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## 1.CONTEXT OF THE STUDY

**What is Siyadiyeh?**
**A Lebanese coastal classic — the fisherman's dish (from Arabic sayad, "fisherman"): white fish pan-fried and set over basmati rice cooked in a rich fish broth, built on a base of deeply caramelised onions and warm spices (cumin, cinnamon, turmeric, coriander), finished with toasted almonds or pine nuts.**

**Why fish allergy matters**
- **Prevalence: ~1% of the global population is affected by IgE-mediated fish allergy, rising to up to 7% in paediatric cohorts (Wai et al., 2025).**
- **The culprit protein: β-parvalbumin, a heat-stable, cross-reactive muscle calcium-binding protein that triggers reactions across most bony fish species.**

**Objective**
**Reformulate Siyadiyeh replacing fish and fish broth with plant-based analogues, while preserving the characteristic flavour profile — caramelised-onion depth, warm spice aroma, and umami richness — that defines the dish culturally and sensorially.**

## 2.R&D METHODOLOGY

**Replacing the fish fillet**
- **Cauliflower steaks: dense, sliceable, develops golden Maillard crust on pan-frying; meaty bite and visual resemblance to fish fillet on the platter.**
- **Coated in the same cumin-turmeric spice blend as the traditional fish; pan-seared in olive oil.**

**Replacing the fish broth**
**An umami synergy broth was designed exploiting glutamate–guanylate amplification:**
- **Dried seaweed: natural plant glutamate source, provides the oceanic-savoury base - Kombu**
- **Dried shiitake mushrooms: rich in guanylate (GMP); kombu + shiitake produces a synergistic 8× umami amplification vs. either alone.**
- **Caramelised onion base + spices: adds Maillard-derived sweetness and depth; rice cooked in this broth as in the traditional recipe.**

***Garnish: toasted almonds, pine nuts, parsley — identical to the traditional dish.***

## 3.ENSURE THE QUALITY

**Allergen safety**
- **Fish parvalbumin ELISA: confirms absence of β-parvalbumin in all reformulated components; target below detection limit (< 1 ppm).**
- **Cross-contamination audit: ingredient traceability review for hidden fish derivatives (seaweed verified fish-protein-free).**

**Physicochemical analyses**
- **pH: measured on the broth and the cauliflower; target pH 5.5–6.5 for optimal flavour perception.**
- **Color comparison: verifies the golden-brown crust of the cauliflower steak vs. the traditional pan-fried fish.**
- **Texture analysis : firmness and springiness of the cauliflower steak benchmarked against white fish fillet.**

**Sensory evaluation**
**Sensory panel: 9-point hedonic scale on aroma, colour, texture, umami depth, overall acceptability. Paired t-test α = 0.05 vs. traditional control.**

## 4.CONVIVIAL MEAL

**Siyadiyeh as a shared table**
**Siyadiyeh is a coastal celebration dish — a Friday lunch, a fisherman's homecoming, a special-occasion platter. Fish allergy forces exclusion from the centrepiece. The reformulated dish restores inclusion: one platter, every guest welcome.**

**Serving & accompaniments**
- **Cauliflower steaks plated over spiced basmati rice, topped with caramelised onions, toasted almonds and pine nuts.**
- **Served with traditional sides: tarator (tahini-lemon sauce), fattoush or tabbouleh.**
- **Suitable for vegan, vegetarian and fish-allergic guests simultaneously — broad inclusivity with zero flavour compromise.**

## 5.CONCLUSIONS & PERSPECTIVES

- **Fish-free reformulation achieved: cauliflower steak replaces the fish fillet; kombu–shiitake broth replicates the umami depth of fish stock. Make sure that the chosen seaweed does not contain allegens.**
- **Allergen safety confirmed: β-parvalbumin undetectable by ELISA; all ingredients verified free of fish-derived proteins.**
- **Sensory parity: colour, aroma, umami depth and overall acceptability comparable to the traditional dish ($p > 0.05$).**
- **Next steps: shelf-life study, nutritional profiling (protein, omega-3 gap assessment).**

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# SUGAR-FREE QATAYEF- A REFORMULATION STUDY FOR DIABETIC CONSUMERS

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## 1.CONTEXT OF THE STUDY

### Diabetes & the Lebanese sweet tradition

**Type 2 diabetes affects an estimated 14% of Lebanese adults. Traditional sweets such as qatayef are prepared with refined wheat flour and saturated in sugar syrup, a combination that drives sharp glucose spikes and effectively excludes diabetic consumers from a culturally central food.**

### Sugar is hard to remove

**Sugar is difficult to remove because it plays several key roles: it provides bulk and texture by binding water and softening the crumb, supports browning through the Maillard reaction for the golden crust and aroma, feeds yeast to create the characteristic qatayef surface bubbles, and helps preservation by lowering water activity, which extends shelf life and limits microbial growth.**

### Objective

**Develop a sugar-free qatayef whose sensory profile — appearance, aroma, texture, sweetness — is statistically comparable to the traditional product, while delivering a glycemic load suitable for diabetic consumers.**

## 2. R&D METHODOLOGY

### Sweetener system

**Three types of sweetners were selected to mimic sucrose multifunctionality while keeping the glycemic index near zero:**

- **Erythritol (GI=0): bulking agent, ~70% sweetness of sucrose, mild cooling effect.**
- **Stevia (GI=0 ): high-intensity sweetener (~250× sucrose), heat-stable.**
- **Xylitol (GI 7–13): sugar alcohol with 1:1 sweetness vs. sucrose; provides bulk, humectancy and soft crumb; non-fermentable by yeast.**

### Flour reformulation

**Refined wheat flour (GI ≈ 71) was partially replaced with two lower-GI flours:**

- **Whole wheat flour (GI=45): fibre, B vitamins, slower digestion.**
- **Oat flour (GI=25): β-glucan content shown to lower postprandial glucose response.**

## 3.ENSURE THE QUALITY

### Analytical methods

- **Benedict's test:** qualitative confirmation that no reducing sugars remain in the reformulated product.
- **Water activity ($a_v$):** measured with a calibrated hygrometer; target $a_v < 0.85$ to prevent microbial growth.
- **Moisture content:** oven-drying method (105 °C, AOAC 925.10); benchmark = traditional qatayef.

### Sensory evaluation

Triangle test (n=30) to detect differences vs. traditional control, followed by a 9-point hedonic scale evaluating:

- Appearance & colour, aroma, sweetness, texture, overall acceptability.
- Statistical analysis.

## 4.CONVIVIAL MEAL

### Restoring qatayef to the Diabetes table

Qatayef is a staple shared with family and neighbours. The reformulated product is designed to fit the same ritual without isolating diabetic relatives or forcing a separate menu.

### Suggested fillings & pairings

- Walnut – cinnamon filling: low GI, healthy fats, naturally low sugar.
- Reduced-sugar ashta with stevia and rose water replacing the classic syrup soak.
- Light orange-blossom syrup made with erythritol – stevia in place of sucrose.

## 5.CONCLUSIONS & PERSPECTIVES

- **Sucrose-free formulation achieved** using an erythritol – stevia – xylitol either alone or as a blend with whole wheat / oat flour, giving a low estimated glycemic load.
- **Quality benchmarks met:** negative Benedict's test, $a_v < 0.85$, moisture and texture comparable to traditional qatayef.
- **Sensory acceptance:** no significant difference detected by panellists for overall liking ($p > 0.05$).
- **Next steps:** in-vivo glycemic index measurement, shelf-life trial, scale-up to a Lebanese pastry partner, clinical pilot with type 2 diabetic volunteers.

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# GLUTEN-FREE, SUGAR-FREE KNEFEH- A REFORMULATION STUDY FOR CELIAC AND DIABETIC CONSUMERS

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Supervised by Dr. Reine Barbar & Dr. Samar Azzi | Department of Agriculture and Food Engineering, USEK

## 1.CONTEXT OF THE STUDY

**What is knefeh?**

**A traditional Lebanese dessert built on three pillars: a semolina-based dough, a melting cheese filling (akkawi or ricotta-type), and a hot sugar syrup soak that delivers the signature sweetness and moisture.**

**A double exclusion**

- **Celiac disease: ~1% global prevalence; semolina is wheat – gluten triggers villous atrophy and acute GI symptoms.**
- **Type 2 diabetes: ~14% of Lebanese adults; the syrup soak delivers a high glycemic load that triggers sharp postprandial glucose spikes.**

**Objective**

**Reformulate knefeh into a gluten-free, sugar-free version whose taste, texture and golden appearance remain comparable to the traditional product, while being safe for celiac and diabetic consumers.**

## 2.R&D METHODOLOGY

**Replacing the semolina dough**

- **Almond flour: naturally gluten-free, low GI, high in protein and unsaturated fats; provides nutty colour and rich flavour.**
- **Xanthan gum: polysaccharide hydrocolloid that mimics gluten's viscoelasticity, binds the dough and prevents crumbling. Dose: 0.25–0.5% w/w of flour.**

**Replacing the sugar syrup**

**A ternary sweetener system was selected to replicate the full sucrose function set with GI ≈ 0:**

- **Erythritol: bulk and viscosity carrier; ~70% sweetness of sucrose, mimics syrup body.**
- **Monk fruit (mogroside V): ~250× sucrose, heat-stable to 170 °C, no bitter aftertaste.**
- **Stevia (Reb-A 95%): complements monk fruit, rounds the sweetness profile, GI = 0.**

**Aroma carriers: rose water & orange blossom water preserve the cultural identity.**

## 3.ENSURE THE QUALITY

**Analytical methods**

- **Gluten ELISA: R5 antibody method (Codex limit < 20 ppm) to confirm gluten-free status.**
- **Benedict's test: qualitative confirmation of the absence of reducing sugars.**
- **Water activity ($a_v$): target $a_v$ < 0.85 to prevent microbial growth in the cheese-filled product.**
- **Colour comparison: verifies the golden surface despite no reducing-sugar Maillard substrate.**

**Sensory evaluation**

**Triangle test (n=30) to detect differences vs. control, then 9-point hedonic scale on appearance, aroma, sweetness, cheese pull, syrup absorption, overall liking. Paired t-test, α = 0.05.**

## 4.CONVIVIAL MEAL

**Knefeh as a shared experience**

**Knefeh is rarely eaten alone, it is a Sunday-morning kaak sandwich, a wedding dessert, a celebration centrepiece. The reformulated product allows celiac and diabetic family members to share the same plate, not a separate one.**

**Service & pairings**

- **Served warm with a light orange-blossom syrup made with erythritol – monk fruit – stevia in place of sucrose.**
- **Akkawi cheese desalted by traditional water bath; ricotta variant for a milder profile.**
- **Topped with crushed pistachios; paired with unsweetened Lebanese coffee.**

***One knefeh, one table — tradition kept, no one excluded.***

## 5.CONCLUSIONS & PERSPECTIVES

- **Dual reformulation achieved: almond flour + xanthan gum dough, erythritol – monk fruit – stevia syrup — both gluten-free and effectively zero-glycemic.**
- **Quality benchmarks met: gluten content < 20 ppm, negative Benedict's, $a_v$ < 0.85, texture and colour comparable to traditional knefeh.**
- **Sensory acceptance: traditional taste, cheese pull and aroma preserved through rose & orange-blossom water carriers.**
- **Next steps: in-vivo glycemic index measurement, shelf-life trial.**

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TRADINNOVATIONS

# SENSORY EVALUATION OF CHICKEN HALEEM SPREAD

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## 1. CONTEXT OF THE STUDY

To understand consumer acceptance and market viability.
Define the perceived flavor profile and nutritional perception

**Step 1: Soaking * Duration:** 6–8 hours.
**Scientific Purpose:** This step hydrates the grains and improves the gelatinization of starches during the cooking phase.
**Step 2: Base Preparation**
Sautéing the onions, spices, and meat to build the initial flavor profile.
**Step 3: Slow Cooking**
**Duration:** Traditionally 6–8 hours, though your adapted method used a 30-minute high-flame cook with ground lentils.
**Step 4: Mechanical Mixing**
Mashing or blending the cooked mixture breaks down the ingredients further.
**Scientific Purpose:** This creates a distinct fibrous meat texture while simultaneously achieving a smooth overall consistency.
**Step 5: Tempering (Tarka) & Final Preparation**
Applying a temper (Tarka) adds final aroma and gloss to the dish.
Garnishing with fried onions, coriander, and lemon juice completes the preparation.


## 2. SCIENTIFIC METHODOLOGY

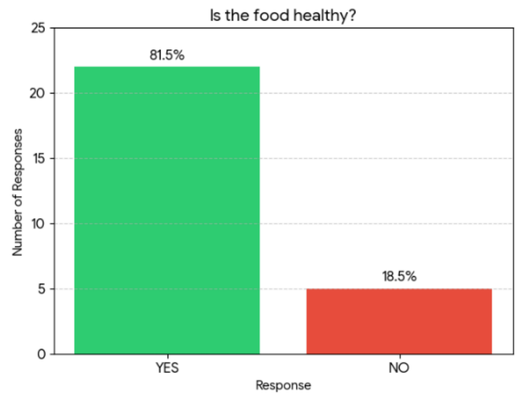
- **Slow cooking utilizes gentle heat** (75°C to 95°C) to safely unwind proteins without destroying their nutritional value.
- **It relies on a "moist-heat" method**, which creates a water barrier that prevents scorching and protects protein quality.
- **The gradual simmering process** allows tough meat fibers to relax and break down, yielding a highly tender and shreddable texture.
- **Lentils naturally contain phytic acid**, an anti-nutrient that binds to essential minerals in your digestive tract.
- **Soaking neutralizes this phytic acid**, successfully unlocking crucial minerals like iron, zinc, and calcium for your body to absorb.
- **Lentils also contain oligosaccharides**, which are complex carbohydrates that humans struggle to digest, often causing bloating.
- **Soaking leaches out these complex sugars**, making the lentils significantly easier on your digestive system.
- **The soaking process mimics germination**, which naturally activates the lentils' internal enzymes.
- **These activated enzymes begin breaking down** complex starches and proteins before the cooking process even begins.
- **Together, soaking and slow-cooking** essentially "pre-digest" the food, maximizing both nutrient absorption and overall digestibility.

## 3. INNOVATIONS LEVERS

- **Healthier Fat Profile:** Reducing the *tarka* (tempering) directly cuts down on added oils, lowering the overall calorie and fat content to create a much healthier, lighter spread.
- **Textural Contrast:** Adding fresh cucumber introduces a crisp, refreshing crunch that perfectly balances the thick, smooth consistency of the blended Haleem.
- **Spice Mitigation:** The natural cooling effect of the fresh cucumber helps mellow and balance the high heat and spiciness that your sensory panelists reported.
- **Aromatic Lift:** Garnishing with fresh coriander provides a vibrant pop of color and a bright, herbal aroma without adding the heavy calories associated with traditional fried onion garnishes.
- **Flavor Balancing:** A squeeze of fresh lemon juice cuts right through the savory richness of the slow-cooked meat and lentils, brightening the entire flavor profile while adding a beneficial boost of Vitamin C.

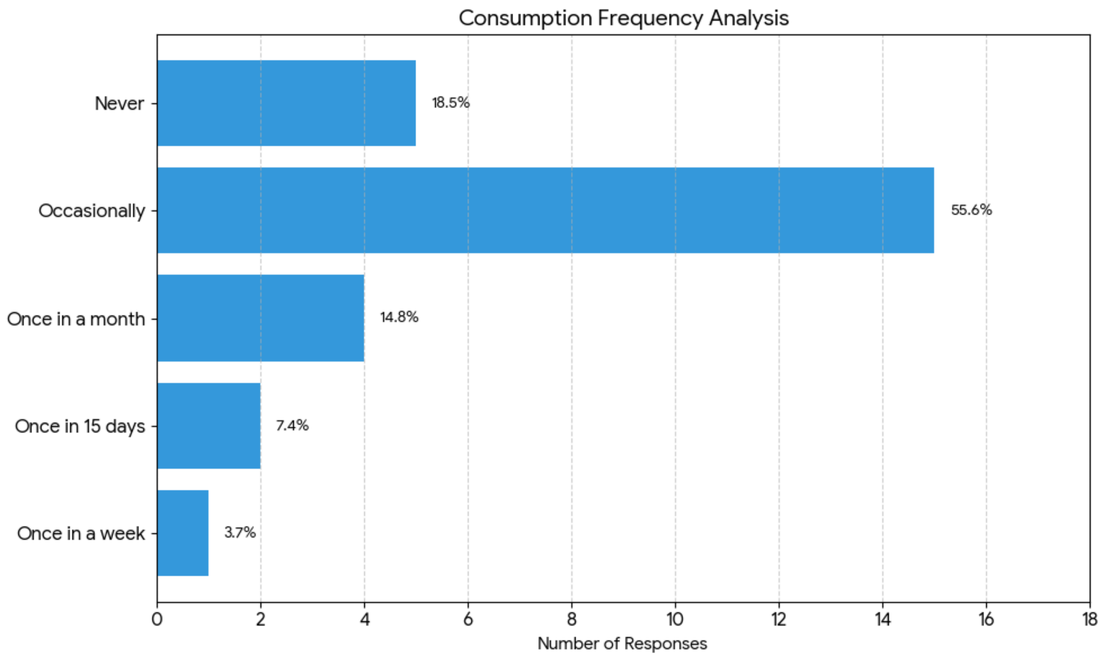
## 4. MAIN RESULTS

### Is the food provided perceived to be healthy ?




- The Unstructured **Visual Analog Scale** (VAS) line was 10 cm long and 0cm was dislike and 10 cm was like the results are as follows
  Appearance 7.3 cm average
  Smell 6.8 cm average
  Taste 5.7 cm average
  Overall 5.6 cm average
- If consumer wanted to consume with a combination of something 26 yes, 1 no and the most common item to mix with is bread, tortilla, toast and rice.
- For the spiciness of the spread most people felt it spicy
- For the viscosity of the product people felt it a little thick

### How often will people consume ?




## 5. CONCLUSIONS & PERSPECTIVES

- Chicken Haleem Spread showed **moderate overall acceptance** among consumers
- **Appearance and aroma were well liked**, but **taste scored lower**
- Product was perceived as **too thick and overly spicy**
- Most consumers preferred it **with accompaniments** (bread, rice, etc.)
- Considered **healthy and homogeneous** by participants
- **Scope for improvement**: adjust spice level and optimize texture
- Overall, the product has **good market potential with refinement**

### Changes to be done when testing next time

- Warn the panalist in advance of the spice
- Provide something to add with (bread).
- Provide more clarification for the questions

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# . REFORMULATION OF THE TRADITIONAL SLOVENIAN DISH MATEVŽ FOR OLDER ADULTS WITH HYPERTENSION

**Authors**
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**Mentors**
dr. Mojca Korosec & assist. Anja Bolha

## 1. CONTEXT OF THE STUDY
## (target population, studied recipe, etc.)

- Matevž is a traditional Slovenian side dish made from mashed potato and beans; classic recipes are salted and often enriched with cracklings, lard or butter.
- The target group was older adults aged 65 and over with hypertension. They may have a reduced ability to taste and smell food or experience difficulties with chewing certain textures, and they benefit from a lower sodium intake.
- The aim was to redesign matevž so that it is nutritionally better suited to hypertension while remaining familiar, acceptable and culturally recognizable.
- To preserve authenticity, the core identity of the dish was retained: beans, potatoes, onion and garlic.

## 2. SCIENTIFIC METHODOLOGY

**1. Consumer insight collection**
1KA questionnaire; assisted completion in a retirement home and online; only complete responses were analysed (n = 11).

**2. Literature review**
Hypertension, sodium reduction, sensory ageing, and the impact of replacing salt and animal fat.

**3. Recipe reformulation**
No salt during potato cooking; olive oil instead of animal fat; carrot, pepper, thyme, parsley and MSG.

**4. Pilot hedonic screening**
Four matevž variants compared on a 9-point hedonic scale for color, appearance, texture and taste.

## 3. INNOVATIONS LEVERS

**Health**
Lower sodium and fewer saturated fats.

**Flavor**
Herbs, spices and MSG rebuilt palatability and umami after salt reduction.

**Texture & appearance**
A mostly creamy structure was preserved; grated carrot added warmer color and slight crunch.

**Tradition**
Beans and potatoes kept the recognizable identity of matevž.
*KCl was considered but not selected because of potential bitter/metallic notes and uncertainty for older consumers.*

## 4. MAIN RESULTS

**Consumer insight (n = 11)**

**91%** knew matevž

**55%** consume it occasionally

**82%** preferred a creamy texture

**73%** preferred the traditional recipe

Respondents showed cautious openness to health-oriented changes, but strong attachment to the traditional look and feel of the dish.

**SELECTED PROTOTYPE AND NUTRITIONAL PROFILE**
Best pilot sensory profile: the version with carrot + spices + MSG performed best overall for color, appearance, texture and taste.

**FINAL ADAPTED RECIPE (4 servings)**

400 g potatoes | 200 g cooked brown beans | 50 g onion |
2 garlic cloves | 50 g carrot | 25 mL olive oil | pepper, thyme, parsley, MSG

**Approx. per 175 g portion:**

233 kcal | 6,4 g protein | 10 g fiber | 0,7 g salt

## 5.CONCLUSIONS & PERSPECTIVES

- Matevž can be reformulated into a more hypertension-friendly dish without losing its traditional basis.
- Olive oil, herbs/spices and a small amount of MSG helped compensate for lower salt and the removal of animal fat.
- A creamy texture appears well suited to older adults, while carrot improves visual appeal.
- Before implementation in care homes or hospitals, the adapted version should be tested directly with older consumers using hedonic and paired comparison tests.
- Future work: optimize plating, compare bean and potato varieties, and communicate the role of MSG clearly to reduce misconceptions.

Source: Seminar paper by Magdalena Marković, Nina Rojc and Zala Racman (University of Ljubljana, 2026).

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# INNOVATION OF FINNISH TRADITIONAL FOOD - LÖRTSY

UNIVERSITY OF TURKU

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TRADINNOVATIONS

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## 1.CONTEXT OF THE STUDY

***Lörtsy* is a half-moon-shaped meat pie with a wheat dough crust**, originating from Savonlinna, a town in Eastern Finland. Its conventional recipe, made with refined wheat flour, rice, and ground beef and prepared by deep-frying, is associated with nutritional and environmental challenges.

**The nutritional challenges include low fiber intake and high intakes of salt and saturated fat**, which are among the main concerns in the Finnish diet.

**The environmental challenges arise from both ground beef and rice being associated with a relatively high nature footprint**. A nature footprint measures how much damage a product, company, municipality, or consumer causes to biodiversity.

**This study examines how selected raw materials affect biodiversity, while also evaluating the health effects of the innovation in relation to Finnish dietary recommendations. The objective was to reformulate a traditional recipe to improve its nutritional profile and reduce its environmental impact.**

## 2. SCIENTIFIC METHODOLOGY

**Dough modification:** Partial replacement of refined wheat flour with whole-grain wheat flour (10% and 30%).

**Filling modification:** Replacement of the beef-and-rice filling with a plant-based oat-and-soy-protein filling.

**Processing modification**: Deep-frying was replaced with baking followed by steaming to retain the traditional texture.

**Analytical Methods**

- Nutritional comparisons were based on the Fineli food composition database.
- Biodiversity impact was assessed using nature footprint (PDN.year) calculations.
- An informal sensory evaluation was conducted by the study team.
- Cultural impact was assessed through an anonymous survey of Savonlinna residents (n = 30).

## 3.INNOVATIONS LEVERS

**Ingredient Innovation**

- Partial replacement of refined wheat flour with whole-grain wheat flour to increase fiber content.
- Substitution of beef and rice with plant-based ingredients to reduce saturated fat intake and biodiversity footprint.

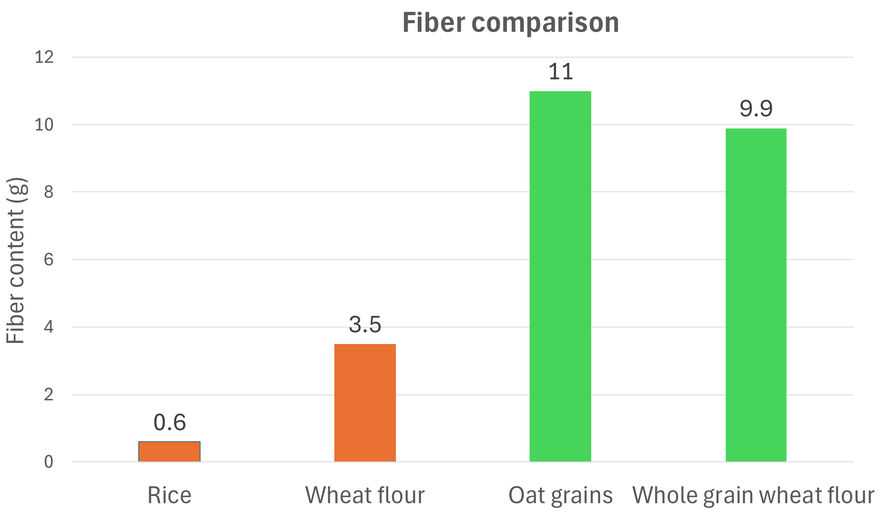
**Process Innovation**

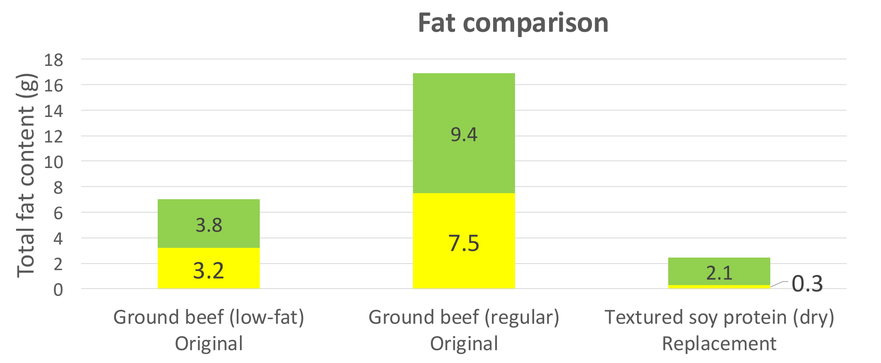
- Replacement of deep-frying with baking and steaming to lower fat content while maintaining the characteristic soft texture of *lörtsy*.

**Nutritional Levers**

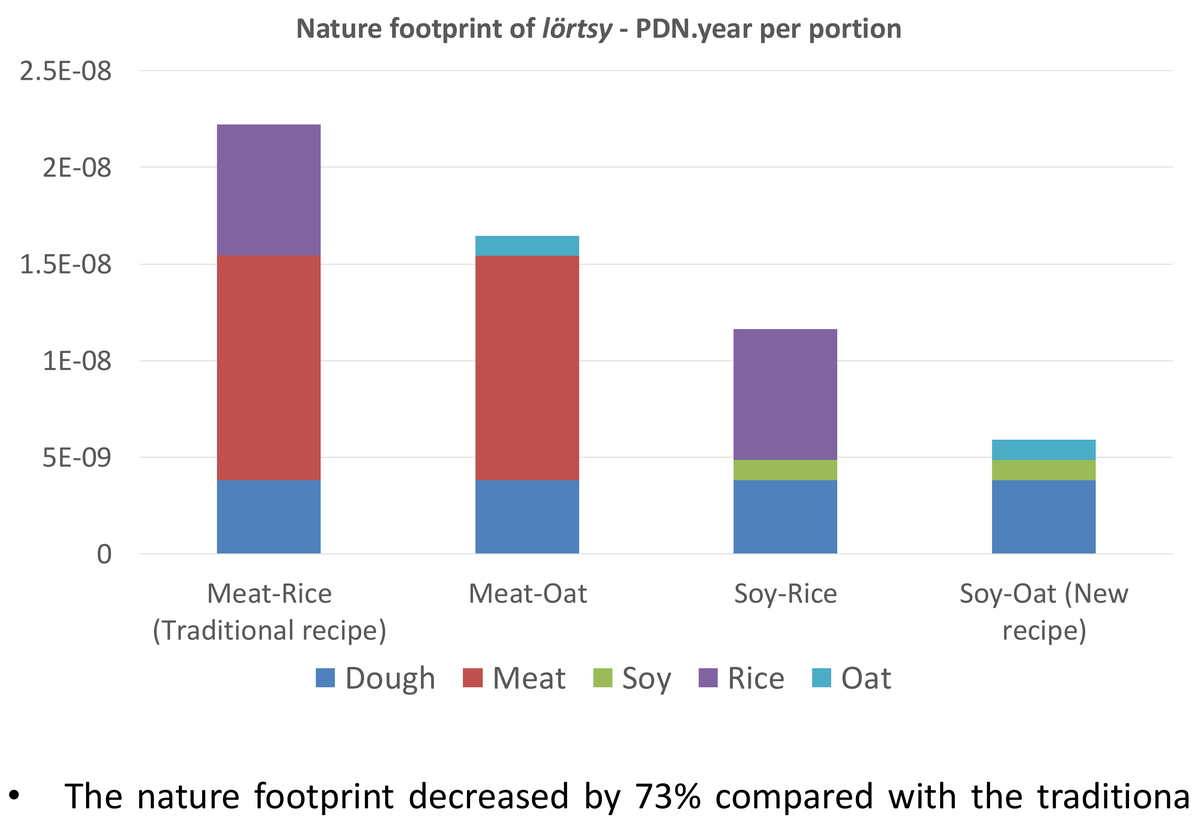
- Increased dietary fiber content compared with the traditional recipe.
- Reduced saturated fat content through the elimination of the beef-based filling.

## 4.MAIN RESULTS




- Fiber content increased by up to 94% when oat was used instead of rice, and by 64% when whole-grain wheat flour was used instead of refined wheat flour.
- Saturated fat content was reduced by 96%.




- The nature footprint decreased by 73% compared with the traditional deep-fried beef-and-rice version.
  - PDN.year expresses the potential long-term contribution to global species loss associated with producing one kilogram of a product.

## 5.CONCLUSIONS & PERSPECTIVES

***Lörtsy* embodies local food culture and illustrates how small-scale regional foods enrich cultural and culinary diversity.** This study shows that a traditional recipe can be reformulated to improve nutritional quality and significantly reduce its biodiversity footprint while maintaining cultural relevance.

These findings suggest that small, evidence-based modifications to traditional recipes can support healthier diets and biodiversity conservation. Further development of the new *lörtsy* recipe should include a consumer sensory study to assess public acceptance of the new product version. In addition, a sensory profile of *lörtsy* could be developed through a trained sensory panel study.

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# RETHINKING FOOD IN RETIREMENT HOMES: TOWARDS A SENSORY, PERSONALISED AND INCLUSIVE EXPERIENCE

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**CONTEXT:**

Elderly dependent people in retirement homes face a high risk of malnutrition, chewing and swallowing difficulties, motor and cognitive impairments affecting eating autonomy and loss of appetite and reduced food intake

Traditional interventions mainly focus on nutritional enrichment (proteins) and texture modification to facilitate swallowing. However, these approaches remain insufficient as they largely ignore the global meal experience.

This exploratory work is part of the Tradinnovations project and was realized by following defere methods:

- Field observations
- Literature review
- Interviews with healthcare professionals

**KEY FINDINGS:**

*Food intake depends on:*

- Biological factors (nutrition, swallowing)
- Sensory perception (taste, texture, smell)
- Emotional state (pleasure, fatigue)
- Social context (caregivers, shared meals)
- Cultural identity (memory, habits)

*Meal intake is shaped by:*

- Sensory stimulation (over/under-stimulation)
- Physical setting (noise, light)
- Caregiver interaction
- Timing and daily fatigue patterns

*Social aspects:*

- Caregivers influence appetite and comfort
- Familiar foods improve acceptance and pleasure
- Meals trigger memory and identity reinforcement

**PROBLEM STATEMENT:**

Current care models tend to reduce eating to a biomedical and nutritional function, neglecting:

- Emotional experience of meals
- Social interactions during eating
- Environmental conditions (noise, light, room setup)
- Cultural and identity-related dimensions of food

As a result, residents risk being considered primarily as "nutritional needs" rather than individuals with preferences, memories, and social identities.

**CONCLUSION:**

Eating in institutional care is not only nutritional. It is a complex interaction between food, body, environment, and social relations.

That's why, improving elderly nutrition requires:

- Moving beyond nutrient-centered care
- Considering the meal environment as a care tool
- Enhancing dignity, pleasure, and social connection through food

# FOOD IN RETIREMENT HOMES: SHARED CHALLENGES AND POTENTIAL LOCAL COOPERATION STRATEGIES

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**CONTEXT:**

Food is a major issue in retirement homes with 46% of residents at risk of malnutrition, 23% with obesity and an increasing demand for care and meals in the coming decades. However, food is still mainly addressed through a nutritional lens, focused on preventing malnutrition.

Despite its importance, elderly food care is constrained by:

- Outdated regulatory frameworks (non-binding guidelines)
- Strong economic pressure (limited budgets, high costs per meal)
- Organizational constraints (outsourced catering, staffing shortages)
- Weak coordination between stakeholders

That's why, a gap between regulations, real-life practices, and residents' needs was identify.

This exploratory work, as part of the Tradinnovations project was based on literature review, field observations and interviews with healthcare professionals and managers. Following that, a focus on institutional practices, territorial food systems and cooperation networks was established.

**KEY FINDINGS:**

*Strong regulatory but disconnected framework:*

- Nutritional guidelines (GEM-RCN, HAS, IDDSI)
- Focus on safety, nutrition, and standardization
- Often mismatched with real consumption patterns
- Leads to waste and poor adaptation to residents' needs

*Economic and structural constraints:*

- High cost pressure (4-5€ per meal)
- Many retirement homes financially fragile
- Outsourced catering limits flexibility
- Local sourcing often restricted by procurement rules

*Organizational fragmentation:*

- High staff workload and multitasking
- Limited training in nutrition and meal experience
- Strong dependence on external providers

*Emerging territorial initiatives:*

Despite constraints, some innovations exist:

- Resident participation in menus and commissions
- Therapeutic and participatory meals
- Local sourcing projects and food platforms
- Territorial cooperation networks (shared kitchens, bio/local supply chains)

These initiatives improve food quality, engagement and social value of meals.

**CONCLUSION:**

Elderly food systems are shaped by a tension between regulation & economics (constraint-driven model) and territorial & participatory approaches (care-driven model). That's why, cooperation and territorial integration are key levers for improvement.

Improving food in retirement homes requires moving beyond isolated practices, strengthening territorial cooperation, integrating food into broader care, social, and political systems and econsidering elderly food as a social and territorial public issue, not only a medical one

Funded by the European Union

L'INSTITUT agro Montpellier

# ADAPTING TRADITIONAL FRENCH RECIPES FOR ALZHEIMER'S PATIENTS: ENHANCING NUTRITIONAL, EMOTIONAL IMPACTS & PLEASURE

**Manon Barboncelli, Axelle Collin, Thomas Delarbre, Camille Jamaleddine, Pauline Koegler, Célia Melquiond, Maryanna Pereira Marinho and Abdel-Aziz Takpa**

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TRADINNOVATIONS

## 1.CONTEXT OF THE STUDY

Alzheimer's disease affects approximately one million people in France (France Alzheimer, 2025)[1] and represents a major public health challenge, particularly for healthcare teams in University Hospitals. The disease leads to cognitive and motor impairments that significantly impact the ability to eat, due to swallowing disorders, reduced motor skills, and decreased interest in food.

These difficulties increase the risk of malnutrition and reduced quality of life. Therefore, a key issue arises: **how can food be adapted for patients with Alzheimer's disease while ensuring safety, meeting medical constraints, and preserving the pleasure of eating?**

In this context, integrating pleasure as well as sensory and emotional dimensions into nutrition appears to be a promising approach. This includes the use of familiar recipes that may trigger positive memories, visually appealing food presentation, and interactive approaches that encourage active patient participation during mealtimes.

This interdisciplinary project brings together engineering students from Institut Agro Montpellier, patients from the Cognitive-Behavioral Unit of Montpellier University Hospital, and culinary arts students from Lycée Georges Frêche. It relies on the complementarity of expertise in food engineering, culinary practices, and healthcare support, as well as on the active involvement of patients in a co-design approach.

**The objective of this project is to design and evaluate texture-modified versions of traditional French dishes adapted to the constraints of Alzheimer's disease, while preserving their sensory qualities and emotional value, in order to enhance appetite, promote eating autonomy, and restore the pleasure of shared meals.**

Within this framework, patients selected two traditional recipes: **roast chicken stuffed with chestnuts and lemon meringue pie**. Adapted French fries and a fiber-enriched beverage were also developed to complement the meal.

1] France Alzheimer. (2025, 9 septembre). Alzheimer : 1,4 M de personnes malades en 2025. France Alzheimer. https://www.francealzheimer.org/prevalence-de-la-maladie-dalzheimer-et-des-maladies-apparentees-14-m-de-personnes-malades-en-2025/

## 1.RESEARCH & DEVELOPMENT METHODOLOGY

**Challenges & innovation levers:**

- Dimension and format
- Texture
- Handling (finger food)
- Color
- IDDSI scale between 4 and 6
- Organoleptic properties
- Nutrition (enrich in proteins and fibers)
- Use local and seasonal ingredients

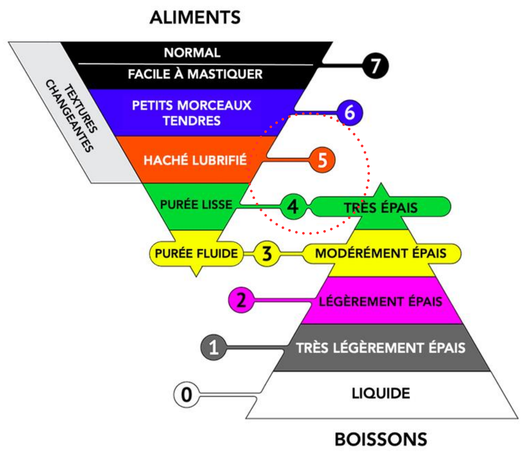
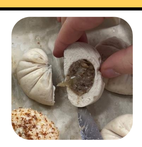
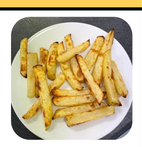
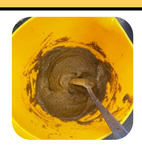
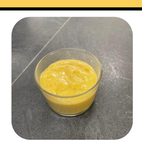
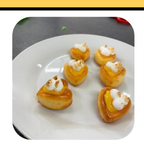
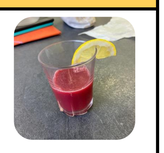


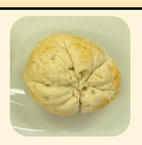
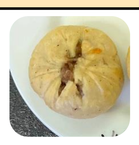

**Table 1: Nutrition facts of one individual meal**

| **Energy (kcal)** | **840** |
|---|---|
| Total Fat (g) | 32,68 |
| Satured fat (g) | 11,2 |
| Total carbohydrates (g) | 103 |
| Sugars (g) | 10,5 |
| **Fibers (g)** | **10** |
| **Proteins (g)** | **33,6** |
| Salt (g) | 0,6 |

**Composition of an individual meal:**

- 3 chicken ballotins (150g)
- 70g of french fries
- 25g of honey-mustard sauce
- 25g of chicken and mushroom sauce
- 40g of dessert
- 100g of beverage

| | Ballotin | Fries | Sauce 1 | Sauce 2 | Dessert | Beverage |
|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |
| Results | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| IDDSI | 6 | 6 | 4 | 4 | 4 (cream) 5 (biscuit) | 0 |

| Lactoserum concentrate | Protarmor 80 | Potassium Caseinate | Type of proteins | Whey Décathlon | Lactoserum isolat | Calcium Caseinate |
|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |
| **Golden**, **slightly wilted** surface with visible **holes** | | | | | | **Very golden**, slightly brown, **smooth** and **shiny** surface |
| **Slight protein taste, breaks down in the mouth, slightly dry.** | | | | | | **Juicy** and **tender** |
| 6 | 6 | 6 | IDDSI | 6 | 6 | 6 |

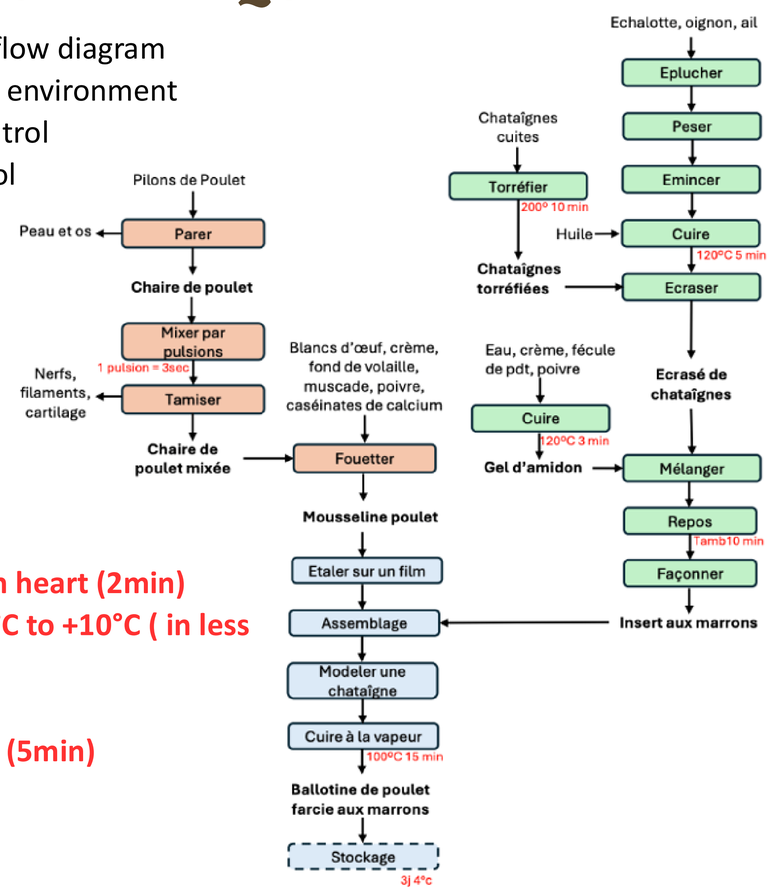
## 3.ENSURE THE QUALITY

**HACCP METHOD:** Based on flow diagram

**a) PRP:** General hygiene and environment

**b) OPRP:** Specific hazard control

**d) CCP:** Critical hazard control




**4 CCPs:**

- **Cook the chicken ≥70°C in heart (2min)**
- **Rapid Cooling: From +63°C to +10°C ( in less than 2 hours)**
- **Reheating to ≥63°C**
- **Cook lemon cream ≥70°C (5min)**

**GOOD HYGIENIC PRACTICES**

**a)** Hygiene rules

**b)** Hygiene control sheet

## 4.CONVIVIAL MEAL

**Create a social meal that allows patients with Alzheimer's disease to:**

- rediscover the joy of eating,
- stimulate their senses, creativity, and memories,
- maintain fine motor skills through handling food,
- promote communication (verbal and nonverbal),
- enjoy a social experience

**Social and sensorial animations:**

- 2 different activities (aromatic plants bouquets and sensory experience (ceramic texturized beads)
- < 30 minutes

**Analysis:**

- Impact assesment questionnaire

## 5.CONCLUSIONS & PERSPECTIVES

This student project brings together different fields of study to work on a project-based-learning project, in a practical and collaborative way. It was built with partners such as the hospital central kitchen, the Montpellier hospital, Georges Frêche high school, and a local retirement home, allowing strong real-life experience.

This year, a budget for the project was established by students, so it can be repeated and developed on a larger scale in the future as part of collective kitchens.

The project shows the value of teamwork between different disciplines and ends with a shared meal experience.

Beyond the academic and professional outcomes, the project also created moments of shared enjoyment and connection, reflected in smiles and a wonderful shared meal.

Funded by the European Union

# REINVENTING PORTUGUESE SEAFOOD RICE:
# A PLANT-BASED APPROACH USING HYDROCOLLOIDS AND SEAWEED

**José Miguel Pestana, Marianna Slompo, Luccas Oliveira, Paulina Mata, Bruno Moreira-Leite**

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## 1. CONTEXT OF THE STUDY

Seafood rice is a widely recognized symbol of Portuguese gastronomy, deeply rooted in cultural identity and associated with coastal culinary traditions.

However, the increasing prevalence of seafood allergies, combined with environmental concerns such as overfishing, has raised the need to rethink such dishes in a more inclusive and sustainable way.

This work proposes a plant-based reinterpretation of seafood rice, aiming to preserve its sensory identity while eliminating allergenic ingredients and expanding accessibility to a broader audience, including vegetarians and individuals with dietary restrictions.

## 2. R&D METHODOLOGY

The development followed an experimental and iterative approach, combining traditional culinary practices with food science tools.

The original recipe was analyzed to identify the functional role of seafood in flavour, texture and visual composition. Based on this, two plant-based analogues were developed, inspired by shrimp and fish.

These analogues were formulated using tofu, starch-rich ingredients and seaweed infusions, combined with hydrocolloids such as agar, xanthan gum, carrageenan and gellan to reproduce structure, elasticity and thermal stability.

The dish was assembled following the traditional preparation method, including sautéing aromatics and cooking rice in a seaweed-based broth, allowing the integration of flavour and texture within a familiar culinary framework.

## 3. ENSURE THE QUALITY

Sensory evaluation was conducted with six untrained tasters using a 9-point hedonic scale.

All evaluated attributes showed high acceptance, with average scores above 8, including appearance (8.33), aroma (8.17), flavour (8.17), texture (8.33) and overall appreciation (8.50).

These results indicate a strong sensory performance of the plant-based formulation, particularly in terms of flavour balance and textural coherence.

The combination of seaweed, miso and spices contributed to a convincing marine and umami profile, while the hydrocolloid system ensured structural stability and a pleasant mouthfeel.

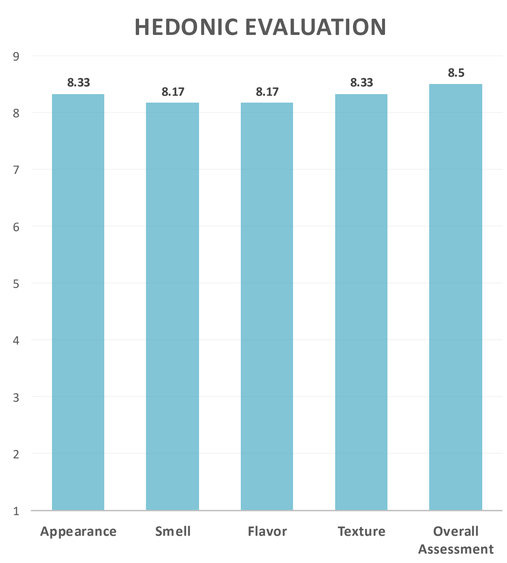
## 4. CONVIVIAL MEAL

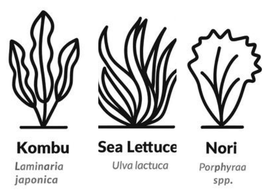
Beyond its technical development, the dish was conceived as an inclusive and culturally grounded gastronomic experience.

Traditional seafood dishes often exclude individuals with allergies or specific dietary choices, limiting their participation in shared culinary contexts. By removing seafood while preserving key sensory elements, this reinterpretation allows a broader audience to engage with a culturally significant meal.

The use of seaweed and plant-based analogues not only replicates flavour and texture but also maintains the visual and emotional references associated with the original dish.

In this sense, the project reinforces the idea that inclusivity in gastronomy is not about replacing tradition, but about expanding it – ensuring that cultural food experiences remain accessible, relevant and shared.




## 5. CONCLUSIONS & PERSPECTIVES

The results demonstrate that a plant-based reinterpretation of seafood rice is both technically feasible and sensorially effective.

Hydrocolloids played a key role in reproducing structural and textural properties, while seaweed-based systems enabled the recreation of marine flavour profiles without the use of seafood.

This approach highlights the potential of combining culinary tradition with scientific knowledge to create innovative and inclusive dishes.

Future developments may focus on refining texture of the plant-based seafood analogues, expanding flavour systems and applying similar strategies to other traditional seafood-based recipes.

Funded by the European Union

# REINVENTING "BACALHAU COM TODOS" IN A PLANT-BASED VERSION THROUGH THE APPLICATION OF HYDROCOLLOIDS AND MOLECULAR COOKING TECHNIQUES

**Paula Cristina Santos, Alexandre Correia, Shengji Wang, Paulina Mata, Bruno Moreira-Leite**

School of Science and Technology, NOVA University of Lisbon (NOVA FCT)

## 1. CONTEXT OF THE STUDY

“Bacalhau com Todos” (salted cod with vegetables) is one of the most emblematic dishes of Portuguese gastronomy, traditionally associated with Christmas Eve, family gathering and collective memory.

This work proposes a plant-based reinterpretation of the dish, not as a simple replacement of animal ingredients, but as a sensory and symbolic reconstruction of a deeply rooted culinary tradition.

By combining plant-based ingredients with hydrocolloids and molecular gastronomy techniques, the project aimed to preserve the visual, textural and emotional references of the original preparation while responding to contemporary challenges related to sustainability, food ethics and dietary inclusion.

## 2. R&D METHODOLOGY

The development followed an iterative experimental process in which each traditional component was redesigned according to its sensory function. The “cod” was recreated using thin layers of celeriac, blanched in a 30 g/L saline solution, cooled in an ice bath and infused with aromatic olive oil, garlic, onion, bay leaf and nori seaweed to evoke the marine and salted profile of cod. The chickpea component was transformed into a warm, aerated mousse, stabilized with 3% methylcellulose, taking advantage of its thermal gelation properties. The cabbage was reformulated as a crispy film made from cabbage juice, agar, xanthan and maltodextrin, then dehydrated at low temperature. The olive element was presented as a glossy green olive gel, structured with xanthan gum and Ultratex 3. Finally, the egg yolk was reimagined through direct spherification of roasted pumpkin purée with sodium alginate and calcium chloride, with *kala namak* (Himalayan black salt) added to evoke the sulfurous aroma of cooked egg.

## 3. ENSURE THE QUALITY

The final preparation was evaluated by a focus group of five tasters, aged between 25 and 45 years, using a structured hedonic scale from 1 to 9.

The dish obtained average scores of 7.5 for appearance and aroma, and 8.5 for flavour, texture and overall appreciation.

Qualitative feedback highlighted the excellent flavour, texture and presentation of the dish, while the main improvement identified concerned the crispness and salt balance of the cabbage element.

These results indicate a strong overall acceptance and confirm the effectiveness of the technical approach in creating a coherent and appealing plant-based reinterpretation.

## 4. CONVIVIAL MEAL

Beyond technical reconstruction, the dish was designed as a convivial, inclusive and emotionally recognizable gastronomic experience.

Adapting traditional dishes to people with dietary restrictions is essential to ensure that cultural food heritage remains accessible to everyone, including vegan and vegetarian consumers, as well as individuals with specific food intolerances or ethical dietary choices.

Each element was developed to perform a dual role: a functional role, related to texture, structure and stability, and a symbolic role, connected to memory, tradition and cultural identity.

The final composition preserves the recognizable codes of “Bacalhau com Todos” while presenting them through a contemporary culinary language.

In this sense, the dish is not merely a vegan alternative, but an example of inclusive gastronomy, where science and creativity allow more people to participate in shared culinary rituals without losing the emotional and cultural meaning of the original dish.

## 5. CONCLUSIONS & PERSPECTIVES

This work demonstrates that hydrocolloids can be powerful tools for the plant-based reinterpretation of traditional dishes, enabling the reconstruction of texture, stability, appearance and sensory meaning without relying on animal-derived ingredients.

The final result shows that innovation in gastronomy does not require the abandonment of tradition; rather, it can expand its relevance by making it more inclusive, sustainable and technically refined.

Future developments may explore nutritional profiling, environmental impact assessment, larger sensory panels and the adaptation of this approach to other traditional Portuguese dishes. Ultimately, this project positions gastronomy as a bridge between heritage and innovation, memory and technology, pleasure and responsibility.

Funded by
the European Union

# REINTERPRETATION OF AVEIRO'S "OVOS MOLES" USING THE "NOTE BY NOTE" COOKING METHODOLOGY

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## 1. CONTEXT OF THE STUDY

Aveiro's "Ovos Moles" (soft eggs) are a traditional Portuguese confectionery product with strong cultural, historical and sensory relevance, recognized as a Protected Geographical Indication (PGI).

This work proposes their reinterpretation through the "Note by Note" (NbN) approach, which constructs food using isolated compounds instead of whole ingredients.

The objective was to recreate a product functionally equivalent to the original, without eggs or wheat flour, preserving its creamy texture, visual identity and symbolic value while addressing contemporary demands related to sustainability, innovation and dietary inclusion.

## 2. R&D METHODOLOGY

The work followed an iterative experimental process based on theoretical research, functional analysis and formulation testing.

The traditional recipe was deconstructed to identify the role of egg yolk, sugar and water in texture, color, aroma and mouthfeel.

A new system was formulated using water, sucrose, sunflower oil, rice protein, maltodextrin, gellan and sucroester, each selected for a specific structural or sensory function.

The process combined hydrocolloid hydration, gel formation, sugar syrup incorporation and final emulsification with the lipid phase, allowing progressive optimization of texture and stability.

## 3. ENSURE THE QUALITY

Sensory validation was carried out with nine tasters, using a 9-point hedonic scale and purchase intention assessment.

The original/base version achieved the best results, especially for flavour, with scores between 8 and 9.

Almond, orange, coconut, vanilla and caipirinha versions were also well accepted, while the Port wine version obtained lower scores, around 4 to 5, indicating the need for reformulation.

The filling showed good creaminess and stability, but the wafer remained the most critical element, with texture scores around 5 to 6, mainly due to limitations in crispness and structural resistance.

## 4. CONVIVIAL MEAL

This work goes beyond a purely technical exercise, positioning the product within a broader context of inclusive, adaptive and culturally sensitive gastronomy.

Reinterpreting traditional recipes through approaches such as NbN makes it possible to adapt emblematic products to people with dietary restrictions, including egg intolerance, gluten-free diets, vegan preferences or specific nutritional requirements.

This is particularly relevant in the case of products such as Ovos Moles, whose cultural value is strongly associated with memory, regional identity and shared consumption.

By preserving key sensory references, the product allows more people to access a traditional gastronomic experience without feeling excluded from the cultural ritual.

In this sense, the project demonstrates how science can support the continuity of culinary heritage, not by freezing tradition, but by making it more accessible, inclusive and responsive to contemporary food needs.

## 5. CONCLUSIONS & PERSPECTIVES

The results confirm that the NbN methodology can be successfully applied to the reinterpretation of traditional confectionery products.

It was possible to recreate essential characteristics of Ovos Moles, particularly in terms of texture, structure and flavour perception, using hydrocolloids, emulsifiers and isolated compounds.

Despite these advances, challenges remain, especially in reproducing the wafer component and achieving full sensory equivalence.

Future work may focus on improving structural elements, refining flavour systems and exploring the application of this approach to other traditional products, reinforcing the role of science as a driver of innovation in gastronomy.

Funded by the European Union

# HOSPITAL GASTRONOMY AND HUMANIZATION OF CARE: IMPROVING DIET ACCEPTABILITY IN A HOSPITAL SETTING IN MOZAMBIQUE

**Beatriz da Sorte Maurício[1,2], Paulina Mata[1], Bruno Moreira-Leite[1], Rámula Juma Issa[2]**

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[2] Lúrio University – Faculty of Health Sciences (UniLúrio)

## 1. CONTEXT OF THE STUDY

Hospital food plays a critical role in patient recovery. However, it is often reduced to its nutritional function, neglecting sensory quality, presentation and the overall experience of eating.

Hospital gastronomy emerges as an interdisciplinary approach that integrates nutrition, culinary techniques and humanized care, aiming to improve not only dietary adequacy but also patient well-being and dignity.

In low-resource settings, such as the Nacala-Porto General Hospital in Mozambique, limitations in infrastructure, training and organization can significantly affect diet acceptability and patient satisfaction.

This work explores how simple context-adapted interventions can enhance the hospital food experience without increasing costs, by focusing on organization, training and gastronomic principles.

**Figure 1**: Creating new recipes with local and affordable raw materials.

## 2. R&D METHODOLOGY

The intervention began with a diagnostic assessment of the food and nutrition unit, including observation of production processes, evaluation of recipes and identification of structural and operational gaps.

Based on this analysis, a set of practical actions was implemented, including the provision of essential equipment and the reorganization of workflows.

A training program was conducted with 13 staff members, covering hygiene and food safety, culinary techniques, recipe development, plating and principles of humanized service.

The existing menu was reworked through the reformulation of 5 core recipes, while additional 13 preparations were developed using locally available and affordable ingredients, ensuring feasibility within the hospital context.

## 3. ENSURE THE QUALITY

Following the intervention, qualitative improvements were observed across multiple dimensions of the food service.

Meals showed clear enhancements in presentation, portion organization and visual appeal, contributing to a more structured and appetizing dining experience.

The introduction of standardized preparation methods and new recipes increased menu diversity and consistency while the training of staff improved technical execution and service practices.

These changes demonstrated that even in resource-constrained environments, targeted interventions can significantly improve the acceptability and perceived quality of hospital diets.

## 4. CONVIVIAL MEAL

Beyond its functional role, food in a hospital setting represents a moment of comfort, identity and connection, particularly for patients in vulnerable conditions.

Integrating principles of humanized care into food service allows meals to become part of the therapeutic process, contributing to emotional well-being and a sense of dignity.

By improving presentation, diversifying preparations and training staff to deliver meals with greater care and attention, the intervention helped transform eating from a routine task into a more positive and engaging experience.

In this context, hospital gastronomy reinforces the idea that access to dignified, appealing and culturally appropriate food should be considered an essential component of healthcare, regardless of economic or structural limitations.

**Figure 2:** From left to right: Delivery of equipment and materials; Steps for proper handwashing; Types of cuts; Simulation of humanized care.

**Figure 3:** Rice with feijoada (before intervention)

**Figure 4:** Chima with fried fish and tomato sauce (before intervention)

## 5. CONCLUSIONS & PERSPECTIVES

The results demonstrate that improving hospital food systems does not necessarily depend on increased financial investment, but rather on knowledge, organization and training.

The integration of gastronomy into a hospital proved effective in enhancing diet acceptability, patient satisfaction and overall service quality.

This approach highlights the potential of simple interventions to promote more inclusive, humane and effective healthcare environments.

Future developments may focus on long-term monitoring of patient outcomes, expansion of training programs and adaptation of this model to other healthcare contexts with similar constraints.