International FoodTec Conference

Shaping the Future of Sustainable Food Ecosystems

1st Edition '25

Interreg España – Portugal

Cofinanciado por la Unión Europea
Cofinanciado pela União Europeia

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

ipb INSTITUTO POLITÉCNICO DE BRAGANÇA · Universidade de Vigo · PORTUGAL FOODS · clúster alimentario de galicia · AQUA VALOR · montanhas de investigação

TECHNICAL DATA

Title

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

Authors

Lillian Barros (CIMO/IPB, Portugal)

Alexandre Gonçalves (MORE, Portugal)

Sara Vieira (CIMO/IPB, Portugal)

Tiago Reis (CIMO/IPB, Portugal)

Natacha Pinto (MORE, Portugal)

Bárbara Matias (MORE, Portugal)

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WELCOME TO THE

IFTC 2025

The **I International FoodTec Conference** – *Shaping the Future of Sustainable Food Ecosystems* – will be held from the 27th to 29th of October 2025. The event convenes together leading experts in advanced research, innovative food solutions, prominent stakeholders from the food industry, and policymakers focused on strategic planning and funding for the sector.

Organized under the scope of the European **Net4Food Project** – *Research and Innovation Network for the Food Sector in the Cross-Border Region* – and funded by Interreg POCTEP, the conference aims to enhance a network of excellence within the food sector of the Galicia-Northern Portugal Euroregion. Additionally, it will strengthen the scientific and technological capacities of the food industry by driving innovation, adding value to regional endogenous resources, and promoting sustainable, safe, and healthy food practices.

The conference is closely aligned with the establishment of the future Iberian FoodTec Lab (IFL), an international reference center for technological innovation in the food sector. Attendees will engage in insightful discussions addressing challenges and opportunities within the industry, focusing on sustainability, innovation, and knowledge transfer. Key topics include innovative food technologies, emerging nutritional trends, food quality and safety, consumer

behavior, digital transformation, and strategic developments within the food sector. A highlight of the event will be the presentation of the advancements from the **Net4Food Project**.

The **I International FoodTec Conference** is structured around six core topics:

- 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

The **Net4Food Project** brings together a distinguished consortium coordinated by the Polytechnic Institute of Bragança, including strategic partners such as the University of Vigo, the International Iberian Nanotechnology Laboratory (INL), the Galician Food Cluster (Clusaga), PortugalFoods, and the collaborative laboratories MORE CoLAB and AquaValor. Their expertise reinforces the development of pioneering initiatives, laying the foundation for an innovative hub in the European Food Sector. This collaborative effort is posed to advance sustainable practices and promote transformative changes within Food Ecosystems.

All the information contained in this Book of Abstracts is accurate at the time of its publication. The Conference Organizers reserve the right to make modifications.

IFTC 2025 COMMITTEE

Scientific committee

Lillian Barros
(CIMO/IPB, Portugal)

Isabel Ferreira
(IPB, Portugal)

Lorenzo Pastrana
(INL, Portugal)

David Fernández Calviño
(UVigo, Espanha)

Alexandre Gonçalves
(MORE, Portugal)

Maria José Alves
(AquaValor, Portugal)

Deolinda Silva
(PFoods, Portugal)

Organizing committee

Lillian Barros
(CIMO/IPB, Portugal)

Alexandre Gonçalves
(MORE, Portugal)

Sara Vieira
(CIMO/IPB, Portugal)

Tiago Reis
(CIMO/IPB, Portugal)

Maria José Alves
(AquaValor, Portugal)

Teresa Carvalho
(PFoods, Portugal)

Noelia Dosil (CLUSAGA, Espanha)

Lorenzo Pastrana (INL, Portugal)

Patricia Reboredo
(UVigo, Espanha)

Local organizing committee

Lillian Barros
(CIMO/IPB, Portugal)

Alexandre Gonçalves
(MORE, Portugal)

Sara Vieira
(CIMO/IPB, Portugal)

Tiago Reis
(CIMO/IPB, Portugal)

Luana Fernandes
(MORE, Portugal)

Ana Paula Pereira
(MORE, Portugal)

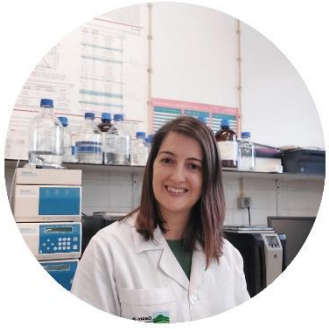
Joana Amaral
(IPB, Portugal)

Bárbara Matias
(MORE, Portugal)

Natacha Pinto
(MORE, Portugal)

Eliana Pereira
(CIMO/IPB, Portugal)

Cristina Caleja
(CIMO/IPB, Portugal)



Filipa Reis
(CIMO/IPB, Portugal)

Filipa Mandim
(CIMO/IPB, Portugal)

Ângela Fernandes
(CIMO/IPB, Portugal)

GENERAL INFORMATION

Conference venue

The conference will be held at the **Hotel Exe São Lázaro** in Bragança, Portugal, in the **Salão Armindo Correia**. The hotel is conveniently located just 2 km from the historical center of Bragança.

Day 1 – Day 3
Monday – Wednesday
October 27th – October 29th
09:00 AM – 6:00 PM

Exe São Lázaro
Avenida do Sabor, Nº 2
5300-367
Bragança, Portugal

Telephone: (+351) 273 310 070
Mobile: (+351) 925 272 609

Fax: (+351) 273 310 071

General e-mail:
scfom@exesaolazaro.com

Getting to and from the venue

You can use private transportation (taxi) to get to the congress venue.

Registration and information desk

The Registration Desk will be located in the hall of the in the Salão Armindo Correia at the Hotel Exe São Lázaro and will be open for all three days of the conference: Monday to Wednesday, 9:00 – 6:00 PM.

All attendees must be registered for the conference. Please proceed to the Registration Desk to collect your badge and conference materials. Admission to the conference is permitted only to those wearing the official conference badge. If a badge is lost or misplaced, please contact the Registration Desk.

Internet access

A wireless network will be available at Hotel Exe São Lázaro. Please contact the Information Desk to obtain the username and password, if needed.

Smoking policy

As of 1 January 2008, Portuguese legislation prohibits smoking in all public places, including cafés, bars, and restaurants (except in designated smoking areas). Smoking is permitted only outside the conference venue.

Electricity supply

The standard voltage in Portugal is 220 V. If you need a plug or power adapter, you can purchase one at electronics stores.

Transportation

In Bragança, a city bus service is available for travel around the city center. Bus tickets start from 2.50 €. For more route's options, please visit:

https://bus.cm-braganca.pt/routes

Taxis operate 24 hours a day and can be ordered from the conference venue or your hotel. Taxis can also be hailed on the streets if they display a green light with the word "TAXI". Please avoid using unlicensed taxis, which are ordinary cars operated by drivers solicitating fares on the street.

Renting a car can be a convenient option if you plan to stay in areas farther from the city center. Car rentals are generally affordable, and having a car allows you to take longer trips. However, to fully experience the city, it is best to explore the city center on foot, as many of its charming streets are accessible only by walking.

Emergencies

For police, ambulance, or fire services, dial 112.

Weather

For up-to-date weather information, please visit the Portuguese Meteorology Institute website:

https://www.ipma.pt/pt/index.html

Tourism and leisure

The conference venue is located just 2 km from the historical center of Bragança. Step outside and enjoy the city! For more information, please visit:

https://turismo.cm-braganca.pt/

Currency

Portugal uses the Euro (€). Traveler's cheques can be exchanged for cash at banks and currency exchange offices.

Liability

The Organizing Committee of the conference accepts no liability for personal injuries or loss/damage to personal property incurred during, or as a result of, the conference or its social events. The Committee reserves the right to make any changes, modifications, or omissions to the information published in this book.

Insurance

The Conference Organizers cannot accept any responsibility for personal accidents and damage to the private property of Conference and Exhibition Delegates.

CONFERENCE PARTICIPATION

Certificate of Attendance

All registered participants will receive a Certificate of Attendance for the IFTC via email within a few days following the conclusion of the conference.

Certificate of Presentation

Participants who delivered a presentation at the IFTC will receive a Certificate of Presentation via email within a few days following the conclusion of the conference.

Photography policy

Recording and photographing conference presentations is permitted.

SCIENTIFIC INFORMATION

Roundtable

Two roundtables will be held during the IFTC, each addressing key aspects of the Iberian agri-food ecosystem.

Roundtable I — Challenges and Opportunities in the Food System of the Transborder Region

This 1-hour session will discuss the main challenges and opportunities faced by cross-border food systems, particularly in Northern Portugal and Galicia. It will highlight the strategic relevance of establishing the Iberian Food Laboratory as a shared infrastructure to foster innovation, strengthen territorial cooperation, and secure sustainable funding for regional development.

Roundtable II — Strategic Developments in the Net4Food Project

This roundtable will have a duration of 1.5 hours and aims to encourage the exchange of experiences and perspectives on the present and future of the Iberian agri-food sector. Six Portuguese and Spanish companies, together with the agri-food industry clusters PortugalFoods and CLUSAGA, and the collaborative laboratories MORE CoLAB and AquaValor, will reflect on the main challenges, innovation strategies, and emerging trends shaping the evolution of the sector.

Reflective lecture

One Reflective Lecture will take place, with a duration of 45 minutes.

Plenary lecture

A total of **six** Plenary Lectures will be held, each lasting 30 minutes.

Keynote lecture

A total of **thirteen** Keynote Lectures will be held, each lasting 20 minutes.

Oral presentation

A total of **thirty-six** Oral Presentations will be held, each lasting 5 minutes.

Please check your Oral Presentation code in the Oral Presentation List included in this book.

Thought exchange

At the end of each session, there will be a 5-minute Q&A.

Presentations upload

All conference presentations will all take place in the Salão Armindo Correia at Hotel Exe São Lázaro. Personal computers will not be allowed for presentations; speakers may use their personal USB drives. Accepted formats are PowerPoint (.pptx) or PDF.

An IT Desk will be available on-site. All speakers must upload their presentations at least two hours before the start of their respective session.

E-Poster presentation

Posters will be displayed on LCD monitors in the hall of the Salão Armindo Correia at Hotel Exe São Lázaro throughout the three days of the conference as part of the scientific program.

The poster should be prepared in portrait orientation, with a maximum size of 90 cm (height) × 50 cm (width), and saved in PDF format.

Please check your poster code in the Poster List included in this book.

Each poster abstract will be assigned to a specific display screens as follows:

Monitor	#Poster
1	1 – 52
2	53 – 104
3	105 – 156
4	157 – 208

Poster presentations will take place during the coffee breaks on each conference day. Presenters are expected to be at their posters during these breaks to engage with attendees and answer questions.

Awards

Oral presentations and posters will be evaluated by a selective committee of experts appointed by the Conference Scientific Committee. The highest-scoring contributions will receive the Best Oral Presentation and the Best Poster awards, provided by ReadyToPub – Author Services Provider. These awards will be officially presented during the Closing Session of the conference.

The competition is open exclusively to undergraduate, master's, and doctoral students. For further details, please refer to the ReadyToPub Awards Regulation.

SOCIAL EVENTS

Different activities have been planned to give participants the opportunity to explore the city, its culture, and traditions. In addition to the scientific program, participants will be able to socialize during the coffee breaks, lunches, Welcome Cocktail, and Conference Gala Dinner.

Typical Portuguese dishes with a contemporary twist, accompanied by a selection of Portuguese wines, will be served.

The social events will also feature dynamic performances, including traditional cultural presentations, ensuring an unforgettable experience!

Please inform the Organizing Committee of any dietary requirements.

Coffee breaks & lunches

Coffee breaks and lunches during the conference are free for registered participants who have confirmed their attendance.

Coffee Breaks - served in the hall of the conference room:

- Day 1, Monday, 27th: 4:00 – 4:30 PM
- Day 2, Tuesday, 28th: 11:00 – 11:30 AM and 4:00 – 4:30 PM
- Day 3, Wednesday, 29th: 10:40 – 11:10 AM

Lunches - served at the Hotel Exe São Lázaro, Alcina Ramos room.

- Day 1, Monday, 27th: 12:45 – 14:30 PM, for confirmed participants
- Day 2, Tuesday, 28th: 12:45 – 14:30 PM, for confirmed participants
- Day 3, Wednesday, 29th: 13:00 – 15:00 PM, for invited guests only

Welcome Cocktail

The Welcome Cocktail is free for registered participants who have confirmed their attendance. Caretos, a traditional masked character, will be present to entertain participants during the social event. Transportation from the Hotel to the Restaurant will be provided by the Organizing Committee.

Day 1
Monday, October 27th
7:30 – 11:00 PM

Casa do Lago, Albufeira do Azibo
Fraga da Pegada
5340-410
Santa Combinha
Macedo de Cavaleiros

Telephone:
(+351) 917 343 125

General e-mail:
clientes@acasadolago.pt

Dress code:
Formal/Smart Casual

Gala Dinner

The Gala Dinner is open to participants who have confirmed their attendance. The cost is €50 per person, payable at the registration desk upon arrival. Invited guests may attend free of charge.

Participants will be entertained by Grupo D'Alma Fado, performing traditional Portuguese songs.

Transfer from the Hotel Exe São Lázaro to the Quinta da Carvalhinha will be provided by the Organizing Committee via a tourist train. Time permitting, guests will have the opportunity to enjoy a panoramic tour of the city center aboard the tourist train.

Day 2
Tuesday, October 28th
8:00 – 11:00 PM

Quinta da Carvalhinha
Hotel Estalagem Turismo
Estrada de Turismo - Cabeça Boa
5300-852
Bragança, Portugal

Telephone:
(+351) 273 324 204

General e-mail:
infoquintadacarvalhinha@gmail.com

Dress code:
Formal/Smart Casual

AGENDA

Day 1 | 27th OCTOBER

Welcome Ceremony
Challenges and opportunities in the food system of the Transborder Region

09h00 **Registration**

09h30 **Opening Session**
Manuel Reigosa, UVigo
Orlando Rodrigues, IPBragança
CCDR Norte *
Lillian Barros, IPBragança

10h00 **Round Table**
Moderator: Deolinda Silva, PTFoods
Jesus Barreiro-Hurle, European Commission
Jaime Piçarra, IACA
Manuel Reigosa, UVigo
Orlando Rodrigues, IPBragança
Isabel Ferreira, IPBragança
Lorenzo Pastrana, INL
Xosé Lago García, Xunta de Galicia
Raquel Rocha, ADC
CCDR Norte *

12h00 **Reflective Lecture**
Manuel Heitor, IST

12h45 **Lunch | E-Poster Session**

Session 1. Innovation, Technology and Food Security in a Changing Global Landscape

Plenary Speaker
14h30 Isabel Ferreira, IPBragança

Keynote Speaker
15h00 Veronica M. T. Lattanzio, CNR

15h20 **Oral Presentation Session**

16h00 **Coffee Break | E-Poster Session**

Plenary Speaker
16h30 Pedro Queiroz, FIPA, FMUL

Keynote Speaker
17h00 Mohamed Wageih, PRIMA

17h20 **Oral Presentation Session**

19h30 **Welcome Cocktail**

* to be confirmed

Day 2 | 28th OCTOBER

Session 2. Nutrition and Consumer Trends: Enhancing the Value of Endogenous Resources

	Plenary Speaker
09h00	Giorgia Spigno, UCSC
	Keynote Speakers
09h30	Manuela Pintado, UCP
09h50	Mario M. Martinez, UVa
10h10	**Oral Presentation Session**
11h00	**Coffee Break | E-Poster Session**
	Keynote Speakers
11h30	Victor Freitas, UPorto
11h50	José Teixeira, UMinho
12h10	**Oral Presentation Session**
12h45	**Lunch | E-Poster Session**

Session 3. Quality, Food Safety and Environmental Responsibility

	Plenary Speaker
14h30	Carlos das Neves, EFSA
	Keynote Speakers
15h00	Avelino Álvarez-Ordóñez, ULE
15h20	Ana Barros, UTAD
15h40	**Oral Presentation Session**
16h00	**Coffee Break | E-Poster Session**
	Plenary Speaker
16h30	María José Arreola, IBERO Puebla
	Keynote Speakers
17h00	Manuel Vázquez Vázquez, USC
17h20	Patricia Morales, UCM
17h40	**Oral Presentation Session**
20h00	**Event Dinner with musical event**

Day 3 | 29th OCTOBER

Session 4. Marketing, Digitalization and the Future of the Food Sector

Plenary Speaker

09h00 Lan van Wassenaer, WUR

Keynote Speakers

09h30 Paola Giavedoni, FoodValley NL
09h50 Rui Costa Lima, Sense Test
10h10 Beatriz Oliveira, UPorto

10h30 **Oral Presentation Session**

10h40 **Coffee Break | E-Poster Session**

Session 5: Presentation of the Net4Food Project

11h10 Lillian Barros, IPBragança

Round Table

11h20 Moderator: Lorenzo Pastrana, INL
Helena Jamardo, CLUSAGA (ES)
Deolinda Silva, PortugalFoods (PT)
Alexandre Gonçalves, MORE CoLAB (PT)
Maria José Alves, AquaValor (PT)
Elisabete Ferreira, Pão de Gimonde (PT)
Filipe Centeno, Proenol (PT)
Carolina Dias, Casa Mendes Gonçalves (PT)
Pedro Babo, Landratech (PT)
Iván García, Néboda Farms (ES)
M.ª Rocío Cid Díaz, Grupo Cuevas (ES)

12h45 **Final Remarks: The Impact of the Net4Food**
David Fernández Calviño and Liliian Barros

15h00 **Satellite Event**
Moderated by ReadyToPub
"How can scientific writing help you?"

SCIENTIFIC PROGRAM

Day 1 | Monday, October 27th	
Welcome Ceremony	**Challenges and Opportunities in the Food System of the Transborder Region** **Chair:** Lillian Barros
09:00 – 09:30	**Registration**
09:30 – 10:00	**Opening Session** Orlando Rodrigues (Instituto Politécnico de Bragança) Manuel Reigosa (Universidad de Vigo) (Comissão de Coordenação e Desenvolvimento Regional do Norte)* Lillian Barros (Instituto Politécnico de Bragança)
10:00 – 12:00	**Roundtable** Jesus Barreiro-Hurle (European Commission) Jaime Piçarra (Associação Portuguesa dos Industriais de Alimentos Compostos para Animais) Manuel Reigosa (Universidad de Vigo) Orlando Rodrigues (Instituto Politécnico de Bragança) Isabel Ferreira (Instituto Politécnico de Bragança) Lorenzo Pastrana (International Iberian Nanotechnology Laboratory) Xosé Lago García (Xunta de Galicia) Raquel Rocha (Agência para o Desenvolvimento e Coesão) (Comissão de Coordenação e Desenvolvimento Regional do Norte)* **Chair:** Deolinda Silva (PortugalFoods)
Welcome Ceremony	**Reflective Lecture** **Chair:** João Barreira
12:00 – 12:45	**Emerging challenges and opportunities for science and innovation in Europe: the next multiannual financial framework (2028–2034) and challenges in food science** Manuel Heitor (Instituto Superior Técnico)
12:45 – 14:30	**Lunch | E-Poster Session**
Session 1	**Innovation, Technology, and Food Security in a Changing Global Landscape** **Chairs:** Fátima Martins and Ana Paula Pereira
14:30 – 15:00	**PL1 - Research & innovation initiatives in the agro-food sector** Isabel Ferreira (Instituto Politécnico de Bragança)

15:00 – 15:20	**KN1 - Cultivating multi-stakeholder collaboration and innovation in food safety: R&I priorities for a safe transition towards sustainable food systems** Veronica M. T. Lattanzio (National Research Council of Italy)
15:20 – 15:25	**OP1 - BRAINR: the brain of the food industry** João Santos (Brainr)
15:25 – 15:30	**OP2 - Nutritional profile, polyphenol bioaccessibility, and functional potential of walnut oil by-products assessed through simulated digestion and cell-based model** Rafael Mascoloti Spréa (Instituto Politécnico de Bragança)
15:30 – 15:35	**OP3 - Selenium biofortification of swiss chard microgreens under indoor vertical farming conditions** Alexis Pereira (Instituto Politécnico de Bragança)
15:35 – 15:40	**OP4 - Novel processing technologies to address by-products valorization, new food trends, and scale-up challenges** Viviana Monteiro (INOV.LINEA, TAGUSVALLEY)
15:40 – 15:45	**OP5 - Characterization of multilayer bacterial cellulose-chitosan films loaded with gallic acid for innovative active food packaging** Patricia Cazón (Universidad de Santiago de Compostela)
15:45 – 15:50	**OP6 - Role of protein composition and refinement level in plant protein structure and functionality during hydrothermal processing** Parle Florencia (Universidad de Valladolid)
15:50 – 15:55	**OP7 - A soft matter approach to fibre for the design of sustainable and healthier foods** Patricia Lopez-Sanchez (Instituto de Investigaciones Marinas)
15:55 – 16:00	**OP8 - Subcritical water treatment for enhancing fiber solubility and nutritional value of cereal brans by-products** Diogo Salvati (Universidad de Valladolid)
16:00 – 16:30	Coffee Break | E-Poster Session
Session 1	**Innovation, Technology, and Food Security in a Changing Global Landscape** Chairs: Cristina Caleja and Eliana Pereira
16:30 – 17:00	**PL2 - Innovation, technology, and food security in a changing global landscape** Pedro Queiroz (Federação das Indústrias Portuguesas Agro-Alimentares, Universidade de Lisboa)
17:00 – 17:20	**KN2 - Driving innovation for mediterranean food security: PRIMA's impact through research and technology. Showcasing research, innovation, and policy synergies to build resilient agro-food systems in the mediterranean** Mohamed Wageih (PRIMA)
17:20 – 17:25	**OP9 - Unveiling the role of polyphenols in modulating gluten proteins: a molecular and functional perspective** Jorge Pardellas Soto (Universidad de Vigo)
17:25 – 17:30	**OP10 - Advancing food protein functionality through ohmic heating** Ricardo N. Pereira (Universidade do Minho)

17:30 – 17:35	**OP11 - Valorization of *Agaricus bisporus* by-products: incorporation of fermented and non-fermented flours into gluten-free bread nutritional, functional, and technological impact** Ana Saldanha (Instituto Politécnico de Bragança)
17:35 – 17:40	**OP12 - Chemical and bioactive characterization of propolis extracts and application in food preservation** Aritson Tolentino (Instituto Politécnico de Bragança)
17:40 – 17:45	**OP13 - Clean-label smoothies with apple and carrot pomaces: rheology and antioxidant stability** Saeed Salari (Universidade de Lisboa)
17:45 – 17:50	**OP14 - Effect of dietary polyphenols in bioaccesibility, bioavailability and further allergenicity of immunogenic proteins** Rodolfo Simões (Universidad de Vigo)
17:50 – 18:00	**Thought Exchange** Q&A Session
19:30 – 23:30	**Welcome Cocktail** Casa do Lago (Albufeira do Azibo)

Day 2 | Tuesday, October 28th	
Session 2	**Nutrition and Consumer Trends: Enhancing the Value of Endogenous Resources** **Chairs:** Filipa Reis and Ângela Fernandes
09:00 – 09:30	**PL3 - Upcycling: opportunities and challenges** Giorgia Spigno (Università Cattolica del Sacro Cuore)
09:30 – 09:50	**KN3 - Transforming endogenous resources into high-value ingredients with value creation** Manuela Pintado (Universidade Católica do Porto)
09:50 – 10:10	**KN4 - Designing next-generation plant polysaccharide ingredients: from soft matter to precision nutrition** Mario M. Martinez (Universidad de Valladolid)
10:10 – 10:15	**OP15 - Pancreatic lipase exhibits selective esterase activity on carboxyl linked hydroxycinnamic acid glucosides** Pablo Gallego-Lobillo (Aarhus University)
10:15 – 10:20	**OP16 - in vitro analysis of starch digestibility and predicted glycemic index in traditional and industrial breads from the galician market** M. Pilar España-Fariñas (Universidad de Santiago de Compostela)
10:25 – 10:30	**OP17 - Prebiotic potential of apple pomace before and after simulated digestion: an in vitro evaluation with probiotic strains** Liege Aguiar Pascoalino (Instituto Politécnico de Bragança)
10:35 – 10:40	**OP18 - From waste to food: valorization of oat pulp from commercial oat drinks** Sara Berguices (Universidad de Valladolid)
10:40 – 10:45	**OP19 - Valorization of fruit distillation pomaces** Ofélia Anjos (Instituto Politécnico de Castelo Branco, Centro de Biotecnologia de Plantas da Beira Interior)
10:45 – 10:50	**OP20 - From ham to 3D snacks: towards sustainable solutions** Lisiane Carvalho (Universidade de Lisboa)
10:50 – 10:55	**OP21 - Highly protein-dense spreads: a strategy for micronutrient delivery in nutritionally vulnerable populations** Sheyma Khemiri (Universidade de Lisboa)
10:55 – 11:00	**OP22 - Sustainable insect proteins: evaluating digestibility, allergenicity, and inflammatory potential** Lisete M. Silva (Universidade do Porto)
11:00 – 11:30	Coffee Break | E-Poster Session
Session 2	**Nutrition and Consumer Trends: Enhancing the Value of Endogenous Resources** **Chairs:** Sara F. Vieira and Filipa Mandim
11:30 – 11:50	**KN5 - Multi-omics characterization of emerging pigmented wheat genotypes: nutritional, molecular and functional perspectives** Victor Freitas (Universidade do Porto)

11:50 – 12:10	**KN6 - Ohmic heating: advancing food safety, quality, and bioprocessing innovation** José Teixeira (Universidade do Minho)
12:10 – 12:15	**OP23 - Diving into marine resources: exploring the ocean's reservoir of biomolecules** Gabriela Sousa (Universidade de Lisboa)
12:15 – 12:20	**OP24 - Nanoencapsulation of Rhus coriaria L. Leaf extract as a natural food preservative** Elizandra N. G. Ardohain (Instituto Politécnico de Bragança)
12:20 – 12:25	**OP25 - XTREMEGOURMET 2.0: connecting gastronomy, science, and sustainable agronomic practices to deliver enhanced halophyte products** Marta Oliveira (Universidade do Algarve)
12:25 – 12:30	**OP26 - Characterization of pumpkin and almond ice-creams produced with food industry side streams** Francisco Herdeiro (Universidade de Lisboa)
12:30 – 12:35	**OP27 - Honeychest cereal bar: a safe, nutritious, and stable product derived from bee products** Sandra Barbosa (MONTESINO – Bee Products Sustainable and Socialy Responsible)
12:35 – 12:40	**OP28 - Evaluating antidiabetic activity of dark tea peptides: methodological insights for sustainable nutritional solutions** Marisol Dias (International Iberian Nanotechnology Laboratory)
12:40 – 12:45	**Thought Exchange** Q&A Session
12:45 – 14:30	**Lunch | E-Poster Session**
Session 3	**Quality, Food Safety, and Environmental Responsibility** **Chairs:** Teresa Carvalho and Tayse F. F. da Silveira
14:30 – 15:00	**PL4 - Global challenges to food safety and risk assessment: how to ensure a more sustainable future for our food systems?** Carlos das Neves (European Food Safety Authority)
15:00 – 15:20	**KN7 - Hidden microbial biodiversity in food production systems: impact on quality, safety and sustainability** Avelino Álvarez-Ordóñez (Universidad de León)
15: 20 – 15:40	**KN8 - Phenolic compounds: a sustainable key to health, quality, and circular food systems** Ana Novo Barros (Universidade de Trás-os-Montes e Alto Douro)
15:40 – 15:45	**OP29 - Evaluation of the effects of the fungicides oxathiapiprolin and spiroxamine on Sacccharomyces cerevisiae cerevisiae viniferm 3D and Saccharomyces cerevisiae bayanus lalvin EC1118^{TM} yeasts** Icía Gómez-Pérez (Universidad de Vigo)
15:45 – 15:50	**OP30 - Preliminary investigation of surface modifications in LDPE microplastics under simulated gastrointestinal conditions** Mariana Lamas (Universidade do Porto)
15:50 – 15:55	**OP31 - Food Safety, Quality, and Environmental Responsibility: Addressing Modern Challenges for a Healthier Future** Renald Blundell (University of Malta)
15:55 – 16:00	**OP32 - Improving municipal biowaste composting management strategies in Resíduos do Nordeste, EIM, S.A. using a life cycle approach** Laís Fabiana Serafini (Instituto Politécnico de Bragança)
16:00 – 16:30	Coffee Break | E-Poster Session

Session 3	**Quality, Food Safety, and Environmental Responsibility** **Chairs:** Bianca R. Alburquerque and Rossana Cardoso
16:30 – 17:00	**PL5 - Unlocking the power of bioactive compounds and emerging technologies for a sustainable food future** María José Rivas-Arreola (Universidad Iberoamericana Puebla)
17:00 – 17:20	**KN9 - Valorization of bioactive ingredients through their incorporation into eco-friendly films for food applications** Manuel Vázquez (Universidad de Santiago de Compostela)
17:20 – 17:40	**KN10 - New challenges in the risk assessment of food additives. Ensuring food safety without neglecting sustainability and environment concern** Patricia Morales (Universidad Complutense de Madrid)
17:40 – 17:45	**OP33 - Emerging and persistent contaminants in honey: insights into pfas, veterinary drug residues, alkaloids, and mycotoxins** Marta Leite (REQUIMTE/LAQV)
17:45 – 17:50	**OP34 - Impact of NPK ratios on proximate composition, tocopherols and fatty acids of purslane leaves** Beatriz H. Paschoalinotto (Instituto Politécnico de Bragança)
17:50 – 18:00	**Thought Exchange** Q&A Session
20:00 – 23:30	**Gala Dinner with musical event** Quinta da Carvalhinha

Day 3 | Wednesday, October 29th	
Session 4	**Marketing, Digitalization, and the Future of the Food Sector** **Chairs:** Luana Fernandes and Ana Luísa Machado
09:00 – 09:30	**PL6 - Feeding the future: when agrifood systems meet the data economy** Lan van Wassenaer (Wageningen Social & Economic Research)
09:30 – 09:50	**KN11 - Working together for a sustainable and competitive food system** Paola Giavedoni (Foodvalley NL)
09:50 – 10:10	**KN12 - Exploring consumers: from classical to contemporary techniques and multisensory experiences** Rui Costa Lima (Sense Test)
10:10 – 10:30	**KN13 - Agrifood by-products: have they a future in the food sector?** Beatriz Oliveira (Universidade do Porto)
10:30 – 10:35	**OP35 - Try or not to try? A theoretical proposal to change eating behavior** Oliva M. D. Martins (Instituto Politécnico de Bragança)
10:35 – 10:40	**OP36 - Need for SPEed: a microextraction approach to streamline the analysis of bioactive compounds and other molecules of interest in complex samples** Jorge A. M. Pereira (Universidade da Madeira)
10:40 – 11:10	Coffee Break | E-Poster Session
Session 5	**Strategic Developments in the Net4Food Project** **Chair:** David Fernández Calviño
11:10 – 11:20	**Presentation of the Net4Food Project** Lillian Barros (Instituto Politécnico de Bragança)
11:20 – 12:50	**Roundtable** CLUSAGA (Helena Jamardo), PortugalFoods (Deolinda Silva), MORE CoLAB (Alexandre Gonçalves), AquaValor (Maria José Alves), Pão de Gimonde (Elisabete Ferreira), Proenol (Filipe Centeno), Casa Mendes Gonçalves (Carolina Dias), Landratech (Pedro Babo), Néboda Farms (Iván García), Grupo Cuevas (M.ª Rocío Cid Díaz), **Chair:** Lorenzo Pastrana (Iberian Nanotechnology Laboratory)
12:50 – 13:00	**Closing Session** **Final Remarks: The Impact of the Net4Food** David Fernández Calviño (Universidad de Vigo) and Lillian Barros (Instituto Politécnico de Bragança)
13:00 – 14:30	**Lunch** (only for invited)

ROUNDTABLE I

CHALLENGES AND OPPORTUNITIES IN THE FOOD SYSTEM OF THE TRANSBORDER REGION

JAIME PIÇARRA

Associação Portuguesa dos Industriais de Alimentos Compostos para Animais

Jaime Piçarra, Agronomist Engineer, 61 years old, married and father of two, specialized in Agricultural Economics and Rural Sociology, began his professional career in 1985 at the Ministry of Agriculture, in the Agricultural Market Information Service (SIMA), and was a member of the Portuguese delegation in the negotiations for the second stage of Portugal's integration process into the EEC, now the EU. He has followed all the reforms of the Common Agricultural Policy (PAC) since 1992 and is currently participating in discussions on the post-2027 PAC.

Jaime Piçarra is the Secretary-General of IACA, the Portuguese Feed Industry Association. He is Vice-President of the Committee for Industrial Compound Feed Production of FEFAC (the European Feed Manufacturers' Federation), coordinator of FEFAC's Task Force on the PAC, and its representative in the Civil Dialogue Groups on Arable Crops, CAP Horizontal Matters, and International Aspects of Agriculture at DG AGRI (European Commission). He also follows sustainability issues, particularly FEFAC's strategy on sustainable soy. He coordinates the Working Group on Agricultural Policy and External Relations of FIPA (the Federation of Portuguese Agro-Food Industries), represents it on the Monitoring Committee of PEPAC (the Portuguese CAP Strategic Plan), and in Brussels, in the Competitiveness Committee of FoodDrinkEurope, the European Food and Drink Industry Organization. He is also President of the General Assembly of CIB (Centro de Informação em Biotecnologia).

He is the author of several articles on OGMs, agricultural markets, and the Common Agricultural Policy – he writes a weekly column, "Notes of the Week", in IACA's Newsletter, also published on Agroportal – and frequently participates, as moderator or speaker, in numerous conferences in Portugal and abroad.

He has been an Honorary Member of FEFAC since April 2016 and an Honorary Member of IAAS/UTAD since March 2019. In 2022, he received the CESFAC Medal for "Personality of the Year," awarded by CESFAC and the Spanish

Government, in recognition of his services and dedication to the feed sector in the Iberian Peninsula and globally. He is also a member of the General Assembly of the EU CAP Network (European Commission), representing FEFAC, and of the CPA, a forum for dialogue between the European Union and the United States.

Given his experience in matters related to food security (feed & food security), he accepted the invitation from the GPP (Office for Planning, Policies, and General Administration) of the Ministry of Agriculture and Fisheries to represent Portugal as a national expert at NATO in the area of supply security and food security, within the FAPG (Food and Agriculture Planning Group).

JESUS BARREIRO-HURLE

European Commission

Jesus Barreiro-Hurle is an economist working at the Economics of the Food System Unit at the Joint Research Centre of the European Commission in Seville. He holds a Master of Science in Agricultural Economics and a PhD in Environmental Economics. During this 30-year professional life he has worked as a researcher, university professor and in international organizations such as the Food and Agriculture Organization of the United Nations. In 2009 he joined the European Commission and since 2015 he is working for the Joint Research Centre. Here he transitioned from pure academic research towards research for policy support thereby ensuring that the findings of research could inform real-life policy options. His work focuses on understanding farmer and consumer decisions incorporating a behavioural dimension and has led to more than 100 peer-reviewed publications including papers in leading journals such as the European Review of Agricultural Economics, Journal of Agricultural Economics, Food Policy and the Ecological Economics. He is member of the editorial boards of the Spanish Journal of Agricultural Research and Q-Open and since September 2025 President of the Spanish Association of Agrifood Economics.

ISABEL FERREIRA

Instituto Politécnico de Bragança

Isabel Ferreira, former Member of the Portuguese Parliament and Secretary of State for Regional Development, is a Professor at the Polytechnic Institute of Bragança.

Throughout her career, she has been deeply committed to promoting science, innovation, and regional development, having served as Director of the Mountain Research Center and mentor of the MORE and AQUAValor Collaborative Laboratories. She coordinated the Scientific Council of Natural and Environmental Sciences of the Portuguese Foundation for Science and Technology, was a member of the Advisory Board of the Science Foundation – Flanders (FWO), and a member of the Committee of Experts monitoring the European Framework Programmes H2020 and Horizon Europe.

She is one of the most cited researchers in the world (top 1%), having been distinguished in the last 9 years in the Essential Science Indicators index, one of the most prestigious indicators of research quality. Her work includes the publication of 4 international books, 60 book chapters, more than 900 scientific articles and several national and European patents, most of them resulting from technology transfer to industry, some of them being the basis for the creation of spin-offs. She received several distinctions such as the Gulbenkian Prize for Stimulating Scientific Research. She was also recognized for the dissemination of Portuguese science in the world and mentioned by Ciência Viva – National Agency for Scientific and Technological Culture, in the book Women in Science. In 2019 she received the European Social Innovation Award from the European Commission; in 2022 she was distinguished by Superbrands as a personality of excellence in the area of Science.

Soon, she will take on a new and inspiring challenge as the next Mayor of Bragança.

LORENZO PASTRANA

International Iberian Nanotechnology Laboratory

Since 2015, Professor **Lorenzo Pastrana** is Group Leader of the Food Processing Group, and former Head of the Department of Life Sciences and Chair of the Research Office at the International Iberian Nanotechnology Laboratory (INL). He is also a Professor of Food Science at the University of Vigo and was a visiting Professor at different Universities in Europe and America. He was Director of the Centre of Research Transference and Innovation (CITI) and Head of Knowledge Transfer Office at the University of Vigo. He founded the Galician Agri-Food Technology Platform.

Currently, he is a member of the scientific board of the Portugal Foods innovation cluster.

At INL, his research is marked by a multidisciplinary approach integrating methods and concepts of biotechnology and nanotechnology to develop personalised functional foods (including Food Structure with emphasis on 3D printing materials and encapsulation technologies); active and intelligent food packaging and development of Gut-on-a-chip devices to assess Safe by Design food ingredients.

He is a prolific scientific author (*h*-index 62), PI of National and European research projects and entrepreneur. In 2025 was included in Stanford/Elsevier Top 2% Scientists List that highlights the world's leading scientists who have made a substantial impact in their respective fields through their citation influence.

XOSÉ LAGO GARCÍA

Xunta de Galicia

Xosé Lago García

Academic data:

- Degree in Law from the University of Santiago de Compostela

- Degree in Political Science and Sociology (specialization in Administrative Science) from the Complutense University (Madrid).

- Advanced studies about Contemporary Political Processes. University of Santiago de Compostela

- Graduate's Degree in Political Science. University of Santiago de Compostela

Professional data:

- Civil servant at Galician Autonomous Government (Xunta de Galicia) since 1985.

- Deputy Director of External Action and Cross-Border Cooperation, at the General Direction of Foreign Relations and with the European Union (from 2009 to the present)

- Between 2014 and 2024, part of the management team of the European Grouping of Territorial Cooperation Galicia-North of Portugal, as secretary-deputy director (2014-2017 and 2021-present) or as director (2017-2021)

- Professor at the Galician School of Public Administration, in subjects of administrative law, namely European Community law and environmental law

MANUEL J. REIGOSA ROGER

Universidad de Vigo

Manuel J. Reigosa Roger is Professor at the Universidade de Vigo since its creation in 1990, graduate in Biology and Philosophy from the Universidade de Santiago de Compostela, where he also obtained a PhD in Biology. Professor of Vegetable Physiology at the University, he was a regular member of governing bodies. It is worth highlighting his work in the three statutes commissions, including the constituent one.

As a governmental responsibilities, he was secretary of the University College of Vigo, director of the R+D Office, deputy vice-rector for Research, twice dean of the Faculty of Science of Vigo (now divided into three faculties), director of the Department of Vegetable Biology and Soil Science and vice-rector of Research.

Manuel Reigosa also coordinated a master's degree (Terrestrial Ecosystems) and chaired the academic committee of a doctoral programme, which at the time was awarded a mention for excellence.

He is the author of more than 100 research articles and editor of five books for publishers such as Kluwer and Springer, among others. With six six-year research fellowships and six five-year teaching fellowships, he is currently involved in editorial work, including work as editor-in-chief of two JCR journals (Thalassas and Allelopathy Journal) and participation as associate editor in three others (PLOS ONE, Acta Physiologiae Plantarum and Weed Biology and Management).

ORLANDO RODRIGUES

Instituto Politécnico de Bragança

Orlando Rodrigues holds a degree in Agronomic Engineering from the Instituto Superior de Agronomia of the University of Lisbon, a Master's in Agricultural Policies and Rural Development from the Instituto Agronómico de Montpellier, and a PhD in Agronomy – Rural and Natural Resource Economics, also from the Instituto Superior de Agronomia. He is a Coordinating Professor at the Escola Superior Agrária of the Instituto Politécnico de Bragança, in the field of Agricultural Economics and Rural Sociology.

He was President of the Board of Directors of the Escola Superior Agrária from June 1999 to June 2005, and from June 2006 to July 2018, he was Vice-President of the Instituto Politécnico de Bragança. Since July 2018, he has been serving as President of the same Institute.

RAQUEL ROCHA

Agência para o Desenvolvimento e Coesão

Raquel Rocha is the Coordinator of the European Territorial Cooperation Unit at the Agency for Development and Cohesion (AD&C) in Portugal. In this role, she represents AD&C, the National Authority for several European programs, including Interreg, which promotes cross-border cooperation between regions. She actively participates in events, debates, and information sessions on European funding opportunities, focusing on the impact of territorial cooperation on citizens' lives. Her work centers on strengthening European territorial cooperation and managing cross-border programs that foster regional development and cohesion.

ROUNDTABLE II

STRATEGIC DEVELOPMENTS IN THE NET4FOOD PROJECT

PORTUGAL FOODS

Deolinda Silva

PortugalFoods is a non-profit association, founded in 2008, and officially recognized by the Portuguese Government as the managing entity of the Portuguese Agrofood Cluster.

With over 200 members – including startups, SMEs, large companies, and scientific and technological institutions such as universities and R&D centers – PortugalFoods supports collaboration across the agrifood sector.

Created with the vision of becoming the reference partner for the Portuguese agrifood sector, PortugalFoods acts as a collaborative platform where its members build win-win relationships. Its mission focuses on the transfer, application, and economic valorization of knowledge to foster innovation, competitiveness, and the internationalization of Portuguese food and beverage companies.

PortugalFoods also promotes the visibility and positioning of the Portuguese agrifood sector in international markets, contributing to the global recognition of national products, companies, and capabilities.

Its core areas of expertise are innovation and internationalization, which are operationalized through two main departments:

- The Knowledge Division, focused on the PortugalFoods Observatory, support for R&D projects, and the national coordination of the ECOTROPHELIA competition.
- The Market Division, dedicated to strengthening exports, empowering companies through international promotion, and identifying business opportunities.

PortugalFoods plays a key role in promoting and disseminating advances in science and technology, as well as in showcasing new products, effectively connecting consumers, retailers, and the industry through strategic information and collaborative innovation.

Deolinda Silva is the Executive Director of PortugalFoods – Association for Agrifood Internationalization and Innovation, manager of the Portuguese Agrifood Cluster, since June 2017.

Previously, from 2004 to 2017, responsible for the analysis and technical monitoring of Research & Innovation Projects at the Portuguese Innovation Agency.

Degree in Food Engineering at Biotechnology School, from the Universidade Católica Portuguesa.

Extensive experience in bridging academia and industry, facilitating knowledge transfer and the economic valorisation of technology.

Strong background in research and innovation collaborative ecosystems, particularly in the Biotechnology and Agri-Food sectors.

CLUSAGA

Helena Jamardo

Clusaga, Galicia's leading agri-food cluster, represents more than 150 members from across the value chain. It contributes to the strengthening, promotion, sustainable growth and improvement of competitiveness and internationalisation of Galicia's food sector.

Helena Jamardo is a Project Manager in the Innovation, Digital Transformation and Entrepreneurship Area at Clusaga – the Galician Food Cluster.

She has experience in the coordination and implementation of European projects focused on innovation within the agri-food sector. At Clusaga, she is also responsible for planning, organizing, and facilitating networking events that foster collaboration across the food ecosystem.

Prior to her current role, she worked at an international food startup as an Upcycling Assistant, where she was involved in product development, management of nutritional information databases, participation in agri-food innovation events, sales process coordination, and the preparation of product launch proposal.

Helena holds a degree in Biochemistry and a Master's in Nutrition and Health.

PÃO DE GIMONDE

ELISABETE FERREIRA

M FERREIRA & FILHAS LDA - Pão de Gimonde is a family business, in the market since the 1960´s. They have been producing bread food products based on traditional recipes, being regionally and nationally recognised as a notorious producer of quality products. Their growth strategy in the last years has been focused on reaching markets outside Portugal and in developing innovative products.

I am **Elisabete Ferreira**, 46 years old and since I was 8 years old, I have grown up in a Bakery. Nowadays, I am the 3rd generation in the Bakery, and I'm passionate about bakery and valorizing the profession and bread.

I have graduated in Business Management and postgraduate in international management.

I am CEO of Pão de Gimonde, for over 30 years, a bakery located in the northeast of Trás-os-Montes, producing and selling its products throughout the national territory, and in some European countries.

In addition, I am President of the Richemont Portugal Club since its creation in 2020, member of the International Richemont Club since 2015.

I can say that I am also a Baker Trainer and Conference Speaker in Several Congress, about innovation Bakery, Sustenability and Food Waste.

I have participated, and I continue to participate, in several research and innovation projects in this area.

In October 2024, I was awarded the recognition of 'Best Baker of the World 2024' in honor of the passion and dedication I have devoted to this profession over the past 30 years.

PROENOL

Filipe Centeno

Founded in 1985, **Proenol** is a Portuguese biotechnology-based company whose core business focuses on the development of innovative oenological and food solutions using microorganisms.

The company's first major innovation was the development of a unique industrial process for the immobilization of microorganisms. The resulting products have various applications in oenology, ranging from the fermentation of sparkling wines to the biological deacidification of musts and the effective treatment of stuck fermentations. These unique solutions are essential for achieving more efficient winemaking with optimized costs.

More recently, the company has developed a process for the production and extraction of yeast proteins with applications in both the wine and food industries. These new products are the result of several years of research and development, contributing to precision oenology. In the food sector, these proteins and their derivatives are highly functional, enabling the development of high-protein, vegan, and clean-label products — all with a neutral and balanced sensory profile.

The merit and recognition of Proenol's technical quality in its products and services are demonstrated by its sustained growth and significant financial commitment to continuous investment across all business areas.

Filipe Centeno is Technical Director of Proenol – Indústria Biotecnológica.

He has a degree in Chemical Engineering by the University of Aveiro and a PhD in Chemical Process and Environmental Engineering by the Instituto National Polytechnique de Toulouse.

He started his career as a researcher at the Laboratoire de Génie Chimique de Toulouse, where he provided research services to the Commissariat d'Energie Atomique and to the company Omya.

In 2001 he joined Proenol, where he worked as process engineer and later as production manager. In 2007, he became responsible for the R&D department where he took over the development of process engineering and new products. He also provided technical support to the various markets where Proenol is present. In 2014 he was invited to assume the technical direction of Proenol.

He is co-author of several scientific and technical articles in the field of oenological microbiology.

CASA MENDES GONÇALVES

Carolina Dias

Flexibility to think differently.

Casa Mendes Gonçalves wants to be a reference for the future of the food industry, with profitability, a high level of demand, and a positive impact on the people, the society, and the environment.

Innovation is our watchword and what we strive for every day.

Our brands:

- Peninsular
- Paladin (www.paladin.pt/)
- Dona Pureza (www.donapureza.pt)

Carolina Dias, originally from Leiria, is characterized by a cheerful spirit, resilience, and a strong desire to learn and help others. She spent 15 years in the Scouts, an experience that provided her with valuable skills and contributed significantly to the person she is today.

She attended the Faculty of Science and Technology at Universidade Nova de Lisboa, where she graduated in Chemical Engineering — a field that has always fascinated her, particularly due to her desire to understand what lies behind everyday phenomena. Her path in engineering led her to the food industry, where she developed her master's thesis and where she continues to work today.

Her three-year journey at Casa Mendes Gonçalves has been marked by continuous personal and professional growth: from a new product development technician to an innovation project manager. With a constant drive to evolve, she pursued a postgraduate degree in Agile Project Management (FCT Nova Executive Education 2025), which strengthened this

aspect by equipping her with practical tools to better manage teams and day-to-day challenges, making them lighter and more effective. Participation in international fairs has further consolidated her mission: to carry the values of Casa Mendes Gonçalves, from Golegã to the world.

She approaches this session as an opportunity for sharing, but above all for learning. She believes in the power of collaboration and innovation when people are placed at the center — and it is with this conviction that she aims to spread the values and mission of Casa Mendes Gonçalves.

LANDRATECH

Pedro Babo

LANDRATECH Lda is a Portuguese start-up company rooted in the valorization of endemic forest resources as a path toward sustainable, resilient, and nutritious food systems. Founded in 2020 by Pedro Babo, PhD, LANDRATECH translates scientific research and ecological knowledge into high-value, bio-based ingredients derived from acorns and other native species.

The company's work is guided by a circular bioeconomy vision, connecting forest owners, research institutions, and agri-food industries in collaborative innovation networks. Through this integrated approach, LANDRATECH promotes regional resilience, biodiversity valorization, and low-impact production models that redefine how local ecosystems contribute to global food security.

LANDRATECH's R&D activity extends across European and Mediterranean partnerships, including LandFood, WebLand, Acorn4MED, and MEDACORNET, fostering knowledge exchange between academia, industry, and territorial stakeholders.

At its core, LANDRATECH embodies a science-based and network-driven approach to the future of sustainable nutrition –transforming underutilized forest resources into opportunities for innovation, health, and regional development.

Pedro Babo, PhD, is the Founder and Chief Scientific Officer of LANDRATECH Lda, a pioneering Portuguese company transforming acorns and other endemic forest resources into sustainable, high-value ingredients for the agri-food industry.

He holds a degree and a Master's in Molecular Biology and Genetics from the University of Lisbon, and a PhD in Tissue Engineering and Stem Cells from the University of Minho, in collaboration with Radboud University (The Netherlands).

Since 2018, Pedro has been leading initiatives at the intersection of circular bioeconomy, sustainable food systems, and regional development, including the Armazém da Bolota initiative. In 2020, he founded LANDRATECH, through which he is advancing a science-driven approach to the valorization of endemic forest resources, integrating innovation, sustainability, and local value chains.

Pedro coordinates and collaborates in European and Mediterranean R&D networks that connect academia, industry, and territorial actors, fostering innovation in sustainable nutrition and forest-based bioeconomy. His work bridges research and application, positioning LANDRATECH within a growing ecosystem of partners committed to rethinking the future of food through regional biodiversity and circular innovation.

NÉBODA FARMS

Iván García Besada

Néboda develops scientific and technological solutions to optimize indoor vertical farming. Its model integrates industrial engineering, plant biology, and artificial intelligence to precisely control all growing parameters – light, climate, irrigation, nutrients, and CO_2 – maximizing photosynthetic efficiency and crop quality. The company applies Lean manufacturing methodologies adapted to agriculture, enabling cost reduction, minimal direct labor, and scalable production systems.

Néboda has successfully cultivated basil and leafy greens with a significantly longer shelf life, free from pesticides and herbicides, and using 90 % less water. Its goal is to transfer this expertise to the production of premium salad mixes, advancing toward fully automated and energy-efficient vertical farming facilities capable of sustainable year-round production.

Iván García Besada, an industrial engineer specialized in electronic systems and holding a master's degree in project management, is the CEO and co-founder of Néboda Farms, a leading company in indoor vertical farming. Before founding Néboda, he worked as a control systems engineer in various technology integrator companies and served as Robotics Coordinator at AKWEL, a French multinational in the automotive sector.

At Néboda, in addition to the general duties of a CEO – strategy definition, financial management, and business development – he is also responsible for industrialization, leading technological development, process automation, and the transfer of scientific knowledge into large-scale production.

GRUPO CUEVAS

M.ª Rocío Cid Díaz

Cuevas y Cía, a company belonging to the Grupo Cuevas business group, specializes in chestnut processing, with a special focus on the production of marron glacé and other products derived from this unique and distinctive fruit of Galicia. From its facilities in Ourense, the company combines tradition, technology, and environmental commitment to offer high-quality products that respect the natural essence of the chestnut.

Chestnuts as a superfood in new nutritional trends. In a context of growing interest in healthy eating, chestnuts are positioned as a functional food, rich in fiber, minerals, and antioxidants, low in fat, and gluten-free. Cuevas y Cía leverages these properties to develop products that respond to the demands of consumers who are increasingly conscious of their health and well-being.

With a long history of experience exporting products to more than 30 countries around the world, Cuevas y Cía actively contributes to the development of the Galician agri-food sector, promoting innovation, sustainability, and collaboration with training centers and scientific institutions, boosting the local economy, fostering rural employment, and promoting the added value of a local product like the chestnut.

M.ª Rocío Cid Díaz is a seasoned executive with extensive experience in business management, commercial strategy, and leadership within the agri-food sector. She currently serves as General Manager at Cuevas y Cía S.A., a role she has held since September 2022. Prior to this, she led Frunatur S.A. as General Manager for four years, and held various commercial and administrative positions at Fru-Cid S.L. and Ignacio de las Cuevas S.A., building a solid foundation in sales, operations, and strategic planning.

Her academic background reflects a strong commitment to continuous professional development. Rocío holds an Executive MBA and a specialization in Purchasing Management and Negotiation from Galicia Business School (2021–2022). She has also completed advanced training in leadership, team development, and productivity management through programs at Galicia

Business School and Forgal Talent. Her early education includes a B.U.P. from I.E.S. Río Cabe and an E.G.B. from Colexio Monte Baliño.

In addition to her managerial expertise, Rocío has cultivated strong language skills, achieving a B2 level in English at the Official School of Languages. She has also completed specialized courses in small business management, accounting, and commercial techniques, including a 400-hour practical training program with Grupo Leche Pascual S.A.

Rocío's career is marked by her strategic vision, leadership capabilities, and dedication to excellence in business operations. Her trajectory demonstrates a deep understanding of the food distribution industry and a passion for driving sustainable growth and innovation.

MORE CoLAB

montanhas de investigação

Alexandre Gonçalves

MORE CoLAB is a non-profit association of private law recognized since 2018 as a Collaborative Laboratory by the Foundation for Science and Technology (FCT). Results from the consortium of research units, laboratories, higher education institutions, technological centers, companies and intermediate and interface institutions.

We were born with the mission of bringing together the mountain regions and looking to the Mediterranean. The economic, environmental and social sustainability represents our focal points and the innovation of products and services, the bet on qualified employment and respect for endogenous products, traditions and communities of these regions are our coordinates.

Alexandre Gonçalves holds a European PhD in Technologic, Comparative and Molecular Genetics. At MORE CoLAB he is an Assistant Researcher and performs the functions of Technical-Scientific Coordinator for the Food and Bio-Based Products Area. He has skills in several thematic areas, including microbiology, genomic and proteomic characterization of bacteria resistant to antimicrobials, innovation in the food sector through the valorization of foods and agri-food by-products and innovative agricultural practices and technologies that promote the sustainable development of Mediterranean crops in adverse climate conditions. At MORE CoLAB he also develops skills in team management, project management and coordination of competitive proposals, helping MORE to connect with the agri-food business sector.

AquaValor

Maria José Alves

AquaValor – Water Technology Valorization and Transfer Center is a private, non-profit association founded by the Polytechnic Institute of Bragança (IPB), the Comunidade Intermunicipal do Alto Tâmega (CIMAT), the Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência (INESC TEC), the University of Vigo (UVIGO), the Centro Hospitalar de Trás-os-Montes e Alto Douro EPE (CHTMAD), the Associação de Desenvolvimento da Região do Alto Tâmega (ADRAT), the Agrupamento Europeu de Cooperação Territorial Eurocidade Chaves-Verín, the Associação Empresarial do Alto Tâmega (ACISAT), as well as key stakeholders from the private sector linked to the water value chain.

It is presented as a thematic yet multifunctional interface infrastructure that aims to support companies by involving them in its activities, addressing unmet needs in the market, and fostering the creation of new channels for knowledge transfer and dissemination within the economic fabric.

AquaValor's activities revolve around the theme of water, in its various dimensions, as a distinctive and identity-defining element that unites and drives economic growth in the Alto Tâmega subregion, focusing primarily on four functional areas:

- Information and Communication Technologies (ICT) applied to Thermal Waters and Wellness Tourism;
- Specialized Services dedicated to Value Creation;
- Research and Innovation;
- Capacity Building of Highly Qualified Human Resources, through master's and doctoral programs, Higher Professional Technical Courses (CTeSP), and training courses for professionals in tourism, hospitality, and catering.

Maria José Alves is an Adjunct Professor at the School of Health, Polytechnic Institute of Bragança (IPB). She holds a PhD in Biotechnology – Microbiology branch, a Specialist title in Clinical Analysis and Public Health, a Master's degree in Toxicology, and a Bachelor's degree in Clinical Analysis and Public Health. Throughout her research career, she has published 30 peer-reviewed scientific papers as author or co-author. She is also the author/co-author of 58 scientific papers published in conference proceedings, 32 oral communications, and over 42 posters presented at national and international events. One of her papers was distinguished by the Journal of Applied Microbiology as the best article for science dissemination to the general public in 2013. Her scientific activity also includes participation in several national and international research projects, such as DeCodE (FCT), ValorNatural (P2020), and IBERPHENOL (POCTEP). She previously served as the Technical Manager of the Microbiology Department at CHTMAD-E.P.E – Chaves Unit. Currently, she is the Course Director of the Bachelor's Degree in Biomedical Laboratory Sciences and the Higher Professional Technical Course (CTeSP) in Thermalism and Well-being.

REFLECTIVE LECTURE

MANUEL HEITOR

Instituto Superior Técnico

Manuel Heitor is a professor at Instituto Superior Técnico (IST) the engineering school at the University of Lisbon. He served as Minister for Science, Technology and Higher Education for the Government of Portugal in 2015-2022 and as Secretary of State from 2005 to 2011. In 2023 he was appointed by the European Commission to chair the Expert group for the interim evaluation of the Horizon Europe programme.

Professor Manuel Heitor will deliver a Reflective Lecture entitled “Emerging Challenges and Opportunities for Science and Innovation in Europe: The Next Multiannual Financial Framework (2028–2034) and Challenges in Food Science”.

PLENARY LECTURES

PL1 | RESEARCH & INNOVATION INITIATIVES IN THE AGRO-FOOD SECTOR

Isabel Ferreira[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *iferreira@ipb.pt

Achieving a genuine transformation in European society requires research and innovation initiatives that are both ambitious and strategically significant. Our region is widely recognized for the exceptional quality of its agri-food products, a distinctive feature that, under the growing challenges of climate change, demands renewed commitment to sustainability, competitiveness, and technological advancement.

Such progress can only be achieved through the integration of scientific knowledge and technological development, which play a decisive role in generating new research fields, strengthening skills and qualifications, and stimulating innovation capable of driving business modernization and regional economic growth.

In the Food Chemistry domain, research and innovation activities should align with emerging priorities such as: integrating the climate-water-energy-food nexus into research and policy; developing nature-based solutions to achieve carbon-neutral cities and improved air quality; assessing and preserving soil biodiversity; reducing food losses and waste throughout the agri-food chain; promoting innovative and sustainability-driven value chains; reinforcing links between producers and consumers through new supply models; minimizing plastic use and understanding its impacts on human health; exploring alternative protein sources for food and feed; and encouraging the adoption of healthier and more sustainable dietary patterns.

Our research agenda is built upon two fundamental pillars:

- The development of bio-based solutions for the food sector, harnessing natural resources to obtain safer, healthier, and more sustainable ingredients such as natural preservatives and colorants.
- The innovation of functional foods, addressing consumer expectations for quality and well-being while supporting global strategies that ensure food availability and sustainability.

Acknowledgements

Foundation for Science and Technology (FCT, Portugal) for financial support through national funds FCT/MCTES (PIDDAC) to CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020).

ISABEL FERREIRA

Instituto Politécnico de Bragança

Isabel Ferreira, former Member of the Portuguese Parliament and Secretary of State for Regional Development, is a Professor at the Polytechnic Institute of Bragança.

Throughout her career, she has been deeply committed to promoting science, innovation, and regional development, having served as Director of the Mountain Research Center and mentor of the MORE and AQUAValor Collaborative Laboratories. She coordinated the Scientific Council of Natural and Environmental Sciences of the Portuguese Foundation for Science and Technology, was a member of the Advisory Board of the Science Foundation – Flanders (FWO), and a member of the Committee of Experts monitoring the European Framework Programmes H2020 and Horizon Europe.

She is one of the most cited researchers in the world (top 1%), having been distinguished in the last 9 years in the Essential Science Indicators index, one of the most prestigious indicators of research quality. Her work includes the publication of 4 international books, 60 book chapters, more than 900 scientific articles and several national and European patents, most of them resulting from technology transfer to industry, some of them being the basis for the creation of spin-offs. She received several distinctions such as the Gulbenkian Prize for Stimulating Scientific Research. She was also recognized for the dissemination of Portuguese science in the world and mentioned by Ciência Viva – National Agency for Scientific and Technological Culture, in the book Women in Science. In 2019 she received the European Social Innovation Award from the European Commission; in 2022 she was distinguished by Superbrands as a personality of excellence in the area of Science.

Soon, she will take on a new and inspiring challenge as the next Mayor of Bragança.

PL2 | INNOVATION, TECHNOLOGY, AND FOOD SECURITY IN A CHANGING GLOBAL LANDSCAPE

Pedro Queiroz[1,2,3]*

[1]Federation of the Portuguese Agrifood Industries, Lisbon, Portugal; [2]Nutrition laboratory, Lisbon School of Medicine, University of Lisbon, Lisbon, Portugal; [3]Department of pharmaceutical sciences and medicine, Faculty of Pharmacy of the University of Lisbon, Lisbon, Portugal. *pedro.queiroz@fipa.pt

Food security is increasingly under pressure from a convergence of global challenges that are reshaping agricultural landscapes and food systems. Climate change is intensifying the frequency and severity of extreme weather events, affecting crop yields and disrupting supply chains [1]. Simultaneously, geopolitical instability - such as armed conflicts, trade disruptions, and migration - further exacerbates the fragility of food access, particularly in regions already vulnerable to food insecurity. Population growth, projected to reach 9,7 billion by 2050 (UN 2019) [2], places added pressure on already strained food production systems, while environmental degradation - including soil erosion, water scarcity, biodiversity loss and pollution - undermines the very ecosystems on which agriculture depends. In this complex and rapidly evolving context, innovation and technology have become indispensable drivers of transformation within food systems. This presentation explores the critical role of emerging technological solutions – ranging from precision agriculture, biotechnology and gene editing, to artificial intelligence, Internet of Things (IoT), blockchain, and digitalised supply chains - in reshaping the production, distribution, and consumption of food. These tools offer immense potential for improving agricultural productivity, reducing post-harvest losses, enhancing supply chain transparency and traceability, optimising the use of natural resources, and promoting fairer and more inclusive access to nutritious food. However, the adoption of these innovations is not without challenges. Ethical, social, and economic concerns must be addressed to ensure equitable access and sustainable implementation. Issues such as technological exclusion in low-income regions, the monopolisation of proprietary technologies, lack of infrastructure, and digital illiteracy pose significant barriers. Furthermore, the environmental implications of certain technologies and the socio-economic displacement of traditional farming communities require careful consideration. The risk of deepening existing inequalities - between countries, regions, and populations - demands a critical, inclusive, and context-sensitive approach to food technology development. This presentation adopts an interdisciplinary perspective, integrating insights from agricultural science, technology studies, economics, and public policy, to propose actionable pathways for embedding innovation into comprehensive food security strategies. It argues that technological solutions must be accompanied by robust governance frameworks, inclusive public policies, and mechanisms for knowledge sharing and capacity-building. Public–private partnerships, international cooperation, and cross-sectoral dialogue are essential for aligning technological advancement with the Sustainable Development Goals (SDGs), particularly those related to zero hunger, climate action, responsible consumption and production, and reduced inequalities.

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PEDRO QUEIROZ

Federação das Indústrias Portuguesas Agroalimentares

Faculdade de Medicina da Universidade de Lisboa

Pedro Queiroz is a seasoned executive with extensive experience in the agri-food industry, currently serving as General Manager of FIPA – the Portuguese Agri-food Industries Federation.

Actively engaged in shaping the strategic direction and representation of the Portuguese food sector at both national and international levels. Represents the national industry as a member of the Committee of Directors General at FoodDrinkEurope, a prominent voice in European food policy. Also serves as Portugal's national representative at SPES/GEIE – Spread European Safety and Sustainability. Combines leadership in the food industry with a strong academic background, lecturing in the Master's in Food Quality and Health at the Faculty of Pharmacy, University of Lisbon, and in the Degree in Nutrition Sciences at the Faculty of Medicine, University of Lisbon. Has also collaborated with several leading higher education institutions across Portugal.

Has been actively involved in numerous national and European research and development projects and is regularly invited to participate in governmental commissions, national platforms, and working groups led by public administration and academic bodies. Frequently serves as a jury member in national food innovation competitions and contributes regularly to the written press on topics related to food policy, innovation, and industry trends. Holds a Master's degree in Biotechnology – Biochemical Engineering, and a Degree in Biotechnological Engineering, supported by a diverse portfolio of additional training undertaken both in Portugal and abroad.

PL3 | UPCYCLING: OPPORTUNITIES AND CHALLENGES

Giorgia Spigno[1*]

[1]DiSTAS – Department for sustainable food process, Università Cattolica del Sacro Cuore, Via Emilia Parmense 84 – 29122 Piacenza, Italy. *giorgia.spigno@unicatt.it

Although it may appear as a relatively new and emerging approach, upcycling food is an ancient tradition, probably more applied in the past, neglected during the boom of the linear economy, and now emphasized in the run for a fully circular food system. However, as happened with the definition of food waste and food loss, the definition of food upcycling still faces some issues [1] aimed to establish a clear and concise definition of upcycled foods, involving researchers and participants from the Upcycled Food Association, and releasing the final definition: "Upcycled ingredients and food products elevate food that would otherwise be wasted to higher uses and have tangible benefits to the environment and society".

In another study [2], a more systematic approach was employed, highlighting the dual function of upcycled foods in addressing both food waste (alternative uses) and food loss (novel uses). Upcycled foods were here defined as products that "reduce food waste through alternative use and avoid food loss through novel use", but with two important recommendations. First, the value of food otherwise wasted being turned into alternative foods needs to be carefully assessed to avoid that other preferable options are not chosen; second, the upcycled ingredients and foods should only be called upcycled as long as they are commonly wasted.

With a focus on food processing, under-valorised side-streams, represents a societal problem due to the loss of valuable nutrients and bioactives which could, instead, be consumed contributing to a healthy and sustainable nutrition; environmental pollution if not optimally/properly disposed of; economic loss in terms of both lost valuable material and missed opportunities of new business linked to economic exploitation of food resources; cost of disposal in case the side-stream is not valorized at all and then sent to landfill/ incineration. Under-valorised food processing side-streams is, first, a problem for the local communities where they are generated, but also a problem at a larger and global scale since their upcycling into high-value new food ingredients might benefit consumers in other regions and countries, reduce the environmental burden, and promote new business activities for different food side-streams. Together with such opportunities, many challenges still exist (Figure 1) for the valorisation of food processing side-streams through up-cycling strategies, with peculiarities dependent on the specific food sector [3].

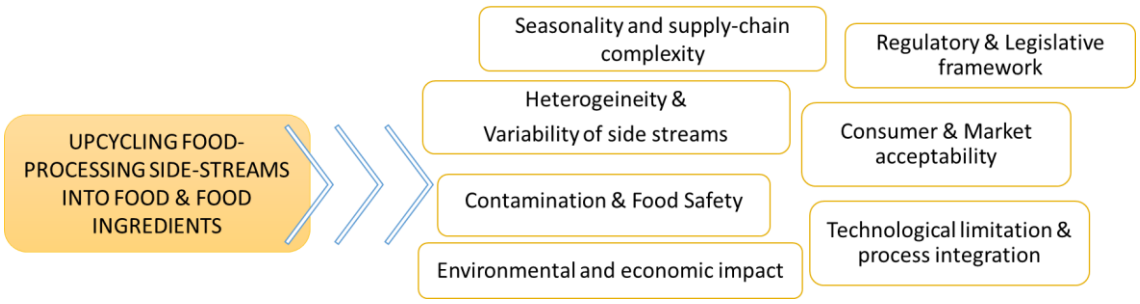

Figure 1 – Challenges and issues to address for a successful large-scale implementation of upcycling strategies to convert food processing side-streams into food and food ingredients.

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GIORGIA SPIGNO

Università Cattolica del Sacro Cuore

Giorgia Spigno holds an MSc in Food Science and Technology (1999) and a PhD in Chemical and Processing Engineering. She is Full Professor in Food Science and Technology and Head of the Department for Sustainable Food Process (DiSTAS) at Università Cattolica del Sacro Cuore (Italy), where she is also Coordinator of the MSc in Food Science and Technology and where she teaches different courses in Food Processing and Plants, Food Packaging and Risk mitigation in Food processing.

Her main expertise is in food processing, food packaging, and process design, optimisation, innovation, modelling, and characterisation and optimisation of food functional properties and shelf-life.

She has gained relevant experience in the field of agri-food residues upcycling for the recovery of different compounds (mainly antioxidants and fibres) and their use in the food value chain, including more sustainable food contact materials; in the sector of plant-based proteins, oil structurisation, and rheology. Based on Scopus, she has 124 publications with an h-index of 32.

PL4 | GLOBAL CHALLENGES TO FOOD SAFETY AND RISK ASSESSMENT: HOW TO ENSURE A MORE SUSTAINABLE FUTURE FOR OUR FOOD SYSTEMS?

Carlos das Neves[1*]

[1]Chief Scientist of European Food Safety Authority (EFSA). *carlos.dasneves@efsa.europa.eu

Food systems are undergoing rapid transformation, driven by scientific innovation in areas like cellular agriculture, precision fermentation or AI-driven monitoring and advanced packing, which promise greater sustainability and resilience. However, this progress is counteracted by unsustainable and unhealthy patterns, such as the overreliance on ultra-processed foods, inefficient resource use, and environmental degradation, which impose significant hidden costs on society and the environment. These uncounted costs, estimated at least $10 trillion annually on a global scale, are largely driven by health issues linked to unhealthy diets.

In this fast-moving context, risk assessment remains essential for protecting public health and maintaining consumer trust. Yet its role is increasingly challenged by the complexity and novelty of emerging hazards, as well as the speed at which innovations reach the market. Traditional frameworks, while scientifically robust, can be perceived as slow or rigid, sometimes acting as bottlenecks for solutions that could support healthier, more sustainable food systems, and enable innovation and resilience in Europe in times of increase geopolitical and socioeconomic tensions. This complexity is further compounded by an increasingly demanding public, heavily influenced by media narratives or quick evolving political priorities.

This reality challenges both risk assessors and managers and can raise the question whether the current framework in Europe require a mere "evolution" in its approach to risk assessment, or a fundamental "revolution", necessitating a re-evaluation of foundational paradigms, definitions, and regulatory constructs.

In this presentation we highlight how "evolution" may involve refining current methodologies, integrating new scientific tools such as predictive modelling and big data analytics, and improving cooperation between science, policy, and industry. But we also consider how "revolution" would require rethinking and assessing "risk vs benefit", more adaptive risk assessment regulatory pathways for new technologies (*e.g.* development of sandboxes), legal efforts to harmonize risk assessment methodologies across Europe and embedding *e.g.* sustainability, environment or nutrition aspects into food safety risk assessments.

To address these interconnected challenges, a One Health approach is paramount. This integrated framework recognizes that the health of humans, animals, and ecosystems are interdependent and must be optimized in a balanced way. By fostering collaboration across multiple sectors – including public health, agriculture, and environmental sciences – the One Health approach can effectively address the full spectrum of food-related threats, from antimicrobial resistance and zoonotic diseases to food safety and security. Embracing this holistic vision is crucial for developing an agile and future-ready food system that delivers a safer and more sustainable future for all.

CARLOS DAS NEVES

European Food Safety Authority

Carlos das Neves is EFSA's Chief Scientist and has been a member of EFSA's senior management team since November 2022.

A Portuguese and Norwegian national, Carlos was Director of Research and Internationalisation at the Norwegian Veterinary Institute (NVI) before joining EFSA, and previously served as Head of Virology and Head of Food Safety & Emerging Threats at the NVI. Additionally, he was a Full Professor at The Arctic University of Norway (UiT) from 2012 to 2025.

Carlos is a veterinarian (DVM – Technical University of Lisbon) and holds a PhD in veterinary sciences (Norwegian School of Veterinary Sciences). He also has a Postgraduate Certificate in Public Health from the London School of Hygiene and Tropical Medicine, and a Certificate in Public Policy Analysis from the London School of Economics and Political Science. In April 2024, he has been appointed as a member and co-chair of the One Health High-Level Expert Panel (OHHLEP), the scientific and strategic advisory group to the Quadripartite organisations – Food and Agriculture Organisation, UN Environment Programme, World Health Organization and World Organisation for Animal Health.

PL5 | UNLOCKING THE POWER OF BIOACTIVE COMPOUNDS AND EMERGING TECHNOLOGIES FOR A SUSTAINABLE FOOD FUTURE

María José Rivas-Arreola[1*]

[1]Science and Engineering Department, Universidad Iberoamericana Puebla, San Andrés Cholula 72810 Puebla, Mexico. *mariajose.rivas@iberopuebla.mx

The growing demand for sustainable food systems requires innovative strategies that integrate bioactive compounds and emerging biotechnologies to improve nutritional and environmental outcomes. This talk explores the valorization of natural resources – particularly agro-industrial by-products and biopolymer residues – as sources of phenolic compounds and functional materials. Our research has focused on elucidating the antioxidant, cytotoxic, and techno-functional properties of bioactives derived from plants and insects, as well as their potential applications in food and biomaterial innovation. We have obtained compounds from oak and pine bark, developed kombucha analogs for the revalorization of mulberry coproducts, and explored emerging technologies for the extraction of biopolymers, opening new pathways for circular resource utilization and the development of biocompatible scaffolds. Altogether, these studies highlight the importance of linking natural product chemistry, green processing, and functional food design to build a more resilient and sustainable food future.

MARÍA JOSÉ ARREOLA

Universidad Iberoamericana Puebla

Dr. **Rivas Arreola** is a professor and researcher at Universidad Iberoamericana Puebla, with a background that spans chemical engineering (BSc), biotechnology (MSc), and biochemical engineering (PhD), complemented by a postdoctoral research stay in materials science. Her work lies at the intersection of biotechnology, food innovation, and sustainable materials, focusing on the valorization of agro-industrial waste through the development of advanced polymeric matrices. These materials find applications in tissue engineering, functional foods, textiles, and environmental technologies. Over the past 15 years, Dr. Rivas has led or collaborated on multiple academic and industry-linked R&D projects, working closely with national and international institutions to promote sustainable innovation.

In 2017, she was recognized with the “She4She” MujerTec Award by Tecnológico de Monterrey for her work mentoring and promoting women in STEM. She has also served as a judge for innovation and science competitions, including the Talent and Innovation Competition of the Americas (TIC Americas) and the international synthetic biology competition iGEM. Her ongoing work explores the integration of bioactive compounds, emerging technologies, and principles of social and solidarity economy to support sustainable and inclusive food systems.

She is actively involved in networks for science, entrepreneurship, and education, and holds professional diplomas in areas such as social economy, biomaterials, and innovation. Dr. Rivas is currently a member of professional associations including the Institute of Food Technologists (IFT), the Society for Biomaterials, the Mexican Society for Biotechnology and Bioengineering (SMBB), IEEE Bionanotechnology and BioMEMs (BNM), and serves on the board of AMECA (2023–2025).

PL6 | FEEDING THE FUTURE: WHEN AGRIFOOD SYSTEMS MEET THE DATA ECONOMY

Lan van Wassenaer[1*], Bobby Tsvetkov[1]

[1]Wageningen Social & Economic Research. *lan.vanwassenaer@wur.nl

As agrifood systems become increasingly digitalized, digital observatory ecosystems are emerging as critical infrastructures for monitoring and guiding complex transformations [1,2]. By integrating diverse signals, these observatories connect data ecosystems, business ecosystems, and digital innovation ecosystems (see Figure 1 for the conceptual framework developed in the Horizon Europe 4Growth project). This integration supports evidence-based decision-making, fosters cross-sector and cross-border collaboration, and accelerates the translation of knowledge into actionable innovation. Organizing digital observatory ecosystems presents both opportunities and challenges. Opportunities include enhancing situational awareness for policymakers and businesses, linking fragmented data into interoperable datasets, stimulating innovation across research and industry, and improving transparency along value chains. Challenges include maintaining data quality, ensuring interoperability and real-time analytics at scale, and addressing governance issues such as aligning stakeholder incentives, protecting data privacy, and securing sustainable funding. Drawing on insights from 4Growth, we outline strategies for designing flexible, adaptive, and collaborative observatory ecosystems.

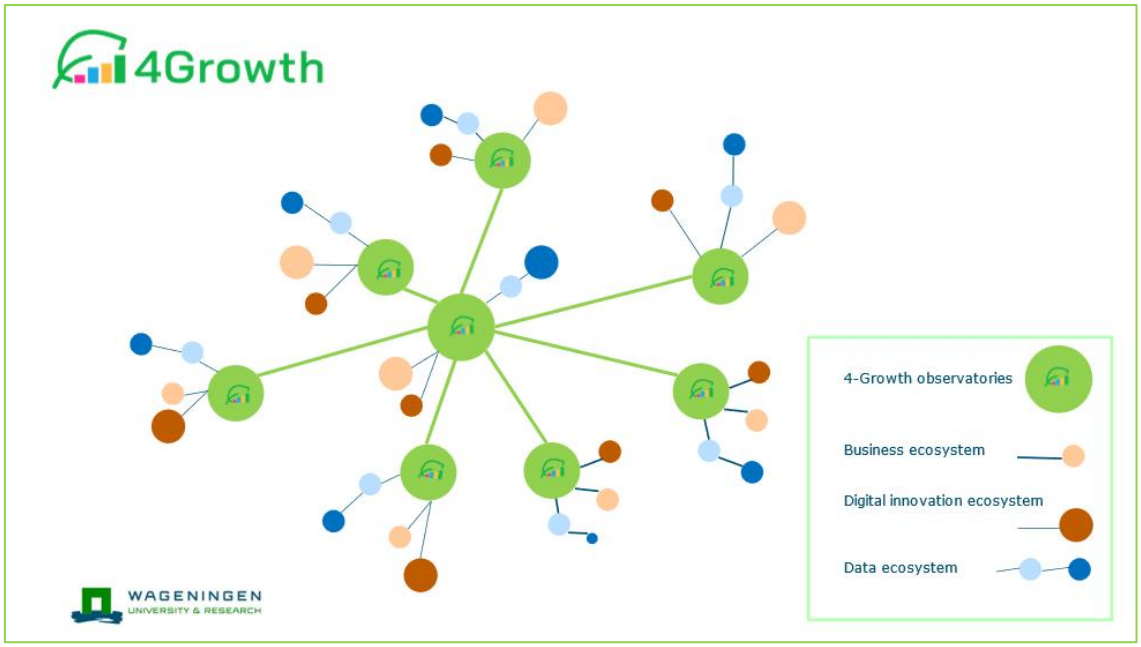

Figure 1 – Conceptual framework for the 4Growth observatory ecosystem.

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Acknowledgments

The research was carried out partly within the 4Growth project, funded by the European Union's Horizon Europe research and innovation programme under grant agreement No. 101134855 and benefited from insights from related projects such as Data4Food2030 and FutureFoodS.

LAN VAN WASSENAER

Wageningen University & Research

Lan van Wassenaer is Chief Data Economist and Strategic Senior Scientist at Wageningen Social & Economic Research. She holds a PhD in Business Economics and MSc in Agricultural Economics from Wageningen University. Her research focuses on the socio-economic analysis and modelling of current and emerging issues in agri-food systems, with particular emphasis on the economics of innovation and information, risk and uncertainty, transparency, data-driven governance, and evolving business models in the digital era.

In recent years, her research has increasingly centered on the emergence of the data economy and its transformative impact on agri-food value chains. She explores how data-driven governance and digital technologies—such as blockchain, artificial intelligence, and IoT—can enhance traceability, transparency, and compliance, contributing to more resilient and sustainable food systems.

She has extensive experience leading multidisciplinary research and innovation projects at both national and international levels. Her projects often involve close collaboration with policymakers, industry stakeholders, and technology providers to design and assess digital solutions that support evidence-based decision-making and responsible innovation in the agri-food sector

KEYNOTE LECTURES

KN1 | CULTIVATING MULTI-STAKEHOLDER COLLABORATION AND INNOVATION IN FOOD SAFETY: R&I PRIORITIES FOR A SAFE TRANSITION TOWARDS SUSTAINABLE FOOD SYSTEMS

Veronica MT Lattanzio[1*], Nunzia M Cito[1], Martina Loi[1], Antonio Moretti[1]

[1]National Research Council of Italy, Institute of Sciences of Food Productions, via Amendola 122/O, Bari, Italy.
*veronicamariateresa.lattanzio@cnr.it

In response to the dynamic transformation of global food systems - driven by interconnected challenges such as climate change, resource depletion, technological innovation, and evolving consumer expectations - the European Union (EU) is advancing integrated policy frameworks and fostering science-policy-society interfaces to ensure resilient and adaptive food systems governance. Food safety must remain a central pillar of this approach; however, it cannot be addressed in isolation. Systemic approaches, new technologies, and open access to data are needed to ensure that our food remains safe as the EU innovates the food system and adapts to major driving forces.

The EU Food Safety Platform, established under the FoodSafety4EU project (H2020), exemplifies this strategy by convening diverse stakeholders – including regulators, scientists, industry, and citizens – to co-create solutions and align research agendas. Through a dynamic operational model encompassing geographical hubs, food safety operational labs, digital tools, and participatory approaches, the Platform addresses the evolving food safety landscape and supports evidence-based decision-making.

A cornerstone output of the Platform is the Strategic Research and Innovation Agenda (SRIA) for food safety, which prospects emerging food safety issues and addresses consumers' expectations, emerging technologies and policy priorities. Updated annually through multi-actor discussions – many hosted by the EU Food Safety Forum – the SRIA addresses priority topics that are transversally connected to the main food safety system challenges.

Looking at the new EU policy priorities, it is expected that upcoming research agendas will address the urgent need to close the research and innovation gap for sustainable and competitive food systems in Europe. To leverage the knowledge and innovation developed through Food 2030 and other EC initiatives, future efforts will focus on maximizing uptake across the food industry, regulatory bodies, and society at large. Further development and deployment of cutting-edge technologies and methodologies to future-proof food safety are expected to involve embracing digital transformation, advanced biotechnology, and innovative data-driven approaches to tackling complex environmental, social, and systemic challenges.

Existing living lab networks and multi-stakeholder platforms that structure and guide actors within innovation ecosystems are anticipated to play a pivotal role in facilitating regulatory innovation, scaling up startups, and integrating sustainability and bioeconomy principles into food safety practices.

VERONICA LATTANZIO

National Research Council of Italy

Veronica Lattanzio. Chemist. Senior Researcher at the Institute of Sciences of Food Production, of the National Research Council of Italy. She has/had responsibility in several national and international projects relevant to food safety. Coordinator of the H2020 project "FOODSAFETY4EU: Multi-Stakeholder platform for Food Safety in Europe" and then of the "EU FOOD SAFETY PLATFORM" (https://foodsafetyplatform.eu/) " which main goal is to deliver solutions to support the EC in its endeavour in aligning research, policy and innovation with the societal needs and perspectives and improving food safety across Europe.

Member of the Scientific and Stakeholder Advisory Board of FutureFoodS, the European partnership for a sustainable Future of Food Systems. Her main research domains are i) food contaminants: mycotoxins, pesticides, risk assessment, risk communication, standard/official methods, screening methods, and ii) multi-actor co-creation of input for R&I agendas and policies in the food safety/sustainability domain.

She is Member of the Working Group "Biotoxins" (CEN/TC 275 WG5 "Food Analysis – Horizontal Methods – Biotoxins), of the European Committee for Standardization. She collaborates with the International Atomic Energy Agency (IAEA) as project advisor and expert to provide individual and collective training related to testing chemical contamination for food safety.

KN2 | DRIVING INNOVATION FOR MEDITERRANEAN FOOD SECURITY: PRIMA'S IMPACT THROUGH RESEARCH AND TECHNOLOGY. SHOWCASING RESEARCH, INNOVATION, AND POLICY SYNERGIES TO BUILD RESILIENT AGRO-FOOD SYSTEMS IN THE MEDITERRANEAN

Mohamed Wageih[1]*

[1]PRIMA Partnership, Nexus 2 Building, Carrer Jordi Girona 29, 2nd floor 2A, 08034 Barcelona, Spain. *mohamed.wageih@prima-med.org

The Mediterranean basin is at the frontline of climate change, water scarcity, demographic pressures that threaten food security & socio-economic stability. Fragmented food systems across borders amplify vulnerabilities, while at the same time offering unique opportunities for cooperation, knowledge exchange, and technological innovation. The PRIMA Programme (Partnership for Research and Innovation in the Mediterranean Area) is the largest Euro-Mediterranean initiative addressing these challenges through research and innovation solutions and multilateral collaboration. Since 2018, PRIMA has mobilized over €400 million to fund 269 projects, connecting researchers, innovators, SMEs, farmers, and policymakers.

PRIMA supports the transition from research excellence to market readiness, fostering innovation pathways. Its portfolio includes technologies reducing food loss & waste, valorising by-products within the circular bioeconomy, advancing climate-smart farming, strengthening the Med. diet as a model of sustainable and healthy nutrition. By enhancing technology transfer, patents, start-ups, and spin-offs, PRIMA ensures that knowledge generated is translated into socio-economic impact. At the same time, it builds capacity and networks, empowering Mediterranean actors to cooperate beyond borders and co-create systemic solutions.

By bringing together cutting-edge research, technological innovation, and policy frameworks, PRIMA is strengthening the resilience of Mediterranean food systems. Its projects demonstrate how scientific advances can be scaled via innovation pathways, while policy alignment with the EU Green Deal, Farm to Fork Strategy, SDGs ensures that outcomes are embedded into systemic transitions. Looking ahead, initiatives such as Future4PRIMA will further connect research results with policy agendas and innovation ecosystems, reinforcing the Mediterranean as a hub of resilient, sustainable, and inclusive food systems.

The presentation will spotlight PRIMA actions and achievements in the Food sector (2018-2024):

- Innovation to Market: how PRIMA Actions move from research outputs (TRL) to market-ready solutions (MRL) – ensuring technologies are scalable and applicable in real farming and food systems.
- Agro-Food Priorities: PRIMA Actions address food loss and waste reduction, circular bioeconomy approaches, water-efficient farming, sustainable production methods, promotion of the Med. diet.
- Impact Pathways: Strong emphasis on technology transfer, start-ups, patents, and spin-offs to turn research into socio-economic benefits within agro-food sectors.
- Policy Integration: Alignment between PRIMA Partnership and the EU Green Deal, Farm to Fork Strategy, and SDGs, embedding agro-food innovations into broader food system transitions.
- Cross-Border Cooperation: PRIMA acts as a platform uniting EU- MENA to co-create resilient, sustainable, and inclusive agro-food systems. Clustering initiatives (FoodWaStop, ENFIBER) have been initiated to magnify the international collaboration among beneficiaries.

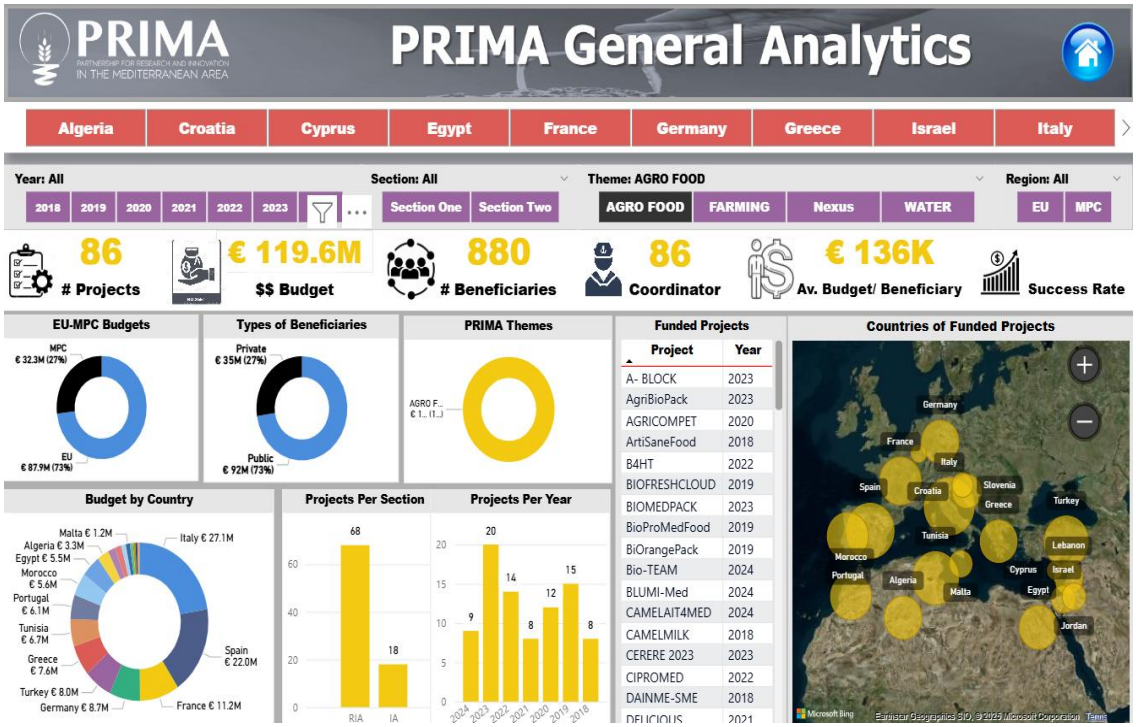

Figure 1 – PRIMA Intelligent Analytical Dashboard – Agrofood Projects (2018-2024).

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[2] PRIMA Annual Report 2023, PRIMA Foundation, Barcelona, 2024.
[3] FAO, "The State of Food Security and Nutrition in the World," Rome, 2023

MOHAMED WAGEIH

PRIMA

Mohamed Wageih – Project Officer @PRIMA Secretariat Barcelona. Certified STI professional and M&E Specialist from ILO with a track record of expertise in EU projects. Prior to PRIMA, he served as the Director of the Observatory of Business Innovation at a private University and held a pivotal role as an EU Project Coordinator at the Academy of Scientific Research.

He was an R&I consultant at various Egyptian and European institutes. Over the years, he successfully developed a portfolio of over 25 EU-funded projects (EuropeAid, FP7, H2020, Horizon Europe, DG NEAR …) across Egypt, Europe, the Middle East and Africa, reflecting his deep understanding of international cooperation and R&I dynamics.

Currently, I am monitoring more than 45 projects spanning Europe and the MENA region. His visionary leadership has led to the creation of innovative tools such as PRIMA Intelligent Analytical Tool and PRIMA M&E Platform. He has enriched his knowledge through specialized internships at prestigious institutes (UNESCO, WB, DLR, Manchester Univ….) Moreover, he has co-authored several policy reports and a book chapter, represented PRIMA at numerous international conferences, and delivered various training sessions at EU-Mediterranean countries.

KN3 | TRANSFORMING ENDOGENOUS RESOURCES INTO HIGH-VALUE INGREDIENTS WITH VALUE CREATION

Manuela Pintado[1]*

[1]CBQF- Escola Superior de Biotecnologia - Universidade Católica Portuguesa, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal. * mpintado@ucp.pt

The valorisation of endogenous Portuguese resources through green processing and bioactivity-driven design represents a strategic opportunity to create sustainable, high-value ingredients and strengthen regional bioeconomy models. This presentation explores how selected national resources and agro-industrial by-products can be transformed into functional ingredients through targeted fractionation, bioactivity validation and bioaccessibility assessment and some application examples. Some key matrices from our recent research are highlighted. Olive pomace, a major by-product of the olive oil sector, is rich in hydroxytyrosol, tyrosol and other phenolics showing strong antioxidants and antimicrobial activities; its aqueous and lipidic fractions have demonstrated potential for use in functional foods and edible coatings. Citrus peel contains hesperidin, eriocitrin, pectin and dietary fibre, displaying radical-scavenging and anti-inflammatory properties that support its use as a food additive or nutraceutical ingredient. Melon peels and seeds, often discarded, are sources of polyphenols and lipophilic compounds with high antioxidant capacity and improved bioaccessibility after *in-vitro* digestion. Acorn (bolota), a forest-derived material, provides oleic and linoleic acids, tannins and phenolic lipids with antioxidants and stabilizing effects on PUFA-rich systems, representing also a promising functional lipid and starch source. Mushroom contain β-glucans, phenolics and antimicrobial metabolites with potential prebiotic and preservative roles. Fish by-products, such as sardine processing residues, yield bioactive peptides and ω-3 fatty acids with antihypertensive and antioxidant properties, contributing to marine-based functional formulations. Across these matrices, the implementation of green extraction technologies, such as ultrasound-assisted extraction, enzymatic hydrolysis and subcritical water processing, enables the recovery of bioactive fractions while preserving their functional integrity. For food or nutraceutical applications the use of the INFOGEST *in-vitro* digestion model supports the evaluation of bioaccessibility and stability of bioactives, strengthening their validation as functional ingredients. Rather than aiming at large-scale industrial conversion, this presentation highlights realistic and tangible valorisation pathways grounded in Portuguese biodiversity and expertise. It will demonstrate how endogenous resources are not low-value materials or environmental burdens, but rather valuable sources of innovation, identity and opportunity, reinforcing the bridge between science, sustainability and regional resilience.

MANUELA PINTADO

Universidade Católica Portuguesa do Porto

Manuela Pintado has been a Professor at the College of Biotechnology of the Portuguese Catholic University (ESB-UCP) since 2005. In 2017, she became the director of CBQF (Chemistry and Biotechnology Center – State Associate Laboratory), an ESB UCP research unit as well as Associate Director of ESB UCP. She was a member of the Research and Internationalization Group of UCP (2014-2016). She has established a strong interaction with industry, and she has been the Coordinator of Department of Scientific Services for Industry (SETIF) (2013-2016). Additionally, she has been an invited professor at Paraíba Federal University (2012 and from 2014 to 2016).

She coordinated the Task Force of Dairy Products of the College of Biotechnology Industry Association (AESBUC; 2000-2005). Her research interests include biotechnology and biochemistry, carrying out research in a range of key technologies for the production, characterization, and preservation of industrially/traditionally processed products.

KN4 | DESIGNING NEXT-GENERATION PLANT POLYSACCHARIDE INGREDIENTS: FROM SOFT MATTER TO PRECISION NUTRITION

Mario M. Martinez[1]*

[1]InnograinLab, Food Technology Division, University of Valladolid, Spain. *mmartinez@uva.es

While genes influence metabolic responses, diet remains the real game changer, offering a powerful route to prevent chronic diseases. To harness this potential, we need precise insights into how food structures shape physiology. Dietary fibres, for example, show promise but require careful consideration of fermentation rates and microbiota-specific responses, which can be attained by increasing the structural complexity of the fibres. Think of the requirement for specialized glycoside hydrolases or cellulosome-like tools that allow a narrow group of beneficial bacteria to break into insoluble matrices. But there is more, interactions between fibres and polyphenols further add layers of complexity with untapped prebiotic potential. In this presentation, I will discuss structure-dependent partitioning of polyphenols, showing that large, hydrophobic molecules with multiple hydrogen-bonding sites are strongly retained by apple pomace cell wall material. Using an integrated in vitro digestion model (INFOGEST 2.0 static [1] and semi-dynamic [2], with and without rat intestinal enzymes [3]) coupled to transepithelial absorption and UHPLC-ESI-QTOF-MS/MS1, we identified a specific esterase activity of pancreatic lipase on hydroxycinnamic acid glucose esters [4]. This highlights the substrate specificity of pancreatic enzymes and the key role of chemical structure in determining phenolic acid bioaccessibility and bioavailability. We then examined whether whole apple and apple pomace modulate transepithelial glucose transport and GLP-1 secretion, using a laboratory-implementable solubilization and purification method that doubled polyphenol concentrations without cytotoxicity. Remarkably, pomace, in particular, showed potential to modulate appetite. Moreover, overall polyphenol bioaccessibility remained low, highlighting pomace as a potential colonic carrier [1]. In this context, to explore three-way interactions between polysaccharides, polyphenols, and gut microbiota, we developed a polyphenol-free artificial apple cell wall (aACW) from bacterial cellulose incorporating pectin and xyloglucan [5]. This analogue allows controlled incorporation of polyphenols and native supramolecular structure. Apple-derived polyphenols bound to aACW were gradually released during faecal fermentation, transiently enhancing acetate production. While interindividual microbiota composition remained the main driver of outcomes, both aACW and retained polyphenols shaped community trajectories, with polyphenols in some donors affecting as many or more microbial families as the fibre matrix itself [5]. This presentation shows that there is a whole world of complexity in food systems waiting to be explored.

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Acknowledgments

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MARIO M. MARTINEZ

Universidad de Valladolid

Mario M. Martinez began his independent research career as an Assistant Professor (Tenure Track) at the University of Guelph (ON, Canada), where he received the College of Engineering and Physical Science (CEPS) Assistant Professor Research Excellence Award from the University of Guelph, the Ontario Early Researcher Award (ERA) from the Government of Ontario, and the Young Scientist Award from the Cereals & Grains Association in the United States. Then, Mario became Associate Professor at Aarhus University, where his research was recognized with prestigious awards and elite grants, including the Nils Foss Talent Prize 2021 (Foss Analytics, Denmark) and the DFF-Sapere Aude excellence project.

In June 2024, he joined the University of Valladolid (Spain) as an Associate Professor and Consolidated Researcher through two talent-attraction programs. Mario is also Adjunct Professor at the Whistler Center for Carbohydrate Research (Purdue University, USA) and editor of the International Journal of Biological Macromolecules.

His research focuses on understanding structure-function relationships of plant biopolymers, establishing analytical methods to elucidate the complex structural features, and exploring chemical, enzymatic, and physical modifications of plant polysaccharides. His team also works on understanding the interactions between food macromolecules and small metabolites in complex systems.

KN5 | MULTI-OMICS CHARACTERIZATION OF EMERGING PIGMENTED WHEAT GENOTYPES: NUTRITIONAL, MOLECULAR AND FUNCTIONAL PERSPECTIVES

Victor Freitas[1*], Ricardo Dias[1], Daniela Milheiro[1], Sara da Silva[1]

[1]LAQV-REQUIMTE, FCUP, Portugal. vfreitas@fc.up.pt

Coloured wheat genotypes have recently emerged as promising alternatives to conventional varieties due to their unique phytochemical composition, particularly phenolic compounds and anthocyanins with antioxidant and anti-inflammatory potential. This study combines metabolomic, proteomic and functional analyses to explore the nutritional composition, phenolic biosynthesis patways and gastrointestinal bioaccessibility, protein digestibility and immunoreactivity as well as biological effects of anthocyanin-rich wheat cultivars. Four coloured wheat genotypes from the Czech Republic - yellow (Bona Vita), purple (Jumiko), blue (Oxana), and black (Zora) - were compared to conventional wheat (Bohemia). Comprehensive metabolite profiling using high-resolution HPLC-Orbitrap-MS/MS and targeted SRM quantification revealed over 100 bioactive metabolites, including flavonoid glycosides and anthocyanins, with black wheat showing the highest accumulation. Peptidomic profiling of wholegrain wheat flour digests, on the other hand, revealed genotype-specific immunogenic peptide patterns, with a reduced immunogenic peptide load in phytochemical-rich genotypes compared to Bohemia. To assess their physiological relevance, gastrointestinal digests of anthocyanin-rich flours were evaluated in gluten-responsive intestinal models derived from duodenal organoids of celiac individuals. These digests modulated reactive oxygen species (ROS) metabolism and cytokine secretion in Caco-2/HT-29-MTX co-cultures, showing dose-dependent effects, alongside regulation of autophagy markers p62 and pE4BP. Together, these results highlight the nutritional and functional potential of coloured wheat as a source of bioactive compounds that may mitigate gluten-induced inflammation and promote intestinal homeostasis. The integrative approach bridges metabolomic profiling with cellular bioactivity, providing a foundation for developing nutritionally optimized, polyphenol-rich wheat-based foods for both the general population and individuals with gluten sensitivity.

VICTOR FREITAS

University of Porto

Victor Freitas graduated in Chemistry from the Faculty of Sciences of the University of Porto (FCUP) in 1984, with a specialization in Organic Chemistry. He pursued further studies with a PhD in Biological and Medical Sciences at the University of Bordeaux (1991–1994), where he deepened his knowledge in the field of vine and wine chemistry and biochemistry. He returned to FCUP in 1996 and was promoted to Full Professor in 2011.

He is a member of the Associated Laboratory for Green Chemistry (LAQV) at REQUIMTE, where he coordinates the research group "Food Quality and Technology."

Scientifically, Victor Freitas has gained international recognition for his innovative research on polyphenols, significantly contributing to the understanding of food flavour and biological properties. Notable honours include the Award from the Division of Agricultural and Food Chemistry of the American Chemical Society (ACS) in 2014 and the Manfred Rothe Award for Research Excellence. In 2024, he was awarded the Scientific Excellence Award from the University of Porto, and in 2025 he received the GP Award from the International Group of Polyphenols.

His scientific output includes over 400 articles in leading journals and more than 20 books or book chapters. He has collaborated with various research groups and companies on national and international projects, mainly within the agri-food sector.

He is an active member of several scientific societies, having chaired the International Group of Polyphenols (2016–2021), served as President of the Organic Chemistry Division of the Portuguese Chemical Society (SPQ), and is currently President of the SPQ Porto Division.

PL6 | OHMIC HEATING: ADVANCING FOOD SAFETY, QUALITY, AND BIOPROCESSING INNOVATION

José Teixeira[1,2*], A. Vicente[1,2], C. Vicente[1,2], R. Rodrigues[1,2], R. Pereira[1,2]

[1]Center of Biological Engineering, University of Minho, Braga, Portugal; [2]LABBELS – Associate Laboratory, Braga/Guimarães, Portugal. *jateixeira@deb.uminho.pt

Ohmic heating (OH) is emerging as a promising technology in food safety and engineering, offering distinct advantages over conventional thermal processing. Through the passage of alternating electric fields directly through food matrices, heat is generated uniformly by the Joule effect. This direct heating minimizes diffusional effects, contrary to indirect heating methods that rely on thermal conduction and convection. This results in rapid, energy-efficient processing (>90% energetic efficiency), reduced product degradation caused by temperature gradients, as well as reduces water consumption (no need of boilers).

OH also introduces unique non-thermal phenomena, including cell electroporation and protein structural modifications. These mechanisms enable new applications in biotechnology and food engineering, such as enhanced mass transfer, improved protein functionalization, and controlled aggregation. For instance, studies have shown that OH can improve excitation efficiency and yields, modulate the structural behavior of proteins, modulate protein-antibody affinity, thus affecting allergenicity, and influence enzyme activity.

Industrial applications of OH are already evident in pasteurization and sterilization of milk, fruit juices, liquid egg, and prepared meals, with documented improvements in microbial inactivation, sensory quality, and reduced fouling. Moreover, OH has proven versatile for processing fruit purées, creams, and structured foods with enhanced textural and nutritional attributes.

OH has also been shown to be an efficient technology for the extraction of bioactive compounds from different materials, including food industry by-products, contributing to the sustainability of the processes and for the implementation of circular economy.

Overall, OH represents a versatile processing platform that combines safety assurance with opportunities for novel food design and efficient extraction processes. By integrating its operational advantages with its biotechnological potential, OH can play a central role in shaping sustainable, safe, and functional foods for the future.

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JOSÉ ANTÓNIO TEIXEIRA

Universidade do Minho

José António Teixeira is currently Professor at Biological Engineering Department, University of Minho (since 2001). He has a degree in Chemical Engineering from University of Porto (1980) and a PhD in Chemical Engineering also from University of Porto (1988).

José António Teixeira has been developing his research activities in two main areas: Industrial Biotechnology, including bioprocess development for the valorisation of agro-industrial residues and new design bioreactors and continuous processing, and Food Biotechnology, including non-conventional food processing and food nanotechnology.

He supervised/supervises numerous researchers, including 52 PhD students and 25 post-Docs. He was Principal Investigator in 39 projects with external financial support. He edited 6 books and published more than 750 papers in peer reviewed journals (h-index of 102 for Scopus/ISI) being named Highly Cited Researcher in 2018, 2019, 2020, 2021, 2022, 2023 and 2024.

PL6 | HIDDEN MICROBIAL BIODIVERSITY IN FOOD PRODUCTION SYSTEMS: IMPACT ON QUALITY, SAFETY AND SUSTAINABILITY

Coral Barcenilla[1], José F. Cobo-Díaz[1], Avelino Álvarez-Ordóñez[1*]

[1]Department of Food Hygiene and Technology and Institute of Food Science and Technology, Universidad de León, León, Spain. *aalvo@unileon.es

Understanding the full extent of microbial diversity in foods, and how these microbes influence quality, safety, and sustainability, is essential for advancing food science and public health. Here, findings from the recently developed curatedFoodMetagenomicData (cFMD) resource [1], integrating ~2,500 food metagenomes and ~10,000 metagenome-assembled genomes (MAGs) to explore microbial communities across diverse food types, will be presented and critically discussed. Food microbial communities show high variability both within and between food categories. Non-fermented foods typically display greater richness and alpha diversity than their fermented counterparts, as fermentation imposes selective pressures that shape microbial composition in ways strongly tied to product type, raw material, processing and geography. The study of the MAGs included in the cFMD database revealed that around 20% of them represent unknown species, when compared with >1 M existing public genomes, highlighting large blind spots in our knowledge of food-associated microbial diversity. Such uncharacterized species were widespread as they were detected in all food categories, except non-fermented fish, and in 59 food types. These novel species may represent an important source of functions for their future exploitation to advance food microbiome-based biotechnological applications. Indeed, hidden and uncharacterized microbes may contribute to flavor, texture, fermentation dynamics, spoilage and other organoleptic traits. Additionally, mapping them may allow for improved starter cultures, new fermentation strategies, or biomarkers for product authenticity. Moreover, a deeper, knowledge of food microbiomes supports strategies that reduce waste (by controlling spoilage), enhance resource efficiency (optimizing fermentation processes), and possibly reduce reliance on chemical preservatives or additives. On the other hand, unexplored biodiversity can represent yet unknown risks. Recent activities carried out for the characterization of food resistomes (the collection of antimicrobial resistance genes in metagenomes) [2] will be also presented. Findings obtained demonstrate that more than 70% of all known antimicrobial resistance genes (ARGs), including many associated with resistance to critically important antibiotics, circulate throughout food production chains, and that there is greater diversity and abundance of ARGs in industries related to the production of food of terrestrial animal origin, particularly meat and meat products. Bacteria from the ESKAPEE group, along with Staphylococcus equorum and Acinetobacter johnsonii, are the main carriers of ARGs. Approximately 40% of the ARGs (and an even higher percentage for genes associated with aminoglycoside and tetracycline resistance) were linked to mobile genetic elements, primarily plasmids. Overall, our findings highlight that implementing culture-independent microbiome mapping methods in the food industry is an effective means of characterizing hidden microbial biodiversity and identifying potential biological hazards that pose a risk to food safety.

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Acknowledgments

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AVELINO ÁLVAREZ-ORDÓÑEZ

Universidad de León

Avelino Álvarez-Ordóñez is Doctor in Veterinary Medicine and PhD from Universidad de León, where he currently develops his professional activity as Associate Professor of the Department of Food Hygiene and Technology and Director of ICTAL (Instituto de Ciencia y Tecnología de los Alimentos). Previously, he worked as a postdoctoral researcher at University College Cork (Ireland; 2010-2013) and Principal Investigator at Teagasc (Ireland; 2013-2016).

Since his appointment at Universidad de León in February 2016, he has secured >2,000,000€ as Principal Investigator of projects funded by the Spanish Ministry of Science, Innovation and Universities, BBVA Foundation and the European Food Safety Authority (EFSA), related to the identification of routes and mechanisms of antimicrobial resistance acquisition and spread through the food chain; one H2020 innovation action project focused on characterizing the microbiome of foods and associated processing environments, and developing biopreservation agents to extend the shelf-life and improve the safety of meat products; and one Horizon Europe Soil Mission project aimed at developing innovative solutions to valorise nutrients and organic matter in food processing side-streams as tailored biofertilizers and soil improvers.

To date, he has published >130 research articles, co-authored >60 EFSA scientific opinions, and acted as keynote speaker at various national and international congresses. Since 2018 he is member of the Panel on Biological Hazards (BIOHAZ) of the European Food Safety Authority (EFSA), and has acted as chair of 7 working groups of the BIOHAZ Panel of EFSA. His main research interests: food safety, food microbiomes, new food processing and preservation technologies, foodborne pathogens, antimicrobial resistance, bacterial physiology and ecology, bacterial responses to stress conditions, and the ecology and biocontrol of microbial biofilms.

KN8 | PHENOLIC COMPOUNDS: A SUSTAINABLE KEY TO HEALTH, QUALITY, AND CIRCULAR FOOD SYSTEMS

Ana Novo Barros[1]*

[1]Centre for the Research and Technology of Agroenvironmental and Biological Sciences, CITAB, Inov4Agro, Universidade de Trás-os-Montes e Alto Douro, UTAD, Quinta de Prados, 5000-801 Vila Real, Portugal. abarros@utad.pt

Phenolic compounds are among the most abundant and diverse bioactive molecules in plant-derived foods, playing a key role in linking food functionality, human health, and sustainability. Their wide range of biological activities – including antioxidant, anti-inflammatory, and antimicrobial effects – makes them essential contributors to the prevention of chronic diseases and the development of health-promoting food products. Beyond their technological importance in improving food stability, color, and flavor, phenolics act as central agents in the valorization of agricultural by-products, fostering circular food systems and reducing environmental impact.

A growing body of evidence highlights the bioefficacy of phenolic compounds in multiple physiological domains. Their cardioprotective properties are associated with improved endothelial function, modulation of lipid metabolism, and reduction of oxidative stress and inflammation. Similarly, phenolic compounds exert neuroprotective effects, contributing to the prevention of cognitive decline and neurodegenerative disorders through the regulation of neuronal signaling pathways and mitochondrial protection. In the context of menopause and osteoporosis, certain flavonoids and stilbenes exhibit estrogen-like activity, mitigating bone loss and alleviating vasomotor symptoms. Their anti-diabetic potential arises from the inhibition of α-glucosidase and α-amylase enzymes and the enhancement of insulin sensitivity, while their anti-aging effects are linked to the activation of cellular defense mechanisms against oxidative and glycation stress.

However, the bioavailability of phenolic compounds remains a critical bottleneck that limits their full physiological potential. This presentation will address innovative strategies to enhance bioavailability, including nanoencapsulation, complexation with dietary proteins and fibers, enzymatic hydrolysis to release bound phenolics, and fermentation-based approaches that promote biotransformation into more bioaccessible metabolites. Moreover, attention will be given to the chemical resistance of phenolic compounds during digestion, processing, and storage – factors that strongly influence their functionality and bioefficacy *in vivo*.

By integrating advances in analytical chemistry, food science, and nutritional biochemistry, this work underscores the role of phenolic compounds as pivotal elements of sustainable and circular food systems. Their capacity to add value to agri-food by-products while improving human health positions them as a cornerstone in the design of next-generation functional foods and nutraceuticals.

Acknowledgments

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ANA NOVO BARROS

Universidade de Trás-os-Montes e Alto Douro

Ana Novo Barros is an Associate Professor with Habilitation from the University of Trás-os-Montes and Alto Douro. She has been the Director of the Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB) for 5 years (May 2017-July 2022) and of Institute for Innovation, Capacity building and Sustainability of Agri-Food production (Inov4Agro) for one year and half (January 2021-July 2022). She is responsible for the Phytochemicals Laboratory, and Coordinator of the Agri-Food Quality Group. Her research targets are mainly in the identification, separation, and recovery of functional molecules from different natural products, as well as their implementation as ingredients and bioactive compounds in food, pharma and cosmetic industries, with an ultimate goal to extract high added-value molecules and re-use them in the circular economy and industrial symbiosis concepts.

In the last years, she was awarded with several prizes and distinctions. She has published more than 140 scientific documents, including research articles, reviews, and editorials, within the highest impact factor journals in the Food Science and Technology field (37 h-index, SCOPUS, May 2025). She has registered 9 national and international patents. She has international collaborations and is PI and member of several financed research projects with different typologies (last 5 years). She is the coordinator from the European project WASTELESS|TOPIC ID: HORIZON-CL6-2022-FARM2FORK-01-08. Her scientific work has raised interest and has led to the supervision of Post-doc (3 concluded, 1 ongoing), PhD (12 concluded and 7 ongoing), Master (50 concluded and 7 ongoing) and Bachelor (46 concluded) students. She has been member of organizing committees of scientific conferences, presented invited lectures in international and national conferences, and have >400 oral/poster communications, including papers in conference proceedings.

KN9 | VALORIZATION OF BIOACTIVE INGREDIENTS THROUGH THEIR INCORPORATION INTO ECO-FRIENDLY FILMS FOR FOOD APPLICATIONS

Manuel Vázquez[1*], Mª Ángeles Romero-Rodríguez[1], María Flórez[1], Patricia Cazón[1]

[1]Department of Analytical Chemistry, Faculty of Veterinary Science, Campus Terra, University of Santiago de Compostela. Calle Carballo Calero, s/n, 27002, Lugo, Spain. *manuel.vazquez@usc.es

The food industry is under increasing pressure to replace synthetic plastics with environmentally sustainable alternatives, while ensuring food safety and extending shelf life. In this context, bio-based active packaging emerges as a promising solution. This keynote addresses recent advances in the valorization of bioactive compounds from agro-industrial by-products and marine resources, with a focus on their incorporation into eco-friendly biopolymer films for food applications.

Chitosan, a biocompatible polysaccharide with excellent film-forming ability, was combined with extracts from *Saccharina latissima* (sugar kelp). These films exhibited enhanced antioxidant and UV-barrier properties, despite a moderate reduction in mechanical strength. When applied as separators in vacuum-packed Havarti cheese slices, the chitosan–seaweed films significantly reduced lipid oxidation (by 53% after 45 days of storage), confirming their potential as active packaging systems (Figure 1).

A complementary approach involved multilayer films based on bacterial cellulose and chitosan enriched with grape bagasse extracts. These films demonstrated remarkable antioxidant activity, effective UV protection, and improved flexibility. In cheese preservation trials, they achieved a 67% reduction in lipid oxidation after 60 days, highlighting their robustness as functional packaging materials.

The results show that the incorporation of natural antioxidants from seaweed and winery by-products into biopolymer matrices not only improves packaging functionality but also contributes to circular bioeconomy strategies. For the Galicia–North Portugal transborder region, rich in both marine biodiversity and viticulture, these innovations represent a strategic opportunity to valorize local resources, reduce waste, and foster sustainable food systems.

This presentation discusses the scientific and technological challenges of scaling up these materials, as well as opportunities for cross-border collaboration, regulatory alignment, and industrial adoption. The work underscores how bioactive-enriched eco-films can contribute to building a more sustainable, competitive, and resilient agri-food sector.

Figure 1 – Active chitosan films enriched with sugar kelp extract for improved preservation of Havarti cheese slices.

MANUEL VÁZQUEZ VÁZQUEZ

Universidad de Santiago de Compostela

Manuel Vázquez Vázquez is a Full Professor of Food Technology at the University of Santiago de Compostela (Spain). His research focuses on: (a) the biotechnological production of food additives, (b) the application of additives and emerging technologies like HPP in food processing, and (c) the development of new biodegradable materials for food packaging. He has conducted extensive research on the use of by-products from the agri-food industry for the production of the enzyme transglutaminase and its application in the development of various foods, particularly fish and dairy products.

Currently, his work centers on the production of biofilms for use as sustainable food packaging. He has published more than 190 articles in high-impact scientific journals. He served as Editor-in-Chief of CyTA – Journal of Food for over 20 years and is currently a member of the editorial board of Food Hydrocolloids. His research has an h-index of 45, with over 7,500 citations by independent research groups worldwide. In 2005, he received the Young Scientific Award for Excellence in Research from the European Federation of Food Science and Technology (EFFoST).

He is founder of the Galician Association of Food Technologists and a promoter of the Mexican Society of Nutrition and Food Technology.

KN10 | NEW CHALLENGES IN THE RISK ASSESSMENT OF FOOD ADDITIVES. ENSURING FOOD SAFETY WITHOUT NEGLECTING SUSTAINABILITY AND ENVIRONMENT CONCERN

Patricia Morales[1*]

[1]Department Nutrition and Food Science. Faculty of Pharmacy. Complutense University of Madrid. Spain. *patmoral@ucm.es

According to the European Regulation (CE) No. 1333/2008 [1] only approved food additives (FA) included in the Community list in Annex II [2] may be placed on the market as such and used in foods under the conditions of use specified therein. EFSA (European Food Safety Authority) provides scientific advice to support the authorization process of food additives overseen by the European Commission, who decides on the approval of food additives on the EU market and their conditions of use. Before any new additive or proposed new use of an existing additive can be authorized, the Scientists at EFSA, thought the FAF Panel, conduct an extensive evaluation to assess its safety for human consumption.

The risk assessment for food additives is a multi-step scientific process to ensure public safety by identifying hazards and evaluating exposure to potential risks. It involves the evaluation of food additive composition, how it interacts with food, its potential effects on the human body (through toxicological test evaluation), and the estimated potential exposure along the diet. In addition to assessing new additives, EFSA regularly re-evaluates those already permitted to ensure they continue to meet current safety standards [3,4].

In the recent years, an emerging practice involves substituting synthetic food additives with plant-derived bioactive chemicals, which are seen as safer and more natural (*e.g.* E392 – Rosmarinus extract, E999 – Quillaia extract). In this regard, food industry is replying to consumer demand for new natural additives development, primarily obtained from plant-based products and by-products, in line with the principles of sustainability and the circular economy. Most of these new food additives are consider as complex mixtures and should be characterised as fully as possible, which in a great challenge in the risk assessment, since this information is particularly important for the component-based approach, which is employed in the genotoxicity and toxicity assessments.

Finally, the potential environmental impact of non-degradable food additives and/or their by-products, focusing on human consumption as the main emission route, is another relevant issue that will be taken into consideration in future FA risk assessments.

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PATRICIA MORALES

Universidad Complutense de Madrid

Prof. Dra. **Patricia Morales** is an Associate Professor in the Department of Food Science and Nutrition at the Complutense University of Madrid. Researcher at the ALIMNOVA research group (UCM 951505 – Campus Excelencia Moncloa). Currently, she is a member of the EFSA Panel on Food Additives and Flavourings (FAF) and serves as a scientific expert on the Sweeteners and Re-evaluation & Follow-up working groups.

Her main research interests focus on the study of singular plant sources (as wild edible vegetables/fruits or food by-products derived from plant food processing activities) as new natural sources of food ingredients with functional and technological properties, which include chemical characterization, biological activity evaluation and food safety assessment.

She has published over 150 scientific documents, including research articles, EFSA scientific opinions, reviews and book chapter in the Food Science and Technology. She has also registered national and international patents/utility models.

KN11 | WORKING TOGETHER FOR A SUSTAINABLE AND COMPETITIVE FOOD SYSTEM

Paola Giavedoni[1*]

[1]Foodvalley NL, Bronland 10F, 6708 WH Wageningen (The Netherlands). *paola.giavedoni@foodvalley.nl

Innovation today is marked by open, collaborative models. Organisations like Foodvalley play a critical intermediary role: identifying shared barriers among stakeholders, orchestrating safe innovation communities, and steering novel solutions through to viable business models. Foodvalley's four priority transitions – protein diversification, healthier food offerings, upcycled food, and regenerative agriculture – provide concrete arenas in which new stakeholder collaboration models come together, bolstering in this way the food innovation ecosystem.
By understanding the evolution from past R&I practices (centralised labs, linear product innovation, siloed stakeholders) with present Trends (iterative pilots, rapid scale-ups, cross-disciplinary teams, regulatory and market pull, and coalition-driven adoption), this framework highlights how the agrifood sector can navigate and succeed in this era. If barriers like scaling-risks, shortage of demand, unknown new business & funding models, consumer acceptance – are addressed, the result can be large-scale adoption of sustainable, health-forward, and competitive innovations.

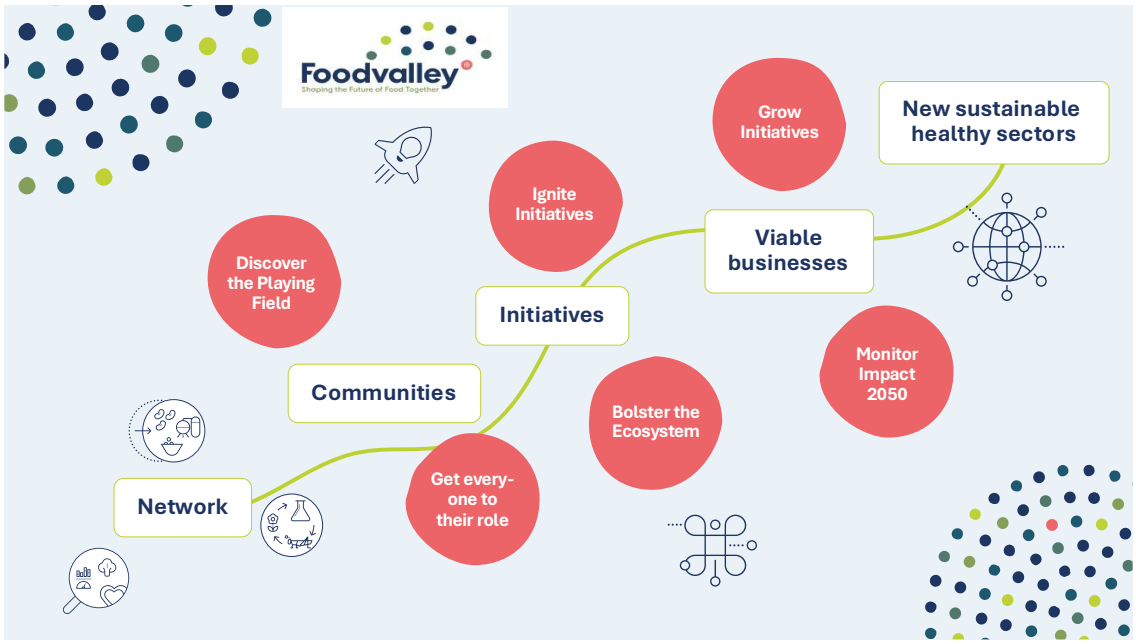

Figure 1 – Foodvalley practical approach.

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PAOLA GIAVEDONI

Foodvalley NL

Dr. **Paola Giavedoni** is a Food-System expert, with extensive international experience in the sector.

Grounded on an early scientific career (she owns a Master in Food Science and a Doctorate in Food Biotechnology), she worked 25 years in the Food Industry (at Unilever, Chiquita, & Migros) in different managerial & leadership roles in R&D and Innovation, developing new products and technologies in different product categories.

From 2019 to 2022, Paola joined EIT food (European Institute of Innovation & Technology) as Director of Innovation and Member of the Management Board. In this capacity, she was responsible for bringing together key actors from across Europe to accelerate the delivery of innovative solutions, and therefore support the transformation of the agrifood sector.

Since 2023 Paola is an independent senior consultant and holds the role of Head of Global Collaborations at Foodvalley in The Netherlands. In this role she contributes to the development of AgriFood Ecosystems and Hubs around the World, by deploying the Foodvalley Practical Approach and by transferring knowledge and best practices.

Paola is also EU Expert and Reviewer and Advisory Board member.

KN12 | EXPLORING CONSUMERS: FROM CLASSICAL TO CONTEMPORARY TECHNIQUES AND MULTISENSORY EXPERIENCES

Rui Costa Lima[1*], Célia Rocha[1,3], Luís Miguel Cunha[2,3], Luís Baião[1,3], José Carlos Ribeiro[2,3], Bruna Barbosa[1,3], João Pedro Marques[1,3], Diego Martinez[1]

[1]Sense Test, Lda., Vila Nova de Gaia, Portugal; [2]Faculty of Sciences, University of Porto, Porto, Portugal; [3]GreenUPorto –Inov4Agro, DGAOT, Faculty of Sciences, University of Porto, Campus de Vairão, Portugal. *rcl@sensetest.pt

The evolution of food science systems demands advanced approaches to sensory evaluation and the development of sustainable, consumer-accepted products. This work presents a multi-step synthesis demonstrating how methodological innovation and contextual sensory technologies can drive both product development and sensory insight in future-oriented food systems.

Recent research has emphasized sustainable alternatives spanning the food matrix: from macroalgae fortification in canned fish, novel insect-based meal strategies, and plant-based meat analogues, to reduced-sugar extruded breakfast cereals.

The evolution of sensory analysis techniques has led to integrated solutions of digital, rapid and immersive solutions that enhance both the efficiency and ecological validity. Early sensory science relied either on trained panels performing descriptive or on consumers performing preference, and traditional hedonic tests. In recent decades, rapid methods such as Projective mapping combined with Ultra Flash Profiling, and digital data acquisition systems has enabled the precise mapping of similarities and differences, enabling robust studies with large consumer samples.

Digital platforms like SenseGest have facilitated remote and high-throughput sensory assessments, increasing data accuracy and scalability. Techniques like Check-All-That-Apply (CATA), Projective Mapping, and Temporal Methods enable a more dynamic characterization of food attributes, with advanced statistical analyses uncovering subtle consumer preferences and sensory drivers of liking.

Most recently, immersive technologies such as Augmented and Virtual Reality (AR/VR) have revolutionized sensory evaluation. Systems like Sense-AV integrate product interaction with multi-contextual environments, simulating real-world consumption scenarios and supporting real-time data capture on mobile devices. These immersive platforms increase participant engagement, expand the variety of qualitative feedback, and reinforce ecological validity, overcoming many limitations of traditional sensory booths.

Instrumental and biometric tools, such as electronic noses, eye tracking, and emotion interfaces, further complement human perception, providing objective assessment and multisensory integration. Together, these advances mark a paradigm shift toward more holistic, rapid, and context-responsive product evaluation, supporting innovation and market success in food science.

Acknowledgments

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RUI COSTA LIMA

Sense Test

Rui Costa Lima stands as a leading specialist and innovator in sensory science and perception, with a degree in Food Engineering from the Portuguese Catholic University. With over 25 years of experience, he currently manages Sense Test, pioneering advanced methodologies that bridge sensory analysis, consumer research, and emerging food products and technologies. He is responsible for Sense Test's participation and leadership in high-impact European and national projects – such as H2020 Susinchain, Transit, CLabel+ and VIIAFood.

Rui Costa Lima's work is distinguished by a strong scientific component: he has authored and co-authored dozens of publications, book chapters, and intellectual property on consumer acceptance and advanced methodologies. His active presence in international conferences – including Pangborn and Eurosense – complements his role as an invited lecturer for postgraduate programs.

He is a regular member of technical and regulatory committee CT114, serves as technical auditor for sensory panel accreditation in various wine regions, and is the current representing Sense Test at the Colab4Food association, helping to catalyse innovation between industry and academia. Recognized for both scientific rigor and bold innovation, Rui Costa Lima is a frequent speaker, shaping the future of food through research-driven transformation.

KN13 | AGRIFOOD BY-PRODUCTS: HAVE THEY A FUTURE IN THE FOOD SECTOR?

Beatriz Oliveira[1]*

[1]LAQV/REQUIMTE, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal. *beatoliv@ff.up.pt

Nowadays there is growing interest in the application of agro-industrial by-products as ingredients in diverse food matrices. By-products such as pomaces, oilcake, and vegetable parts/peels are increasingly appreciated not only for their content of nutrients and bioactive compounds, but also for their ability to replace synthetic additives in food formulations. Their incorporation improved nutritional value, oxidative stability, and supports more natural, health-oriented innovations and aligns with the principles of a circular and sustainable economy.

The valuation of agri-food by-products should consider technological innovations framed in bioeconomy and circular economy, also considering regulatory, economic and social challenges. A direct bridge between academic developments and their industrial applicability will be needed to overcome key gaps in scalability, consumer acceptance, and regulatory frameworks, providing necessary insights to guide future research. Promoting partnerships between universities, research centers, companies, and local governments is crucial to the adoption of technological innovations in the food industry.

From a nutritional perspective, several studies have shown that agro-industrial by-products incorporation improves the content of dietary fiber, antioxidants, and other nutrients without significant changes in organoleptic characteristics. The sensory evaluation has become particularly relevant since consumers may resist products containing ingredients derived from residues. In specific cases proper microencapsulation and formulation can be used to achieve favorable acceptability.

Applying science-based communication strategies that clearly explain the nutritional, environmental, and economic benefits is key to increasing acceptance and willingness to pay for such foods. Global trends show that consumers, especially younger generations, increasingly demand functional and sustainable foods aligned with circular economy principles, representing a strategic opportunity to expand these innovations. Additionally, specific certifications, sustainability labels, and seals that highlight these products' circular and eco-friendly nature can favorably differentiate them in the market, enhancing their appeal.

Finally, from a regulatory and policy perspective, strengthening the frameworks that enable the safe and efficient incorporation of ingredients derived from agri-food by-products into production chains is essential. Digital technologies have recently emerged in the agri-food industry through biosensors, artificial intelligence (AI), big data, and blockchain. These are considered modern tools for optimizing agri-food processes, guaranteeing traceability, and improving the sustainability and competitiveness of production chains. Several applications of agro-industrial by-products in real food matrices will be presented, showing the real potential of waste valorization as a strategy for the design of value-added foods.

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BEATRIZ OLIVEIRA

Universidade do Porto

M. Beatriz P. P. Oliveira, Full Professor at FFUP, Director of the Master's Degree in Quality Control, member of an EFSA Scientific Network, and member of a specialized committee of ASAE. She has extensive experience in supervision (26 PhD theses, including 19 collaborations with international institutions, and 110 MSc theses from different institutions) and is co-author of over 530 publications in international journals, 90 in national journals, book chapters, conference proceedings, and around 1,500 communications at national and international scientific meetings (h-index 74 and approximately 20,000 citations).

Her current research focus is influenced by the One Health approach, an integrative concept that recognizes the interdependence between science, food safety/health, and environmental sustainability, promoting a holistic vision to address global challenges related to health and sustainability.

She has always maintained close collaborations with companies in the food sector, leading to several award-winning works. She primarily employs environmentally friendly and sustainable methodologies and holds seven patents in this field of study (two granted in Europe and the USA, and five under international review). The submitted patents have a strong emphasis on the valorization of by-products, with a strong focus on the valorization of olive pomace.

ORAL PRESENTATIONS

ORAL PRESENTATION LIST

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OP26	Francisco Herdeiro	Characterization of pumpkin and almond ice-creams produced with food industry side streams
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OP33	Marta Leite	Emerging and persistent contaminants in honey: insights into pfas, veterinary drug residues, alkaloids, and mycotoxins
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OP1 | BRAINR: THE BRAIN OF THE FOOD INDUSTRY

João Santos[1]*

[1]Brainr S.A., Cova das Faias Industrial Zone, lot 4, Leiria, Portugal. *joao.santos@brainr.co

BRAINR is a cloud-based MES, specialized in the food industry, that connects people, machines, and ERP systems to operate the factory in real time, from reception to shipment. It digitalizes the shop floor end to end, ensures full traceability, and provides operational visibility across all shifts and production lines. With a modern UX, standard integrations, and fast implementation, it helps increase efficiency and yield, reduce waste and downtime, and scale best practices across sites. Today, BRAINR manages over one billion euros in annual production in Portugal, with a proven track record across multiple food industry sub-sectors.

Figure 1 – BRAINR.

OP2 | NUTRITIONAL PROFILE, POLYPHENOL BIOACCESSIBILITY, AND FUNCTIONAL POTENTIAL OF WALNUT OIL BY-PRODUCTS ASSESSED THROUGH SIMULATED DIGESTION AND CELL-BASED MODEL

Rafael Mascoloti Spréa[1,2], Daniele Bobrowski Rodrigues[1], Ricardo C. Calhelha[1], Tânia C. S. Pires[1], María E. Brassesco[3], Manuela Pintado[3], Susana Santoyo[4], Elena Arranz[4], Miguel A. Prieto[2], Lillian Barros[1], Joana S. Amaral[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Nutrition and Bromatology Group, Department of Analytical and Food Chemistry, Faculty of Food Science and Technology, University of Vigo-Ourense Campus, E-32004 Ourense, Spain; [3]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005, Porto, Portugal; [4]Institute of Food Science and Research (CIAL), Universidad Autónoma de Madrid (CEI UAM + CSIC), Madrid, Spain. *jamaral@ipb.pt

The sustainable valorization of agri-food residues offers a promising route for the development of functional ingredients. This study evaluated walnut oilcake (WOC) and walnut oil dregs (WOD), generated respectively after cold pressing and during oil decantation, focusing on their chemical composition, phenolic content, and biological properties after gastrointestinal simulation. Using the INFOGEST 2.0 standardized protocol [1], the *in vitro* digestion process was conducted in three sequential phases (oral, gastric, intestinal), enabling the recovery of bioaccessible and non-bioaccessible fractions. HPLC-DAD-ESI/MS analysis revealed glansreginin A and ellagic acid as major phenolics. Total polyphenol bioaccessibility was significantly higher in WOD (78%) compared to WOC (15%). Ellagic acid was the most bioaccessible compound (118% in WOC; 732% in WOD), while glansreginin A exhibited low bioaccessibility (<40%).

Antioxidant capacity improved notably after digestion. For WOD, EC_{50} values decreased from 4.2 ± 0.6 to 2.6 ± 0.8 mg/mL (TBARS) and from 2.5 ± 0.2 to 0.4 ± 0.1 mg/mL (DPPH); for WOC, values dropped from 2.6 ± 0.2 to 0.4 ± 0.1 mg/mL (TBARS) and from 0.9 ± 0.1 to 0.4 ± 0.1 mg/mL (DPPH), reflecting improved release of antioxidant compounds. In Caco-2 cell assays, glansreginin A was detected only in the apical compartment, confirming limited transepithelial transport and suggesting that the biological activity of these phenolics may primarily depend on microbial metabolism in the colon.

Non-bioaccessible fractions, particularly rich in insoluble fiber (up to 30 g/100 g in WOC), exhibited strong prebiotic potential. These residues significantly promoted the growth of *Lactobacillus rhamnosus, L. casei, L. acidophilus*, and *Bifidobacterium animalis*, with optical density values often exceeding those achieved with fructooligosaccharides.

Overall, the results underscore the functional potential of WOC and WOD as ingredients with antioxidant and prebiotic activities, reinforcing their incorporation into circular and sustainable food systems.

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OP3 | SELENIUM BIOFORTIFICATION OF SWISS CHARD MICROGREENS UNDER INDOOR VERTICAL FARMING CONDITIONS

Alexis Pereira[1,2], Maria Inês Dias[1], M. Beatriz P. P. Oliveira[2], José Pinela[1,3*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/LAQV, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, Rua Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]Instituto Nacional de Investigação Agrária e Veterinária, I.P. (INIAV, I.P.), Rua dos Lágidos, Lugar da Madalena, 4485-655 Vairão, Vila do Conde, Portugal. *jose.pinela@iniav.pt

Selenium (Se) is an essential trace element with vital functions in human health, and its deficiency has been linked to increased risks of cancer, cardiovascular disorders, and immune dysfunction [1]. However, Se deficiency remains a widespread public health issue in many regions due to low soil Se content and limited dietary diversity [1]. Microgreens, nutrient-dense young seedlings of vegetables and herbs, are particularly suited for Se biofortification due to their rapid growth cycle, high nutritional value, and growing demand as functional foods [2]. Moreover, soilless cultivation under controlled conditions offers precise nutrient delivery, enabling targeted plant enrichment with minimal environmental impact [3]. Therefore, agronomic biofortification of microgreens with Se in controlled-environment vertical farming presents a promising and sustainable approach to enhance dietary Se intake and address global micronutrient deficiencies. This study was performed to investigate the Se biofortification potential of white Swiss chard (*Beta vulgaris* subsp. *cicla*) microgreens and to characterize their phytochemical and mineral element compositions. Microgreens were cultivated in a climate-controlled growth chamber under LED lighting, using vermiculite-filled trays. Plants were grown under a 14/10 h photoperiod at 20–25 °C and ~60% relative humidity. A 3:1:6 NPK nutrient solution supplemented with sodium selenate or sodium selenite at concentrations of 10, 20, or 40 µM Se, or a mixture of both salts at 20 µM Se, was used for irrigation. Seventeen days after sowing, microgreens were harvested and analyzed using chromatographic and spectroscopic techniques. A total of 10 phenolic compounds (2 phenolic acids and 8 flavonoids), 7 betalains (2 betacyanins and 5 betaxanthins), and 17 saponins were identified in the samples. Sodium selenite treatments enhanced saponin accumulation, whereas sodium selenate significantly increased the levels of phenolic compounds, betalains, and mineral elements. Overall, Se supplementation, particularly via sodium selenate, substantially improved the nutritional and functional quality of white Swiss chard microgreens grown under indoor conditions.

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OP4 | NOVEL PROCESSING TECHNOLOGIES TO ADDRESS BY-PRODUCTS VALORIZATION, NEW FOOD TRENDS, AND SCALE-UP CHALLENGES

Viviana Monteiro[1], Enrique Pino-Hernández[1], Telma Orvalho[1], Sara Dias[1], Diogo Gonçalves[1], Marco Alves[1*]

[1]INOV.LINEA, TAGUSVALLEY – Science and Technology Park, 2200-062 Abrantes, Portugal. *marco_alves@tagusvalley.pt

The food industry generates substantial amounts of food waste, which has a negative impact on the environment. Advances in processing technologies and the development of innovative products are responding to emerging food trends and the challenge of valorizing abundant by-products that are currently underused. These by-products offer the opportunity to create value-added ingredients with improved functional properties and health benefits [1]. Nowadays, innovative processing technologies are a promising alternative due to their efficiency and low impact on food quality [1-3]. This study aimed to integrate co-products and off-grade fruits and vegetables into the food value chain by using them as ingredients in new product development, following circular economy and sustainability principles [1-5]. Formulations validation and application of preservation methodologies at pilot-scale were also performed. A variety of products (snacks, smoothies, ice cream, and pesto) have been developed through academia/industry collaboration. Each proof of concept was analyzed as a standalone case study, focusing on two main innovation axes: product quality and process efficiency. The base formulations incorporate agro-industrial co-products, such as Liquid Whey (LW), Pear Pomace (PP), Beetroot Pomace Flour (BPF), Apple Pomace Flour (APF), and off-grade fruits and vegetables, like Fruit and Vegetable Caliber Low (FVCL), sourced from agro-industrial production streams. Preservation technologies employed include Freeze-Drying, Thermal Pasteurization, High Pressure Processing, and Pulsed Electric Field [1-3,5]. In these developments, the incorporation levels reached: 100% in snacks (FVCL), 50% in ice cream (LW), 40% in pesto (PP, LW, BPF), and 20% in smoothies (APF). The proposed product and processing technologies show how agro-industrial co-products can be reintroduced into the food system as value-added ingredients, fully supporting circular economy principles. All processes have reached Technology Readiness Level (TRL) 6, with pilot-scale validation, confirming the technical feasibility and robustness of the developed formulations and preservation methods. This study not only demonstrates the potential for creating innovative food products from diverse co-streams but also significantly advances sustainable practices within the agro-industrial sector by minimizing waste and enhancing resource efficiency, thereby directly contributing to the principles of a circular economy.

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OP5 | CHARACTERIZATION OF MULTILAYER BACTERIAL CELLULOSE-CHITOSAN FILMS LOADED WITH GALLIC ACID FOR INNOVATIVE ACTIVE FOOD PACKAGING

Patricia Cazón[1,2*], María Flórez[1], Manuel Vázquez[1]

[1]Dept. Analytical, Chemistry, Nutrition and Food Science, University of Santiago de Compostela, Campus Terra, Spain; [2]Dairy Products and Food Technology Centre (APLTA), University of Santiago de Compostela, Spain. *patricia.cazon.diaz@usc.es

In response to the increasing need for sustainable and active food packaging solutions, this study presents the development of a novel bioactive composite film that integrates bacterial cellulose (BC) and chitosan in a multilayer structure, leveraging the mechanical strength and water resistance of BC alongside the bioactive, film-forming properties of chitosan. The chitosan inner layer serves as a matrix for the incorporation of gallic acid, aiming to provide controlled antioxidant release to enhance food preservation. Conventional packaging materials often fail to offer both structural integrity and bioactive functionality, highlighting the need for innovative materials that can improve food quality and extend shelf life. This study focuses on the comprehensive characterization of the film's structure, physicochemical properties, and antioxidant efficacy, including evaluations of water absorption, mechanical strength, thermal stability, and antioxidant capacity. The multilayer films were prepared by separately fabricating BC films and chitosan films incorporating varying concentrations of gallic acid, which were then assembled to form a BC-Chitosan-BC multilayer composite. The films' microstructure was examined using scanning electron microscopy (SEM), and Fourier Transform Infrared Spectroscopy (FT-IR) was employed to analyze the chemical interactions between the layers. Physicochemical properties, including moisture content, water vapor permeability (WVP), swelling capacity, solubility, and mechanical properties such as tensile strength and elongation, were evaluated, while antioxidant activity was assessed using DPPH and ABTS assays and Total Phenolic Content (TPC) analysis was conducted to confirm the distribution of antioxidants within the films. The films were also tested in a lipid-based food system to assess their potential for preventing lipid oxidation, demonstrating their suitability as active packaging materials for food preservation. SEM analysis confirmed the successful fabrication of the multilayer structure, clearly distinguishing the BC outer layers and the gallic acid-enriched chitosan inner layer, while FT-IR spectroscopy revealed interactions between BC and chitosan that contributed to the film's structural integrity. The incorporation of gallic acid into the chitosan layer influenced the physicochemical properties of the films, with changes observed in moisture content and water vapor permeability depending on the concentration of gallic acid. The mechanical properties demonstrated that the layered structure enhanced the films' strength. DPPH and ABTS assays confirmed that the chitosan layer effectively provided antioxidant activity to the composite film, and in the model food system the multilayer films reduced lipid oxidation, showcasing their potential as active food packaging materials for enhanced preservation. In conclusion, this study successfully developed and characterized multilayer films consisting of BC outer layers and a gallic acid-enriched chitosan inner layer, effectively combining the structural benefits of BC with the antioxidant delivery capacity of chitosan. The films exhibited promising physicochemical properties and notable antioxidant activity, driven by the controlled incorporation of gallic acid in the chitosan layer, underscoring their potential as active food packaging materials that offer a targeted approach to antioxidant protection and food preservation, although further research is still needed to optimize film performance and explore their use in diverse food systems.

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OP6 | ROLE OF PROTEIN COMPOSITION AND REFINEMENT LEVEL IN PLANT PROTEIN STRUCTURE AND FUNCTIONALITY DURING HYDROTHERMAL PROCESSING

Parle Florencia[1], Sara Berguices[1], Laura Román[1*]

[1]Food Technology Area, Department of Agricultural and Forestry Engineering, University of Valladolid, Spain.
*lroman@uva.es

The transition from animal-based proteins to plant-based alternatives is essential to address environmental concerns and promote sustainable food systems. Plant proteins are mainly available as either concentrates (~50-80% protein) or isolates (>80% protein), which vary not only in purity and composition but also in their protein structural organization and functionality depending on the extraction method and source. To unravel these effects, two protein sources were studied: sunflower, a by-product of oilseed extraction, and lupin, a protein-rich legume with high fiber content. These proteins were evaluated as concentrates (50–53% protein), along with their corresponding laboratory-prepared isolates, obtained by alkaline extraction and isoelectric precipitation (80–85% protein), which were systematically compared to commercially available lupin and sunflower protein isolates (90–92%). The proteins were characterized in terms of molecular weight, globulin/albumin fractions, secondary structure, gelation, solubility, and surface charge to establish structure–function relationships. To evaluate their gelation behavior, the 6 proteins were further subjected to hydrothermal processing under high-moisture (20% solids), low-shear conditions at 95 °C and 140 °C, representing moderate and severe heat-treatments. The processed samples were subsequently analyzed for microstructure, secondary structure and protein solubility. The studied proteins differed in subunit composition: sunflower proteins and the commercial lupin isolate were mainly composed of 11S globulins, whereas lupin concentrate and its laboratory isolate contained both 7S and 11S globulins, with a predominance of 7S. Notably, only the commercial sunflower isolate was pre-denatured, while the others were native, enabling assessment of the effect of protein nativity on functional behavior. After hydrothermal processing at 95 °C, sunflower concentrate showed the highest gel viscosity, followed by its laboratory isolate, while the commercial isolate exhibited an almost flat profile near zero throughout the measurement. Meanwhile, lupin concentrate and its laboratory isolate exhibited similar profiles with much lower viscosity than sunflower, and the commercial lupin isolate showed only a brief initial increase due to cold-water absorption, followed by very low viscosity. During hydrothermal processing at 140 °C, sunflower concentrate displayed higher viscosity but also greater breakdown and lower final viscosity than at 95 °C. Both sunflower isolates, particularly the commercial one, exhibited a spiky viscosity profile during cooling, indicating protein aggregation. In contrast, lupin concentrate displayed a second peak not observed at 95 °C or in its laboratory isolate at 140 °C, suggesting contributions from non-protein components or dissembling and solubilization of larger protein aggregates. The commercial lupin isolate showed higher final viscosity compared to its near-zero viscosity at 95 °C, although it did not reach gel formation. Microscopy revealed larger aggregates in sunflower samples with increasing heat-treatment, likely due to the predominance of 11S globulins, whose hydrophobic nature and disulfide bonds could promote further re-aggregation. Meanwhile, lupin samples remained more homogeneous across treatments, with only slightly coarser particles at 140 °C, mainly in the isolates. These changes were also reflected in the protein secondary structure, showing increased intermolecular aggregates (A1) and/or random coils relative to native samples, indicating unfolding and aggregation, especially under more severe treatments. Protein solubility generally decreased under severe conditions, except for the sunflower laboratory isolate, which remained stable, and both commercial isolates, which increased at 140 °C. Overall, these findings demonstrate how protein origin, purity, and structure influence structural changes during heat processing, underscoring the importance of thorough ingredients characterization, and providing a deeper

understanding to guide the development of plant-based food systems with enhanced functionality.

Acknowledgments
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OP7 | A SOFT MATTER APPROACH TO FIBRE FOR THE DESIGN OF SUSTAINABLE AND HEALTHIER FOODS

Patricia Lopez-Sanchez[1*], Tania Ferreiro[2], Jakob Ytterbeg[3], Anna Ström[3]

[1]Department of Food Technology, Institute of Marine Research IIM-CSIC, Vigo, Spain; [2]Aula de Productos Lácteos e Tecnoloxías Alimentarias, Universidade de Santiago de Compostela, Lugo, Spain; [3]Department of Applied Chemistry, Chalmers University of Technology, Gothenburg, Sweden. *plopez@iim.csic.es

Plant and algal cell walls (*i.e.*, dietary fiber) present in raw materials and agri-food side streams, are remarkable soft matter systems that define food texture, stability, and nutritional value. Understanding and controlling these structures by processing conditions offers powerful opportunities for designing foods that are both high in nutritional quality and aligned with sustainability goals. Our research builds on learnings from fruits and vegetables to seaweeds, revealing how structural and compositional differences can be harnessed to create innovative, sustainable, healthier foods.

We explore how physical and enzymatic treatments can be combined to generate microstructures with distinct rheological properties relevant for organoleptic properties and food digestion. Combining advance characterization techniques such as rheology, Confocal Laser Scanning Microscopy (CLSM), and small angle scattering X-ray and neutron (SAXS and SANS) at large research infrastructures such as the synchrotron ALBA (Spain), we show how polysaccharide solubilization and cell wall nanostructure control gelation and flow properties. By linking particle size and morphology to functional behavior, we present strategies to fine-tune texture and boost dietary fiber in food products, while minimizing waste.

From a soft matter perspective, our results highlight the structuring ability of both terrestrial (fruit, vegetables, legumes) [1] and marine (algal) [2] sources. The findings suggest that food innovation can increasingly move beyond approaches relying on extractions and the use of highly refined fiber ingredients, towards strategies that exploit and reconfigure inherent architectures in raw materials. Such an approach not only enables the design of novel textures and functionalities but also aligns with sustainable food processing.

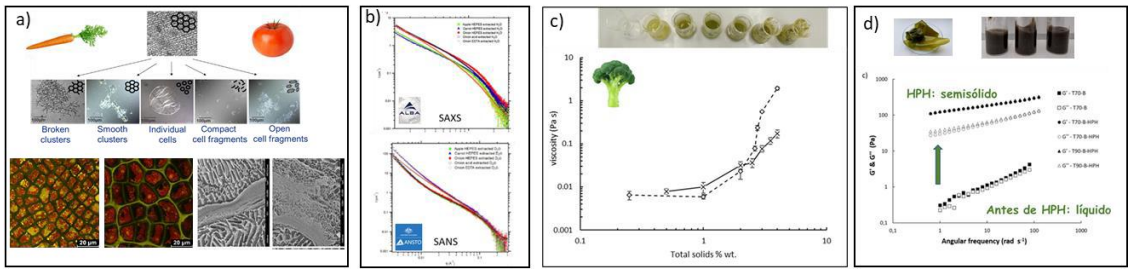

Figure 1 – Microstructures of raw materials using LM, CSLM, and Cryo-SEM. B) Small-angle scattering techniques (SAXS, SANS). C) Viscosity of broccoli purée structures with and without texturizers. D) Rheological characterization of seaweed dispersions.

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OP8 | SUBCRITICAL WATER TREATMENT FOR ENHANCING FIBER SOLUBILITY AND NUTRITIONAL VALUE OF CEREAL BRANS BY-PRODUCTS

Diogo Salvati[1], F. L. Brochiero[1], E. Menalla[2], J. García-Serna[2], D. Cantero[2], L Román[1*]

[1]Food Technology Area, Department of Agricultural Engineering, University of Valladolid, Av. Madrid, 50, 34004, Palencia, Spain; [2]Pressure Technologies group (PressTech), Instituto de Bioeconomía (BioEcoUVa), School of Industrial Engineering, University of Valladolid, 47011, Valladolid, Spain. *lroman@uva.es.

Cereal brans comprise the outer layers of the kernels, being the main by-product of grain milling for white flour production. The bran fraction constitutes about 13-17% of the grain and it is an excellent source of dietary fiber (DF), minerals, vitamins, and bioactive compounds. However, the use of cereal brans is limited due to the presence of some antinutrients (like phytic acid) and insoluble and recalcitrant DF, which have adverse effects on the texture, hydration, and volume of wholegrain food products. In this sense, different treatments such as micronization and heat treatment significantly reduced phytic acid, while fermentation improved the antioxidant and flavor profile, but these treatments were insufficient to enhance fiber solubility. An alternative to these methods is subcritical water treatment due to its properties for biomass hydrolysis, which can be beneficial to increase the soluble DF and reduce anti-nutrients by adjusting the pressure and temperature of the water. This work aims to understand the effect of various treatments with subcritical water on the composition and functionality of bran fractions from rye, wheat, and spelt sources. The bran fractions were treated in a continuous hydrolysis plant with water at 170 bars for 4 s and three different subcritical water temperatures (200, 270, and 340 °C). Following these three treatments, the samples were filtered and fractionated into soluble and insoluble fractions. The samples were compositionally characterized, including fiber and mineral composition, phytic acid, and starch content as well as structurally analyzed using microscopic, chromatographic and FTIR tools. For functionality, foaming, water absorption, viscosity and solubility were evaluated. Increasing subcritical water temperature resulted in a higher ratio of soluble to insoluble fraction for the three cereal sources, with wheat bran showing the greatest solubility increase. Filtration after subcritical water treatment led to the removal of small-molecular weight compounds (*i.e.*, sugars) as well as high starch depletion in the insoluble fraction, especially at 340 ºC, compounds remaining in the soluble fraction. Insoluble fractions exhibited higher concentrations of fiber (~75%) and protein (9-12%) compared to the controls. While FTIR and chromatographic analyses also suggested that both proteins and polysaccharides (*i.e.*, arabinoxylans) suffered from hydrolysis due to the treatment. The concentration of phytic acid in the treated samples was lower than in the control samples, and increasing temperature resulted in a decrease in phytic acid content, especially abundant in spelt and wheat brans. Regarding functional properties, the insoluble fractions exhibited increased water absorption due to fiber solubilization, which was enhanced at higher temperatures, while viscosity development was reduced due to counteracting effect of starch removal. The foaming capacity of the soluble fractions was higher than the insoluble ones, especially at higher temperatures, but temperature had a negative effect on stability. Overall, treatment with subcritical water resulted in fiber solubilization and starch depletion, reducing antinutrients and resulting in a high fiber fraction that exhibited enhanced water absorption and reduced viscosity, which can be beneficial for various wholegrain bakery applications.

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OP9 | UNVEILING THE ROLE OF POLYPHENOLS IN MODULATING GLUTEN PROTEINS: A MOLECULAR AND FUNCTIONAL PERSPECTIVE

Jorge Pardellas Soto[1,2*], Fátima Garbayo Rey[1], Elena Martínez Carballo[1], M. Rosa Pérez Gregorio[1,2,3]

[1]Instituto de Agroecoloxía e Alimentación (IAA), Campus Auga, Food and Health Omics Group, University of Vigo, As Lagoas Campus s/n, 32004 Ourense (Spain); [2]Galicia Sur Health Research Institute Sur (IISGS). Department of Chemistry and Biochemistry. Food and Health Omics Group. SERGAS-UVIGO; [3]LAQV-REQUIMTE. Department of Chemistry and Biochemistry, Faculty of Sciences, University of Porto. Rua do Campo Alegre s/n 4169-007 Porto (Portugal). *jorge.pardellas@uvigo.gal

Phenolic compounds have recently emerged as promising agents in modulating Celiac Disease (CD), a chronic autoimmune condition triggered by gluten in genetically predisposed individuals. Their therapeutic potential stems from their antioxidant and anti-inflammatory properties, and their ability to interact with gluten proteins at the molecular level [1]. Studies have shown that certain phenolics can mitigate or even reverse intestinal mucosal damage caused by gluten [2]. However, the complexity and variability of both gluten proteins and phenolic compounds hinder a full understanding of their interactions and effects across different cereal genotypes. Moreover, their influence during industrial food processing remains poorly understood, emphasizing the need for further multidisciplinary research.

This study investigates the molecular interactions between gluten proteins in autochthonous Galician wheat varieties Caaveiro, Callobre and Grandal and dietary polyphenols from green tea, blueberries, black corn, and red onion. The aim is to create bread formulations incorporating these polyphenols and evaluate their effects on gluten protein bioaccessibility and bioavailability. Protein–polyphenol complexes were analyzed using SDS-PAGE, Western blot, and LC-MS/MS. Functional breads enriched with polyphenol extracts were then subjected to in vitro digestion and transepithelial transport using a Caco-2 cell monolayer model, followed by proteomic analysis.

The results showed that green tea polyphenols exhibited the most significant structural interactions with gluten proteins. Functional breads demonstrated a notable reduction in the bioaccessibility of immunogenic gluten peptides and this trend depends on the wheat variety and gluten composition. These findings highlight the potential of using specific polyphenol sources while exploring traditional wheat varieties to reduce gluten immunogenicity, offering a new avenue for developing functional foods.

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OP10 | ADVANCING FOOD PROTEIN FUNCTIONALITY THROUGH OHMIC HEATING

Rita Leal[1], Ricardo S. Pereira[1], Elisa Molinari[2], Giorgia Spigno[2], Rui Rodrigues[1,3], Ricardo N. Pereira[1,3*]

[1]CEB - Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal; [2]Department for Sustainable Food Process, Università Cattolica del Sacro Cuore, via Emilia Parmense, 84, 29122, Piacenza, Piacenza, Italy; [3]LABBELS-Associate Laboratory, 4710-057 Braga/Guimarães, Portugal. *rpereira@ceb.uminho.pt

There is still a considerable knowledge gap regarding the impact of ohmic heating on the functional and structural properties of food proteins when applied under ultra-high temperature (UHT) conditions. Ohmic heating, with its volumetric energy transfer and the presence of moderate electric fields (MEF), has the potential to modify the conformational dynamics of food proteins, influencing their aggregation behavior formation of functional structures [1] and possible allergenicity modulation [2]. This study aims to systematically investigate the effects of Ohmic heating at UHT on the structural properties of proteins from diverse sources, ranging from animal to microbial origin. Ohmic heating was conducted within a temperature range of 50 °C to 165 °C, allowing for a comprehensive analysis of structural transitions. Parameters assessed included intrinsic fluorescence, surface hydrophobicity, secondary structure distribution, hydrolysis rates, structure of aggregates and antibody binding affinity.

Ohmic heating treatment significantly improved protein solubility at neutral pH. For whey protein isolate (WPI), solubility increased by 52% at pH 6 and by 47% at pH 7, while mung bean protein isolate (MBPI) showed a 44% increase at pH 7. These results are particularly relevant for the development of protein beverages and plant-based dairy alternatives. Unlike WPI, MBPI and yeast protein isolate (YPI) exhibited increased surface hydrophobicity upon Ohmic heating, suggesting marked structural alterations. Notable changes in the distribution of secondary structures were observed, particularly in the proportions of α-helix and β-sheet, which are likely associated with protein folding and stability modifications induced by treatment. In respect to WPI an increased hydrolysis rate and the appearance of unordered structures were observed from 130 to 165 °C. The presence of fibrillar aggregates upon heating were confirmed and achieved a maximum yield at 100 °C with influence on the immunoreactive properties.

This study brings a novel perspective on how MEF and Ohmic heating drives structural modifications in sustainable protein sources, offering a novel approach to technological and functionality enhancement. As an emerging food processing technology, Ohmic heating demonstrates considerable potential for advancing protein ingredient design and expanding its applications in innovative functional food systems.

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OP11 | VALORIZATION OF AGARICUS BISPORUS BY-PRODUCTS: INCORPORATION OF FERMENTED AND NON-FERMENTED FLOURS INTO GLUTEN-FREE BREAD NUTRITIONAL, FUNCTIONAL, AND TECHNOLOGICAL IMPACT

Ana Saldanha[1,2], Mikel Añibarro-Ortega[1], Diogo Salvati[3], Laura Roman[3], Lillian Barros[1], Manuel A. Coimbra[2], Maria Inês Dias[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]LAQVREQUIMTE, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal; [3]Food Technology Division, Department of Agricultural Engineering, University of Valladolid, Av. Madrid 50,34004 Palencia, Spain. *maria.ines@ipb.pt

Edible mushrooms stand out for their high nutritional value, low fat content, and bioactive compounds with health benefits. Lactic fermentation is an effective strategy for preservation and valorization of food products, enhancing stability, sensory attributes, and functional profile [1-3]. This study evaluated the incorporation of *Agaricus bisporus* by-products, either fermented with *Lactobacillus plantarum* (ABF) or non-fermented (AB), into gluten-free breads, as an innovative approach for residue valorization and functional food development. Samples were dehydrated, milled, and incorporated at 5% and 10% into rice, corn, and tapioca flour mixtures, while the control contained no mushroom flour. Breads were produced under controlled fermentation and baking, and characterized for physicochemical, nutritional, technological, and functional properties. Mushroom flour addition increased protein (2.3 g/100 g in control vs. 4.1 g/100 g in AB 10%), dietary fibre (1.2 g/100 g vs. 3.8 g/100 g in AB 10% and ABF 10%), and minerals, with marked ash enhancement in ABF. Fermentation promoted organic acids, antioxidant activity, and a more balanced lipid profile (SFA/PUFA), while AB breads showed higher PUFA (46.5% in AB 10%). Technologically, specific volume decreased (5.28 mL/g control vs. 3.11 mL/g ABF 10%), with increased hardness (1.6 N vs. 13.3 N after 24 h), though elasticity and cohesiveness were preserved. Functional properties improved, with higher water absorption (WAI up to 2.19 g/g in AB 10%) and solubility (WSI up to 8.30 g/g in AB 10%), indicating stronger interactions with the gluten-free matrix. Rheological assays (RVA, farinograph, reofermentometer) revealed reduced viscosity and dough expansion, particularly at 10% substitution, linked to lower availability of gelatinizable starch. Progressive darkening of crust/crumb and reduced pH were also observed in ABF. Overall, *A. bisporus* flours represent a sustainable strategy for gluten-free breads with improved nutritional quality and functional properties. The comparison between AB and ABF shows that fermentation adds benefits, including higher organic acids, antioxidant activity, and a more balanced lipid profile, positioning ABF as an ingredient of greater added value. This work highlights the role of food biotechnology in agri-food residue valorization and in developing healthier, differentiated foods aligned with circular economy, innovation, and food security.

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OP12 | CHEMICAL AND BIOACTIVE CHARACTERIZATION OF PROPOLIS EXTRACTS AND APPLICATION IN FOOD PRESERVATION

Aritson Tolentino[1], Seymanur Ertosun[1], Paula Rodrigues[1], Miguel Vilas Boas[1], Soraia Falcão[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal. *sfalcão@ipb.pt

Propolis is a resinous by-product of the beehive, produced by honeybees (*Apis mellifera* L.) from various plant sources, that are mixed with salivary enzymes bees and transformed. In the beehive, propolis is essential for sealing holes in the combs and protects the entrance from pests and other threats [1]. Furthermore, it is used in the pharmaceutical and food industries due to its high chemical complexity, which provides several bioactive properties, such as antiviral, antioxidant, and antimicrobial [2].

Cheese is a food subject to a wide variety of contaminants, which makes it a food with a short shelf life. However, studies have described that propolis has anti-fungal and antibacterial activity against a quite part of the contaminants microorganism in cheese, namely *Staphylococcus aureus*, *Escherichia coli* and yeast and molds [2,3]. This study aimed to evaluate the chemical potential of propolis for subsequent use in preservation of cheese. For that, propolis samples, was collected in Portugal-Bragança from a beekeeper, and fully characterized in terms of physicochemical properties (loss on drying, ash and wax), phenolic composition and antioxidant activity. The phenolic composition was evaluated by LC/DAD/ESI-MSn analysis after the extraction of the bioactive compounds. Total phenolics, flavonoids of the extract of propolis were determined by spectrophotometric methods. Antioxidant activity was studied by the method of DPPH (α-diphenyl-β picrylhydrazyl). In addition, four types of cheese (goat, sheep, cow–sheep mixture and a cow–sheep mixture with walnuts) were characterized through microbiological parameters, to study the cheese microbiota during maturation, to know which microorganisms we want that propolis inhibits.

Propolis raw show a good result of physicochemical parameters (0.92±0.0% of water content, 1.016±0.076% of ash content and 14±0.013% of wax content). However, for the hydroethanolic extract, a good extraction yield was obtained (71±0.141%). The results showed a phenolic composition typical of temperate poplar propolis, which include phenolic acids and their esters derivatives, such as caffeic acid and *p*-coumaric acid and flavonoids and their methylated/esterified forms, such as pinocembrin, pinobanksin, pinobanksin-3-*O*-acetate and pinobanksin-3-*O*-butyrate. For the total phenolics and flavonoids, the extract present (363.51 mg/g propolis and 79.45 mg/g propolis respectively). The extract demonstrated the ability to neutralize free radicals (EC_{50} = 0.013 mg/mL). Regarding microbiological parameters, only *Staphylococcus aureus* and Molds counts showed a significant increase during maturation, with *S. aureus* being more frequently detected in mixed cow–sheep cheeses with walnuts, and Molds being more prevalent in sheep cheeses. These results support the use of propolis as a potential source to improve cheese safety and extend shelf life.

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O13 | CLEAN-LABEL SMOOTHIES WITH APPLE AND CARROT POMACES: RHEOLOGY AND ANTIOXIDANT STABILITY

Saeed Salari[1*], Pedro Coelho[1], Joana Ferreira[1,2], Ana Lima[3], Isabel Sousa[1]

[1]LEAF - Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017, Lisboa, Portugal; [2]Santarém Polytechnic University, School of Agriculture, Quinta do Galinheiro – S. Pedro, 2001-904 Santarém, Portugal; [3]Research in Veterinary Medicine (I-MVET), Veterinary and Animal Research Centre (CECAV), Faculty of Veterinary Medicine, Lusófona University, Lisbon, University Centre, Portugal. *saeedsalari@isa.ulisboa.pt

Smoothies are thick blended beverages made from fruits, vegetables, and additional ingredients such as yogurt, rice beverage, or honey. Therefore, smoothies with different formulations were developed by using a by-product from the cheese industry and plant-based beverages alternative to milk for the vegan market, these plant-based beverages are showing a high demand from consumers [1].

In this study, clean-label smoothies were formulated using commercial rice beverage, liquid whey, and a 50:50 blend of rice beverage and whey, each of these liquid bases was further enriched with 5% (w/w) apple or 5% (w/w) carrot pomace powder. The impact of the formulations on viscosity was evaluated, along with their effect on total phenolic compounds and antioxidant properties before and after in vitro gastrointestinal digestion.

The viscosity of carrot pomace-based smoothies was approximately five times higher than that of apple pomace formulations. Smoothies made with whey exhibited higher initial total phenolic content and antioxidant activity (through DPPH and FRAP assays). However, their post-digestion bioaccessibility was significantly reduced, likely due to protein–polyphenol interactions and lower pH. In contrast, rice beverage-based smoothies demonstrated greater retention of antioxidant capacity after digestion, especially those containing carrot pomace. These findings emphasize the importance of matrix effects on the bioaccessibility of functional compounds and suggest that rice beverage-based formulations with fruit/vegetable pomaces may be preferable for developing functional beverages with improved post-digestive bioactivity.

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OP14 | EFFECT OF DIETARY POLYPHENOLS IN BIOACCESIBILITY, BIOAVAILABILITY AND FURTHER ALLERGENICITY OF IMMUNOGENIC PROTEINS

Rodolfo Simões[1,2], Jorge Pardellas Soto[1], Susana Soares[2], Rosa Pérez-Gregorio[1,2*]

[1]Food and Health Omics Group, Food and Agroecology Institute, University of Vigo, Campus As Lagoas, s/n, 32004 Ourense, Spain; [2]LAQV-REQUIMTE, Department of Chemistry and Biochemistry, Faculty of Sciences, University of Porto, Portugal. *mariarosa.perez@uvigo.gal

Food allergies (FAs) [1] are one of the primary forms of allergy and may induce severe and life-threatening reactions. FAs are increasingly more prevalent in Europe [2]. However, despite the great advances, currently, the elimination of allergens from the diet is the main strategy to manage this pathology [3]. As such, there's a great emphasis on the development of new therapeutic strategies or nutritional approaches able to control the prevalence of FAs [4].

The digestion of proteins is a crucial factor in determining proteins immunogenicity [5]. The digestion process may be influenced by the way food components interact with each other and with digestive enzymes, ultimately affecting human health. Indeed, dietary polyphenols have been previously described as able to molecularly bind to proteins influencing their digestibility and immunogenicity [6]. This study is thus focused on analyzing the effect of different dietary polyphenols on the bioaccessibility, bioavailability and immunogenicity of peanut, egg and milk proteins, three of the most prevalent forms of FAs.

Different polyphenol-rich extracts (PPs) and immunogenic proteins were extracted, isolated and characterized. The protein extracts and/or the PPs were submitted to an in vitro human digestion [7] and the release of immunogenic peptides during digestion was characterized by HRLC-MS/MS. Furthermore, an epithelial transport assay was performed to monitor bioavailability of the immunogenic peptides by HRLC-MS/MS.

The results indicate that different PPs can alter the digestion of immunogenic proteins and peptides. In some cases, the food matrix also greatly influenced the action of the PPs. The altered digestion of proteins and peptides, in turn, resulted in changes in the bioaccessibility and bioavailability of immunogenic peptides. Overall, these results indicate that the consumption of dietary polyphenols can significantly affect the development of FAs, allowing for new nutritional strategies to be developed.

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OP15 | PANCREATIC LIPASE EXHIBITS SELECTIVE ESTERASE ACTIVITY ON CARBOXYL LINKED HYDROXYCINNAMIC ACID GLUCOSIDES

Pablo Gallego-Lobillo[1,2†], Ivan M. López-Rodulfo[1†], Mario M. Martinez[1,2*]

[1]Centre for Innovative Food (CiFOOD), Department of Food Science, Aarhus University, Agro Food Park 48, Aarhus N, 8200, Denmark; [2]InnograinLab, Food Technology Division, Department of Agricultural Engineering, University of Valladolid, Avda. Madrid 50, 34004, Palencia, Spain. [†]Both authors have contributed equally to this work. *mmartinez@uva.es

Phenolic acids (PAs) are predominantly glycosylated (~95%) in their natural dietary sources and their aglycone form is considered the most bioactive and absorbed part [1,2]. Most of the health benefits of PAs are exerted in the upper gastrointestinal tract, highlighting the need for sufficient concentrations of bioaccessible PA aglycones in the small intestine for their metabolic effects [3]. This fact influences the suppression of glycaemic carbohydrate-digesting enzymes and trans-epithelial sugar transport [4]. Therefore, it is essential to investigate the chemical modifications and deglycosylation of these compounds to fully understand their impact throughout the digestive system.

In this work, the *in vitro* digestibility of 24 phenolic acids from Jonagold apples was investigated using the INFOGEST 2.0 digestion model, including 6 hydroxybenzoic acids (HBAs) and 18 hydroxycinnamic acids (HCAs), most of which were derivatives. Three clusters determined by the chemical structure of the polyphenols and the type of linkage were revealed. Group 1, with HBAs and HCAs, linked via an ester bond to glucose, had lower bioaccessible concentrations after the intestinal phase than Group 2, which included HCAs esterified to quinic acid or glycosylated via a β-O-glycosidic bond. Group 3 consists of the aglycone forms of HCAs (ρ-coumaric acid, ferulic acid and caffeic acid), which suggested hydrolysis from the digestive enzymes. In this way, under different digestion conditions, the β-O-glycosidic bonds in ferulic acid 4-O-β-D-glucoside (FAG) and 4-hydroxybenzoic acid 4-O-β-D-glucoside (HBG) resisted hydrolysis. However, 6-O-feruloyl-D-glucose (FG), linked by an ester bond, was hydrolyzed by pancreatin. When FG and its isomer FAG were digested with individual pancreatic enzymes (amylase, trypsin or lipase), FAG remained intact, whereas FG was hydrolyzed by lipase, mirroring the effect observed with pancreatin. To the best of our knowledge, this is the first evidence reporting a specific esterase activity of porcine pancreatic lipase on HCAs esterified to a glucose moiety via a carboxyl ester bond. In contrast, no hydrolysis was observed for the same linkage when bound to quinic acid, as seen for 3-caffeoylquinic acid (3-CQA). These results underline the substrate specificity of pancreatic enzymes and emphasize the key role of the chemical structure in the bioaccessibility and bioavailability of PAs during gastrointestinal digestion.

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OP16 | *IN VITRO* ANALYSIS OF STARCH DIGESTIBILITY AND PREDICTED GLYCEMIC INDEX IN TRADITIONAL AND INDUSTRIAL BREADS FROM THE GALICIAN MARKET

M. Pilar España-Fariñas[1], Esperanza M. Méndez-Sánchez[1], Santiago Pereira-Lorenzo[2,3], María Ángeles Romero-Rodríguez[1,2*]

[1]Areas of Nutrition and Food Science and Food Technology, Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Sciences, Campus Terra, Universidade de Santiago de Compostela, 27002 Lugo, Spain; [2]Instituto de Biodiversidade Agraria e Desenvolvemento Rural (IBADER), Campus Terra, Universidade de Santiago de Compostela, 27002 Lugo, Spain; [3]Department of Crop Production and Engineering Projects, Escuela Politécnica Superior, Campus Terra, Universidade de Santiago de Compostela, 27002 Lugo, Spain. *angeles.romero@usc.es

In Galicia (NW Spain), bread holds a prominent role not only in daily consumption but also as a symbol of cultural heritage and artisanal value [1]. However, the increasing predominance of industrially produced bread raises concerns about its nutritional implications [2]. This study investigates differences in *in vitro* starch digestibility and estimated glycemic index (eGI) between traditional and industrial breads available in the Galician market. Traditional samples were usually produced using long fermentation and sourdough, following artisanal protocols, while industrial breads encompassed highly processed variants with standardized formulations. The results showed that traditional breads generally exhibited lower eGI, along with a more favorable profile of starch fractions, such as higher levels of resistant starch. Although certain industrial tin loaf breads displayed reduced eGI, often due to the inclusion of added fiber or alternative flours [3], their classification as ultra-processed foods remains a concern. These findings emphasize the nutritional benefits of preserving traditional breadmaking practices and their relevance in promoting healthier carbohydrate choices.

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OP17 | PREBIOTIC POTENTIAL OF APPLE POMACE BEFORE AND AFTER SIMULATED DIGESTION: AN *IN VITRO* EVALUATION WITH PROBIOTIC STRAINS

Liege Aguiar Pascoalino[1,2], Lillian Barros[1], João C. M. Barreira[1], M. Beatriz P. P. Oliveira[2], Filipa S. Reis[1,2*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/LAQV, Faculdade de Farmácia, Universidade do Porto, Rua Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal. * freis@ipb.pt

Apple pomace (AP), the primary by-product of cider production, is rich in fibers and bioactive compounds that can be valorized within the circular economy framework due to their potential health-promoting effects [1]. In particular, its prebiotic properties remain underexplored, particularly in relation to its behavior after gastrointestinal digestion. This study investigated the prebiotic activity of AP, both before and after simulated digestion (as per the INFOGEST protocol), using an *in vitro* approach with *Lactobacillus casei* NCTC 6375, *L. plantarum* DSM 12028, *L. acidophilus* LA-5, and *Bifidobacterium animalis* subsp. Lactis Bb12. Probiotic growth was evaluated in modified MRS broth without glucose, supplemented with lyophilized AP, its hydroethanolic extract (HE_AP), and digested AP (D_AP), all at 2% (w/v). Positive controls included inulin, fructooligosaccharides (FOS), and glucose. Growth curves were monitored for 48 h by optical density at 620 nm under anaerobic conditions. Results showed that lyophilized AP strongly promoted the growth of all probiotic strains, achieving maximum levels comparable to those of glucose and superior to those of inulin and FOS before digestion. After digestion, AP retained significant prebiotic activity, with profiles resembling those of established prebiotics, confirming the resilience of its functional properties through the gastrointestinal process. Lyophilized AP consistently outperformed HE_AP, suggesting that soluble fibers, largely absent in the extract, are key contributors to its activity, although HE_AP still demonstrated relevant effects. These findings reinforce the role of AP as a sustainable and effective prebiotic source, supporting beneficial bacteria associated with gut health, and highlight its potential for incorporation into functional food and nutraceutical formulations. By combining health benefits with waste valorization, AP represents an auspicious candidate for future applications in food innovation and microbiome modulation.

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OP18 | FROM WASTE TO FOOD: VALORIZATION OF OAT PULP FROM COMMERCIAL OAT DRINKS

Sara Berguices[1*], Mishell D. Montenegro[1], Valentín Pando[2], Manuel Gómez[1], Laura Román[1]

[1]InnograinLab, Food Technology Area, Department of Agricultural and Forestry Engineering, University of Valladolid, Av. Madrid, 50, 34004, Palencia, Spain; [2]InnograinLab, Department of Statistics and Operations Research, University of Valladolid. *s.berguices@uva.es

In recent years, the market for plant-based beverages as milk alternatives has grown steadily, with oat beverage standing out due to its favorable nutritional profile and pleasant sensory characteristics. However, an unavoidable and direct consequence of this product's success is the formation of oat pulp (OP), a highly unstable byproduct due to its high moisture content (~60-70%). Rather than seeing this as a waste management challenge, this byproduct represents an opportunity to develop new value-added oat-based ingredients, such as oat fiber and protein. Oat beverage is obtained through the hydrothermal processing of oat flour, in which starch is hydrolyzed. The resulting slurry is filtered to recover the liquid fraction, leaving behind a solid residue, the OP (*oatara*), which represent 500 g/kg of drink produced. While similar byproducts, most notably soy's okara, have been extensively studied, there is a research gap regarding OP stabilization and subsequent upcycling. Therefore, this study focuses on the stabilization of OP, as well as the compositional and functional characterization of both the produced oat pulp and the oat flour from which it is derived.

Frozen OPs obtained from five different commercial beverages were dried at 70 °C for 10 h in a forced-air oven, optimized to achieve both a reduced moisture content (<6%) and the inactivation of the active processing enzymes (*i.e.*, starch hydrolases and proteases). The dried OP was milled and sieved to obtain a fine flour. Compositional analyses revealed a high content of dietary fiber (~43%) (insoluble: ~34%, soluble: ~9%), proteins (~21%), and lipids (~14%). Ash content was consistent between samples (~7%), while reducing sugars (~5%) revealed that one sample underwent a shorter saccharification process, containing minimal reducing sugars and over twice the starch content (~8%) compared to the others (~3%), which suggests limited enzymatic hydrolysis during processing. Water binding capacity doubled (~3%) compared to that of the native oat flour, which could be attributed to OP's higher insoluble dietary fiber and protein content. During thermo-rheological analyses, all OP samples exhibited very low viscosities compared to flour, due to extensive starch dextrinization during the beverage production, with no differences associated with their starch content. This research highlights the potential of *oatara* as a promising, sustainable ingredient for the cereal industry, with only minor variations depending on the type of beverage from which the pulp originated, rather than the flour itself.

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OP19 | VALORIZATION OF FRUIT DISTILLATION POMACES

Lara Serra[1], Inês Pitacas[2], Soraia I. Pedro[2], Bruno Pires[1,3], Tiago A. Fernandes[4,5], Ângelo Luís[1,3], Eugenia Gallardo[1,3], Ofélia Anjos[2,6*]

[1]RISE-Health, Department of Medical Sciences, Faculty of Health Sciences, University of Beira Interior, 6200-506 Covilhã, Portugal; [2]CERNAS-IPCB, Research Centre for Natural Resources, Environment and Society, Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal; [3]Laboratório de Fármaco-Toxicologia – UBIMedical, Universidade da Beira Interior, Covilhã, Portugal; [4]MINDlab: Molecular Design & Innovation Laboratory, Centro de Química Estrutural, Institute of Molecular Sciences, Department of Chemical Engineering, Instituto Superior Técnico (IST), University of Lisbon, Portugal; [5]DCeT, Department of Science and Technology, Universidade Aberta, Lisbon, Portugal; [6]CBPBI, Spectroscopy and Chromatography Laboratory, Centre of Plant Biotechnology of Beira Interior, Castelo Branco, Portugal. *ofelia@ipcb.pt

This study aims to characterise the nutritional composition of distillation pomace from the production of spirits from apple, pear and strawberry tree fruits (STFs) and to assess its potential for valorisation within circular economy and zero waste strategies. Pomace samples were collected after distillation at a distillery in Castelo Branco. Two batches per fruit type, each with three replicates, were analysed. The following parameters were analysed: ash content, organic matter content, protein content, fat content, fibre content, lignin content, hemicellulose content, cellulose content, non-fibrous carbohydrate content, total phenolic content (TPC) and total flavonoid content (TFC). The antioxidant and antimicrobial activities were determined and the compound profiles were assessed by HPLC. FTIR-ATR spectroscopy was applied for chemical fingerprinting. ANOVA and principal component analysis (PCA) were used for data interpretation.

PCA for nutritional parameters explained 96.6% of the total variance and clearly distinguished between the pomaces used. Apple pomace had the highest protein content (6.04 ± 0.07 g/100 g), whereas pear pomace had the lowest (2.83 ± 0.27 g/100 g). STF pomace had the highest fat content (4.71 g/100 g) and was rich in organic matter, fibre, hemicellulose and cellulose. STF and apple pomaces additionally exhibited higher TPC and TFC values. Using HPLC-DAD, we were able to identify 28 phenolic compounds, as well differentiating between the pomaces and confirming the presence of compounds of interest. The highest concentrations were found for resveratrol and syringic acid, particularly in pear extracts (0.73–0.59 µg/mg extract). Benzoic acid, p-coumaric acid and rutin also appeared in relatively high amounts. FTIR-ATR spectroscopy identified functional groups, supporting chemical discrimination and different potential valorisation.

Distillation pomace revealed valuable nutritional and chemical properties, highlighting its potential as a raw material for use in the food industry. STF pomace, in particular, is characterised by its high fibre and bioactive compound content. Further research is needed to optimise its industrial use.

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OP20 | FROM HAM TO 3D SNACKS: TOWARDS SUSTAINABLE SOLUTIONS

Lisiane Carvalho[1], Leonor Pereira[1], Adriana Ferreira[2], Maria Otília Carvalho[1], Anabela Raymundo[1], Teresa J. S. Matos[1], Isabel Sousa[1*]

[1]LEAF - Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017, Lisboa, Portugal; [2]R&D Departament, Primor Charcutaria-Prima, S.A., Gavião, 4760-00, Vila Nova de Famalicão, Portugal. *isabelsousa@isa.ulisboa.pt

The global demand for sustainable and nutritionally enhanced foods is fostering the replacement of animal-based proteins with alternative sources such as plant proteins, microalgae, and edible insects [1-3]. This study presents a set of works aimed to develop hybrid and vegan meat alternatives, ranging from hams to 3D-printed snacks (Figure 1), highlighting the transition from meat-based to fully plant-based systems.

Hybrid hams were prepared with pork meat combined with alternative protein sources such as pea protein, microalgae, and edible insect flours, resulting in clean-label products with enhanced nutritional quality, increased antioxidant activity, and favorable texture properties, while maintaining consumer-relevant characteristics. Concurrently, the development of a vegan clean-label ham offers a meat-free alternative that aligns with health-conscious and environmentally aware consumer demands.

In parallel, 3D printing technology was employed to produce hybrid snacks with pork meat and pea protein and fully vegan snack using pea and potato proteins. The hybrid snacks showed nutritional improvements, reduced pork content, and acceptable sensory properties, while the vegan version demonstrated high protein content, rich mineral profile, and promising texture results.

Together, these approaches confirm the feasibility of designing innovative, clean-label protein alternatives with improved functionality and sustainability. Overall, this work underscores the role of hybrid products as transitional foods that bridge conventional meat consumption and vegan alternatives, while 3D printing emerges as a powerful tool to create attractive, tailored products. The integration of plant proteins, microalgae, and insects in hybrid systems, along sing the development of fully plant-based products, offers promising pathways to reduce the food production environmental impact and meet evolving consumer expectations.

Figure 1 – Model Pork meat (a), hybrid (b), vegan (c) ham; 3D hybrid (d) and vegan (e) snack.

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OP21 | HIGHLY PROTEIN-DENSE SPREADS: A STRATEGY FOR MICRONUTRIENT DELIVERY IN NUTRITIONALLY VULNERABLE POPULATIONS

Sheyma Khemiri[1*], João Matias[1], Anabela Raymundo[1]

[1]Linking Landscape, Environment, Agriculture and Food (LEAF), TERRA Associated Laboratory; School of Agriculture, Lisbon University (ISA), Tapada da Ajuda, 1349-017 Lisboa, Portugal. *Sheymak@isa.ulisboa.pt

Plant-derived storage proteins are central to the transition toward sustainable diets, yet single-source formulations often fall short of providing a complete amino acid spectrum and certain micronutrients [1]. Nuts such as almonds contribute desirable lipids, vitamin E and textural functionality but are relatively poor in some essential amino acids [2], whereas pulses supply complementary amino acids but can introduce flavor and textural constraints. In this study, a modular formulation strategy for a vegan, cheese-like spread was investigated (Figure 1). An almond-dominant matrix was selected together with oat milk and lupin protein, produced a base recipe that satisfied the nutritional claim "source of protein." Building on this foundation, we evaluated enrichment with two alternative protein materials; yeast protein extracts and *Chlorella* biomass, aiming to broaden essential amino-acid coverage and supply micronutrients and bioactives absent from the base formulation. Formulations were characterized by proximate analysis, amino-acid profiling, mineral and targeted phenolic quantification, antioxidant capacity and *in vitro* digestibility (simulated gastrointestinal conditions). A clear escalation from "source of protein" to "high in protein" for enriched formulations was obtained. Inclusion of *Chlorella* at 3% (w/w) produced a marked increase in iron content consistent with a "rich in iron" claim. Antioxidant assays produced variable but consistently favorable outcomes. Targeted chemical profiling revealed the presence of gallic acid, catechin and epicatechin, particularly in *Chlorella*-containing formulations. *In vitro* digestibility averaged 37% across formulations; differences attributable to the alternative biomasses were observed but were not statistically significant. Combining nut, pulse and alternative protein sources yielded spreads that are nutritionally denser, deliver complementary essential amino acids and micronutrients, and possess distinct sensory profiles for market differentiation.

Figure 1 – Different steps involved in the production of the vegan spreads.

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OP22 | SUSTAINABLE INSECT PROTEINS: EVALUATING DIGESTIBILITY, ALLERGENICITY, AND INFLAMMATORY POTENTIAL

Lisete M. Silva[1*], Inês E. Silva[1], Sara da Silva[1], Rafaela Fantatto[2], Marisa V. Santos[3], Ricardo Dias[4], Susana Soares[1], Victor Freitas[1]

[1]Faculty of Sciences of University of Porto, Porto, Portugal; [2]EntoGreen, Santarém, Portugal; [3]Thunder Foods, Santarém, Portugal; [4]LAQV-REQUIMTE, Porto, Portugal. *lisete.silva@fc.up.pt

Insect-derived proteins are emerging as a sustainable alternative to animal proteins, offering high protein content, a complete aminoacid profile, and versatile food applications, while reducing greenhouse gas emissions, land use and water consumption. Although a few studies suggest their digestibility may match or exceed that of traditional proteins, it varies by species and processing methods. Thus, assessing their digestibility, allergenicity and inflammatory potential is crucial for evaluating their suitability as food ingredients. In this work, dehydrated *Hermetia illucens* (Black Soldier Fly, BSF) and *Tenebrio molitor* (TM) larvae, as well as the defatted insect meals, and protein extracts (PE) obtained after a protein extraction optimization and characterization, were subjected to *in vitro* gastrointestinal digestions, following the INFOGEST protocol. The samples were desalted and analyzed by nano-LC-MS/MS. The allergenicity potential of the resulting peptides were predicted *in silico* using the AllerCatPro 2.0 web server. The pro-inflammatory response of BSF and TM meals and their corresponding PE was assessed using a transwell-based human intestinal epithelial cell model consisting of differentiated Caco-2 and HT-29-MTX co-cultures. For BSF samples, 1076 peptides (0.6-3.6 kDa) were identified, with 0.2 % in the PE, and 0.9 % in the larvae and meal showing strong allergenicity potential. For TM, 1329 peptides (0.6-3.9 kDa) were identified, with 0.9 % in the PE, 3.9 % in the meal and 2.6% in the larvae predicted as allergenic. Despite these results, further tests are needed to confirm the allergenicity potential of these insect-based ingredients. None of the insect samples induced a significant pro-inflammatory response under the tested conditions – monitored through IL-8 release –, supporting their potential as sustainable food ingredients.

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OP23 | DIVING INTO MARINE RESOURCES: EXPLORING THE OCEAN'S RESERVOIR OF BIOMOLECULES

Gabriela Sousa[1,2*], Suzana Ferreira-Dias[1,3], Carla Tecelão[2], Vítor D. Alves[1,4]

[1]Instituto Superior de Agronomia, LEAF-Linking Landscape, Environment, Agriculture and Food Research Centre, Universidade de Lisboa, 1349-017 Lisboa, Portugal; [2]MARE—Marine and Environmental Sciences Centre, ARNET-Aquatic Research Network, Politécnico de Leiria, 2520-641 Peniche, Portugal; [3]Laboratório de Estudos Técnicos, Instituto Superior de Agronomia, Universidade de Lisboa, 1349-017 Lisboa, Portugal; [4]Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, 1349-017 Lisboa, Portugal. *gabriela.spsousa@gmail.com

Oceans are an untapped reservoir of high-value biomolecules with significant potential for sustainable innovation. In this context, proteins, polysaccharides and antioxidant compounds can be extracted from underutilized marine resources [1]. Portugal, with its extensive coastal area, offers unique opportunities to explore these resources. As such, the present study aims to simultaneously extract and characterize polysaccharides and antioxidant compounds of underexplored seaweeds from the Portuguese coast. Thus, two green seaweeds (*Codium tomentosum* Stackhouse and *Ulva* sp.) and one brown seaweed (*Sargassum vulgaris* Grunow) were studied. To obtain the target compounds, hydrothermal (HT) and ultrasound-assisted extraction (UAE) processes were applied, following a central composite rotatable design (CCRD). Extracts and precipitates were characterized in terms of sugar content, uronic acid content, phenolic content, antioxidant capacity and molecular weight of the extracted compounds. Data were analyzed using Principal Component Analysis (PCA) and Clustering Analysis (CA). The statistical analysis showed a clear difference among different seaweed species. Moreover, a clear distinction was observed for different extraction treatments. The results showed that *Ulva* was the most promising polysaccharide source, with higher precipitation yields (11.9 – 34.5 % w/w) than *Codium* (7.3 – 14.5 % w/w) and *Sargassum* (3.2 – 10.6 % w/w). Furthermore, hydrothermal treatment allowed higher yields (21.5 – 34.5 % w/w) than UAE (11.9 – 20.8 % w/w). Regarding phenolic content and antioxidant capacity, *Sargassum* samples presented the most remarkable results, mainly when HT was used. Considering that *Sargassum* belongs to the brown phylum, a higher phenolic content was already expected due to the presence of phlorotannins (a group of polyphenols only synthesized by brown algae). Still, UAE was expected to be the method which maximizes the phenolics extraction since it was performed for shorter extraction periods and at lower temperatures. However, our results indicated that the HT conditions followed did not degrade these compounds. Conversely, they facilitated the extraction by increasing the diffusion rate, and thereby, increasing the mass transfer rate and extraction efficiency. CCRD data allowed to identify a trend and choose the best conditions to promote the extraction of the target compounds. For higher precipitation yield, and precipitates with higher sugar and uronic acid contents, HT at 92 °C for 84 min, with 0.086 g *Ulva*/mL water led to the best results. To obtain higher phenolic content and antioxidant capacity, a HT at 92 °C for 84 min, with 0.086 g *Sargassum*/mL water, was the best option. These results highlight the potential of Portuguese seaweeds as sustainable sources of polysaccharides and phenolic compounds and indicate HT as a promising method for their valorisation.

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OP24 | NANOENCAPSULATION OF *RHUS CORIARIA* L. LEAF EXTRACT AS A NATURAL FOOD PRESERVATIVE

Elizandra N. G. Ardohain[1,2,3*], Gabriel Azevedo[3], Salette Reis[3], Ricardo Calhelha[1], Miguel A. Prieto[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança, Portugal; [2]Grupo de Nutrição e Bromatologia, Departamento de Química Analítica e Alimentar, Faculdade de Ciência e Tecnologia de Alimentos, Universidade de Vigo, C. Ourense, 32004 Ourense, Espanha; [3]LAQV, REQUIMTE, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, 4050-313 Porto, Portugal. *elizandra.ardohain@ipb.pt

Growing concerns over food safety and the potential health risks of synthetic preservatives have fueled interest in natural compounds with antimicrobial activity. However, many of these compounds are unstable, underscoring the importance of strategies such as nanoencapsulation to preserve their effectiveness [1]. This study aimed to develop and characterize lipid-based nanoparticles for the encapsulation of *Rhus coriaria* L. leaf extract, with a view to its application as a natural food preservative, given its proven antioxidant and antimicrobial properties [2]. Two different extraction methods were employed: the 80:20 ethanolic extract was obtained by maceration, whereas the 50:50 extract was produced using ultrasound-assisted extraction. Eight formulations were tested, combining two lipids (Witepsol E85 and Cetyl Palmitate Peller) with two surfactants (Tween 80 and Pluronic F-68). After optimizing surfactant concentrations to minimize foam formation, nanoparticles were produced via hot melt emulsification followed by ultrasonication. All formulations were characterized by their average particle size, polydispersity index (PDI), and zeta potential (ζ). The best-performing formulation, combining Tween 80 with Witepsol E85, exhibited average particles sizes around 335 nm, low polydispersity index (PDI) values (< 0.3), and ζ values close to -42 mV, indicating good colloidal stability. Encapsulation efficiency was evaluated using the *Folin-Ciocalteu* method through an indirect approach, based on the quantification of non-encapsulated total phenolic content. The formulation with the 50:50 extract obtained via ultrasound showed the highest encapsulation efficiency (65.3%), followed by the formulation 80:20 extract obtained via maceration (58.3%). The results confirm the feasibility of encapsulating *R. coriaria* extract in food-grade lipid nanoparticles, opening promising perspectives for its application as a bioactive preservative. Future studies will focus on evaluating the long-term stability of the formulations and their effectiveness in real food systems.

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OP25 | XTREMEGOURMET 2.0: CONNECTING GASTRONOMY, SCIENCE, AND SUSTAINABLE AGRONOMIC PRACTICES TO DELIVER ENHANCED HALOPHYTE PRODUCTS

Marta Oliveira[1], Luísa Barreira[1*], Nicolle Prates[1], Miguel Salazar[2], Pedro Girão[2], Susana Casal[3], Isabel Ferreira[3]

[1]Grupo de Biotecnologia Marinha, Centro de Ciências do Mar (CCMAR), Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal; [2]Agro-on, Sítio do Besouro, CX 547B. 8005-421 Faro, Portugal; [3]LAQV/REQUIMTE, Departamento de Ciências Químicas, Laboratório de Bromatologia e Hidrologia, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira n.° 228, 4050-313, Porto, Portugal. *lbarreir@ualg.pt

The Ria Formosa and Algarve coastline are biodiversity hotspots that host a wide range of plant species, including halophytes, *i.e.*, those adapted to saline environments. Due to their unique physiological traits, like high contents of minerals and bioactive metabolites, halophytes have growing economic potential across multiple markets, such as in the food and beverage industries, many being edible and offering proven nutritional and health benefits [1]. Moreover, they are also increasingly valued in gourmet cuisine for their salty and crunchy texture [2], and their use in this segment is rising. Building on this potential, several halophyte species were successfully adapted to soilless cultivation and integrated into the RiaFresh® portfolio during the nationally funded project XtremeGourmet (2016–2020; ALG-01-0247-FEDER-017676). The current project, XtremeGourmet 2.0 (2024–2027; COMPETE2030-FEDER-01195200), aims at expanding innovation by 1) adapting 3 novel halophyte species to soilless conditions, opening venues into new markets, and 2) partially replacing sodium with magnesium in three already commercialized species, preserving their nutritional and sensory qualities while maximizing health benefits. During the first year, we carried out agronomic trials to test different levels of sodium substitution with magnesium in the three commercialized species, and their nutritional profiles were then assessed. In parallel, sensory analyses were conducted with 12 renowned chefs, who evaluated the organoleptic qualities of the modified plants compared with the control group (0% substitution). Altogether, the integration of the agronomic, nutritional, and organoleptic data for each species will be presented and discussed in this work, guiding the next phase of the project, namely the commercial-scale trials planned for the coming months. Ultimately, this work gives emphasis to the exploitation of Portuguese coastal resources to develop innovative food products with enhanced biotechnological and nutritional value through sustainable agronomic practices.

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OP26 | CHARACTERIZATION OF PUMPKIN AND ALMOND ICE-CREAMS PRODUCED WITH FOOD INDUSTRY SIDE STREAMS

Francisco Herdeiro[1], Isabel Sousa[1], Anabela Raymundo[1*]

[1]LEAF – Linking Landscape, Environment, Agriculture and Food Research Centre, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisbon, Portugal. *anabraymundosa.ulisboa.pt

This study investigated the physicochemical and rheological properties of ice creams formulated with food industry by-products – pumpkin pomace, almond residues, and cheese whey. In short, ice-creams are formed by an emulsion of oil droplets stabilised by a protein matrix, with some thin bubbles of air in a smooth texture melting solid [1]. This structure is often more complex with macromolecules to strengthen the matrix like fibres and polysaccharides [2]. Rheological tests revealed shear-thinning behaviour in all samples, with pumpkin ice-cream exhibiting the highest apparent viscosity due to its high dietary fibre content. Melting points were closer to the (C) commercial sample (-6.5 ºC) with values of -6.5ºC for the pumpkin (P) and −5.0 °C for the almond ice-creams (A). Particle size distribution highlighted bimodal patterns in C and P versus unimodal in A emulsions. Texture was evaluated at the solid state with values for firmness of 1.4 N and 21.3 N for P and A ice-creams respectively and adhesiveness of 0.006 and 0.031 -N·s. Texture analysis confirmed P softer profile, less firm and the firmness of A being smoother with higher adhesiveness. The results demonstrate that pumpkin by-products yield lighter, fibre-enriched textures, whereas almond residues enhance structure and melting resistance attributed to its lipid-protein matrix, aided by short dietary fibres. This valorisation aligns with circular economy principles, offering sustainable alternatives for functional ice cream production without compromising quality [3]. Further sensory and shelf-life studies will follow to assess commercial viability.

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OP27 | HONEYCHEST CEREAL BAR: A SAFE, NUTRITIOUS, AND STABLE PRODUCT DERIVED FROM BEE PRODUCTS

Sandra Barbosa[1,2,3,4*], Francimara Marques[1], Alexandra Gonçalves[1], Susana M. Cardoso[3], Cristina Almeida-Aguiar[4]

[1]MONTESINO – Bee Products Sustainable and Socialy Responsible, Bragança, Portugal; [2]CITAB - Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; [3]LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Aveiro, Portugal; [4]CBMA – Centre of Molecular and Environmental Biology, Department of Biology, University of Minho, Braga, Portugal. *sandra.barbosa@montesino.pt

Bee products are recognized for their nutritional and functional properties, as well as for their contribution to human health and well-being. In this study, a cereal bar was developed containing chestnut cream, honey, seeds, pollen, dehydrated apple, nuts, puffed rice and propolis. Its nutritional profile, microbiological safety, and shelf-life were characterized.
The nutritional composition was determined through proximate analysis of macronutrients (carbohydrates, proteins, and lipids), energy value, and selected micronutrients, in line with the reported profiles of honey, pollen, and propolis [1,2]. Microbiological quality was evaluated according to European legislation (Regulation (EC) No. 2073/2005) [3], including hygiene indicators and foodborne pathogens to ensure safety. Shelf-life was assessed by monitoring nutritional stability and microbiological parameters during storage, following approaches applied in studies on functional/protein bars [4] and bee products such as honey [5]. The results showed that the Honeychest bar has a balanced nutritional profile, providing carbohydrates and proteins with moderate fat content and relevant micronutrients. Microbiological analyses confirmed compliance with safety standards, and shelf-life tests demonstrated stability of both nutritional value and microbiological quality over six months. In conclusion, the Honeychest bar can be considered a safe, nutritious, and stable functional food, reinforcing its potential for innovation in bee-derived products for the food industry.

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OP28 | EVALUATING ANTIDIABETIC ACTIVITY OF DARK TEA PEPTIDES: METHODOLOGICAL INSIGHTS FOR SUSTAINABLE NUTRITIONAL SOLUTIONS

Marisol Dias[1], Pablo Fuciños[1], Catarina Gonçalves[1], Lorenzo Pastrana[1], Isabel R. Amado[1*]

[1]INL- International Iberian Nanotechnology Laboratory, Av. Mestre José Veiga s/n, 4715-330 Braga, Portugal.
*isabel.rodriguez@inl.int

Diabetes *mellitus* is a rapidly growing global health issue, and despite advances in pharmacological treatments, there is a lack of functional foods specifically formulated to help manage or prevent diabetes [1]. Bioactive peptides derived from food sources, such as tea leaves, have shown promise in modulating key enzymes, including α-glucosidase, involved in carbohydrate metabolism, offering new avenues for the development of functional foods with antidiabetic properties [2].

This study compared two analytical methods for quantifying the α-glucosidase inhibitory activity of a peptide extracted from tea (AdTP), using acarbose – the standard in diabetes treatment – as a reference. A standard *in vitro* enzymatic method using *p*-nitrophenyl-α-*D*-glucopyranoside as a substrate [3] and an *in vitro* method using differentiated Caco-2 cell monolayers and maltose as the substrate were employed to quantify α-glucosidase inhibitory activity [4,5].

Our results (Figure 1, Table 1) showed that AdTP consistently exhibited lower IC_{50} values than acarbose in both enzymatic and cell-based assays, indicating the peptide has more active α-glucosidase inhibitory activity. The cell-based assay revealed a more pronounced difference in IC_{50} values between the two compounds, suggesting differential inhibitory potency under conditions more closely mimicking physiological environments. These findings support the potential of tea protein-derived peptides as bioactive compounds for the dietary management of diabetes, underscoring the importance of selecting analytical tools that closely replicate physiological conditions.

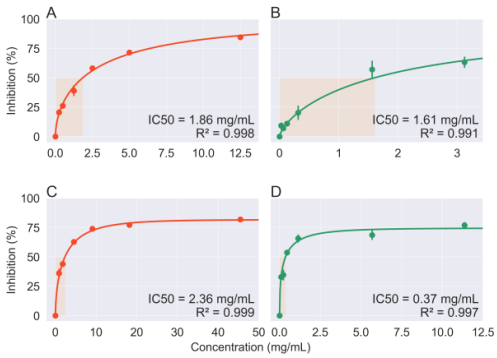

Figure 1 – Dose-response plots of AdTP and acarbose α-glucosidase inhibitory activity using *in vitro* enzymatic (left) and *in vitro* cell-based methods (right). Experimental data (points) and Weibull model (lines) are shown.

Table 1 – IC_{50} values (mg/mL) of AdTP and acarbose using *in vitro* enzymatic and in vitro cell-based methods. Means of two independent assays, and four replicates each are shown.

Sample	*In vitro*	Cell-based
AdTP	1.61 ± 2.42	0.37 ± 0.10
Acarbose	1.86 ± 0.79	2.36 ± 0.57

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OP29 | EVALUATION OF THE EFFECTS OF THE FUNGICIDES OXATHIAPIPROLIN AND SPIROXAMINE ON *SACCCHAROMYCES CEREVISIAE CEREVISIAE* VINIFERM 3D AND *SACCHAROMYCES CEREVISIAE BAYANUS* LALVIN EC1118™ YEASTS

Icía Gómez-Pérez[1], Noelia Briz-Cid[1,2], Raquel Rial-Otero[1,2*]

[1]Instituto de Agroecoloxía e Alimentación (IAA), Universidade de Vigo – Campus Auga, Food and Health Omics, 32004 Ourense, Spain; 2 Galicia Sur Health Research Institute (IIS Galicia Sur), SERGAS-UVIGO, Spain. *raquelrial@uvigo.gal

Numerous studies have established a correlation between the presence of fungicides residues in grape must and their impact on the fermentation process [1], as well as on the characteristics of the final wines obtained [2,3]. However, the observed effects are influenced by the specific fungicide and yeast under investigation. Consequently, the aim of this research is to evaluate the impact of two new generation fungicides, oxathiapiprolin and spiroxamine, on two *Saccharomyces cerevisiae* yeast strains. For this purpose, an exhaustive study was conducted into the fermentation behaviour of both yeasts, in the absence and presence of the fungicides under investigation.

The present study was conducted in triplicate using laboratory-scale microfermentations with synthetic must fortified with the target fungicides at their corresponding maximum residual limits in grapes (0.7 mg/kg for oxathiapiprolin and 0.5 mg/kg for spiroxamine, respectively). During the alcoholic fermentation process, aliquots of the fermentation medium were taken to determine the biomass concentration, the sugar consumption rate, the ethanol and glycerol production, and the sugar-to-ethanol and biomass-to-ethanol yields. Furthermore, the progression of yeast viability was assessed using trypan blue as a stain and an automated cell counter to quantify the percentage of live and dead cells in the sample. In addition, the major aromas of the fermented musts obtained were analysed using gas chromatography coupled to a flame ionisation detector (GC-FID).

Regardless of the absence or presence of fungicides, all fermentations were initiated and completed in a homogeneous manner, reaching the endpoint in all cases. No statistically significant differences in fermentation parameters were observed between the assays with fungicides and the control fermentations (without fungicides). On the contrary, statistically significant differences were observed at the aromatic level. Thus, a substantial increase in the volatile fatty acid content was observed in those assays performed with the Lalvin EC1118™ yeast strain in the presence of oxathiapiprolin.

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OP30 | PRELIMINARY INVESTIGATION OF SURFACE MODIFICATIONS IN LDPE MICROPLASTICS UNDER SIMULATED GASTROINTESTINAL CONDITIONS

Mariana Lamas[1,2], Francisca Rodrigues[3,4], Marta Oliveira[1], Paulo C. Costa[3,4], Virgínia Cruz Fernandes[1,5,6*]

[1]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 431,4249-015 Porto, Portugal; [2]ICBAS - School of Medicine and Biomedical Sciences, University of Porto, Rua de Jorge Viterbo Ferreira n.º 228, 4050-313 Porto, Portugal; [3]i4HB – Associate Laboratory Institute for Health and Bioeconomy, Faculty of Pharmacy, University of Porto, Rua de Jorge Viterbo Ferreira, 4050-313, Porto, Portugal; [4]UCIBIO – Applied Molecular Biosciences Unit, MedTech-Laboratory of Pharmaceutical Technology, Faculty of Pharmacy, University of Porto, Rua de Jorge Viterbo Ferreira, 4050-313, Porto, Portugal; [5]Chemical and Biomolecular Sciences, E2S, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida 400, 4200-072 Porto, Portugal; [6]RISE-Health, Center for Translational Health and Medical Biotechnology Research (TBIO), E2S, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 400, 4200-072, Porto, Portugal. *fcv@ess.ipp.pt

Microplastics (MPs) are emerging ubiquitous pollutants, increasingly identified in food items, packaging, and biological systems, including human biological samples and tissues [1]. Traditionally viewed as chemically stable, recent evidence indicates that MPs may undergo structural and chemical alterations [2] when subjected to biological environments. Within the human gastrointestinal tract, conditions such as pH variations, enzymatic activity, bile components, and microbial presence may promote these changes, potentially affecting how MPs behave, interact with tissues, and contribute to toxicological outcomes [3]. This study aims to evaluate how the surface chemistry of low-density polyethylene (LDPE), a polymer widely used in food packaging [4], may change during digestion. Briefly, LDPE fragments were exposed to a standardized *in vitro* digestion model that simulated the oral, gastric, and intestinal stages [5]. Afterwards, Fourier-Transform Infrared Spectroscopy was employed to analyse the surface-level chemical variations at each phase. The analysis revealed noticeable differences between untreated and digested LDPE samples. Overall, transmittance was reduced in digested samples, suggesting surface modifications. A decline in the CH_2 rocking vibration (~719 cm^{-1}) pointed to potential changes in crystallinity. Additionally, the expected methyl group band (~1379 cm^{-1}) was not observed, and the CH_2 bending region (~1460 cm^{-1}) displayed minor shifts and intensity variations, possibly reflecting molecular rearrangement or degradation. A distinct new band at ~2070 cm^{-1} was observed in oral and phases, which may correspond to by-products formed during early digestion. These preliminary results indicate that digestive conditions can alter the surface properties of LDPE. Such transformations could influence how these particles interact with biological environments or transport other contaminants. Further analyses are underway, including expansion to other MP types, to better characterize these effects and assess their relevance to food safety and human health.

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OP31 | FOOD SAFETY, QUALITY, AND ENVIRONMENTAL RESPONSIBILITY: ADDRESSING MODERN CHALLENGES FOR A HEALTHIER FUTURE

Renald Blundell[1*]

[1]Department of Physiology and Biochemistry, Faculty of Medicine and Surgery, University of Malta, Msida MSD 2080, Malta. *renaldblundell@gmail.com

Food safety has always been central to public health, but in the 21st century it must also be considered alongside quality and environmental responsibility. Today's food systems are highly complex, exposing consumers to risks that go beyond traditional concerns of spoilage and hygiene. Chemical contaminants, industrial processing, and environmental degradation now converge to influence both the safety and the nutritional value of our food, with serious implications for short- and long-term health. [1]

One major issue is the accumulation of harmful residues in crops, such as heavy metals and pesticides, which compromise food quality and consumer health. Equally concerning are toxic by-products of processing, including acrylamide and nitrosamines, which have been linked to cancer and other chronic conditions. The growing dependence on ultra-processed foods compounds these risks, delivering convenience while undermining dietary quality worldwide.

Emerging evidence also highlights hidden threats like microplastics and novel pollutants, which not only pose direct toxicological risks but also point to wider environmental challenges. These realities remind us that food safety cannot be separated from ecological stewardship. Sustainable farming and production practices are therefore vital to protect both ecosystems and diets.

Scientific innovation offers solutions: plasma-functionalized water, for example, shows antimicrobial potential and can enhance seed germination [2,3]. At the same time, simple measures-washing produce, reducing waste, and choosing minimally processed foods-remain essential, accessible tools. Ultimately, safeguarding safe, high-quality, and responsibly produced food requires stronger regulation, informed consumers, and sustainable practices. This is not only a scientific and regulatory task but a moral responsibility to future generations.

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OP32 | IMPROVING MUNICIPAL BIOWASTE COMPOSTING MANAGEMENT STRATEGIES IN RESÍDUOS DO NORDESTE, EIM, S.A. USING A LIFE CYCLE APPROACH

Laís Fabiana Serafini[1*], Paulo Praça[2], Fernando González-Andrés[3], Artur Gonçalves[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Escola Superior de Comunicação, Administração e Turismo do Instituto Politécnico de Bragança; [3]Chemical, Environmental & Bioprocess Engineering Group, University of León, Institute of Research and Innovation in Engineering (I4), 24008 León, Spain. *lais.serafini@ipb.pt

The growing generation of biowaste poses a significant environmental, economic, and social challenge for municipalities [1]. This study aims to evaluate and propose improvements to the biowaste management model of the intermunicipal company Resíduos do Nordeste, EIM, S.A. (Portugal), based on Life Cycle Assessment (LCA) approach methodologies. The work includes: *(i)* detailed characterization of current and developing collection and treatment models; *(ii)* preparation of life cycle inventories of operations; *(iii)* physicochemical and biological monitoring of the produced compost; *(iv)* laboratory and field trials to assess the agronomic viability of the compost; and *(v)* comparative modeling of scenarios (unsorted and mixed biowaste collection and biowaste selective collection) (**Erro! A origem da referência não foi encontrada.**). This presentation outlines the preliminary results from an ongoing PhD taking place in a Non-Academic Environment. The expected results will allow for the identification of critical stages in terms of environmental impacts, the proposal of eco-efficiency strategies, the improvement of compost quality, and the promotion of its safe and sustainable agricultural application. This study directly contributes to the Sustainable Development Goals (11 – Sustainable cities and communities, 12 – Responsible consumption and production, 13 – Climate action), reinforcing the role of the circular economy in valorising biowaste and mitigating environmental impacts.

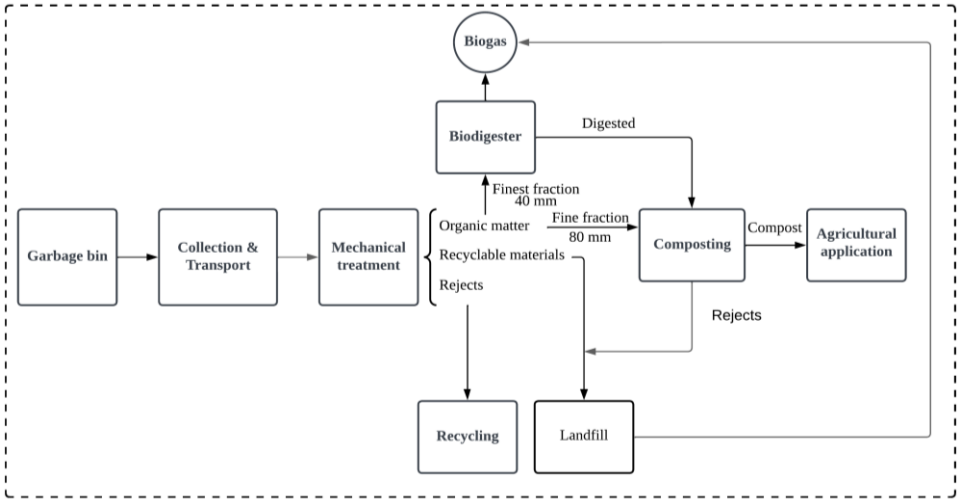

Figure 1 – System boundary of the biowaste management model by the intermunicipal company Resíduos do Nordeste, EIM, S.A.

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OP33 | EMERGING AND PERSISTENT CONTAMINANTS IN HONEY: INSIGHTS INTO PFAS, VETERINARY DRUG RESIDUES, ALKALOIDS, AND MYCOTOXINS

Marta Leite[1*], Helena Rodrigues[2,3], Maria Beatriz P. P. Oliveira[2], Andreia Freitas[1,3]

[1]REQUIMTE/LAQV, Praça Coronel Pacheco, Porto, Portugal; [2]University of Porto, Faculty of Pharmacy, R. de Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]National Institute for Agricultural and Veterinary Research (INIAV), Rua dos Lágidos, Lugar da Madalena, 4485-655 Vila do Conde, Portugal. *martasofia.22@gmail.com

The growing Honey is a complex natural food product with high nutritional, nutraceutical, and economic value. However, it is susceptible to contamination from natural and anthropogenic sources. Of growing concern are per- and polyfluoroalkyl substances (PFAS), veterinary drug residues, naturally occurring alkaloids, and mycotoxins, which can compromise honey safety and quality. Understanding the occurrence and current implications of these contaminants is crucial for public health, beekeeping activity and environmental monitoring.

This systematic review synthesizes current findings and regulatory reports regarding the occurrence, origin, and detection of PFAS, veterinary drugs, alkaloids, and mycotoxins in honey. Studies were selected based on relevance, analytical robustness, and geographical diversity. Analytical methods include high-resolution mass spectrometry, LC-MS/MS, and GC-MS.

PFAS have been reported in honey due to contaminated water, soil, or atmospheric deposition, though it is still an understudied research area. Veterinary drugs are especially found in regions with intensive beekeeping practices and poor regulatory compliance. Pyrrolizidine alkaloids, and mycotoxins can enter honey through contaminated floral resources or hive materials. While contamination levels are generally low, localized risks could be identified.

The presence of PFAS, veterinary drugs, alkaloids, and mycotoxins in honey highlights the need for improved residue monitoring, sustainable beekeeping, and stronger regulations to ensure honey quality and safety. Contaminant exposure through honey, though generally limited, may pose risks to sensitive groups such as children and high consumers. Continuous monitoring supports honey's role as a safe, functional food while enhancing consumer trust and promoting its nutritional and medicinal value.

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OP34 | IMPACT OF NPK RATIOS ON PROXIMATE COMPOSITION, TOCOPHEROLS AND FATTY ACIDS OF PURSLANE LEAVES

Beatriz H. Paschoalinotto[1,2], Spyridon Petropoulos[3], Lillian Barros[1], Miguel A. Prieto[2], Maria Inês Dias[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal; [2]Department of analytical chemistry and food science, Universidade de Vigo, Nutrition and Bromatology group, Ourense, Spain; [3]Department of Agriculture, Crop Production and Rural Environment, University of Thessaly, Fytokou Street, 38446 Volos, Greece. *maria.ines@ipb.pt

The composition of primary and secondary metabolites in plants is influenced by environmental, genetic, physiological and nutritional factors, representing a critical point in the study of wild edible plants (WEPs) harvested in nature [1]. Nutrient solutions enriched with nitrogen (N), phosphorus (P) and potassium (K) modulate primary and secondary metabolites throughout the development of the plant matrix [2]. Purslane (*Portulaca oleracea* L.) is a WEP that has traditionally been consumed in the Iberian Peninsula thanks to its high nutritional value and phytotherapeutic properties [1,3]. This study aims to evaluate the impact of NPK ratios on the proximate composition (standard method), tocopherol and fatty acids contents (HPLC-FL and GC-FID, respectively) of purslane leaves. The NPK composition (mg L-1) in the fertiliser varied between 100 and 300 of each element during the cultivation of purslane, while a control (without fertiliser) was also considered. Tukey's significant difference (HSD) test (p = 0.05) was performed. Leaves grown with the same proportions of each element (100, 200, or 300 mg L-1 of N, P, and K) showed no statistical differences in the total dietary fibre profile, while leaves grown with 200 or 300 mg L-1 of each one also showed similar carbohydrate contents. Fat content ranged from 4.16 to7.73 g 100-1 on a dry weight of purslane leaves, indicating the direct influence of fertilisers applied on the accumulation of this macronutrient. Leaves grown with 300(N):100(P):100(K) mg L-1 demonstrated higher protein contents. On the other hand, leaves grown with intermediate and high ratios demonstrated the same crude protein contents. The α- and γ-tocopherol isoforms were identified in the leaves of this study, and the second isoform mentioned was the predominant one. The lowest levels of isoforms and consequently the total tocopherol content were observed in the control leaves. Leaves obtained from 200:100:100 and 100:100:100 mg L-1 demonstrated high levels of α- and γ-tocopherol, respectively. Regarding fatty acids, polyunsaturated fractions were the most frequent in the purslane leaf profile, representing 61–67% of the lipids, with emphasis on α-linolenic acid (omega-3) between 41–45% in almost all samples, except for leaves with high NPK ratios (30.9%). The findings underscore the role of nutrient regulation in enhancing the nutritional profile and functional properties of *P. oleracea*, fostering its valorisation as a sustainable dietary resource.

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Acknowledgments

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OP35 | TRY OR NOT TO TRY? A THEORETICAL PROPOSAL TO CHANGE EATING BEHAVIOR

Oliva M. D. Martins[1*], Natacha Jesus-Silva[2], José Paulo Costa[3], Ana Sofia Coelho[1]

[1]Transdisciplinary Research Center on Education and Development, Instituto Politécnico de Bragança, Campus de Santa Apolónia 5300-253 Bragança, Portugal; [2]UNIAG - Applied Management Research Unit, Instituto Politécnico de Bragança, Bragança, Portugal; [3]Instituto Europeu de Estudos Superiores (IEES), Portugal. *oliva.martins@ipb.pt

Considering that animal protein production undermines environmental sustainability and that protein-based foods are essential for human survival, it is necessary to reflect on alternatives in view of global population growth, expected to exceed nine billion by 2050, together with the increase in life expectancy. These factors, combined with the environmental impacts of livestock, may result in an insufficient supply of animal protein, raising the question: how can we meet the growing demand for protein? This proposal aims to identify sustainable and accessible options to replace or supplement animal protein. Insect-based food emerges as a promising solution; however, cultural barriers such as neophobia constitute a major challenge. To understand these barriers, we applied the Social Ecological Model [1], structuring them into different dimensions (structural, community, organizational, interpersonal).
Additionally, we explored factors influencing eating behavior based on individual and social beliefs [2]. Given the complexity of changing food habits, a sequential qualitative and quantitative approach is proposed [3]. Finally, this research suggests experimental investigation on sensorial perception to identify the main agents and variables that influence eating behavior, leading to the development of an interaction model.

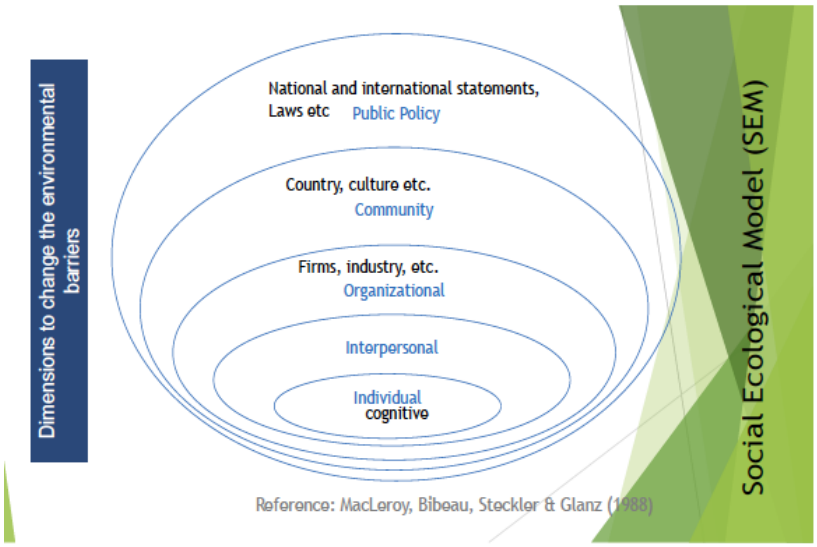

Figure 1 – Social Ecological Model.

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OP36 | NEED FOR SPEED: A MICROEXTRACTION APPROACH TO STREAMLINE THE ANALYSIS OF BIOACTIVE COMPOUNDS AND OTHER MOLECULES OF INTEREST IN COMPLEX SAMPLES

Jorge A. M. Pereira[1,2*], José S. Câmara[1,2]

[1]CQM – Centro de Química da Madeira, Universidade da Madeira, Campus da Penteada, 9020-105 Funchal, Portugal; [2]Faculdade de Ciências Exatas e Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9000-390, Funchal, Portugal. *jorge.pereira@staff.uma.pt

Sample preparation and extraction of target analytes are critical steps, but often neglected, of the analytical workflow. In this regard, µSPEed holds a great potential to streamline the analytical workflow at different moments, notably the sample preparation, but, eventually, at the analytical instrumentation necessary for the target compounds analysis. µSPEed is a miniaturized form of SPE that goes beyond the traditional SPE, employing a single, straightforward and pressure-driven procedure to retain the target analytes in a small chamber containing sub-micron sorbent particles commercially available in a great variety of chemistries and retention mechanisms. Over the last years, we were able to successfully employ µSPEed for the extraction of many bioactive compounds, notably polyphenols from different foods matrices [1], tropane alkaloids from teas and herbal infusions [2,3] or selected pesticides and antibiotics from wastewaters [4,5]. The combination of µSPEed with liquid chromatography favoured the development of simple, fast, environmental-friendly methodologies which open an avenue for even more powerful combinations, namely those employing custom-made sorbents for µSPEed-MS analysis.

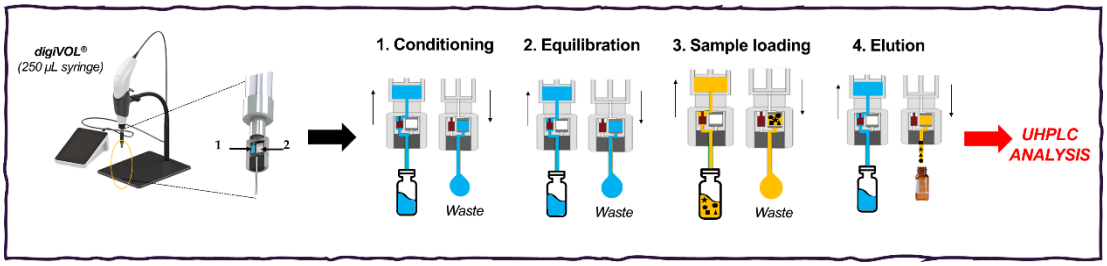

Figure 1 – Schematic representation of the µSPEed sorbent architecture and experimental layout of the µSPEed extraction.

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POSTER PRESENTATIONS

POSTER PRESENTATION LIST

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P20	Berta Nogueiro Estevinho	Microencapsulation of *Ulva lactuca* extracts: a comparative study of techniques and biopolymeric carriers for seaweed byproduct valorization

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P27	Ana M. Vilas-Boas	Circular biorefinery of pineapple peels: extraction, optimization and characterization of functional polysaccharides
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P29	Ana Paula Pereira	Use of brine resulting from table olive fermentation in the production of salicornia in hydroponics – a preliminary study
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P45	Mariana Neto	Green extraction strategies: ultrasound and enzymes for biochemical compound release from *Microchloropsis gaditana*
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P50	Tatiane C. G. de Oliveira	Green extraction of high-value compounds from fruit waste: a microwave-assisted approach
P51	Tatiane C. G. de Oliveira	Optimization of pressurized liquid extraction of phenolic compounds from fruit by-products using RSM
P52	Lívia Cirino de Carvalho	Oral films containing hydroethanolic extract of jatoba pulp as a carrier of phenolic compounds
P53	Paula Martínez	Valorization of chlorella biomass in plant – based foods: development and consumer acceptance
P54	Maria João Barroca	Valorization of wild plants: mirto and portuguese white crowberry
P55	Aida Moreira da Silva	Maritime plants in gastronomy: bridging coastal biodiversity with culinary creativity
P56	Tiago A. Fernandes	From barrel to bench: multidisciplinary insights into wine spirit ageing via LC-HRMS and theoretical calculations
P57	Sheila C. Oliveira-Alves	Ageing technologies: changes in the phenolic content of aged wine spirits during the storage in bottle
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P64	Tânia C. S. P. Pires	Valorization of the mushroom bio-residues for promoting innovation and sustainability in the food sector
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P87	Ângela Liberal	Synergistic effects of physical pretreatments and fermentation on the nutritional improvement of lentil (*Lens culinaris* spp.) flours
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P90	Diana Melo Ferreira	Analysis of the phenolic profiles of olive pomace extracts obtained by green methods
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P92	Rafael Paiva	Artisanal fishing and food security: the role of *Brycon amazonicus* in the southwest amazon
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P97	Lorrane R. de Souza	Effect of *in vitro* gastrointestinal digestion on phenolic compounds and antioxidant activity of genipapo
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P102	Bianca R. Albuquerque	Underutilized brazilian berries as sources of bioactives: comparative study of *Eugenia brasiliensis* and *Eugenia involucrata* residues
P103	André Lopes	Nutritional, chemical, and bioactive characterization of apple by-products for application in novel food products
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P123	Ândria Viegas	From juice co-product to value-added foods: unlocking the potential of apple and pear pulp
P124	Bruna Moreira	Impact of intercropping on the nutritional composition of faba beans and lentils in morocco: a two-year assessment
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P126	Ouarda Della	Reintroducing lentil cultivation in Trás-os-Montes: comparative evaluation of commercial seeds and their local counterparts
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P128	Lorena González-Zamorano	Yogurt ice-cream prototype formulated with wild barberry extract as natural food colorant
P129	Eugénia Baptista	Nutritional and chemical properties of red rice: a potential superfood with different health benefits
P130	Isadora M. M. Torres	Lupin seeds germination vs cooking: effects on antioxidant activity, phenolic compounds, and free amino acids
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P133	Daiana Almeida	From tradition to innovation: valorising Trás-os-Montes' crops for sustainable, functional, and innovative plant-based food products
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P135	Francesca Birolini	Italian biodiversity: a source of plant extracts with antioxidant, anti-inflammatory, and antiglycation potential for nutraceutical formulations
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P158	Teresa Abreu	Unveiling the volatilomic profile of grape pomace: a strategic approach for its valorization
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P193	Guilherme Vaz	Bio4med project: characterization and valorization of honeys collected in olive groves
P194	Sónia Soares	Bioactive composition and health-promoting potential of honey from Montesinho Natural Park
P195	Helena Soares Costa	Monitoring *trans* fats in edible oils from Morocco: a preliminary assessment
P196	José Lucas Gahú Prestes	Impact of hydrological variations on artisanal fishing of the jatuarana (*Brycon melanopterus*): perspectives for food security in southwest amazonia
P197	Soraia I. Falcão	Bee bread sugar content evaluation: a collaborative work within the cost action ca 22105 "besafebeehoney"
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P207	Carlos S. H. Shiraishi	Diabetes protein target database (DPTD): a reference library for metabolic protein targets
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P1 | SUSTAINABILITY OF EDIBLE INSECTS - INSIGHTS FROM A SAMPLE OF PORTUGUESE CITIZENS

Raquel P. F. Guiné[1*], Sofia G. Florença[1]

[1]CERNAS-IPV Research Centre, Polytechnic University of Viseu, Campus Politécnico, Repeses, 3504-510 Viseu, Portugal. *raquelguine@esav.ipv.pt

Edible Insects (EI) have been consumed for immemorial times in many parts of the world, being part of the cultural and gastronomic heritage of entomophagic communities. Contrarily, in other areas, typically in Western countries, they are not traditionally consumed, being vehemently rejected by people who feel disgust towards this type of food [1]. Many support that edible insects are a more sustainable option to other protein-rich foods rich in protein, like beef, pork, or chicken, including the Food and Agriculture Organization of the United Nations, FAO [2]. To incentive consumption, it is important to inform citizens about the environmental advantages of this type of food resource. Therefore, this work focused on a questionnaire survey that took place in Portugal in the ambit of the project EISuFood - Edible Insects as Sustainable Food. The study deals with aspects linked to Environment and Sustainability, assessed through 11 items aimed to measure the participant's level of knowledge. A total of 527 participants were included in the study. The results revealed a generally high level of knowledge towards most of the issues related with sustainability of EI investigated. In particular to highlight the highest knowledge being on items related with EI being a possibility to respond to the growing world demand for protein and also with EI efficiently converting organic matter into protein, thus saving valuable natural resources. In what concerns the influence of sociodemographic variables on the level of knowledge (Table 1), significant differences were found between genders for only three of the 11 issues investigated. Contrarily, differences between age groups were found significant for seven issues, showing that age seems to be a more influential variable on knowledge that gender. However, the most influential variable of all was found to be education level, revealing significant differences between groups for all the 11 issues investigated. Consequently, education assumes a pivotal role in changing peoples' level of knowledge as a motor for behavioral change and in particular for possible acceptance of EI as a sustainable and nutritive food.

Table 1 – Evaluation of statistical differences between groups for the questions investigated using Chi-square tests.

	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	Q 11
Gender	—	—	*	—	*	—	—	—	—	—	*
Age group	*	*	*	*	*	—	—	—	*	—	*
Education Level	*	*	*	*	*	*	*	*	*	*	*

*Significant differences ($p < 0.05$); — No significant differences.

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P2 | XYLITOL PRODUCTION FROM COTTON STALK THROUGH CIRCULAR ECONOMY MODEL – REDUCING LAND AND RESOURCE COMPETITION

Sourish Bhattacharya[1*], Jyoti Sharma[2], Dhiraj Nimje[2]

[1]Process Design and Engineering Division, CSIR- Central Salt Marine Chemical Research Institute, Bhavnagar, Gujarat- 364-002, India; [2]Research and Development, Chemprocess Systems, Ahmedabad, Gujarat, India. *sourishb@csmcri.res.in

Xylitol is a naturally occurring pentahydroxy sugar alcohol used as a natural sweetener a lower glycaemic index of 7.0 [1]. Although it can be found in a variety of fruits, vegetable, barriers, oats and mushrooms, its concentration can be found is less than 1% by weight [2]. Xylitol has been generally considered as most common component of sugar free chewing gums and also used as sweetener in lot of other food formulations in dietary supplements, nutraceutical sector, international market for xylitol exceeded to increase to 1 billion USD by 2026 [3].

By using agricultural residues instead of food crops, xylitol production from cotton stalks avoids competition with food and adds value to existing agricultural systems. This supports rather than undermines food security. Cotton stalks are rich in hemicellulose, which can be hydrolyzed to xylose and then microbially fermented into xylitol. Further, efforts were made to recover hemicellulosic extract of cotton stalk through acid hydrolysis which was later subjected to yeast fermentation using novel isolate of *Candida orthopsilosis*. 62.21 g/L Xylitol production was achieved in fermentation broth wherein 58% conversion with respect to xylose present in hemicellulose extract recovered from cotton stalk biomass was achieved.

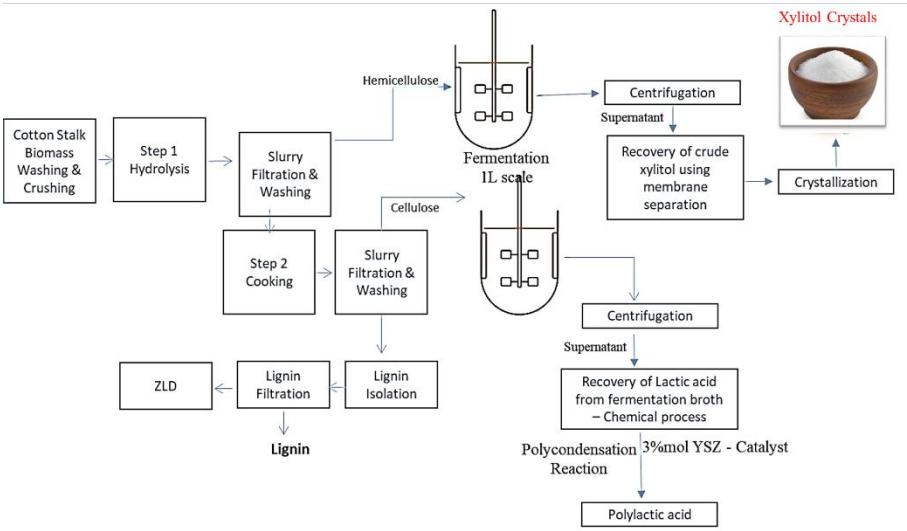

Figure 1 – Xylitol production from cotton stalk biomass through circular economy model.

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

Ana Sofia Rodrigues[1], Cátia Morgado[1,2], Mafalda Alexandra Silva[3,4], Gilberto Costa[1,2], Carlos Brandão[1,2], Helena Soares Costa[3,4], Tânia Gonçalves Albuquerque[1,4*]

[1]Escola Superior de Hotelaria e Turismo do Estoril (ESHTE), Av. Condes de Barcelona, n.º 808, 2769-510 Estoril, Portugal; [2]Centro de Investigação, Desenvolvimento e Inovação em Turismo (CiTUR), Av. Condes de Barcelona, n.º 808, 2769-510 Estoril, Portugal; [3]Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA), Av. Padre Cruz, 1649-016 Lisboa, Portugal; [4]REQUIMTE-LAQV/Faculdade de Farmácia da Universidade do Porto, R. de Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal. *tania.albuquerque@eshte.pt

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/100 g), low fat (≈2.6 g/100 g), and high protein content (≈19 g/100 g), with unsaturated fatty acids predominating. Dietary fibre values ranged from 1.65 g to 1.92 g/100 g, and salt levels remained under 0.3 g/100 g. Notably, the wakame-based version provided substantially higher iodine levels (103.3 µg/100 g) compared to the sea spaghetti version (25.1 µg/100 g), 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 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.

P4 | EFFECT OF SELENIUM SEED PRIMING ON GROWTH PERFORMANCE AND MINERAL COMPOSITION OF SPINACH BABY GREENS

Alexis Pereira[1,2], Maria Inês Dias[1], M. Beatriz P. P. Oliveira[2], José Pinela[1,3*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/LAQV, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, Rua Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]Instituto Nacional de Investigação Agrária e Veterinária, I.P. (INIAV, I.P.), Rua dos Lágidos, Lugar da Madalena, 4485-655 Vairão, Vila do Conde, Portugal. *jose.pinela@iniav.pt

Selenium (Se) is a vital trace element involved in antioxidant defense, immune regulation, and thyroid function in humans [1]. However, dietary Se deficiencies remain widespread globally, often due to low Se availability in soils [1]. Therefore, plant biofortification has emerged as a sustainable strategy to increase Se intake. Seed priming, a pre-sowing treatment in which seeds are soaked in nutrient-enriched solutions, has shown promise for improving crop nutritional quality while also promoting better germination, seedling vigor, and targeted nutrient accumulation in edible tissues [2]. In this context, spinach (*Spinacia oleracea* L.) baby greens were produced under greenhouse conditions to evaluate the effect of Se seed priming on seedling growth and mineral composition. Seeds were primed for 12 h in either water (hydropriming) or sodium selenate solutions (25, 50, 75, or 100 µM Se), and sown in a randomized design with four replicates, using trays filled with organic germination substrate. Plants were irrigated by nebulization under average conditions of 22 °C and 80% relative humidity. Emergence rate and stem height were monitored daily. At 27 days after sowing, seedlings were harvested for shoot and root length measurements, and mineral content was determined using atomic absorption spectroscopy. The hydropriming group exhibited the highest emergence rate, while the non-primed control showed the lowest germination performance. Baby greens from the 75 µM Se treatment showed the greatest total length, followed by those primed with 100 µM Se. In contrast, seedlings from the hydropriming treatment had the shortest shoot length, reflecting the same trend observed for shoot height. Regarding root development, the non-primed control had the highest average root length, followed closely by the 50 and 75 µM Se treatments. In terms of mineral content, baby greens from non-primed control seeds and seeds primed with 100 µM Se presented the highest levels, whereas hydropriming resulted in the lowest. Moreover, 100 µM Se priming led to the greatest Se bioaccumulation, providing approximately eleven times the average daily Se requirement for humans, as recommended by EFSA [3]. Although hydropriming improved germination, Se priming at 75–100 µM notably enhanced shoot growth and mineral content, supporting its potential as an effective Se biofortification strategy for spinach baby greens.

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P5 | VEGAN CHEESES - PRODUCT DEVELOPMENT AND PHYSICAL-CHEMISTRY CHARACTERISTICS

Joana Azevedo[1*], Joana Pinto[2,3], Joana Oliveira[1], Duarte Torres[4,5,6], Daniela Correia[7], Paula Guedes de Pinho[2,3], Victor de Freitas[1], Susana Soares[1]

[1]FCUP- LAQV-REQUIMTE, Rua Campo Alegre, 1002, Porto; [2]Associate Laboratory i4HB – Institute for Health and Bioeconomy, University of Porto, 4050-313 Porto; [3]UCIBIO – Applied Molecular Biosciences Unit, Laboratory of Toxicology, Faculty of Pharmacy, University of Porto, 4050-313 Porto; [4]FCNAUP, Rua Campo Alegre, Porto; [5]EPIUnit - Instituto de Saúde Pública, Universidade do Porto; [6]Laboratório para a Investigação Integrativa e Translacional em Saúde Populacional (ITR), Porto; [7]MC Shared Services S.A., Lugar do Espido, Via Norte, 4470-177 Maia, Portugal. *joana.azevedo@fc.up.pt

The search for innovative food solutions and non-animal protein sources has become a priority due to their potential to mitigate environmental impacts and promote human health [1]. Within this context, plant-based cheeses have emerged as promising products, particularly because they eliminate allergens typically present in dairy-based cheeses [2]. Despite the increasing variety of plant-based alternatives currently available on the market, significant limitations remain with respect to critical attributes such as appearance, texture, nutritional profile, and sensory characteristics [3].

The present study aims to investigate different plant and legume-derived raw materials for the development of vegan cheeses with physicochemical properties comparable to those of traditional dairy cheeses. Special attention was given to proteins derived from chickpea, lupin, and yellow pea, which are recognized for their high protein content and favorable nutritional composition. Several technological processes were evaluated, including fermentation and maturation (curing). Cheeses produced from fermented chickpea and matured for 20 days demonstrated the most satisfactory results in terms of texture and sensory attributes. The analyses performed included color determination (CieLab), protein content (Kjeldahl), textural properties, protein digestibility of yeast protein extract, protein profiling by SDS-PAGE (sodium dodecyl sulfate–polyacrylamide gel electrophoresis), and volatile composition by GC-MS, given the crucial role of aroma in consumer acceptance. All results were benchmarked against commercial dairy cheeses.

Preliminary findings indicated protein contents of approximately 19% for chickpea-based cheeses, 18% for yellow pea-based cheeses, and 20% for chickpea-lupin formulations. These values are competitive when compared to commercial dairy cheeses, which typically contain around 36% protein per gram of dry weight. In terms of texture, the developed vegan cheeses exhibited properties such as hardness, cohesiveness, chewiness, and elasticity comparable to traditional cheeses, with goat cheese being the closest reference. Furthermore, the novel formulations displayed superior digestibility (70–100%) compared to conventional cheeses (~65%). GC-MS analysis confirmed the presence of volatile compounds commonly associated with dairy cheeses, including 2-methylbutanoic acid and isovaleric acid (3-methylbutanoic acid), both short-chain fatty acids with strong, characteristic odors that contribute to the distinctive aroma of ripened cheeses.

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P6 | APPLICATION OF MID- AND NEAR-INFRARED SPECTROSCOPY FOR RAPID QUANTITATIVE ANALYSIS OF WHEAT FLOUR NUTRITIONAL PROFILE

M. Pilar España-Fariñas[1], Patricia Cazón[1,2], María Ángeles Romero-Rodríguez[1,3*]

[1]Areas of Nutrition and Food Science and Food Technology, Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Sciences, Campus Terra, Universidade de Santiago de Compostela, 27002 Lugo, Spain; [2]Dairy Products and Food Technology Centre (APLTA), Campus Terra, University of Santiago de Compostela, Spain; [3]Instituto de Biodiversidade Agraria e Desenvolvemento Rural (IBADER), Campus Terra, Universidade de Santiago de Compostela, 27002 Lugo, Spain. *angeles.romero@usc.es

Wheat is one of the most widely cultivated cereals worldwide, and its flour is highly valued for its nutritional profile [1]. Accurate analysis of wheat flour composition is essential to assess nutritional quality and functionality [2]. However, conventional analytical methods are often laborious, time-consuming, and destructive. Thus, there is a growing need for rapid, cost-effective, and non-destructive alternatives for the food industry [1]. In this context, infrared spectroscopic techniques combined with chemometric tools have emerged as a robust alternative [3].

This study evaluated the potential of near-infrared (NIR) and mid-infrared (MIR) spectroscopy for quantifying the nutritional composition of wheat flour. Calibration models were developed using principal component regression (PCR) and partial least squares regression (PLS) and validated through full cross-validation. Model performance was assessed using statistical indicators such as root mean square error (RMSE), coefficient of determination (R^2), and residual predictive deviation (RPD).

PLS models based on NIR data achieved high accuracy in predicting key nutritional components, including total starch, glucose, and minerals. PCR models derived from NIR spectra were effective for estimating fructose, sucrose, maltose, and Zn. In contrast, PLS models developed from MIR spectra were useful for predicting moisture content, ash, and resistant starch, although with lower robustness in quantitative terms.

Overall, infrared spectroscopy coupled with chemometric analysis proved to be a reliable, rapid, economical, and environmentally friendly approach for the non-destructive quantification of multiple quality parameters in wheat flour.

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P7 | PROTEIN-RICH SAVORY FOOD SPREADS FROM *TENEBRIO MOLITOR*: FUNCTIONAL OPTIMIZATION AND SENSORY ENHANCEMENT

João Gomes[1*], Rui Rodrigues[1,2], José Teixeira[1,2]

[1]Center of Biological Engineering, University of Minho, Braga, Portugal; [2]LABBELS – Associate Laboratory, Braga/Guimarães, Portugal. *pg42497@uminho.pt

The global increase in population, coupled with rising demand for protein-rich diets, poses considerable pressure on traditional food production systems. Conventional livestock farming is associated with substantial environmental burdens, including extensive land and water usage and elevated greenhouse gas emissions. These challenges highlight the urgent need to identify sustainable, efficient alternative sources of protein. Edible insects have emerged as a promising option due to their high protein content, balanced amino acid profile, and low environmental impact. Studies indicate that insect-derived proteins can match or even surpass conventional sources such as beef, poultry, and fish in nutritional quality, while requiring fewer resources and generating less waste, thus supporting circular economy models.

This study examines the potential of *Tenebrio molitor*, a species recently approved for human consumption, as a protein-rich ingredient in food spreads. To improve the functional properties of insect meal, several pre-treatments were used, including thermal processing and mechanical shearing. These approaches significantly reduced particle size by 81.96% (from 792.67 µm to 143.00 µm for 90% of the particles) and enhanced protein solubility by 54.41% ± 3.74, optimizing its suitability for food formulation.

A key challenge in insect-based foods is their not-so-pleasant aftertaste. To enhance sensory appeal, the pre-processed insect ingredients were formulated into a savory spread olives and thus masking the flavour and aroma of the insects. In addition, the impact of three olive variations - black olives, green olives, and a combination of both - were evaluated. The resulting spreads were analyzed for texture, demonstrating favorable sensory characteristics.

Using *T. molitor* flour, we successfully developed innovative, protein-enriched savory spreads providing at least 20% of energy from protein, highlighting strong commercial potential. These findings support the integration of insect-based ingredients into mainstream food products, offering both nutritional benefits and environmental advantages.

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P8 | ENHANCING THE VALUE CHAIN OF JUICE PROCESSING INTERMEDIATES: POLYPHENOL STABILITY AND FUNCTIONAL FOOD DEVELOPMENT

Raquel Nunes da Silva[1,2*], Bárbara Maurício[2,3], Lígia Ronda[1,2], Tomás Garrido[1,2], Irina Ribeiro Alves[4], Maria João Alegria[4], Ana Fernandes[1,2], Iva Fernandes[1,2], Nuno Mateus[1,2], Victor de Freitas[1,2]

[1]Chemistry and Biochemistry Department, Faculty of Sciences, University of Porto, Rua do Campo Alegre 689, 4169-007 Porto, Portugal; [2]LAQV-REQUIMTE, Chemistry and Biochemistry Department, Faculty of Sciences, University of Porto, Rua do Campo Alegre 689, 4169-007 Porto, Portugal; [3]Faculty of Engineering, University of Porto, s/n, R. Dr. Roberto Frias, 4200-465 Porto, Portugal; [4]SUMOL+COMPAL Marcas S.A, Estr. Portela 24, 2790-179 Carnaxide, Portugal. *raq.silva@fc.up.pt

Fruit juice processing intermediates, such as purées and pulps, are promising sources of bioactive compounds with health-promoting potential. Their valorization can reduce waste, support circular economy principles, and enable the development of innovative functional foods [1].
In this work, two complementary studies were conducted. The first focused on red (*Prunus persica* 'Redhaven') and yellow (*Prunus persica*) peach. Quality control parameters - including total phenolic content (Folin–Ciocalteu), polyphenol profile (HPLC-DAD/ESI-MS/MS), and antioxidant activity (DPPH and FRAP) - were evaluated over 0, 1, 3, and 6 months under room temperature (~25 °C) and refrigerated storage (0–5 °C). Results showed that refrigeration better preserved phenolic content, antioxidant capacity, texture, and colour, with yellow peach purées displaying greater overall stability [2].
The second study focused on Golden Delicious apple pulps, aiming to upcycle apple co-products into *roll-pulp* snacks. Four prototypes were formulated with varying pulp percentages, and processing parameters (temperature, humidity, dehydration time) were optimized. Polyphenol content and antioxidant stability were monitored after desydration using chromatographic and colorimetric techniques. Dehydration effectively preserved bioactive compounds, resulting in practical, shelf-stable, and nutrient-rich snacks [3,4]. Together, these findings demonstrate the potential of juice processing intermediates – peach purées and apple pulps – as sustainable sources for functional product development, promoting consumer health while adding value to juice industry co-products.

Figure 2 – Prototypes of roll-pulp snacks developed from Golden Delicious apple processing co-products.

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P9 | OPTIMIZATION OF LIPOSOMAL ENCAPSULATION OF *ACTINIDIA ARGUTA* EXTRACT FOR DELIVERY APPLICATIONS

Filipa Teixeira[1,2], Marta Oliveira[1], Maria de la Luz Cádiz-Gurrea[3], Francisco Javier Leyva-Jimenez[3*], Francisca Rodrigues[4,5**]

[1]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 4249-015 Porto, Portugal; [2]ICBAS, University of Porto, Rua de Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]Department of Analytical Chemistry, University of Granada, Fuentenueva s/n, E-18071, Granada, Spain; [4]i4HB–Associate Laboratory Institute for Health and Bioeconomy, Faculty of Pharmacy, University of Porto, Rua de Jorge Viterbo Ferreira, 4050-313, Porto, Portugal; [5]UCIBIO – Applied Molecular Biosciences Unit, MedTech-Laboratory of Pharmaceutical Technology, Faculty of Pharmacy, University of Porto, Rua de Jorge Viterbo Ferreira, 4050-313, Porto, Portugal. *javier.leyva@ugr.es; **frodrigues@ff.up.pt

The encapsulation of natural bioactive compounds into nanocarriers has garnered increasing attention as a promising strategy to improve compounds' physicochemical stability, bioavailability, controlled release, and skin permeation [1]. The present study focused on the formulation and optimization of liposomal systems encapsulating an antioxidant-rich extract derived from *Actinidia arguta* fruit (commonly known as baby kiwi), recognized for its high content of health-promoting phytochemicals.

The extract was obtained through ultrasound-assisted extraction [2] and incorporated into phospholipid-based liposomes through the thin-film hydration method, followed by probe sonication [3]. A statistical optimization approach was employed using a central composite design to identify the most favorable formulation parameters (lecithin concentration, extract concentration, and sonication amplitude), aiming to obtain a liposomal formulation with minimal vesicle size (VS), minimal polydispersity index (PDI) and maximum encapsulation efficiency (EE). The optimal conditions were defined as 167.9 mg/mL of lecithin, 42.5 mg/mL of extract, and 28% sonication amplitude. Under these conditions, the liposomes presented a VS of 108.9 ± 1.4 nm, a PDI of 0.177 ± 0.014, and a zeta potential (ZP) of -46.9 ± 1.1 mV. The EE reached 68.9 ± 3.5%, suggesting the coexistence of both encapsulated and free extract, likely due to the hydrophilic nature of the antioxidant compounds. The extract antiradical activity was retained after encapsulation, as confirmed by the DPPH radical scavenging activity (192.14 ± 9.78 mg TE/mL). To enhance the liposomes performance, various penetration enhancers and stabilizers (ethanol, glycerin, propylene glycol, transcutol P, polysorbate 20 (Tween 20), and sodium hyaluronate) were incorporated individually and in combination. Most of the formulations exhibited favorable physicochemical characteristics, with PDI values below 0.200, VS under 140.2 nm, strongly negative ZP, and EE ranging from 60.8% to 84.7%. Overall, this study presents a robust and systematic approach to design, prepare, and optimize liposomal nanocarriers for delivery of natural bioactive compounds, laying the groundwork for future development of advanced formulations based on *A. arguta* extract.

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P10 | MICROENCAPSULATION OF ESSENTIAL OILS AS A SUSTAINABLE STRATEGY AGAINST BROWN SPOT IN "ROCHA" PEARS

Beatriz Fernandes[1,2], Inês Mendonça[3,4], Carina Almeida[3,5,6], Miguel Leão[7], Armando Venâncio[4,8], Sónia Carina Silva[4,8], Carmo Serrano[2,9*]

[1]CERENA, Instituto Superior Técnico, Av. Rovisco Pais 628, 1049-001 Lisboa, Portugal; [2]INIAV Oeiras, Av. da República, Quinta do Marquês, 2780-157 Oeiras, Portugal; [3]INIAV Vairão, Rua dos Lagidos, Lugar da Madalena 4485-655 Vairão, Portugal; [4]CEB, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal; [5]LEPABE–Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [6]AliCE–Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [7]INIAV Alcobaça, Rua de Leiria, 2460-059 Alcobaça; [8]LABBELS–Associate Laboratory, Braga/Guimarães, Portugal; [9]LEAF, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal. *carmo.serrano@iniav.pt

The widespread use of synthetic fungicides and pesticides in crop production is increasingly scrutinized due to their potential carcinogenic effects on humans and risk of fungicide resistance among harmful plant pathogens. The "Rocha" pear, a variety unique to Portugal, is particularly vulnerable to the fungi *Stemphylium vesicarium* and *Alternaria* spp., which cause brown spot, one of the most severe fungal diseases affecting pears [1].

Essential oils (EO) contain bioactive compounds with proven antifungal properties against various pathogens, including those affecting pears [2]. However, direct application of EO during harvest is limited by their high volatility and rapid degradation when exposed to oxygen and elevated temperatures.

Microencapsulation offers a protective barrier for these sensitive compounds, enhancing their chemical stability and enabling controlled release of their antifungal agents during crop growth and harvest [3]. This method improves the practical application of EO by maintaining their efficacy over time. In this study, three EO were selected – lemon eucalyptus (LE), lemongrass (LG), and lemon thyme (LT). Initially, the impact of incorporating an emulsifier on the encapsulation process was evaluated using LE EO at 30% concentration. Afterwards, all three EO were microencapsulated via spray drying, using modified maize starch as the encapsulating agent at two oil concentrations (15% and 30%), plus an additional formulation with 7.5% LG EO. The resulting microcapsules were characterized by encapsulation yield, encapsulation efficiency, total phenolic content, solubility, water activity, color, moisture content, antioxidant activity, and SEM imaging. Plus, the antifungal activity of the 15% and 30% oil microcapsules was tested.

The results showed that adding an emulsifier did not significantly enhance the formulation, so it was excluded from further experiments. Both LG and LT EO exhibited the strongest antifungal effects. Higher oil concentrations resulted in the decrease of encapsulation efficiency and solubility, along with increased moisture content in all samples Overall, the data suggests that a 15% oil concentration achieves optimal capsule quality while maintaining potent antifungal activity against *S. vesicarium* and *Alternaria* spp. strains. This highlights the potential of microencapsulated EO as an eco-friendly alternative to conventional fungicides.

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P11 | INNOVATIVE RADIOFREQUENCY APPLICATION FOR EFFECTIVE PEST CONTROL IN INFESTED CHESTNUTS

Bruno Melgar[1*], Caroline Ribeiro[1], Ângela Fernandes[1], Tiane Finimundy[1], Tânia C. S. P. Pires[1], Jorge Moreira[3], Elisabete Alexandre[4], Carlos Freire[4], Tiago Vila Franca[2], Natércia C. P. Fernandes[2], Alexandre Gonçalves[1,2], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]MORE – Collaborative Laboratory Mountains of Research, Brigantia Ecopark, 5300-358 Bragança, Portugal; [3]Sortegel, Produtos Congelados, SA, Rua São Mamede Nr 25, 5300-903 Sortes, Bragança, Portugal; [4]PERFINOX – Indústrias Metalúrgicas AS, Zona Industrial Lameiradas Lt 1 Mansores, 4540-423 Arouca, Portugal. *bruno.melgarc@ipb.pt

Infestations by *Curculio elephas* and *Cydia splendana* in chestnuts represent a major issue for the food industry, reducing product quality and generating economic losses [1]. Traditional disinfestation practices, such as extended thermal treatments, demand high levels of water and energy [2], which has prompted the search for more sustainable alternatives.

In this work, we assessed the performance of a radiofrequency system specifically designed to eliminate chestnut pests, developed in partnership with our collaborators.

Following an initial screening, an augmented central composite design (CCD) was applied, considering two variables: power (793–2500 W) and conveyor speed (190–281 kg/h). A total of 18 experimental runs were carried out, including eight central points. The main responses measured were temperature rise in the fruit, larval survival after treatment, and percentage of cooking.

Numerical optimization using the Nelder–Mead algorithm was employed to minimize both larval survival and cooking rate. The optimal settings identified were 1500 W and 190 kg/h conveyor speed. Under these conditions, the observed averages were ΔT = 34.7 °C, survival = 11.6%, and cooking = 3.4%, all within the 90% confidence interval of predicted values. Additional improvements of the model are foreseen, incorporating realistic environmental variables beyond the controlled laboratory scenario, with the goal of adapting it to industrial chestnut processing and storage. Results indicate that increases in power and conveyor speed strongly affect the final temperature of chestnuts and, consequently, treatment efficiency, reinforcing the need to establish an optimum operating point.

Radiofrequency thus emerges as a promising and sustainable approach for chestnut disinfestation, offering an innovative solution for pest management in the food sector.

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P12 | SYNTHESIS AND MULTISCALE CHARACTERIZATION OF MODEL PLANT CELL WALL ANALOGUES

Rafael Linan-Atero[1], Lucía Medrano-Sanz[1], Julia D. Bechtner[2], Jose C. Orellana-Palacios[1], Mario M. Martinez[1,2*]

[1]InnograinLab, Food Technology Division, Department of Agricultural Engineering, University of Valladolid, Spain; [2]Center for Innovative Food (CiFOOD), Department of Food Science, Aarhus University, Agro Food Park 48, Aarhus, N 8200, Denmark. *mmartinez@uva.es

Plastic pollution and food and agricultural waste (FAW) are critical global challenges. The recycling rate for plastics, especially flexible and non-biodegradable types, remains below 10% due to both economic limitations and technological hurdles, such as complex sorting and contamination issues. Simultaneously, over 5000 million tons of agriculture and agroindustry plant-waste-rich in valuable feedstocks, such as carbohydrates and aromatic compounds, are discarded globally every year, which could be revalorised into high-value compounds for different applications. Tackling these interconnected challenges is essential for advancing sustainability, resource efficiency, and environmental protection. Leveraging recent technological advances in understanding how plant cell wall (PCW) structures and polysaccharides' molecular interactions define PCW biomechanical (and functional) properties, this work aims to design walls 'fit for technological purpose' with the ultimate aim to uniquely valorising FAW components as building blocks for future packaging materials. In vivo multicomponent bacterial cellulose (BC) hydrogels were prepared via cellulose biosynthesis by *Komagataeibacter hansenii*, co-incorporating non-cellulosic polysaccharides xyloglucan (XG) and pectin (PC), at levels mimicking native type I PCW found in dicots. The polysaccharide composition of this system can be adjusted, and the supramolecular arrangement of polysaccharides across different length scales can resemble that of the PCW, that is a network of rigid cellulose microfibrils embedded in a hydrated gel-like matrix phase containing non-cellulosic polysaccharides [1]. We hypothesized that this controlled composition, and supramolecular structure allows for an unprecedented exploration of the effect of single components, such as XG and PC, on cell wall analogue functionality.
A total of 8 PCW analogues were prepared with different levels of incorporated XG and PC. Wall pellicles were analysed in compression using a compression–relaxation technique on a rotational rheometer, as this property is key for both PCW biomechanics and material formulation. In addition, elongation was analysed via uniaxial tensile testing. High-performance anion-exchange chromatography with pulsed amperometric detection (HPAEC-PAD), solid-state nuclear magnetic resonance (ssNMR), and scanning electron microscopy (SEM), were also performed to bridge performance with composition, interactions, and structure at the nanoscale. The different biomechanical contributions were evaluated, with the hydrogels exhibiting both a rigid phase having close interactions with cellulose, together with a flexible phase contributing to the multiscale architecture of the bacterial cellulose hydrogels. Distinct biomechanical roles were observed: XG alone reinforced tensile strength through reversible interactions with cellulose, while PC alone reduced extensibility. Nevertheless, in combination with XG, PC enhanced elongation at break.

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P13 | ALPHACHICK: CLOUD-BASED AI PLATFORM FOR INTEGRAL MANAGEMENT, OPTIMIZATION, AND SUSTAINABILITY OF POULTRY FARMS

Iago Portela Caramés[1], Antonio Sartal[2*], Juan Martinez[3]

[1]Triple Alpha Innovation S.L., Polígono de Boisaca, Rúa de José Villar Granjel, 22, 24, 15890 Santiago de Compostela, A Coruña, Spain; [2]University of Vigo, Lagoas Marcosende, Vigo, Pontevedra, Spain; [3]Plexus Tech., Polígono de Boisaca, Rúa de José Villar Granjel, 22, 24, 15890 Santiago de Compostela, A Coruña, Spain. *antoniosartal@uvigo.es

The poultry industry is facing increasing challenges driven by rising demand for animal protein, stricter environmental regulations, and the need to ensure animal welfare while maintaining competitiveness. Yet, data on feed intake, environmental conditions, health, and productivity are still often collected manually or stored in isolated systems. This fragmentation hampers traceability, delays responses to critical issues, and prevents a holistic, data-driven approach.

ALPHAchick, developed by TripleAlpha, addresses this gap by providing a cloud-based digital platform that leverages Artificial Intelligence (AI), IoT technologies, and Near Infrared (NIR) spectroscopy to transform poultry farming into a sustainable, data-driven model by providing real-time predictive and prescriptive insights. The platform centralizes heterogeneous data streams (environmental, nutritional, and zootechnical) and applies advanced analytics to support decision-making. It combines predictive and prescriptive AI algorithms to forecast growth performance, feed conversion ratios, and sanitary risks with actionable recommendations for feeding schedules, ventilation, and preventive health measures. Real-time nutritional analysis via in-line NIR spectroscopy enables automated diet optimization, while continuous learning models ensure adaptation to specific farm conditions, guaranteeing scalability, robustness and long-term sustainability.

Preliminary experimental trials in pilot farms confirm the value of ALPHAchick: a 4% reduction in feed costs, 2.3% improvement in feed conversion ratio, nearly 4% reduction in mortality, and an overall 13% increase in profitability. These improvements not only optimize farm economics but also foster animal welfare and environmental sustainability.

ALPHAchick directly contributes to the digitalization and decarbonization of agri-food systems, aligning with the EU "Farm to Fork" strategy and the UN Sustainable Development Goals (SDGs 9, 12, and 13). By bridging data silos and transforming fragmented processes into an integrated decision-support system, the project showcases how AI-driven solutions can enhance resilience, efficiency, and sustainability in transborder poultry production systems.

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P14 | HARNESSING NATURAL ELICITORS: ENHANCING POST-HARVEST RESISTANCE IN BRAZILIAN GRAPES WITH β-D-1,6-GLUCANS

Bruno Henrique Fontoura[1*], Solange Teresinha Carpes[2], José Abramo Marchese[3]

[1]Postgraduate Program in Agronomy, Universidade tecnológica Federal do Paraná, Pato Branco, Paraná, Brazil; [2]Postgraduate Program in Chemical and Biochemical Process Technology Universidade tecnológica Federal do Paraná, Pato Branco, Paraná, Brazil. *bruno-hf@hotmail.com

Grapes are among the main fruits produced in Brazil, with emphasis on the cultivars Niágara Rosada and Bordô, which are widely grown in the southern region of the country [1,2]. However, diseases such as ripe rot, caused by *Glomerella cingulata*, pose a serious threat, leading to significant losses both in the field and during the postharvest period. The use of natural elicitors emerges as a sustainable alternative to synthetic fungicides, promoting the activation of plant innate immunity [3]. This study evaluated the effect of a β-D-1,6-glucan derived from the oomycete Lasiodiplodia theobromae [4], compared with the synthetic elicitor acibenzolar-S-methyl (ASM), in inducing postharvest resistance in Niágara Rosada and Bordô grapes. Fruits were treated with water (control), ASM (100 mg L^{-1}), or β-D-1,6-glucan (200 mg L^{-1}), under wounded and unwounded conditions, and inoculated with G. cingulata. The results indicated that fruits treated with β-D-1,6-glucan exhibited lower values of the Area Under the Disease Progress Curve (AUDPC) under all conditions, in addition to higher total phenolic content and greater pulp firmness when compared with ASM and water. Although ASM reduced disease severity up to the 8th day in wounded Niágara grapes, β-D-1,6-glucan showed the lowest values by the 10th day. These findings reinforce that β-glucans can stimulate enzymes such as phenylalanine ammonialyase (PAL), promoting the accumulation of phenolic compounds, lignification, and greater resistance to fungal stresses [5]. It is concluded that β-D-1,6-glucan represents a promising natural alternative to synthetic fungicides, with the potential to extend shelf life, reduce environmental impacts, and strengthen the postharvest defense of grapes against G. cingulata. These results contribute to the promotion of safer and more sustainable agricultural practices.

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P15 | SUSTAINABLE BISCUITS WITH LUPINE FLOUR AND HEMP: INNOVATION IN THE CIRCULAR ECONOMY

Adriana R. Machado[1,2*], Júlio C. Guerreiro[3], Beatriz C. B. Barros[3]

[1]Associação CECOLAB-Collaborative Laboratory towards Circular Economy, Business Centre, Rua Nossa Senhora da Conceição, 2, Oliveira do Hospital 3405-155, Portugal; [2]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, Porto 4169-005, Portugal; [3]Departamento de Tecnologia, Universidade Estadual de Maringá, Avenida Ângelo Moreira da Fonseca 1800, Zona A1, Umuarama, Paraná, 87506-370, Brasil; *adririzo85@gmail.com

The circular economy applied to the food sector seeks to value alternative raw materials, reduce waste, and promote more sustainable production systems. In this work, lupine flour and hemp, sourced from Portugal, were utilized in a practical activity conducted in Brazil within an academic context, serving as a case study focused on innovation and sustainability. The objective was to develop formulations of biscuits made with lupin flour and hemp, in association with other vegetable flours (oats, wheat and corn), evaluating color parameters. Different formulations of biscuits based on vegetable flours were elaborated, all containing lupine and hemp. The samples were organized as follows: Formulation 1: sweet biscuit with lupine, hemp and oatmeal; Formulation 2: lupine, hemp and wheat flour; Formulation 3: salty biscuit, plus pepper with lupin, hemp and oatmeal; Formulation 4: lupine, hemp and maize flour; and Formulation 5: lupine, hemp, corn and wheat flours (Figure 1). Dry ingredients were mixed, followed by liquids (water) and fats (vegetable oil) until homogeneous doughs were obtained, moulded and baked at 180 °C for 15-20 min. After cooling, color was evaluated by colorimetry, showing significant differences between the formulations, all attractive.

Formulation 3 was the darkest (low L*=56.59), while formulation 5 stood out as the lightest, although with an intensely yellow color and a slight greenish hue (b*=46.37). Formulations 2 and 4 presented identical results, with intermediate luminosity (L*=72.28 and 78.91) and marked yellowing (ΔE* = 44.50; 48.32). Formulation 1 (L*=58.35) showed a dark and yellowish profile, located between the extremes. In summary, all formulations differed significantly, with F3 being the most distinct and F2/F4 the least discrepant. The use of lupine and hemp in biscuits represents an innovative and sustainable alternative, capable of adding nutritional value and meeting consumer demands for functional products. Additionally, the valorization of less conventional raw materials contributes to agricultural diversification and the implementation of circular economy practices in the food sector [1].

F1 **F2** **F3** **F4** **F5**

Figure 1 – Different biscuit formulations with lupin flour and hemp.

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P16 | FERMENTATION OF APPLE-PEAR KETCHUP STREAM: AN INDUSTRIAL REINTRODUCTION APPROACH FOR DEVELOPING A NEW SPICY SAUCE

Ana Catarina Costa[1*], Elisa Pataud[1,2], Miguel Nascimento[3], Anabela Raymundo[1], Catarina Prista[1]

[1]LEAF (Linking Landscape Environment Agriculture and Food) Research Centre, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Ecole Nationale Supérieure d'Agronomie et des Industries Alimentaires (ENSAIA), 2 avenue de la Forêt de Haye, 54505 Vandoeuvre-lès-Nancy, France; [3]Mendes Gonçalves, Zona Industrial, lote 6, Golegã, 2154-909 Golegã, Portugal. *acatarinacosta@isa.ulisboa.pt

Casa Mendes Gonçalves (CMG) is a company specialised in manufacturing vinegars and sauces/condiments. In 2024, it produced 13.723 tonnes of vinegar and 24.703 tonnes of sauces and condiments [1]. As a large-scale producer, this industry generates significant quantities of waste stream sauces that do not meet the desired characteristics of the target product, despite being microbiologically safe. Aiming to maximise the use of these by-products and reduce their environmental impact, the project 'Valorisation of waste streams for re-incorporation in sauces' was initiated. Its primary goal was to ferment these streams as a valorisation strategy and give them a new purpose. This work focused on characterising a new vinaigrette/spicy sauce containing 40% fermented stream (PKPM). At laboratory scale, Apple-Pear Ketchup (KPM), containing sorbate, was diluted to 25% with demineralised water and allowed to ferment at room temperature for 7 days. Throughout fermentation, samples were taken to analyse pH, TSS, and titratable acidity. CMG conducted pilot-scale fermentations up to 50 L, which contributed to developing a new formulation of the vinaigrette/spicy sauce. Nutritional and chemical analyses of the new product assessed the effects of the fermented stream and compared it with the standard product. The titratable acidity at the end of fermentation of KPM reached 1.97g/100g of fresh biomass, imparting a very acidic flavour to the fermented stream. The pH of KPM at the beginning of fermentation was 3.81, decreasing to 3.04, while TSS values indicated sugar consumption, decreasing from 8.30 to 7.60 ºBrix. Overall, PKPM exhibited lower nutritional composition and lower bioactivity, when compared to the target product (2.26g/100g), containing less total protein (1.36g/100g), lower antioxidant capacity and total phenolic compounds (31.35mg/100g and 24.05mg/100g GAE, in the target product and in KPMP, respectively), higher humidity (91% and 94%, in the target and in PKPM), and less ash content (4.0% to 1.6%). Similar trends were observed in mineral content. These results can be explained by fermentation processes and the proportion of fermented stream incorporated into the target product. Also, to evaluate the antimicrobial activity potential over the predicted preservation time, a challenge test was carried out for 30 days, under harsh preservation conditions, testing the viability of four yeasts (*Zygosaccharomyces parabailii*, *Z. rouxii*, *Pichia manshurica*, and *Candida stellata*), two lactic acid bacteria (*Levilactobacillus brevis* and *Lactobacillus parabuchneri*), and a pathogenic bacterium (*Bacillus cereus*). PKPM showed significant antimicrobial potential, with no growth of tested microorganisms being observed after 7 days. These results demonstrate the ability of the fermentation processes to produce valuable and safe products.

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P17 | ENCAPSULATED AROMATIC PLANT AND SPICE EXTRACTS FOR SALT REDUCTION AND FLAVOUR ENHANCEMENT: CASE STUDIES IN INGREDIENT INNOVATION

Carmo Serrano[1,2*], Beatriz Fernandes[1,3], Carlos Dias[4], Cláudia Viegas[5]

[1]INIAV Oeiras, Av. da República, Quinta do Marquês, 2780-157 Oeiras, Portugal; [2]LEAF, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]CERENA, Instituto Superior Técnico, Av. Rovisco Pais 628, 1049-001 Lisboa, Portugal; [4]FMSI, Lda, Rio de Mouro, [5]H&TRC—Health & Technology Research Center, ESTeSL — Escola Superior de Tecnologia da Saúde, Instituto Politécnico de Lisboa, Lisbon, Portugal. *carmo.serrano@iniav.pt

The growing consumer demand for natural, functional, and health-promoting foods has intensified interest in aromatic plants and spices, which are rich in bioactive compounds with antioxidant, anti-inflammatory, and antimicrobial properties. Beyond their health benefits, these natural ingredients offer intense and diverse organoleptic characteristics, making them effective flavouring agents and clean-label alternatives to synthetic additives.

Despite the well-documented potential of aromatic plant and spice extracts, their industrial application remains challenging due to the instability and degradation of active compounds during processing and storage. Encapsulation technologies, particularly the encapsulation of plant extracts in the form of oleoresins, have been studied as a means to overcome these limitations. These techniques protect sensitive bioactives from environmental stressors and enable controlled release during cooking or consumption, preserving both functionality and sensory appeal. While the technical aspects of encapsulation have been thoroughly explored, fewer studies have addressed their practical impact when applied directly to food products. This remains a developing field with considerable economic potential, especially as the food industry seeks innovative solutions to improve product quality and sustainability.

One promising application of these technologies is in sodium reduction strategies, where encapsulated plant-based extracts can enhance flavour and aroma, compensating for reduced salt content without compromising sensory quality. Successful implementations have been demonstrated in various food matrices - such as dry-cured meats [1], sauces (mayonnaise, mustard, ketchup) [2], smoked fish [3], seabass sausages [4], and culinary preparations [5,6], showcasing their versatility and effectiveness.

This presentation highlights recent advances in the development of sustainable, scalable encapsulation strategies tailored to specific food systems. These innovations support public health initiatives aimed at reducing sodium intake, while also boosting the competitiveness and innovation potential of the food industry.

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P18 | INNOVATIVE SPIRIT FORMULATIONS USING FRUIT AND HONEY MIXTURES

Soraia I. Pedro[1,2], Carlos Antunes[2,3], Ilda Caldeira[4], Ofélia Anjos[1,2*]

[1]CERNAS-IPCB, Research Centre for Natural Resources, Environment and Society, Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal; [2]CBPBI, Spectroscopy and Chromatography Laboratory, Centre of Plant Biotechnology of Beira Interior, Castelo Branco, Portugal; [3]APROCER – Associação de Produtores do Conselho da Sertã, Sertã, Portugal; [4]INIAV – Polo de Inovação de Dois Portos/Estação Vitivinícola Nacional, Quinta da Almoínha, 2565-191 Dois Portos, Portugal. *ofelia@ipcb.pt

Food safety and diversification of agri-food products are becoming increasingly important. The aim of this study was to develop a new spirit drink based on a mixture of fruits (strawberries and cherries) with honey, emphasising its chemical safety, in particular by reducing the methanol content. In addition, we aimed to analyse the chemical and sensory profiles of the spirit and explore alternative combinations for future product development.

The production process focused on combining arbutus fruit or cherry and honey to produce a spirit with desirable sensory characteristics and lower methanol content. Volatile compounds including methanol, acetaldehyde, ethyl acetate and fusel alcohols were quantified by gas chromatography (GC-FID/GC-MS). Sensory evaluation was carried out by a trained panel. In addition, all spirit samples were analysed by Fourier Transform Infrared Spectroscopy with Attenuated Total Reflectance (FTIR-ATR) to assess their chemical profiles and to discriminate between beverage types.

The new Arbutus-Honey Spirit and Cherry-Honey Spirit have significantly reduced levels of methanol, acetaldehyde and ethyl acetate compared to the traditional products. Fusel alcohols increased in the new Arbutus Honey Spirit and Cherry Honey. The sensory analysis highlighted four significantly different attributes: dried fruit, unctuous, varnish and sweet. FTIR-ATR analysis provided excellent discrimination between all beverage types, demonstrating the effectiveness of the method in differentiating formulations and exploring possible differences in future blends.

The results confirm the potential of fruit-honey blends to produce innovative and safer spirit drinks. FTIR-ATR proved to be a powerful tool for beverage characterisation. This supports the development of new agri-food products based on different fruit and honey combinations.

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P19 | FROM WASTE TO WELLNESS: SPRAY-DRIED MICROPARTICLES FROM TOMATO BYPRODUCTS USING NATURAL ENCAPSULATION MATRICES

Berta Nogueiro Estevinho[1,2*], Antónia Gonçalves[1,2], Fernando Rocha[1,2]

[1]LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [2]ALiCE—Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal. *berta@fe.up.pt

Tomato (*Lycopersicon esculentum*) by-products, generated in large quantities by agricultural and industrial processing, are rich in polyphenolic compounds such as rutin, known for their antioxidant, anti-inflammatory, antibacterial, and antitumor properties. Despite their bioactivity, the poor aqueous solubility and limited gastrointestinal absorption of these compounds hinder their functional potential. In alignment with circular economy principles and the sustainable valorization of agri-food waste, this study investigates the development of bioactive microparticles from tomato byproducts using spray-drying technology.

Extracts rich in rutin were encapsulated using a mini spray-dryer (BÜCHI B-290) into microparticles formulated with individual and blended biopolymers: alginic acid sodium, modified chitosan, and inulin. Microparticle yields reached approximately 35%, with particle sizes ranging from 2.2 ± 0.1 µm to 8.7 ± 0.6 µm. Scanning Electron Microscopy revealed morphology variations influenced by the polymer matrix, from smooth to rough surfaces (Figure 1). All formulations exhibited rapid rutin release in aqueous media within 50 minutes, indicating potential for improved bioavailability. This work presents a sustainable and scalable approach to transforming food processing waste into high-value functional ingredients using environmentally friendly encapsulation systems.

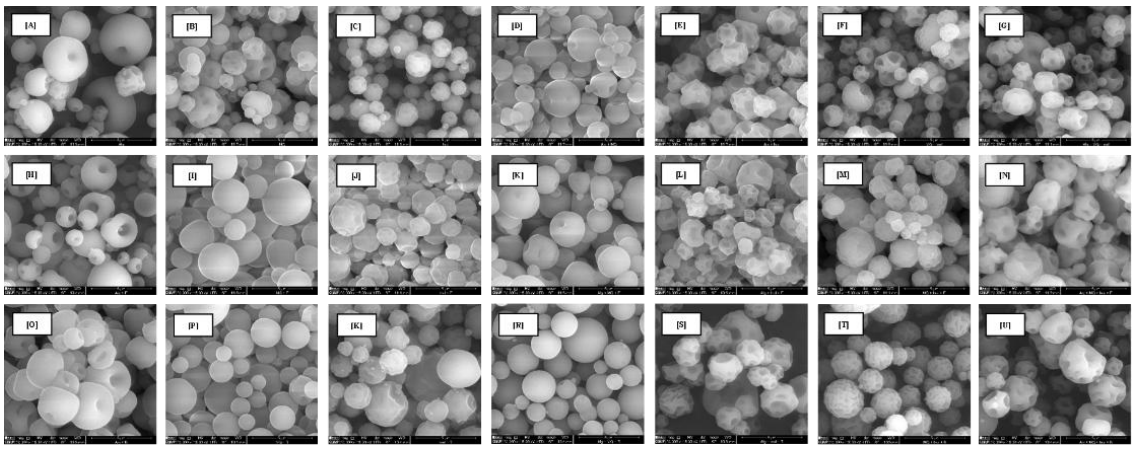

Figure 1 – Surface morphology of empty microparticles (A, B, C, D E, F and G), tomato extract microparticles (H, I, J, K, L, M and N) and rutin microparticles (O, P, Q, R, S ,T and U) microparticles composed by alginic acid sodium (A, H and O), modified chitosan (B, I and P), inulin (C, J and Q), alginic acid sodium + modified chitosan blend (D, K and R), alginic acid sodium + inulin blend (E, L and S), modified chitosan + inulin blend (F, M and T) and alginic acid sodium + modified chitosan+ inulin blend (G, N and U). Magnification = 20,000 times, beam intensity (HV) 15.00 kV, distance between the sample and the lens (WD) around 10 mm.

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P20 | MICROENCAPSULATION OF *ULVA LACTUCA* EXTRACTS: A COMPARATIVE STUDY OF TECHNIQUES AND BIOPOLYMERIC CARRIERS FOR SEAWEED BYPRODUCT VALORIZATION

Beatriz Sousa[1,2], Carolina Simões[1,2], Filipa Ferreira[1,2], Berta Nogueiro Estevinho[1,2*]

[1]LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [2]ALiCE—Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal. *berta@fe.up.pt

The sustainable valorization of marine biomass is gaining increasing attention due to its environmental and economic benefits. In this study, bioactive compounds from *Ulva Lactuca* – a widely available green seaweed in the Portuguese coast – were extracted using ethanol at varying concentrations (50%, 75%, and 100%) to assess extraction efficiency [1]. These extracts, rich in phenolic compounds, were then encapsulated using multiple techniques: spray drying (to produce microparticles) [2], electrospinning (fibers) [3], 3D printing (films), and casting method (films) [4], employing alginate, zein and pullulan as biopolymeric encapsulating agents.

The resulting structures were characterized using Scanning Electron Microscopy (SEM) to assess morphological differences and encapsulation integrity across methods. Different structures were obtained depending on the method and on the encapsulating agent used. Total phenolic content (TPC) was quantified to evaluate the retention of bioactive compounds post-encapsulation. By Spray drying were obtained spherical microstructures with an average diameter around 3-5 µm, by electrospinning were obtained fibers with different diameters according with the encapsulating agent used. The 3D printing and casting methods offered promising structural uniformity for film-based applications.

This study contributes to the Future of Sustainable Food Ecosystems by demonstrating innovative strategies to transform seaweed byproducts into high-value functional materials, supporting circular bioeconomy and sustainable food system development.

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P21 | TEMPORAL DISTRIBUTION AND OCCURRENCE PATTERNS OF FRESHWATER FISH SPECIES IN THE BRAZILIAN AMAZON AND PORTUGAL

Eduardo da Costa Batista[1*], Anderson Gahu Prestes[1], José Lucas Gahú Prestes[1], Cristina Vieira de Almeida, Marcelo Pebles Gomes[1], Josué Gomes Coelho Filho[1], Wilson Ramos Martins[1], Rafael Barroso dos Santos Paiva[1], Vinicius Rafael Batista da Silva[4], Marcelo Rodrigues dos Anjos[5]

[1]Instituto de Educação, Agricultura e Ambiente (IEAA) – Universidade Federal do Amazonas (UFAM), Laboratório de Ictiologia e Ordenamento Pesqueiro (LIOP), Humaitá, AM, Brazil. *eduardo.barista0998@gmail.com

The distribution of freshwater fish species allows understanding both temporal progression and spatial location, providing important information for conservation, management, and fisheries monitoring. In the present study, four native species of ecological and economic interest were used, two from the Amazon: Curimatã (*Prochilodus nigricans*) and matrinxã (*Brycon amazonicus*), and two from Portugal: escalo-do-norte (*Squalius carolitertii*) and barbo (*Luciobarbus bocagei*). Occurrence data were retrieved from the Global Biodiversity Information Facility (GBIF) and previously organized by the author according to year and month of collection, enabling consistent comparisons among indices. *P. nigricans* showed a pronounced increase after 2000, with more than 4,000 annual records, concentrated in May, August, and October, suggesting seasonality associated with spawning periods and/or higher fishing activity. *B. amazonicus* accounted for approximately 40% of records from July to September. In Portugal, the increase of *S. carolitertii* occurred from 1970 onwards, with approximately 45% of records between May and August, reaching over 1,500 in the last two decades, reflecting continuous monitoring during the European spring and summer months. Another species, *Luciobarbus bocagei*, has a continuous historical record since the 19th century, with higher frequency in June and July, showing consistent seasonal patterns associated with its reproductive ecology and local fishing habits. Relating the temporal patterns, both Amazonian and Lusitanian species show higher records in months corresponding to reproductive and fishing activity peaks: in Brazil, between May and October, concentrated in the dry season; in Portugal, between May and August, during spring-summer, highlighting how regional seasonality and monitoring efforts influence data availability and the perception of species' relative abundance.

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P22 | FARINOGRAPH AS A PREDICTOR AND QUALITY CONTROL TOOL IN GLUTEN-FREE BREADMAKING

Silvia de Pablo[1], Diogo Salvati[1], Manuel Gómez[1*]

[1]Food Technology Area. College of Agricultural Engineering. University of Valladolid, Av. Madrid, 34004 Palencia, Spain. *mgpallares@uva.es

Although research on gluten-free bread has increased in recent decades, the variability in the characteristics of gluten-free flours and starches remains a critical challenge for quality control in the industry, making it difficult to maintain consistency in bread volume. This study proposes the use of the farinograph for quality control of flours and doughs, as well as for adjusting formulations based on flour characteristics to improve the uniformity of bread volume. Seven commercial rice flours and one control were selected. The flours were characterised in terms of particle size, water absorption capacity, and viscosity profile. Both the flours and the doughs prepared with them were analysed using the farinograph, and breadmaking trials were conducted at constant and adjusted hydration levels. The studied flours showed wide heterogeneity in particle size, water absorption, and viscosity properties, with differences in both peak viscosity and final viscosity. Farinographic analysis of flours and doughs proved to be a good predictor of final bread volume, showing significant correlations. Furthermore, adjusting formulation hydration based on farinographic tests significantly reduced bread volume variability, decreasing from average differences above 21% to less than 3%. These findings demonstrate that the use of the farinograph can be an effective tool for quality control and formulation optimisation in gluten-free breadmaking, enabling the production of more consistent bread volumes despite variations in flour characteristics.

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P23 | A NEW PERSPECTIVE ON STARCH RETROGRADATION: STARCH, MAIZE FLOUR AND SEMOLINA

Paloma Franco[1], Diogo Salvati[1], Juan M. Antolín[1], Manuel Gómez[1*]

[1]Food Technology Area. College of Agricultural Engineering. University of Valladolid, Av. Madrid, 34004 Palencia, Spain. *mgpallares@uva.es

The starch present in flours and semolina undergoes gelatinization and retrogradation upon heating and cooling in aqueous systems, processes modulated by particle compactness and surrounding matrix. This study examined the pasting properties of maize derivatives (starch, flour, semolina, and remilled semolina) under controlled thermal treatments, varying temperature (95 °C or 140 °C) and holding time (0–600 s). Gel texture and microstructure were also assessed. Gelatinisation at 95 °C was completed before reaching this temperature, with no additional effects of holding time. Finer particles exhibited higher peak viscosities, whereas coarser fractions displayed less defined profiles at low temperature but developed distinct peaks at elevated temperature. Longer treatment durations and higher temperature/pressure enhanced breakdown, except in semolina, characterized by greater compactness and particle size. Treatment time generally increased final viscosity, although an opposite trend was observed for semolina. Heating at 140 °C reduced the final viscosity compared with 95 °C. Microstructural analysis revealed reduced pore size and denser gel networks under more severe thermal conditions. Final viscosity was positively correlated with gel hardness. Extended cold storage was required to more reliably predict gel texture. In summary, treatment temperature and time significantly influenced starch degradation and retrogradation, altering both gel microstructure and texture, with responses determined by particle size and compactness of maize derivatives.

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P24 | UNCONVENTIONAL FOOD PLANTS AS A SOURCE OF PHOTOSENSITIZERS: STUDY OF *PLUMERIA RUBRA* EXTRACT IN PHOTODYNAMIC INACTIVATION

Leandro S. Herculano[1,3*], Caroline T. Marcon[2], Cristiane Canan[2], Tânia C. S. P. Pires[3], Tayse Ferreira[3], Joana S. Amaral[3], Lillian Barros[3]

[1]Departamento Acadêmico de Física, Universidade Tecnológica Federal do Paraná, Campus Medianeira, Brasil; [2]Departamento de Alimentos, Universidade Tecnológica Federal do Paraná, Campus Medianeira, Brasil; [3]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal. *leandroh@utfpr.edu.br

Interest in natural products in food production and innovative decontamination techniques has driven the use of phytochemicals to preserve and inactivate microorganisms. This study evaluates the potential of *Plumeria rubra* flower extract, an Unconventional Food Plant (UFP) known in Brazil as jasmim-manga, as a photosensitizer (PS) in photodynamic inactivation of microorganisms (aPDT). In aPDT, a PS, upon illumination, absorbs part of the incident light energy, generating reactive species that interact with internal cellular structures and membranes, leading to cell death [1].

Fresh *P. rubra* flowers were collected, washed with distilled water, oven-dried at 40–45°C for 48 h to constant weight, and ground. The aqueous extract of *P. rubra* flowers was obtained by hydroethanolic extraction (70% v/v) assisted by ultrasound (80 kHz, 100 W, 60 min) and concentrated in a rotary evaporator. The phenolic compounds were analyzed by UHPLC-Orbitrap, identified by UV-Vis spectra, exact mass, molecular formula, and fragmentation, and quantified by external calibration curves [2].

The aPDT assay was adapted to determine the minimum bactericidal concentration (MBC) of photosensitizers at different optical fluences (0–50 J/cm^2), using serial dilutions of *P. rubra* extract, bacterial inoculation, and light exposure. Growth was assessed on agar, and MBC was defined as the lowest concentration capable of completely killing bacteria. The phenolics identified include hydroxycinnamic acids, phenylpropanoids, flavonols, and iridoids, with rutin (89 mg/g) being the main compound (70%), followed by chlorogenic acid (13%). Studies indicate that the combination of rutin and photosensitizers enhances photodynamic inactivation, possibly by favoring the penetration of PS into cells via interaction with the cell wall [3].

The aPDT assay with *P. rubra* flower extract demonstrated that, at 9 J/cm^2, it inactivated *L. monocytogenes* ATCC 19111 and Methicillin-Resistant *S. aureus* (MRSA); at 19 J/cm^2, it also acted on *E. faecalis* and *L. monocytogenes* (clinical isolate). At fluences of 28 and 38 J/cm^2, all tested bacteria (*L. monocytogenes*, MRSA, *E. faecalis*, and *P. aeruginosa*) were inactivated. These results strengthen the field of aPDT and expand the relevance of UFPs, which, in addition to being sustainable food sources, show potential as reservoirs of photosensitizers, adding value to their cultivation.

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P25 | CONTINUOUS SUBCRITICAL WATER TREATMENT TO FRACTIONATE APPLE POMACE

Jose C. Orellana-Palacios[1], Deisy V. Ayasta-Tejada[1], Rafael Linan-Atero[1], Julia D. Bechtner[2], Enkeledo Menalla[3], Danilo Cantero[3], Juan García-Serna[3], Mario M. Martinez[1,2*]

[1]InnograinLab, Food Technology Division, Department of Agricultural Engineering, University of Valladolid, Spain; [2]Center for Innovative Food (CiFOOD), Department of Food Science, Aarhus University, Agro Food Park 48, Aarhus, N 8200, Denmark; [3]The Institute of Bioeconomy, PressTech, Department of Chemical Engineering and Environmental Technology, University of Valladolid, Paseo Prado de la Magdalena 5, 47011, Valladolid, Spain. *mmartinez@uva.es

The valorization of by-products from the agro-industrial sector allows for the extraction of valuable biocompounds, the development of sustainable materials and/or the creation of new food formulations while reducing the ecological and economic impact by generating this waste. The processing of fruits, such as apples, produces tons of by-products [1] that can be put to good use with the right approach. In this work, apple pomace was modified using a continuous subcritical water treatment (SWC) under different operation conditions (temperature: 150 °C, 200 °C, 250 °C; pH: 3.0; 4.0; time: 1,5 s; 3 s; 9 s) in order to study the selective partitioning of its soluble and insoluble fractions. A multiscale approach was carried out to determine how the treatments affected the insoluble fractions, combining proximal analysis (moisture, ash, pH) with techniques that studied their morphology (SEM), composition (HPAEC-PAD, DUMA, TGA), and the molecular arrangement of their components (FTIR, ssNMR).

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P26 | UNCOVERING SUSTAINABILITY HOTSPOTS IN INSECT CHITIN EXTRACTION: LINKING LITERATURE INSIGHTS WITH EXPERIMENTAL DEMINERALISATION

Lisa Mersmann[1*], Victor Gomes Lauriano Souza[1], Ana Luísa Fernando[1]

[1]MEtRiCS, Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, NOVAFCT, Campus de Caparica, 2829-516 Caparica, Portugal. *l.mersmann@campus.fct.unl.pt

Insects are mainly recognized as biomass sources for protein, feed, or lipids. However, their residues – such as exuviae and byproducts remaining after protein extraction - also contain a considerable amount of chitin, offering opportunities to valorise these streams within a circular bioeconomy [1]. While many extraction routes are presented as "green," such claims are rarely supported by quantitative green metrics. To date, no life cycle assessments (LCAs) exist for insect-based chitin extraction, and most insect LCAs focus on protein production rather than biopolymer recovery [2]. This limits our understanding of the environmental profile of insect chitin valorisation. To address this, we conducted a systematic literature review of LCA studies on chitin extraction from residues, with the aim of identifying the main drivers of sustainability, the principal burdens, and practicable pathways for process adjustment. Across crustacean-based cases, recurring key impact drivers were identified: high energy demand, reliance on hazardous chemicals (HCl, NaOH), and the generation of waste streams. These findings delineate impact determinants that are likely relevant for insect systems as well, although dedicated LCAs are required to verify this assumption. Complementing the literature analysis, we applied the evaluation framework to our experimental study on insect chitin demineralisation. Reducing the demineralisation duration from several hours to ~30 minutes with selected acids did not compromise extraction yields, indicating that operational adjustments can lower energy demand while maintaining process performance.
Taken together, the literature- and experiment-based results indicate that energy intensity, chemical inventories, and waste management are decisive for the climate performance of chitin extraction and should be prioritized in method development. A comprehensive environmental appraisal will ultimately require dedicated LCAs for insect chitin extraction. Moreover, sustainability-oriented adjustments are most likely to be adopted in practice if they also deliver economic benefits, for example through reduced energy costs, process optimization, and minimized reagent use.

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P27 | CIRCULAR BIOREFINERY OF PINEAPPLE PEELS: EXTRACTION, OPTIMIZATION AND CHARACTERIZATION OF FUNCTIONAL POLYSACCHARIDES

Ana M. Vilas-Boas[1], Débora A. Campos[1], Manuela Pintado[1*]

[1]Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, 172, 4200-374 Porto, Portugal. *mpintado@ucp.pt

Pineapple peel pomace, a major by-product of processing, represents a valuable source of polysaccharides with prebiotic, bioactive, and functional properties, offering applications as stabilizers, emulsifiers and drug delivery agents. Its valorization aligns with circular economy principles by reducing waste and generating high-value ingredients [1,2]. This study investigated the extraction and characterization of polysaccharides from pineapple peel pomace using conventional and green methodologies, focusing on optimizing thermal extraction for maximum yield.

Optimization via a Box–Behnken design identified optimal conditions as 100 °C for 120 min at 0.01% (w/v). Substituting water with clarified pineapple juice, a secondary by-product stream, further increased yields to 36.2 ± 2.0%, representing a 16% improvement while enhancing sustainability through multi-stream valorization. Characterization revealed a mannose-rich galactomannan-like structure with a high mannose-to-galactose ratio (15.29 ± 3.63), complemented by arabinose and glucose, indicating a heterogeneous polysaccharide mixture [3]. FTIR confirmed the presence of α-D-galactopyranose and β-D-mannopyranose units [3]. Differential scanning calorimetry showed a glass transition at 159 °C, followed by thermal events linked to water release and backbone degradation, confirming good stability [3]. X-ray diffraction profiles indicated an amorphous nature, while ζ-potential values (–15 mV) suggested moderate colloidal stability consistent with food hydrocolloid behavior [3].

These results demonstrate the feasibility of pineapple peel pomace as a sustainable source of galactomannan-rich polysaccharides, with potential for application in food, nutraceutical and pharmaceutical systems, underscoring the relevance of integrated biorefineries for waste-to-resource innovations. The optimized thermal extraction method, especially when coupled with clarified juice as solvent, maximized recovery while reinforcing a zero-waste valorization approach.

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P28 | DEVELOPMENT AND CHARACTERIZATION OF A CLEAN-LABEL PROTEIN PUDDING USING AMAZAKE AS A FUNCTIONAL SWEETENER

Cristiana Santos[1], Inês Magalhães[2], Daniela Correia[2], Anabela Raymundo[1], Catarina Prista[1*], Juliana Botelho Moreira[1]

[1]LEAF – Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017, Lisbon, Portugal; [2]MC Shared Services S.A., Rua João Mendonça 529, 4464-501 Senhora da Hora, Matosinhos, Portugal. *cprista@isa.ulisboa.pt

Although synthetic food preservatives provide clear benefits for food safety, a growing consumer concern has emerged regarding potential health risks associated with their long-term consumption [1]. Amazake is a traditional Japanese sweet, non-alcoholic beverage produced by the enzymatic breakdown of rice starch by *Aspergillus oryzae* [2]. It can be considered a clean-label ingredient, as amazake is a natural sweetener that also enhances nutritional value and contributes to color.

This work aimed to develop and characterize clean-label protein puddings using amazake as a sugar replacer, to improve both the nutritional and technological characteristics of food products. Six formulations were prepared, varying concentrations of amazake, pumpkin puree and cornstarch: P3 (3% amazake, 34% pumpkin puree); P4 (4% amazake, 34% pumpkin puree); P5 (5% amazake, 29% pumpkin puree, 3% cornstarch); P6 (15% amazake, 17% pumpkin puree, 5% cornstarch); P7 (15% amazake, 15% cornstarch); and P8 (15% amazake, 8% cornstarch). Formulations were evaluated for color, rheological properties, and nutritional composition.

Compared to the control, the clean-label protein puddings showed a total color difference (ΔE) above five, except P5 (ΔE = 3.9), which indicates color changes perceptible to the human eye. However, all ΔE values were less than 12, suggesting no absolute color difference. The formulations P3, P4 and P5 presented a mechanical spectrum (G' 1 Hz and Plateau modulus) similar to the control, while P6, P7, and P8 demonstrated higher values, exhibiting a higher degree of structuring. Regarding apparent viscosity, although all samples differed significantly from the control (11309.06±293.65 Pa.s), P4 (12700.54±563.67 Pa.s) was the formulation closest to it. Moreover, the nutritional composition of all clean-label protein puddings showed higher protein content. The fat content was lower in P3, P4, and P5, while the carbohydrate content was increased in P5, P6, P7, and P8 compared to the control.

Overall, this study demonstrates the strong potential of amazake for the development of clean-label protein puddings, offering benefits to consumers, the food industry, and the environment.

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P29 | USE OF BRINE RESULTING FROM TABLE OLIVE FERMENTATION IN THE PRODUCTION OF SALICORNIA IN HYDROPONICS – A PRELIMINARY STUDY

Ana Paula Pereira[1,2], Luana Fernandes[1,2], Pedro Crugeira[2], Elsa Ramalhosa[2], Teófilo Ferreira[3], David Marques[4], Ermelinda Silva[1,2*], Alexandre Gonçalves[1,2]

[1]MORE-Laboratório Colaborativo Montanhas de Investigação-Associação, 5300-358 Bragança, Portugal; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [3]Adega Cooperativa de Freixo de Espada a Cinta, 5180-103 Freixo de Espada à Cinta, Portugal; 4LOKI, unipessoal Lda, 3750-753 Águeda, Portugal. *esilva@morecolab.pt

The table olive industry generates annually large amounts of wastewater during the natural fermentation, and olive washing stages. The high conductivity, resulting from the high salt content, as well as the high organic and phenolic compounds in these waters, is a global problem, especially in the Mediterranean region, which is the main table olive producing area. So, table olive sector faces the challenge of reducing waste generation and recycling waste and by-products to meet the EU's commitment to a circular economy. In this sense, one of the waste products resulting from table olive processing - brine water - may have the potential to be reused to produce salt-tolerant plants, such as salicornia. Salicornia is a halophyte species, adapted to living in environments with high salt content, and grows preferentially along coastal areas, in salt marshes and mangroves, or on the banks of temporarily flooded salt flats. There are already some studies that refer to the possibility of producing salicornia using saline aquaculture effluents [1,2] and discarded nutrient solutions (with high salt content) resulting from the hydroponic cultivation of vegetables (*e.g.*, cucumber, tomato, and pepper) [3].

In this sense, one of the objectives of the project INOVOlive is to develop a hydroponic system to produce salicornia using the highest % of brine from the fermentation process that will maximize the plant's agronomic performance. In order to verify each % of brine could be used to produce salicornia, a preliminary study has been conducted. Salicornia plants were grown hydroponically in different brine concentrations. In the first test, the salicornia plants were placed in 0%, 5%, 10%, 15%, 25%, and 30% brine solutions. After a week, only plants under 5% and 0% brine were found to be in good phytosanitary condition. In the second test, salicornia plants were placed in brine concentrations of 0, 3, 5, and 7% of brine. Weekly salicornia plants were collected for latter determination of fresh weight, dry weight, and analysis of photosynthetic pigments and phenolic compounds. In the beginning of the experiment, a microbiological analysis of brine has been performed. The results indicated presence of aerobic bacteria, lactic acid bacteria and yeasts and molds and absence of enterobacteria, *Escherichia coli* and *Salmonella*.

The conclusions obtained from these preliminary experiments will allow us to obtain the best conditions for the hydroponic salicornia production on a large scale.

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P30 | RAPID AUTHENTICATION TOOLS FOR HIGH-VALUE FOODS: INSIGHTS FROM OLIVE OIL RESEARCH

Lidia Barreira González[1], Carla Teixeira[1,2], Pilar Calo-Mata[1], Marta Prado[1*]

[1]Department of Analytical Chemistry, University of Santiago de Compostela, Lugo, Spain; [2]Food Quality & Safety Group, International Iberian Nanotechnology Laboratory, Braga, Portugal. *marta.prado@usc.es

High-value foods such as extra virgin olive oil, saffron or wine are particularly vulnerable to fraud due to high prices, global demand, and complex supply chains. In olive oil common frauds include mislabeling lower-quality oils as extra virgin, blending with cheaper vegetable oils, or falsely declaring geographic origin to exploit PDO reputations. These practices undermine consumer trust, harm producers, and distort markets. There is growing demand for rapid and reliable authentication tools to ensure product integrity and support regulatory compliance. DNA-based methods, especially techniques like PCR, are renowned for their high specificity and sensitivity [1]. Among these, SNP genotyping is a powerful strategy for distinguishing closely related cultivars. Moreover, the integration of molecular methods into microfluidic systems allows for the miniaturization of laboratory workflows, supporting faster, low-cost, and portable diagnostics [2,3]. However, complex matrices like olive oil pose challenges for obtaining high quality DNA (4). Additionally, materials used in device fabrication must avoid interfering with DNA reactions [5,6]. Within the TITAN project, this study aims to develop a SNP-based molecular method compatible with microfluidic integration for rapid and accurate olive oil cultivar identification using TaqMan SNP Genotyping Assays and qPCR. Following bioinformatic screening of Sanger sequencing chromatograms, three optimized SNP assays – OEW1 and OEW3 (*Lupeol synthase* gene), and OEX2 (*Cycloartenol synthase* gene) – were selected. After performing the genotyping assays, seven cultivars (*Koroneiki*, *Kilis Yaglik*, *Brava*, *Mansa*, *Picual*, *Ladoelia*, and *Kato Dry*) exhibited unique genotype combinations, enabling their unambiguous identification. Only one cultivar pair – *Kalamata/Arbequina* – shared identical profiles. This tool would be valuable for producers, distributors, and even informed consumers, ensuring quality, preventing fraud and supporting market differentiation.

Table 1 – qPCR genotyping assays results. Genotype codes: heterozygous (+); homozygous for WT allele (*); homozygous for mutant allele (-).

	Koroneiki	*Kilis Yaglik*	*Brava*	*Mansa*	*Ladoelia*	*Kalamatas*	*Kato Dry*	*Arbequina*	*Picual*	[A/B]=C
OEW1	-	+	+	*	*	*	*	*	*	(+) hetero.
OEW3	*	*	+	+	+	*	*	*	*	(-) homo. allele 2
OEX2	+	+	+	-	*	+	*	+	-	(*)homo. allele 1

* Assays with the probes OEW2, OEW4, OEW_Kal and OEX3 showed a WT genotype for each variety.

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P31 | TRUB BY-PRODUCT HYDROLYSATES AS NEW SUSTAINABLE INGREDIENTS

Bianka Rocha Saraiva[1*], Fernando Antônio Anjo[2], Vinicius Cunha dos Santos[3], Paula Toshimi Matumoto-Pintro[1,2]

[1]Animal Science Graduate Program, State University of Maringá, 87020-900, Maringá, Brazil; [2]Food Science Graduate Program, State University of Maringá, 87020-900, Maringá, Brazil; [3]Department of Food Engineering, State University of Maringá, 87020-900, Maringá, Brazil. *biankasaraiva27@gmail.com

Trub is a by-product of brewing generated during wort boiling and clarification, rich in proteins and phenolic compounds. Its direct application in food systems is limited by low solubility and bitter taste. Enzymatic hydrolysis has emerged as a promising strategy to overcome these limitations, producing smaller peptides with improved nutritional and technological properties. In this study, trub proteins were hydrolyzed using a food-grade protease for 2 h (H2) and 8 h (H8). The properties evaluated included water holding capacity (WHC), oil holding capacity (OHC), and least gelation concentration (LGC). WHC was determined according to Rodríguez-Ambriz et al. [1] with modifications, while OHC followed the method of Lin and Zayas [2]. Gelation ability was assessed at protein concentrations ranging from 2–18% (w/v) in distilled water, as described by Ogunwolu et al. [3]. Both hydrolysates showed high WHC values (Table 1), indicating strong hydration capacity due to exposure of hydrophilic groups. In contrast, OHC values were lower than WHC (less than 0.70 g/g), reflecting the reaggregation of hydrophobic residues after hydrolysis. For LGC, both H2 and H8 formed cohesive gels at a low concentration of 3% (w/v), providing a novel property compared to untreated trub. These results highlight the potential of trub hydrolysates as sustainable functional ingredients with high water affinity and strong gelation capacity, suitable for applications in bakery, beverages, fat substitutes, and high-moisture food systems.

Table 1 – Trub hydrolysates properties.

g/g or *%	H2	H8
Water holding capacity (WHC)	5.23 ± 0.06	5.93 ± 0.15
Oil holding capacity (OHC)	0.56 ± 0.02	0.63 ± 0.02
Least gelation concentrate (LGC)*	3	3

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P32 | EFFECT OF MICROSTRUCTURE ON FREE FATTY ACID RELEASE FROM BIGELS

Caroline Ramos-Souza[1*], Ana Cristina Pinheiro[2], Veridiana de Rosso[1], António A. Vicente[2]

[1]Nutrition and Food Service Research Center, Federal University of São Paulo, 11015-020, Brazil; [2]Centre of Biological Engineering, University of Minho, 4710-057, Portugal. *caroline.silva@unifesp.br

Bigels, hybrid systems composed of oleogels and hydrogels, have emerged as promising delivery vehicles for bioactive compounds. In this study, different formulations of bigels based on a beeswax–lecithin–sunflower oil oleogel (OG) and an agar–xanthan gum hydrogel enriched with carotenoids were prepared. Their microstructure was characterized by confocal laser scanning microscopy (CLSM), and lipid digestibility was assessed by the pH-stat method, where free fatty acids (FFA) release was quantified during in vitro static digestion. CLSM revealed clear differences between formulations (Figure 1). The 80% OG bigel exhibited a hydrogel-in-oleogel (W/O) structure, with hydrogel domains embedded in a continuous oleogel phase stabilized by beeswax crystals, conferring high mechanical strength. In contrast, the 60% OG bigel displayed a bicontinuous structure, with no distinct boundaries between phases. At the end of the intestinal phase, both formulations showed a comparable extent of lipid digestion, with 50.20 ± 6.38% FFA release for the bicontinuous bigel (60% OG) and 52.33 ± 5.38% for the hydrogel-in-oleogel bigel, indicating no significant difference. Nonetheless, previous studies have reported more pronounced structural effects, such as higher FFA release in algal oil–beeswax–gellan gum bigels at 80% OG compared to bicontinuous systems [1], reduced digestibility in gelatin–konjac glucomannan bicontinuous structures (52.30 ± 0.94% FFA) [2], and limited lipolysis (12–20% FFA) in candelilla wax–lecithin–fish gelatin bigels [3]. Overall, the effect is strongly composition-dependent, emphasizing the need to tailor bigel formulation and structuring agents to achieve desired digestion profiles and optimize bioactive compound delivery.

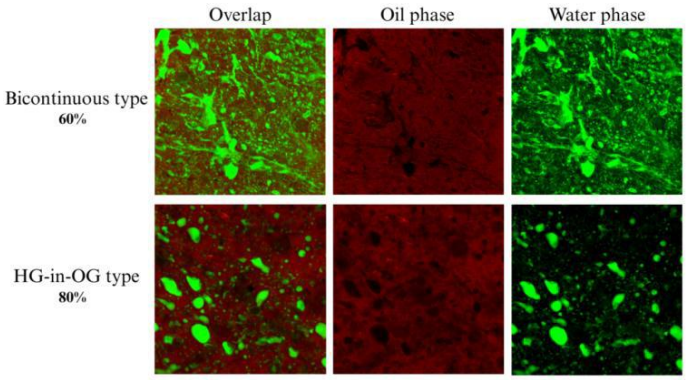

Figure 1 – Confocal laser scanning microscopy (CLSM) images of bigels.

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P33 | BREAKFAST SNACKS MADE FROM EXTRUDED LEGUMINOUS FLOUR

Ali Seif Chouikh[1], Lillian Barros[1], Bruna Moreira[1], Tânia C. S. P. Pires[1,2], Luis Rocha[3], Cristina Caleja[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Research Centre for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, Bragança, Portugal; [3]MORE – Laboratório Colaborativo Montanhas de Investigação – Associação, 5300-358 Bragança, Portugal. *ccaleja@ipb.pt

Legumes are crucial for global food systems due to their high protein content and diverse applications, yet their consumption is often below recommended levels [1]. This research responds to the growing consumer demand for healthy snack alternatives by leveraging the nutritional potential of legumes through extrusion cooking, a process known to enhance digestibility and nutrient bioavailability [2].

In the present study, various formulations were developed using chickpea, rice, and semolina flours. These flours were combined into two main mixtures: Semolina:Chickpea (SGE) and Rice:Chickpea (AGE). With different ratios 50:50 and 60:40 *w/w*. Then, a twin-screw extruder was used for processing, with control over temperature, screw speed, and water flow until the optimized formulations were reached, with the best protein content and guaranteed texture desired by consumers. Finally, the optimized formulations were evaluated for their physical (color), nutritional (lipids, proteins, and moisture), and chemical (free sugars, fatty acids).

Through this process, the extrusion was optimized, leading to the identification of AGE4 (Rice:Chickpea 50:50) and SGE1 (Semolina:Chickpea 50:50). These formulations were selected because they exhibited desirable attributes, including protein content, the AGE showed a higher protein content of 13.39 ± 0.01 g/100 g *dw* compared to the SGE, which had 12.58 ± 0.10 g/100 g *dw*. Regarding the texture and general characteristics, the two formulations presented a white/gold color, a crunchy texture desired by consumers, and a homogeneous flow. Furthermore, they displayed very low-fat levels (SGE 0.048 g/100g, AGE 0.043 g/100g) and reduced humidity (SGE 3.97%, AGE 3.63%), features that not only enhance shelf-life but also contribute to their health benefits. From a chemical perspective, sucrose was identified as the only quantifiable free sugar, a result consistent with recommendations for reducing sugar intake.

This study successfully developed and characterized nutritionally beneficial ready-to-eat snacks from extruded leguminous flour. The low-fat, controlled-sugar, and high-protein content, particularly in the rice-chickpea blend, positions them as viable, health-oriented alternatives to conventional snack products.

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P34 | VALORISATION OF *CASTANEA SATIVA* BURS: ANTIMICROBIAL AND ANTIOXIDANT EXTRACTS FOR CIRCULAR AGRI-FOOD SYSTEMS

Joana C. L. Martins[1,2,3,4,5*], Juliana Garcia[1,2,5], Rafaela Guimarães[1,5], Maria José Alves[1,5,6,7], Maria José Saavedra[2,3,4]

[1]Centre for the Valorisation and Transfer of Water Technology, AquaValor, Chaves, 5400-342, Portugal; [2]Centre for the Research and Technology of Agroenvironmental and Biological Sciences, CITAB, Inov4Agro, University of Trás-os-Montes and Alto Douro, UTAD, Quinta de Prados - Vila Real, 5000-801, Portugal; [3]Veterinary and Animal Research Centre and Associate Laboratory for Animal and Veterinary Science (AL4AnimalS), CECAV, University of Trás-os-Montes and Alto Douro, Vila Real, 5000-801, Portugal; [4]AB2Unit - Antimicrobials, Biocides & Biofilms Unit and Veterinary Sciences Department, University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal; [5]Research Centre for Active Living & Wellbeing (LiveWell), Polytechnic Institute of Bragança, Bragança, 5300-253, Portugal; [6]Mountain Research Centre (CIMO), Polytechnic Institute of Bragança, Bragança, 5300-253, Portugal; [7]Associated Laboratory for Sustainability and Technology in Mountain Regions (SusTEC), Polytechnic Institute of Bragança, Campus of Santa Apolónia, Bragança, 5300-253, Portugal. *martinsjoanacl@gmail.com

As agrifood Building sustainable food systems is essential to ensure a safe, reliable global food supply while minimizing waste. This strategy prevents the overuse of agricultural resources. One promising solution is the utilization of agri-food by-products, which are rich in bioactive compounds that can be repurposed to extend the shelf life of food products, thereby reducing dependence on synthetic additives and mitigating environmental impact [1,2]. For instance, *Castanea sativa* (sweet chestnut) by-products are rich in polyphenols, polysaccharides, and phytochemicals with antioxidants, antimicrobial, and anti-inflammatory properties [3,4]. The present study aimed to evaluate the bioactive potential of *Castanea sativa* burs. The extracts were obtained using two extraction methods: conventional solid-liquid extraction and ultrasound-assisted extraction, employing an ethanol/water mixture as solvent. The antimicrobial activity of the extracts was assessed using the minimum inhibitory concentration (MIC) method against key foodborne and clinical pathogens, including *Staphylococcus aureus*, *Listeria monocytogenes*, *Pseudomonas aeruginosa*, *Escherichia coli*, and *Klebsiella pneumoniae*. MIC values ranged from 0.250 to 2.5 mg/mL, demonstrating the extract's antimicrobial efficacy. Antioxidant capacity was evaluated using four complementary assays. The ABTS assay yielded Trolox Equivalent Antioxidant Capacity (TEAC) values between 517.93 and 854.95 mg Trolox/g of lyophilized extract, while the FRAP assay demonstrated values ranging from 731.80 to 936.52 mg Trolox/g. Total phenolic content, quantified using the Folin-Ciocalteu method, ranged from 10.14 to 15.59 mg of gallic acid equivalents (GAE)/g. Additionally, the determination of total flavonoid content presented results from 39.32 to 39.58 mg of catechin equivalents (CTE)/g. These findings support the potential of *C. sativa* bur extracts as a sustainable source of bioactive compounds with antimicrobial and antioxidant activity, supporting their application in circular economy solutions within the agri-food sector.

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P35 | ULTRASOUND-ASSISTED GREEN EXTRACTION OF BRAGANÇA REGION PROPOLIS: NADES VS. CONVENTIONAL SOLVENTS FOR FOOD APPLICATION

Artem Drogalin[1], Aritson Tolentino[2], Miguel Vilas-Boas[2], Soraia I. Falcão[2], Andreia F. Peixoto[1*]

[1]LAQV-REQUIMTE/, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, Porto, 4169-007 Portugal; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal. *andreia.peixoto@fc.up.pt

Ultrasound-assisted extraction has emerged as a promising green technology to obtain bioactive-rich natural extracts in a fast, efficient, and environmentally responsible way [1]. In this study, propolis samples from local beekeepers in Bragança were extracted using both conventional solvents (ethanol, glycerol) and natural deep eutectic solvents (NADES), designed from biodegradable, food-grade components. Conventional solvent extractions scaled up to 250 g of raw propolis achieved yields above 80% (Figure 1), demonstrating feasibility for industrial processing. NADES-based extractions, employing combinations of lactic acid, 1,2-propanediol, menthol, glycerol, and sugars, enabled the direct preparation of ready-to-use extracts, where the only purification step required was filtration. Quantification of phenolics (TPC) and flavonoids (TFC) revealed that NADES extracts, especially lactic acid/1,2-propanediol and menthol/1,2-propanediol reached values up to ~167 mg GAE/g and ~65 mg QE/g of raw propolis, comparable or superior to extracts obtained with conventional solvents [2]. These results highlight ultrasound-assisted extraction with NADES as a sustainable strategy to valorise regional propolis from the Bragança region, generating high-value food and cosmetic ingredients aligned with consumer demand for natural, safe, and eco-friendly products.

Figure 1 – Propolis enolic extract.

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P36 | VALORIZATION OF LEMON BY-PRODUCTS FOR SUSTAINABLE ACTIVE PACKAGING: ENHANCING FISH SHELF LIFE WITH WHEY PROTEIN-BASED ANTIOXIDANT FILMS

Ana Rita Mateus[1,2,3,4], Patricia Cazón[1,5], Carina Almeida[1,6,7], Angelina Pena[2,3], Ana Sanches Silva[2,4,8*]

[1]National Institute for Agricultural and Veterinary Research (INIAV), I.P., Rua dos Lagidos, Lugar da Madalena, 4485-655 Vairão, Vila do Conde; [2]Faculty of Pharmacy, University of Coimbra, Polo III, Azinhaga de Stª Comba, 3000-548 Coimbra, Portugal; [3]LAQV, REQUIMTE, Laboratory of Bromatology and Pharmacognosy, Faculty of Pharmacy, University of Coimbra, Polo III, Azinhaga de Stª Comba, 3000-548 Coimbra, Portugal; [4]Center for Study in Animal Science (CECA), ICETA, University of Porto, Apartado, 55142 Porto, Portugal; [5]Department of Analytical Chemistry, Area Food Technology, Faculty of Veterinary Science, University of Santiago de Compostela, Campus Terra, Lugo 27002, Spain; [6]LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [7]AliCE - Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [8]Associate Laboratory for Animal and Veterinary Sciences (Al4AnimalS), 1300-477 Lisbon, Portugal. *asanchessilva@ff.uc.pt

The transition toward sustainable food systems requires innovative solutions that both preserve food quality and reduce environmental impact. Active food packaging enriched with natural antioxidants represents a promising approach to simultaneously address food waste and the valorization of agro-industrial by-products. This study investigated the potential of lemon by-products as sources of antioxidant compounds for the development of whey protein-based films aimed to prolong the shelf life of fresh salmon. Films were prepared with concentrated lemon by-product ethanolic extract at 1%, 2%, and 4% (w/v) concentrations, and their antioxidant efficacy was evaluated during refrigerated storage (4 °C) of salmon over 10 days, with lipid oxidation monitored through the Thiobarbituric Acid Reactive Substances (TBARS) assay [1]. All active films significantly reduced lipid oxidation compared with the control, with effects varying according to extract concentration and storage duration (Figure 1). The 4% extract film exhibited the highest initial inhibition, while the 2% extract film achieved the most consistent protection, reducing malondialdehyde (MDA) values by 76% at day 10 relative to the control. These findings demonstrate that whey protein films enriched with lemon by-products can effectively delay lipid oxidation in salmon while contributing to circular economy strategies through by-product valorization. The approach highlights the potential of by-products to extend shelf life and support sustainable food ecosystems.

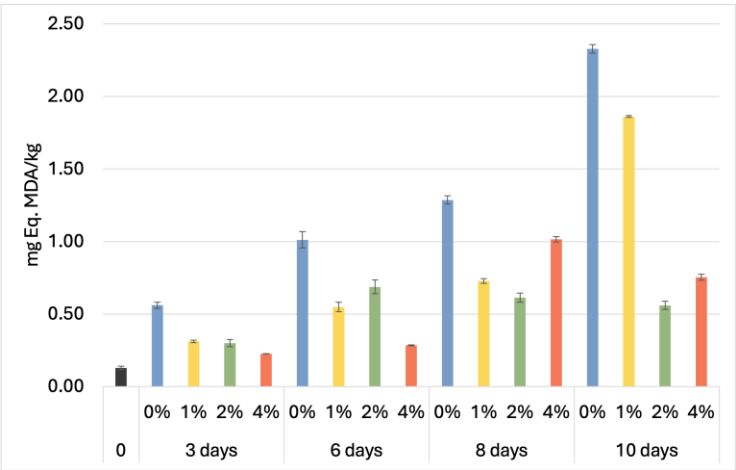

Figure 1 – Results TBARS assay for salmon packaged with whey protein-based films, with lemon by-product extract after 0, 3, 6, 8 and 10 days of storage at 4 ºC.

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P37 | EFFECTS OF RADIOFREQUENCY ON CHESTNUT QUALITY

Caroline Ribeiro[1*], Bruno Melgar[1], Ângela Fernandes[1*], Tânia C. S. P. Pires[1*], Tiane Finimundy[1], Jorge Moreira[3], Elizabete Alexandre[4], Carlos Freire[4], Natércia C. P. Fernandes[2], Alexandre Gonçalves[1,2], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]MORE - Collaborative Laboratory Mountains of Research, Brigantia Ecopark, 5300-358 Bragança, Portugal; [3]Sortegel, Produtos Congelados, SA, Rua São Mamede Nr 25, 5300-903 Sortes, Bragança, Portugal; [4]PERFINOX - Indústria Metalúrgica AS, Zona Industrial Lameiradas Lt 1 Mansores, 4540-423 Arouca, Portugal. *afeitor@ipb.pt and tania.pires@ipb.pt

The chestnut (*Castanea sativa* Mill.) is a fruit with high nutritional value, but it is highly susceptible to infestation and post-harvest deterioration [1]. Infestations by *Curculio elephas* (Gyll) and *Cydia splendana* (Hübner), pose a significant challenge to the food industry, reducing product quality and causing considerable economic losses [2]. This study assessed the impact of radio frequency (RF) application on the post-harvest quality of Judia chestnuts. Trials were conducted at Sortegel's facilities using an industrial-scale pilot system (40.68 MHz) developed by Perfinox. Optimal operating conditions: 1500 W, a conveyor speed of 190 kg/h, and $\Delta T \approx 34.7$ °C, larval survival was reduced to 11.6%, with only 3.4% of chestnuts showing signs of cooking. RF-treated and untreated control samples were compared based on nutritional composition (moisture, lipids, proteins, ash, carbohydrates, and energy value) and physicochemical parameters (color, pH, water activity, texture, sugars, starch, fatty acids, and oxidative stability). Moisture content in both RF-treated and control samples remained within the desirable range (51.0 vs. 45.0 %, respectively). No statistically significant differences were observed in lipid content (1.36 vs. 1.55 g/100 g dry weight (dw)), protein content (4.74 vs. 4.72 g/100 g dw), ash (2.4 vs. 1.94 g/100 g dw), carbohydrates (91.5 vs. 91.8 g/100 g dw), or energy value (397 vs. 399 kcal/100 g dw). Changes in shell color were minimal ($\Delta L^* \approx -0.7$; $\Delta a^* \approx -0.4$; $\Delta b^* \approx -0.2$). The pH (≈6.0) and water activity (≈0.97) showed no statistically significant differences between RF-treated and control samples. No significant differences were observed in kernel hardness between RF-treated and control samples (2838 vs. 2967 g, respectively), while elasticity significantly increased in RF-treated samples (332 vs. 99 %). No significant differences were observed in sugar content (18.46 vs. 17.3 g/100 g dw), starch content (41.93 vs. 38 g/100 g fresh weight (fw)), or fatty acid profile (e.g., oleic acid: 28.60 vs. 28.06 %; linoleic acid: 30.46 vs. 28.32 %) between RF-treated and control samples. Oxidative induction time was the most significant parameter, increasing from 1.55h in control samples to 5.25h in RF-treated samples. The evidence suggests that RF treatment, under the evaluated conditions, achieves high phytosanitary efficacy while preserving and, in some cases, enhancing key chestnut quality parameters.

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P38 | DEVELOPMENT OF FOOD-GRADE SELF-NANOEMULSIFYING DRUG DELIVERY SYSTEMS AS ALTERNATIVE CARRIER FOR CANNABIDIOL

Shahnshah E Azam[1], António A. Vicente[1,2], Renata Vardanega[1,2*]

[1]Centre of Biological Engineering, University of Minho, 4710-057, Braga, Portugal; [2]LABBELS- Associate Laboratory, Braga/Guimarães, Portugal. *renata.vardanega@ceb.uminho.pt

Cannabinoids, such as cannabidiol (CBD), exhibit considerable therapeutic potential in pain management, oncology, and neurological disorders, but its poor solubility, extensive first-pass metabolism, and low bioavailability limit oral applications. Self-nanoemulsifying drug delivery systems (SNEDDS) offer a promising strategy to overcome these challenges by spontaneously forming nanoemulsions (≤200 nm) in gastrointestinal fluids [1], thereby enhancing solubilization, stability, and absorption of lipophilic compounds [2]. While extensively studied in pharmaceuticals, food-grade SNEDDS are increasingly explored to incorporate poorly soluble bioactive compounds like CBD into functional foods, beverages, and nutraceuticals. This study evaluated the solubility of CBD in edible oils (olive, sunflower, corn, soybean, sesame, linseed, avocado, coconut), surfactants (Tween 80, Tween 20, Span 80, lecithin), and co-surfactants (ethanol, PEG 400). Sunflower oil, Tween 80, and ethanol exhibited the highest solubility and were used to construct a ternary-phase diagram. However, this system showed a limited nanoemulsion region. Thus, replacing sunflower oil with oleic acid, which has a CBD solubility of 200 mg/g [3], broadened the singlephase region and enabled the formation of nanoscale emulsions (Figure 1). The optimized system constituted of Tween 80:ethanol:oleic acid (45:45:10) produced the smallest particle sizes of 175.6 ± 0.5 nm, demonstrating its feasibility for developing food-grade SNEDDS suitable for CBD delivery in functional food applications.

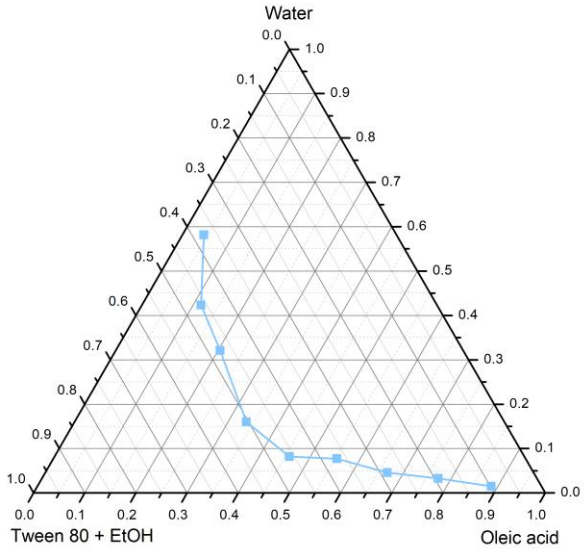

Figure 1 – Pseudo-ternary phase diagram of self-nanoemulsifying delivery system (SNEEDS).

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P39 | BIO-BASED SOLID LIPID NANOPARTICLES AS CARRIERS OF VITAMIN E FOR FOOD APPLICATIONS

Ana Luísa Monteiro[1*], Márcia Marques[1], Jean Michel Fernandes[1], António A. Vicente[1,2], Ana C. Pinheiro[1,2], Joana T. Martins[1,2]

[1]CEB - Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal; [2]LABBELS – Associate Laboratory, Braga, Guimarães, Portugal. *pg53553@uminho.pt

The development of micro/nanostructured release systems can enhance food ingredient effectiveness, dosage control, and broaden their range of applications [1]. Solid lipid nanoparticles (SLNs) increase the stability and bioavailability of lipophilic compounds like vitamins. Natural materials such as candelilla wax (CW) and soybean lecithin (SL) offer sustainable alternatives to synthetic materials [2]. This study aimed to develop vitamin E-loaded SLNs and assess their stability and bioaccessibility under the in vitro digestion process to support their use in functional foods. A Central Composite Rotatable Design (CCRD) was employed to optimise CW (1.5% - 3%) and SL (1.5% - 3%) concentrations, where stability and physicochemical properties of SLNs were evaluated for one month. The SLNs were submitted to an in vitro digestion process using the harmonised INFOGEST digestion method, and the digested samples were analysed by UHPLC to evaluate the vitamin E bioaccessibility (Figure 1). The optimised vitamin E-loaded SLNs values are displayed in Table 1. Results demonstrated that SL and CW can be applied as wall materials for SLNs, effectively carrying bioactives such as vitamin E. This study developed sustainable and bio-based SLNs for potential use in functional foods.

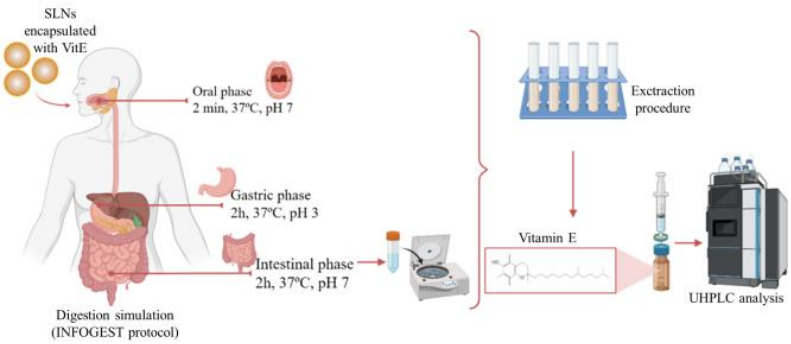

Figure 1 – Schematic illustration of the INFOGEST digestion method.

Table 1 – Optimised vitamin E-loaded SLNs characteristics.

Dependent variable	Day 0	Day 15	Day 30
Particle Size (nm)	264.98 ± 8.90	266.55 ± 7.00	260.33 ± 5.37
PDI	0.25 ± 0.02	0.25 ± 0.02	0.25 ± 0.01
Zeta-Potential (mV)	-19.92 ± 1.46	-16.72 ± 0.88	-12.72 ± 0.81

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P40 | INNOVATIVE FOOD-GRADE NANOSTRUCTURED LIPID CARRIERS FOR EFFECTIVE DELIVERY OF PIPERINE IN FUNCTIONAL FOODS

Renata Vardanega[1,2*], Fernanda L. Lüdtke[1,2], Luis Loureiro[1,2], Raquel F. S. Gonçalves[1,2], Ana C. Pinheiro[1,2], António A. Vicente[1,2]

[1]Centre of Biological Engineering, University of Minho, 4710-057, Braga, Portugal; [2]LABBELS- Associate Laboratory, Braga/Guimarães, Portugal. *renata.vardanega@ceb.uminho.pt

Piperine (PIP) is a natural alkaloid predominantly found in black pepper (*Piper nigrum* L.), widely recognized for its diverse biological properties, including anticancer, antiparasitic, antidepressant, antifungal, anti-inflammatory, anticonvulsant, insecticidal, and hepatoprotective effects [1]. In addition, PIP is well known as a bioenhancer, owing to its ability to increase the bioavailability of various bioactive compounds by inhibiting cytochrome P-450 drug-metabolizing enzymes, thereby reducing first-pass metabolism [2]. Despite these benefits, the application of PIP in food systems is hindered by its poor aqueous solubility (40 µg/mL) and high lipophilicity (log P = 2.25), which limit its oral absorption [3]. Lipid-based formulations have been proposed to overcome these drawbacks, with nanostructured lipid carriers (NLCs) emerging as a particularly promising strategy. NLCs, composed of mixtures of solid and liquid lipids, offer high entrapment efficiency and can enhance the intestinal absorption of lipophilic compounds, making them highly relevant for food applications. In this work, a food-grade NLC was developed as a carrier for PIP, characterized, and evaluated under in vitro digestion to assess its impact on PIP bioaccessibility. The NLC consisted of 10% lipid phase, comprising hemp seed oil (HSO, liquid lipid) and fully hydrogenated soybean oil (FHSO, solid lipid) at a 60:40 (w/w) ratio, stabilized with 3% lecithin as emulsifier. PIP was incorporated at 1% (w/w). The resulting PIP-loaded NLC (NLC-PIP) exhibited a mean particle size of 200.4 ± 0.3 nm with a polydispersity index of 0.200, indicating a narrow size distribution. The zeta potential was -55.8 ± 1.3 mV, suggesting excellent colloidal stability, and the entrapment efficiency exceeded 99.9%. Importantly, the *in vitro* bioaccessibility of PIP increased significantly, reaching 93.5 ± 1.1%. These results demonstrate the feasibility of developing food-grade NLCs as effective carriers for PIP, highlighting their potential to improve the incorporation and functionality of bioactive compounds in innovative food products.

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P41 | BIOACTIVE POTENTIAL OF MUSHROOMS *PAXILLUS INVOLUTUS* AND *BOLETUS EDULIS*: UNLOCKING NATURAL RESOURCES FOR FOOD INNOVATION

Ana Rita Pinto[1,2*], Juliana Garcia[1,2,4], Jani Silva[1,4], Maria José Saavedra[2], Maria José Alves[1,3,4]

[1]AquaValor – Centre for the Valorization and Transfer of Water Technology, Association, 5400-342 Chaves, Portugal; [2]CITAB/UTAD – Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; [3]CIMO/SusTEC – Mountain Research Centre, Associated Laboratory for Sustainability and Technology in Mountain Regions, Polytechnic Institute of Bragança, 5300-253 Bragança, Portugal; [4]LiveWell – Research Centre for Active Living & Wellbeing, Polytechnic Institute of Bragança, 5300-253 Bragança, Portugal. *al60149@alunos.utad.pt

Wild macrofungi are promising sources of bioactive metabolites for sustainable, clean-label food systems. In this context, this study assessed the antimicrobial and antioxidant potential of an edible species (*Boletus edulis*) and a toxic, non-edible species (*Paxillus involutus*), with emphasis on extraction strategy and applicability to circular bioeconomy. Aqueous and methanolic extracts were prepared and evaluated against Gram-positive and Gram-negative bacteria of relevance to food systems and public health - *Staphylococcus aureus* (including MRSA), *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae* - using EUCAST adapted disk-diffusion assays. Phytochemical analysis included total phenolic content (TPC; Folin–Ciocalteu; mg GAE·g^{-1} dry weight) and ABTS radical-scavenging activity. At 1 mg.mL^{-1}, aqueous extracts consistently produced larger inhibition zones than methanolic counterparts, with maximal effects of 14 mm against MRSA for *P. involutus* and 12 mm against *P. aeruginosa* for *B. edulis*. TPC was high in both species (42.5 mg GAE·g^{-1} for *B. edulis*; 35.8 mg GAE·g^{-1} for *P. involutus*), and ABTS scavenging exceeded 80% at 1 mg·mL^{-1}. Aqueous extraction outperformed methanolic extraction and avoided organic solvents, supporting a cost-efficient, safer, and more sustainable methodology. Collectively, the data support the valorization of both edible and non-edible mushrooms as sources of antimicrobial and antioxidant constituents for food-system innovation, recognizing that *P. involutus* is unsuitable for ingestion and, if used, should be restricted to indirect applications (*e.g.*, active packaging or preservative extracts) subject to rigorous safety assessment and regulatory compliance.

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P42 | COUMARIN-DERIVED NATURAL COMPOUNDS AS MAO-B INHIBITORS: HIGH-THROUGHPUT VIRTUAL SCREENING USING AN OPTIMISED VINA PROTOCOL

Cláudia Novais[1,2], Celestino Santos-Buelga[2], Carla Pereira[1], Rui M. V. Abreu[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal; [2]GIP-USAL, Grupo de Investigación en Polifenoles, Facultad de Farmacia, Universidad de Salamanca. *ruiabreu@ipb.pt

Monoamine oxidase B (MAO-B) (Figure 1) is a mitochondrial enzyme strongly implicated in the pathogenesis of neurodegenerative diseases such as Alzheimer's and Parkinson's, making it a valuable therapeutic target [1]. Coumarins, a structurally diverse class of natural compounds, have previously demonstrated promising MAO-B inhibitory activity [2]. Building upon the previously validated and optimized docking protocol in AutoDock VINA, this work aimed to expand the analysis to a large-scale virtual screening of coumarin derivatives [3]. A high-throughput virtual screening of over 25,000 coumarin derivatives from the COCONUT database was performed against the crystallographic structure of MAO-B (PDB: 2V61), applying the optimized parameters identified previously (grid size 28×28×28 Å, exhaustiveness 8). Binding affinities (ΔG values) were obtained for all compounds, and their distribution was analyzed to identify the most promising scaffolds. The majority of compounds (>60%) exhibited binding affinities between –7.4 and –9.1 kcal/mol, while more than 5% displayed values below –10 kcal/mol. Within this subset, approximately 1% showed predicted pKi values above 8. These top candidates were further assessed through ADMET analysis, confirming favorable pharmacokinetic and safety profiles. Notably, the 10 most promising compounds presented binding affinities ranging from –11 to –12 kcal/mol, indicating strong potential as selective MAO-B inhibitors. These candidates will undergo subsequent molecular dynamics simulations to validate stability and interaction profiles, supporting their relevance as scaffolds for the development of therapeutic agents targeting neurodegenerative disorders.

Figure 1 – Crystal structure of MAO-B obtained from the Protein Data Bank, rendered with SAMSON software.

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P43 | ACCELERATING THE CLEAN-LABEL REVOLUTION: SCALABLE TECHNOLOGIES FOR TRANSPARENT AND RESPONSIBLE FOOD MANUFACTURING

Christopher C. F. Rafael[1*], Gabriel Mota Ribeiro[1]

[1]FMSI, Lda, Rio de Mouro, Portugal *c.rafael@fmsi.info

The ever-evolving food market is increasingly shaped by consumer demands for health, authenticity, social responsibility, and sustainability. In line with these expectations, current food trends show a strong shift toward plant-based, clean-label, and environmentally conscious ingredients. Consumers are seeking healthier, more transparent food options, driving interest in natural extracts, functional compounds, and minimally processed ingredients that deliver both nutritional benefits and a reduced environmental footprint.

FMSI functions as a bridge between frontier research and full-scale production, guiding each innovation through a staged pathway while preserving bioactive integrity and sensory performance. This end-to-end capability allows us to convert academic breakthroughs into plug-and-play ingredients that slot seamlessly into existing food lines. FMSI ensures that sustainable, clean-label technologies reach industrial scale quickly, reliably, and economically.

Using pilot-scale equipment, FMSI can apply advanced techniques such as solvent extraction of oleoresins and essential oils [1], processing up to 100 kg of plant material per day. The facility also offers microencapsulation technologies, including spray drying and freeze drying [2], to produce a process matrix that mirrors current food additives, ensuring maximum compatibility with existing manufacturing practices across the food industry. In addition to milling, solvent recovery, and packaging, FMSI supports the scale-up of lab-tested products, enabling large-scale production and industry integration.

One example of this scale-up process is FMSI's involvement in the Pacto Bioeconomia Azul project, where we are contributing to the development and scaling of microencapsulated oleoresins: a practical, forward-looking solution for manufacturers aiming to create a more transparent, resilient, and ecologically responsible food system. This innovation not only supports salt reduction in line with the EU Framework for National Salt Reduction Initiatives, but also delivers additional benefits such as enhanced nutritional value and extended shelf life, all without the need for multiple added ingredients [3].

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P44 | VALORISATION OF MELON PEEL AND SEED FLOURS IN BAKERY PRODUCTS: A SUSTAINABLE APPROACH TO FOOD WASTE REDUCTION

Mafalda Alexandra Silva[1,2], Helena Soares Costa[1,2], M. Beatriz P. P. Oliveira[2], Nelson Félix[3], Tânia Gonçalves Albuquerque[2,3*]

[1]Department of Food and Nutrition, National Institute of Health Dr. Ricardo Jorge, Av. Padre Cruz, 1649-016 Lisbon, Portugal; [2]REQUIMTE-LAQV/Faculty of Pharmacy from University of Porto, R. de Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]Estoril Higher Institute for Tourism and Hotel, Av. Condes de Barcelona, n. º 808, 2769-510 Estoril, Portugal. *tania.albuquerque@eshte.pt

Food waste is widely recognised as a major global problem with direct consequences for the economy, society and environment. The valorisation of fruit by-products offers a promising strategy to face the growing challenge of food waste, which can compromise the implementation of the concept of food sustainability. Additionally, this approach allows for the development of new food products with potential health benefits for consumers [1].

This study aimed to develop two innovative food products based on melon by-products and to evaluate their nutritional composition, total phenolic content, and antioxidant potential. In 2022, melon producers and distributors provided the samples used in this study. The peels were dehydrated and the seeds were oven-dried. Both were then ground into flour and roasted. Using these flours, two cakes were developed: one topped with peel flour (cake A) and the other topped with seed flour (cake B). A control cake was also developed. Nutritional composition was determined analytically, while energy value and available carbohydrates were calculated. Antioxidant activity and total phenolic content were determined using spectrophotometry. Consumer acceptability was also evaluated.

The cakes produced contained levels of 6.42 ± 0.2 (control cake), 7.58 ± 0.3 (cake B) and 9.20 ± 0.0 g/100 g (cake A) of total protein. Dietary fibre levels ranged from 1.19 ± 0.1 g/100 g (control cake) to 6.94 ± 0.0 g/100 g (cake B). According to Regulation (EC) No. 1924/2006 on nutrition claims, cake A can be considered a source of fibre (≥ 3 g/100 g) and cake B can be considered rich in fibre (> 6 g/100 g). The incorporation of melon by-products also enhanced both the antioxidant activity and phenolic content of the cakes. Both products presented satisfactory results in terms of consumer acceptability.

Overall, these findings highlight the potential of incorporating melon by-products into nutritionally improved and appealing foods. Simultaneously, by-products are valued, reducing their environmental impact while increasing their economic and social impacts, aligned with the principles of sustainable production and consumption.

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P45 | GREEN EXTRACTION STRATEGIES: ULTRASOUND AND ENZYMES FOR BIOCHEMICAL COMPOUND RELEASE FROM *MICROCHLOROPSIS GADITANA*

Mariana Neto[1*], Luís Loureiro[1,2], Cristina M. R. Rocha[1,2]

[1]CEB – Centre of Biological Engineering, Universidade do Minho, 4710-057, Braga, Portugal; [2]LABBELS - Associate Laboratory, Braga/Guimarães, Portugal. *pg52279@alunos.uminho.pt

Microchloropsis gaditana (formerly known as *Nannochloropsis gaditana*) is a marine microalga of high interest for its rich composition in biochemical compounds such as proteins, polyunsaturated fatty acids, antioxidants and pigments. Nowadays it is mainly used in aquaculture, but there is also interest in producing nutraceuticals and functional foods using *M. gaditana*. Besides that, it has other potential applications such as cosmetics and biofuels, presenting huge potential for the industry [1]. However, its rigid and complex cell wall significantly limits the accessibility to intracellular compounds of interest, presenting a major challenge for their extraction [2]. Therefore, this work aims to study the application of ultrasonication and enzymatic treatment on the disruption of *M. gaditana* and extraction of biochemical compounds.

For this, four different treatments were applied under optimized conditions: (1) enzymatic treatments with cellulase, pectinase and viscozyme at a concentration of 40 mg gdw-1, incubated at 55 ºC for 72 hours; (2) ultrasonication, using a 40 kHz probe in pulse cycles; (3) combination of ultrasonication with enzymes as pre-treatment (4) and combination of ultrasonication with enzymes as post-treatment. The samples were analyzed by cytometry and the extraction yield and intracellular organic matter released were assessed. Proteins, lipids, carbohydrates, pigments and antioxidant activity were also quantified.

The results suggested that 5 minutes of ultrasonication with pulse cycles of 4 s on and 2 s off provided the higher value of extraction yield without degradation of biochemical compounds. Cellulase was the most effective enzyme in most of the tests performed, in (2), (3) and (4), providing an extraction yield 2-10% higher than the other enzymes. Regarding all the treatments applied, the best results were obtained when enzymes were applied as a post-treatment to ultrasonication, suggesting a possible synergistic effect between these treatments. The combination of ultrasonication for 5 minutes, followed by the incubation with cellulase at 55 ºC for 72 hours resulted in the highest extraction yield of 31,3 ± 0,4 %. Although the treatments allowed the extraction of some intracellular compounds, cytometry analysis indicated partial permeabilization of the cells rather than complete cell lysis, since all the treatments led to a decrease in cell integrity, but values remained above 50 %.

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P46 | SMART FOOD PACKAGING USING ELECTROHYDRODYNAMIC JET PRINTED BIOINKS

Joana Lopes[1,2*], Gabriel Moreira[1], Artur Martins[1], Pedro Miguel Silva[1], Rui M. R. Pinto[1], Michele Michelin[2], Patrícia Sousa[1], Lorenzo M. Pastrana[1], Miguel A. Cerqueira[1]

[1]International Iberian Nanotechnology Laboratory (INL), Av. Mestre José Veiga, 4715-330 Braga, Portugal; [2]Centre of Biological Engineering (CEB), University of Minho, 4710-057 Braga, Portugal. *joana.alveslopes@outlook.com

In the food technology field, the main consumers' concerns lie in the food safety, label transparency and the environmental impact of the product. While smart packaging innovations enhance monitoring and preservation, gaps remain in sustainable technologies for sensor development. Electrohydrodynamic (EHD) jet printing is a new micro-additive manufacturing technology capable of achieving high resolutions with high viscosity inks, and that uses electric fields to precisely deposit material through a nozzle [1]. Seeing as it is a recent technology, bio-based inks have yet to be designed and optimized. Hydroxypropyl methylcellulose (HPMC) stands out as a biodegradable biopolymer with excellent compatibility, paving the way for sustainable smart packaging sensors.

In this work, solutions with different concentrations of HPMC (1%, 2% and 3%) in ethanol (from 0% to 90%) were evaluated and characterized in terms of viscosity, surface tension and conductivity, and used in printability tests using a home-made EHD jet printer. Certain parameters of the EHD jet printer were fixed, such as flow rate (28.28 µl h-1, corresponding to a shear rate of 10 s-1 in the nozzle type), working distance (1 mm), substrate (glass with 100 nm layer of tungsten-titanium) and the nozzle diameter and material (200 µm, stainless steel). The speed was varied between 1 mm s-1 and 15 mm s- 1 and the voltage was manipulated between 1.5 kV and 2.5 kV until Taylor's Cone formation.

Then, a printability ternary graph (water-ethanol-HPMC) was obtained, selecting HPMC- based bioinks that achieved higher resolutions (dots and lines as small as 50 µm, determined by microscopy), showed less clogging and reproducible results. The printable zone was obtained from concentrations between 1 and 2% HPMC in 10%-50% ethanol. On this range, the bioinks present viscosities of 13 mPas to 100 mPas, surface tension of 29 mNm to 42 mNm and conductivities of 16 µS cm-1 to 69 µS cm-1. Further work is being developed to evaluate the effect of printing parameters on the line width of the defined best HPMC-based bioinks.

Overall, the results show the potential of using HPMC to develop bioinks compatible with EHD jet printing, foreseeing their use on food applications.

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P47 | SIZE-CONTROLLED LIGNIN NANOPARTICLES FROM EUCALYPTUS BARK FOR SUSTAINABLE FOOD APPLICATIONS

Mariana Fernandes[1,2*], Michele Michelin[2], Raquel Vaz[1], Lorenzo M. Pastrana[1], Miguel A. Cerqueira[1]

[1]International Iberian Nanotechnology Laboratory (INL), Av. Mestre José Veiga, 4715-330 Braga, Portugal; [2]Centre of Biological Engineering (CEB), University of Minho, 4710-057 Braga, Portugal. *mariana.fern02@outlook.pt

Lignin nanoparticles (LNPs) are sustainable nanomaterials obtained from agro-industrial residues, with increasing potential in food technology. Their biocompatibility and functional properties positions LNPs as promising alternatives to photonic applications and synthetic additives in food packaging, ranging from natural coloration to edible QR codes and anticounterfeiting labels [1,2]. The challenge with LNPs is the lack of uniformity in their production, as broad particle size distributions can limit their effectiveness in advanced applications once these factors directly influence their optical and functional performance. This study presents the extraction of lignin and the synthesis of size-controlled LNPs from eucalyptus bark, using an ethanol-organosolv process followed by antisolvent precipitation. By valuing a low-cost waste material, this work also contributes to circular economy and sustainability goals, positioning LNPs as viable biobased nanomaterials for high-value applications.

Lignin was extracted under non-isothermal conditions at 230 °C using 65% ethanol, resulting in an extraction yield of 49% and purity of 96.07%. The dried lignin was dissolved in ethanol to prepare a precursor solution, which was then added dropwise into deionized water at controlled dilution rates to form nanoparticles, without the use of surfactants or chemical additives. Size control was achieved by adjusting the water-to-solvent ratio during precipitation. Higher water content increased supersaturation, promoting rapid nucleation and the formation of smaller nanoparticles, while lower water content reduced nucleation rates, allowing more particle growth and larger sizes. Dynamic Light Scattering revealed tunable nanoparticle sizes ranging from 148.0 ± 3.2 nm to 274.9 ± 8.1 nm, with polydispersity index values below 0.2, indicating narrow size distributions. Zeta potential measurements confirmed the colloidal stability of the aqueous dispersions. Scanning electron microscopy images show the round shape and confirm the sizes of the produced LNPs.

This environmentally friendly method enables the reproducible production of uniform and stable LNPs using only ethanol and water. Their tunable properties highlight their potential as safe and sustainable materials for innovative food applications, including natural structural coloration, encapsulation for sustained release of bioactive compounds and the production of Pickering emulsions.

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P48 | CONSUMER ACCEPTANCE OF SPIRULINA-ENRICHED FOCACCIA BREAD: TECHNOLOGICAL, NUTRITIONAL, AND BIOACTIVE PROPERTIES

Nancy Mahmoud[1*], Bastien Volatier[1], Anabela Raymundo[1], Maria Cristiana Nunes[1]

[1]LEAF - Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal. *nancerefaey@gmail.com.

Microalgae are recognized as valuable sources of protein, essential micronutrients, and bioactive compounds. However, their use in food products is still limited due to sensory constraints, particularly aroma and flavor, which affect consumer acceptance [1,2]. This study investigated the incorporation of Limnospira platensis (Spirulina) into focaccia bread at levels of 2% and 4% (w/w, flour basis), evaluating its impact on technological performance, consumer acceptance, and purchase intention. Additionally, the nutritional value, protein digestibility, and bioactivity potential were assessed.

Texture profile analysis revealed incorporation-dependent effects. The focaccia with 4% Spirulina exhibited higher firmness (6.18 N) and chewiness (4.94 N) compared to both the control (4.76 N and 4.23 N, respectively) and the 2% formulation (4.61 N and 3.74 N). In contrast, elasticity and cohesiveness were slightly reduced at the higher incorporation level. Crumb structure analysis, performed on binary images of focaccia samples (n = 200 alveolar cells per sample), revealed that the 4% Spirulina bread developed larger and more heterogeneous alveoli.

The addition of Spirulina enhanced the nutritional composition of the focaccia. Protein content increased from 10.21% in the control to 10.86% in the 2% formulation and 11.69% in the 4% formulation, with an improvement in protein digestibility. The mineral profile also exhibited marked enhancement, with calcium content rising by 142% (2%) and 286% (4%). Additionally, both Spirulina-enriched breads exceeded the threshold for the "source of iron" nutrition claim, as defined by Regulation (EC) No. 1924/2006. Total phenolic content and antioxidant activity were also improved, with the most pronounced effects observed at the 4% level.

Focaccia enriched with 2% Spirulina achieved the highest ratings for taste, texture, and overall acceptability, as well as a stronger purchase intent compared to the 4% formulation. Although the bread with 4% Spirulina presented a superior nutritional profile, it was less well accepted sensorially. These results highlight the threshold of Spirulina incorporation that remains acceptable to consumers. Nonetheless, the use of advanced gastronomic strategies may help optimize the formulation and improve consumer acceptance.

Table 1 – Texture parameters for focaccia breads (TPA, probe p/25, 10 mm diameter, 40% compressed, test speed of 1 mm/s).

Sample	Firmness (N)	Cohesiveness	Elasticity	Chewiness (N)
Control	4.76±0.70 [b]	0.82±0.01 [a]	1.10±0.12 [a]	4.23±0.58 [b]
2% Spirulina	4.61±0.85 [b]	0.82±0.01 [a]	1.01±0.05 [b]	3.74±0.72 [c]
4% Spirulina	6.18±1.03 [a]	0.79±0.02 [b]	0.97±0.01 [b]	4.94±0.70[a]

Different letters in the same parameter show a statistically significant difference (p < 0.05, Tukey test).

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P49 | INVESTIGATING THE SIMILARITY OF CYCLIC VOLTAMMOGRAMS IN WINE-DERIVED PHENOLIC COMPOUNDS WITH ANTIOXIDANT ACTIVITY

Miguel Sousa-Dias[1,2*], Nuno A. S. Dias[1,2], Letícia Estevinho[1,2], Luís G. Dias[1,2]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Portugal; [2]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Portugal. *miglsdias@gmail.com

Wine phenolics and selected organic acids (catechin, *trans*-ferulic acid, epicatechin, caffeic acid, *p*-coumaric acid, syringic acid, ascorbic acid, tannic acid, gallic acid, vanillic acid, rutin, and quercetin) determine color, astringency, and antioxidant activity, which can be quantified by cyclic voltammetry (CV) as an integrated readout of redox processes relevant to wine stability [1].
Chemical descriptors of these compounds [2,3] support the following groupings:

- strong antioxidants/low oxidation potentials: ascorbic ≈ tannic ≈ gallic ≈ caffeic ≈ quercetin ≳ catechin/epicatechin (rutin slightly less reactive).
- Moderate-weak antioxidants/higher potentials: *p*-coumaric, *trans*-ferulic, vanillic, syringic.
- Polarity (higher to lower): rutin ≈ tannic > ascorbic ≈ gallic > caffeic ≈ catechin/epicatechin ≈ quercetin > ferulic ≈ *p*-coumaric > vanillic ≈ syringic.
- Metal-chelating capacity (catechol/pyrogallol): tannic, gallic, caffeic, catechin/epicatechin, quercetin/rutin » vanillic, syringic, p-coumaric, ferulic (weak).

This study establishes a procedure to assess similarity among voltammograms in agreement with these expected groupings for application to wine studies. Cyclic voltammograms were recorded for 12 compounds (three replicates) over −2 to +2 V using a portable potentiostat (PalmSens EmStat MUX8) and a three-electrode cell: platinum working electrode, Ag/AgCl reference, and platinum counter electrode. Signals were preprocessed with Savitzky–Golay in two treatments: sm (smoothing) and dv1 (first derivative). For each compound, replicate voltammograms were averaged and similarity was compared between sm and dv1 by making three dendrograms per treatment: r_peak (peak-shape correlation), S_MD (Mahalanobis-distance similarity), and Score (composite/weighted index). All were derived from distance matrices built with identical normalization, metric, and linkage.
The "chemical" groupings were best reproduced by dv1, particularly the r_peak (dv1) dendrogram, which most closely matched expectations. In conclusion, the first derivative (dv1) enhances peak position and shape (redox features) and removes baseline/drift, preserving differences associated with hydroxylation patterns and antioxidant strength, whereas smoothing (sm) flattens amplitudes and slightly shifts extrema, bringing unlike classes closer and degrading chemical similarity.

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P50 | GREEN EXTRACTION OF HIGH-VALUE COMPOUNDS FROM FRUIT WASTE: A MICROWAVE-ASSISTED APPROACH

Tatiane C. G. de Oliveira[1,2], Franklin Chamorro[3], María Carpena[3], Miguel A. Prieto[3], M. Beatriz P. P. Oliveira[2], Lillian Barros[1], Eliana Pereira[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira, 228, 4050-313 Porto, Portugal; [3]Universidade de Vigo, Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain. *eliana@ipb.pt

The efficient recovery of extracts rich in phenolic compounds from fruit by-products is connected to the extraction procedure, as variations in parameters and methods can impact the quality and quantity of these compounds [1]. Green extraction techniques, such as microwave-assisted extraction (MAE), are receiving growing attention over conventional methods, as they combine high efficiency with reduced environmental impact [2]. They represent an excellent alternative for extracting phenolic compounds, while simultaneously minimizing extraction time, solvent use, and energy consumption [3]. In this context, considering the importance of valorizing fruit by-products, this study aimed to optimize MAE to maximize the recovery of phenolic compounds from three different fruit by-products: annona (*Annona cherimola* Mill.), plum (*Prunus domestica* L.), and star fruit (*Averrhoa carambola* L.). The optimization of MAE was conducted by the response surface methodology approach (RSM), with three relevant variables: time (t, 1–25 min), temperature (T, 50–200 °C), and ethanol percentage (S, 0–100%) in a five-level circumscribed central composite design (CCCD), resulting in 28 independent experiments. The responses assessed were yield, antioxidant activity by DPPH assay, and the total phenolic compounds content through HPLC-ESI-QqQ-MS/MS. The global optimal conditions for MAE were reached at 5 min, 50 °C, and 100% ethanol for all fruit by-products, highlighting the ability of this technique to achieve efficient extraction in a short time. Under these conditions, plum by-products achieved the highest performance, with 70.83% yield, strong antioxidant activity (EC_{50} = 0.25 mg dw/mL), and the greatest total phenolic content (134.24 mg/g extract). Star fruit by-products also showed strong antioxidant activity (EC_{50} = 0.40 mg dw/mL) but showed moderate extraction efficiency (41.20% yield) and phenolic content (46.15 mg/g extract). Annona by-products presented 43.13% of yield, EC_{50} = 1.60 mg dw/mL, and 24.55 mg phenolic compounds/g extract, showing that it was the by-product with the least efficiency. In conclusion, MAE was an effective method for quickly obtaining phenolic compounds, while enabling the differentiation of the bioactive profiles of distinct fruit by-products. Due to their high phenolic content, bioactivity, and greater availability in the agro-industrial sector, plum by-products are highlighted as the most valuable raw material, while star fruit may represent an interesting source of antioxidant compounds with a different phytochemical profile.

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P51 | OPTIMIZATION OF PRESSURIZED LIQUID EXTRACTION OF PHENOLIC COMPOUNDS FROM FRUIT BY-PRODUCTS USING RSM

Tatiane C. G. de Oliveira[1,2], Franklin Chamorro[3], María Carpena[3], Miguel A. Prieto[3], M. Beatriz P. P. Oliveira[2], Eliana Pereira[1*], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira, 228, 4050-313 Porto, Portugal; [3]Universidade de Vigo, Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain. *eliana@ipb.pt

Considering the annual generation of agro-food by-products and the European sustainability targets covering the entire food system, from production to consumption and waste management, it is essential to develop strategic measures to reduce waste and promote its reintegration into the value chain. The use of fruit and vegetable by-products for recovering bioactive compounds has gained increasing attention, as these matrices are rich in molecules with potential applications in the food and pharmaceutical industries due to their bioactivities [1]. In this context, this study aimed to valorize three fruit by-products: annona (*Annona cherimola* Mill.), plum (*Prunus domestica* L.), and star fruit (*Averrhoa carambola* L.), by comparing their efficiency as raw materials for producing extracts rich in phenolic compounds. Pressurized liquid extraction (PLE) was optimized using response surface methodology (RSM), considering extraction time (t, 1–25 min), temperature (T, 50–200 °C), and ethanol proportion in the solvent (S, 0–100%) as independent variables. Optimization was based on three dependent variables: extraction yield, antioxidant activity (DPPH assay), and total phenolic compounds (HPLC-ESI-QqQ-MS/MS). The results revealed significant differences among the tested by-products. Plum extracts presented an efficient profile, achieving high yield (421.9 mg/g dw) in less time (1.24 min) at 50 °C and 87% ethanol as solvent, with the highest phenolic content (136.83 mg/g extract) and strong antioxidant capacity (EC_{50} = 1.6 mg dw/mL). Star fruit by-products showed the highest extraction yield (536.1 mg/g dw) and excellent antioxidant activity (EC_{50} = 0.72 mg dw/mL); however, their low phenolic content (33.81 mg/g extract) limits their functional potential compared to plum. Annona presented the lowest performance, with reduced yield, low phenolic levels (26.41 mg/g extract), and weaker antioxidant capacity (EC_{50} = 3.91 mg dw/mL).

For both star fruit and annona, the overall optimal conditions required 25 minutes of extraction, increasing the energy cost of the process compared to the rapid optimization achieved for plums. Overall, plum and star fruit emerge as promising sources of phenolic compounds, each with its own distinct advantages. However, plum by-products stand out as the most attractive option, not only due to their higher phenolic content, obtained under milder extraction conditions, but also because their larger production volumes ensure greater availability of by-products for valorization in the food and pharmaceutical industries.

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P52 | ORAL FILMS CONTAINING HYDROETHANOLIC EXTRACT OF JATOBA PULP AS A CARRIER OF PHENOLIC COMPOUNDS

Lívia Cirino de Carvalho[1], Tais Da Silva Santos[2], Renata Viana Labourdette Costa[2], Pricila Veiga dos Santos[2], Rosemary Aparecida de Carvalho[3], Vitor Augusto dos Santos Garcia[2*]

[1]Department of Food Technology, IFPR, Paraná, Brazil; [2]Department of Plant Production, São Paulo State University, São Paulo, Brazil; [3]Faculty of Animal Science and Food Engineering, São Paulo, Brazil. *vitor.as.garcia@unesp.br

Natural polymer-based oral films have gained attention as innovative carriers for bioactive compounds. The incorporation of plant-derived extracts, such as jatobá (*Hymenaea courbaril*), provides an additional source of phenolic compounds with recognized antioxidant and antimicrobial properties. In this work, oral films were developed using the hydroethanolic extract of jatobá pulp (HEJP) as a functional ingredient. The films were prepared by the tape-casting method with agar-agar (2 g/100 g film-forming solution) as the polymer matrix and glycerol (0.4 g/100 g film-forming solution) as the plasticizer. Casting was performed at a spreading speed of 20 mm/s and a thickness of 3000 µm, resulting in two formulations: a control film without HEJP (F1) and a film containing 50 g HEJP/100 g of film-forming solution (F2). Drying was carried out at 50 °C for 8 h. Both formulations showed uniform appearance and easy handling, evidencing compatibility between agar-agar and HEJP. No significant differences ($p > 0.05$) were observed in thickness (~0.06 mm) or surface pH (~6.7), the latter being close to the physiological value of the oral cavity, which minimizes the risk of irritation. In contrast, disintegration time was significantly affected, decreasing from ~300 s (F1) to ~56 s (F2), likely due to increased solubility interactions between phenolic compounds and the buffer medium (pH 6.8). The total phenolic content of F2 reached 286.31 ± 13.36 mg GAE/g film, confirming the effective incorporation of HEJP. These findings demonstrate that agar-agar films enriched with HEJP are efficient carriers of phenolic compounds, while maintaining favorable physicochemical properties and enabling fast release in oral conditions. Therefore, this approach represents a promising strategy for the design of functional delivery systems with potential applications in pharmaceutical and nutraceutical fields.

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P53 | VALORIZATION OF CHLORELLA BIOMASS IN PLANT – BASED FOODS: DEVELOPMENT AND CONSUMER ACCEPTANCE

Paula Martínez[1,3], Mafalda Trovão[1], Helena Cardoso[1], Camilly Fratelli[1,2], Ana Gómez[3], Ana Barros[1*]

[1]Allmicroalgae – Natural Products S.A., 2445-413 Pataias, Portugal; [2]LEAF – Linking Landscape, Environment, Agriculture and Food Research Center – Food and Feed Group – Instituto Superior de Agronomia, University of Lisbon, Tapada da Ajuda, 1349-017 Lisbon, Portugal; [3]Escola Superior de Biotecnologia, Universidade Católica Portuguesa, R. de Diogo Botelho 1327, 4169-005 Porto, Portugal. *ana.barros@allmicroalgae.com

The nutritional value of microalgae biomass has been recognized for decades. Thus, *Chlorella* sp. is one of the most known microalgae species for human consumption. However, its limited incorporation into mass market products restricts consumer exposure and, consequently, dietary adoption [1]. This work aims to develop a plant-based food product containing Chlorella biomass and to evaluate its acceptance among general consumers. An oat-based beverage was formulated with 3% incorporation of White Chlorella biomass from Allmicroalgae®, obtained through heterotrophic production. Its nutritional, technological, and sensory performance were assessed. The nutritional profile was estimated theoretically, based on ingredient labels and company-provided data on Chlorella biomass, considering macronutrients (protein, carbohydrates, fiber, and fat) and micronutrients (vitamins B6 and B12, and iron) [1]. Product acceptance was evaluated in two stages: preliminary internal trials (8–10 assessors) for prototype selection and a hedonic sensory analysis (n=30), both using a nine-point hedonic scale to evaluate color, aroma, taste, texture, and overall acceptance. Additionally, plant-based beverages available on the market were analyzed, and an exploratory survey (n=50) was conducted to assess consumer habits regarding these beverages and knowledge about microalgae in food. The incorporation of Chlorella biomass improved the nutritional profile of the formulation, particularly due to the contribution of vitamin B12, a micronutrient generally absent in plant-derived foods but present in relevant amounts in Chlorella. The rheological experiments confirmed a pseudoplastic behavior characteristic of the developed plant-based beverage. Sensory analysis showed greater preference for the commercial beverage and the oat-based formulation without Chlorella. Still, after being informed about the nutritional benefits of the microalga, several participants indicated that they would be willing to consume it, prioritizing such benefits over taste as the main factor. It was also observed that some evaluators were not used to consume plant-based beverages, highlighting the need for future tests with a more appropriate target audience, such as vegan or vegetarian consumers or those seeking functional products. Furthermore, the literature emphasizes that while microalgae have high nutritional and functional potential, their incorporation into formulated foods still presents challenges regarding sensory acceptance and technological performance [2]. Overall, the results demonstrated that the incorporation of White Chlorella into a food matrix is feasible, clearly improves the nutritional value, especially through its contribution of vitamin B12, and maintains adequate technological properties, reinforcing its potential both in innovative food products and in the development of functional foods.

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P54 | VALORIZATION OF WILD PLANTS: MIRTO AND PORTUGUESE WHITE CROWBERRY

Lara Silva[1], Cátia Santos[1], Aida Moreira da Silva[1,2,3], Maria João Barroca[1,2,3*]

[1]IPC | Polytechnic University of Coimbra – ESAC | Agriculture School of Coimbra, Bencanta, 3045-601 Coimbra, Portugal; [2]UC | University of Coimbra – Molecular Physical-Chemistry - LAQV-REQUIMTE R&D Unit, Departamento de Química, Rua Larga, 3004-535 Coimbra, Portugal; [3]UL | University of Lisbon – Linking Landscape, Environment, Agriculture and Food-LEAF R&D Unit, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal. *mjbarroca@esac.pt

Wild coastal plants and berries represent promising resources for sustainable gastronomy and functional food innovation [1-4]. This study explores the nutritional and bioactive potential of two underutilized species: *Corema album* (Portuguese crowberry) and *Myrtus communis* (mirto).
Corema album, an endemic shrub of the Iberian Atlantic coast, produces seeds with a high fiber content, essential minerals and remarkable antioxidant activity. Phytochemical analyses revealed significant levels of phenolics, flavonoids, and anthocyanins, with hydroethanolic seed extracts showing strong radical scavenging activity. These results highlight its potential as a functional ingredient and a valuable natural source for mitigating oxidative stress.
Myrtus communis, a traditional Mediterranean shrub, also demonstrated a rich nutritional and phytochemical profile. Its berries are predominantly composed of carbohydrates (~80%), complemented by dietary fibers, proteins, and lipids. Hydroethanolic extracts have high total phenolic content and strong antioxidant activity. Such bioactive properties align with its traditional medicinal uses and suggest applicability as a natural antioxidant source in food systems.
Together, these findings underscore the potential of *C. album* and *M. communis* as nutrient-rich, bioactive-dense species with both gastronomic and health-promoting value. Their integration into modern cuisine offers opportunities to diversify diets, valorise regional biodiversity, and foster the development of more sustainable food systems.

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P55 | MARITIME PLANTS IN GASTRONOMY: BRIDGING COASTAL BIODIVERSITY WITH CULINARY CREATIVITY

Aida Moreira da Silva[1,2,3*], Maria João Barroca[1,2,3]

[1]IPC | Polytechnic University of Coimbra – ESAC | Agriculture School of Coimbra, Bencanta, 3045-601 Coimbra, Portugal; [2]UC | University of Coimbra – Molecular Physical-Chemistry - LAQV-REQUIMTE R&D Unit, Departamento de Química, Rua Larga, 3004-535 Coimbra, Portugal; [3]UL | University of Lisbon – Linking Landscape, Environment, Agriculture and Food-LEAF R&D Unit, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal. *aidams@esac.pt

Coastlines offer unique opportunities for sustainable innovation in gastronomy. Among these, maritime plants - such as halophytes, and Portuguese crowberry - are increasingly recognized for their nutritional and culinary value.

Traditionally used in coastal communities, these species are now capturing the attention of chefs and food innovators worldwide for their distinctive flavors, textures, and health-promoting compounds [1-3].

This work explores the "sea of opportunities" that maritime plants bring to gastronomy highlighting their potential as nutrient-dense ingredients rich in proteins, minerals, and bioactive compounds as well as their role in developing novel taste experiences (Figure 1) and sustainable food systems.

By bridging scientific insights with culinary creativity, maritime plants can contribute to healthier diets, diversify local economies, and promote coastal-conscious gastronomy. The integration of maritime plants into modern cuisine represents not only a gastronomic innovation, but also a pathway toward sustainability and resilience in the global food landscape.

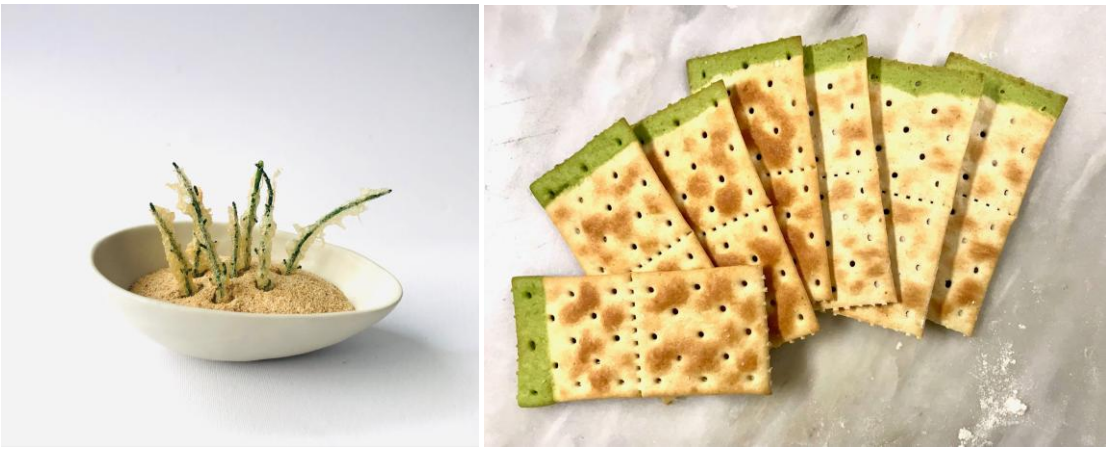

Figure 1 – Sarcocornia "peixinhos da horta" and crakers.

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P56 | FROM BARREL TO BENCH: MULTIDISCIPLINARY INSIGHTS INTO WINE SPIRIT AGEING VIA LC-HRMS AND THEORETICAL CALCULATIONS

Tiago A. Fernandes[1,2], Sheila C. Oliveira-Alves[3,4], Dmytro S. Nesterov[5], Ilda Caldeira[3,6], Alexandra M. M. Antunes[5], Ofélia Anjos[7,8], Sofia Catarino[9,10], Sara Canas[3,6]

[1]DCeT, Departamento de Ciências e Tecnologia, Univ. Aberta, Rua da Escola Politécnica, 141–147, 1269-001 Lisboa, Portugal; [2]MINDlab: Molecular Design & Innovation Laboratory, Centro de Química Estrutural, Institute of Molecular Sciences, Departamento de Engenharia Química, Instituto Superior Técnico, ULisboa, Av. Rovisco Pais, 1049-001, Lisbon, Portugal; [3]INIAV, Instituto Nacional de Investigação Agrária e Veterinária, Quinta de Almoinha, 2565-191 Dois Portos, Portugal; [4]CEF, Instituto Superior de Agronomia, ULisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [5]CQE, Centro de Química Estrutural, Institute of Molecular Sciences, Departamento de Engenharia Química, Instituto Superior Técnico, ULisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal; [6]MED, Instituto de Investigação e Formação Avançada, UÉvora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; [7]CERNAS-IPCB, Research Centre for Natural Resources, Environment and Society, Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal; [8]CBPBI, Spectroscopy and Chromatography Laboratory, Centre of Plant Biotechnology of Beira Interior, Castelo Branco, Portugal; [9]LEAF, Instituto Superior de Agronomia, ULisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [10]CEFEMA, Instituto Superior Técnico, ULisboa, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal. *tiago.fernandes@uab.pt

Traditional ageing of wine spirits (WS) in wooden barrels imparts key chemical and sensory attributes, but alternative ageing systems, such as stainless-steel tanks with wood fragments and the use of micro-oxygenation to mimic or accelerate the aging process, have been investigated [1,2]. However, much remains to be understood at the molecular level during the aging process of wine spirits. Using advanced analytical techniques (LC-ESI-HRMS/MS and GC–MS), we were able to monitored target compounds and identify gallotannins and ellagitannins in WS aged with chestnut staves under three micro-oxygenation regimes, nitrogen, and wooden barrels [3,4]. Samples collected at 8, 21, 60, 180, 270, and 365 days of ageing allowed comparing their relative abundances according to the ageing technology. For the first time, oxygen's pivotal role in gallotannin and ellagitannin formation/degradation pathways was demonstrated, helping to explain the progressive rise of gallic and ellagic acids during ageing. Additionally, the roles of copper and iron in oxidative transformations of phenolic aldehydes were inquired using coniferaldehyde as a model compound. Combined experimental and theoretical approaches indicated that copper-catalysed hydroxyl radical formation drives coniferaldehyde derivative generation and degradation. These findings improve understanding of the chemical mechanisms underlying WS ageing, supporting the prediction of differences between traditional and alternative ageing systems, for promoting the quality, food safety and sustainability of WS production process.

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P57 | AGEING TECHNOLOGIES: CHANGES IN THE PHENOLIC CONTENT OF AGED WINE SPIRITS DURING THE STORAGE IN BOTTLE

Sheila C. Oliveira-Alves[1,2], Sílvia Lourenço[1], Tiago A. Fernandes[3,4], Sofia Catarino[5,6], Sara Canas[1,7]

[1]INIAV, Instituto Nacional de Investigação Agrária e Veterinária, Quinta de Almoinha, 2565-191 Dois Portos, Portugal; [2]CEF, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]DCeT, Universidade Aberta, Rua da Escola Politécnica, 141–147, 1269-001 Lisboa, Portugal; [4]MINDlab, Centro de Química Estrutural, Institute of Molecular Sciences, Departamento de Engenharia Química, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001, Lisboa, Portugal; [5]LEAF, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [6]CEFEMA, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal; [7]MED, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal. *sheila.alves@iniav.pt

Alternative ageing technology (AAT) seeks to provide sustainable alternatives for the spirits beverage industry, particularly in situations of wood scarcity. This study assessed the effect of the storage in bottle over four years on the evolution of total phenolic content (TPI) of the wine spirits (WS) aged with Limousin oak (*Quercus robur* L.) wood, using three modalities in stainless steel tanks with wood fragments and micro-oxygenation (MOX levels: O15, O30 and O60) of AAT; and traditional ageing technology using wooden barrels (TAT). This research was conducted as part of the Oxyrebrand Project (https://projects.iniav.pt/oxyrebrand) [1]. Figure 1 depicts the average values of TPI of the aged WS from AAT (O15, O30, O60) and TAT (barrels, B) during storage time (0, 6, 12, 48 months) in bottle. In fact, the full stave contact combined with MOX flows (O30 and O60 modalities) increased extraction, affecting the balance between of additive and subtractive phenomena, resulting in higher phenolic content in WS compared to TAT (Figure 1-A). The findings revealed that after four years of storage (Figure 1-B), all modalities performed similarly, preserving the phenolic content of aged WS and contributing to its quality. Considering the highest TPI content of O60 wine spirit during four years, this modality might be a promising alternative for ageing process of WS.

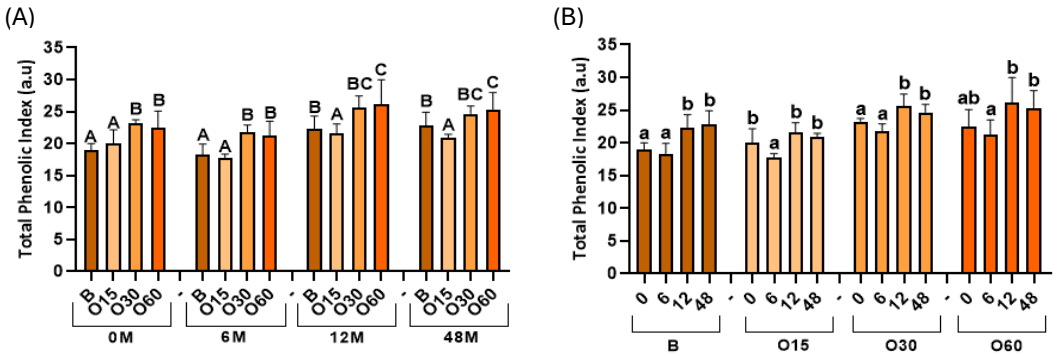

Figure 1 – Total Phenolic Index (TPI) of aged wine spirits using Limousin oak over storage time in bottle (0 month (0M), 6 months (6M), 12 months (12M), and 48 months (48M)) according to ageing technologies (Traditional: B modality; Alternative: O15, O30 and O60 modalities). Results are expressed as mean values ± standard deviation (n= 4). TPI: (A) the different uppercase letters (A, B, C) in the bars indicate significant differences between ageing modalities in each storage time by Tukey's test (p < 0.05); (B) the different lowercase letters (a, b) in the bars indicate significant differences between storage time for each ageing modality by Tukey's test (p < 0.05).

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P58 | SUSTAINABLE CULTIVATION OF *TRAMETES VERSICOLOR*: NUTRITIONAL, CHEMICAL, AND BIOACTIVE DIFFERENCES BETWEEN *EX-SITU* SYSTEMS AND WILD GROWTH

Ana Saldanha[1,2], Mikel Añibarro-Ortega[1], Helena Laronha[2], Gonçalo S.A. Martins[3], Higor Rosse[4], Estefânia Gonçalves[4], Khadija Sabiri[4], Lillian Barros[1], Manuel A. Coimbra[2], Bruno Melgar[1], Carla Pereira[1], Maria Inês Dias[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]LAQVREQUIMTE, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal; [3]Ostras do Campo, Baçal estrada de Rabal, 5300-432 Bragança, Portugal; [4]MORE – Laboratório Colaborativo Montanhas de Investigação, Edificio do Brigantia Ecopark, Avª Cidade de León 506, 5300-358 Bragança. *maria.ines@ipb.pt

Sustainable cultivation of *Trametes versicolor*, a medicinal mushroom of ecological and biotechnological relevance, offers a promising alternative to the intensive exploitation of wild populations and a strategic pathway for the valorization of lignocellulosic forest residues. This study compared *ex situ* cultivation on chestnut logs (*Castanea sativa*) with natural growth in Montesinho Natural Park (Portugal), assessing productive performance, nutritional composition, chemical and bioactive profiles, and antioxidant and antimicrobial activities of the fruiting bodies. The *ex-situ* system, monitored by IoT sensors, integrated into a blockchain platform, achieved fruiting in 68% of inoculated logs after an average of 327 days, with low mean yield (1.39%) and biological efficiency (2.79%). Despite reduced productivity, cultivated mushrooms displayed a more homogeneous metabolic profile, with significantly higher levels of protein, fat, ash, and fiber, and lower carbohydrate content compared with wild specimens. They also contained more organic acids (malic and ascorbic) and free sugars (fructose, mannitol), fewer polyunsaturated but more monounsaturated fatty acids. These traits correlated with higher antioxidant activity (DPPH, OxHLIA), indicating functional consistency and potential for supplements and functional foods. Wild mushrooms exhibited a more diverse chemical profile, with greater amounts of simple sugars, organic acids (oxalic, malic, fumaric), polyunsaturated fatty acids (linolenic, conjugated linoleic), δ-tocopherol, and a broader range of phenolics (chlorogenic, ferulic acids) and the flavonoid baicalin. This biochemical diversity translated into stronger lipid peroxidation protection (TBARS) and broader antimicrobial effects, particularly against filamentous fungi (*Aspergillus Penicillium, Trichoderma viride*). Multivariate analyses (PCA, Random Forest) confirmed clear differences between cultivation systems, with 84.7% of the variance explained by environmental conditions, and highlighted key metabolites (α-tocopherol, gallic acid, quinic acid, specific fatty acids) as potential origin markers. Controlled cultivation thus favored standardized profiles linked to structural stability and targeted antioxidant functions, whereas wild specimens retained metabolic plasticity and bioactive diversity relevant for conservation, natural antimicrobials, and adaptogenic applications. *Ex-situ T. versicolor* production offers an environmentally responsible strategy that supports circular bioeconomy, sustainable forest management, and complements wild populations in supplying high-value natural ingredients.

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P59 | BREWER'S SPENT YEAST ENCAPSULATION OF SEAWEED EXTRACTS: UNLOCKING NEW FUNCTIONALITIES FOR YOGURT

Elsa F. Vieira[1*], Rúben Dominguez[1,2], Beatriz Rodrigues[2], Cristina Delerue-Matos[1]

[1]REQUIMTE/LAQV, School of Engineering (ISEP/IPP), Polytechnic of Porto, Portugal; [2]School of Health, Polytechnic of Porto (ESS/IPP), Porto, Portugal. *EMFVA@isep.ipp.pt; elsavieiraf@gmail.com

Brewer's spent yeast (BSY) has been extensively investigated as a bio-carrier due to its affordability, availability, and alignment with circular economy principles [1]. Seaweeds, on the other hand, are rich sources of bioactive compounds with recognized pharmaceutical and biomedical applications. This study explores the encapsulation of extracts from two iodine- and antioxidant-rich brown seaweed species into BSY and assesses their functionality through incorporation into yogurt.

Subcritical water extraction (SWE) was applied to *Laminaria digitata* (LD) and *Fucus vesiculosus* (FV) following the procedures of [2]. The resulting extracts were adsorbed onto alkaline-modified BSY (A.BSY) and unmodified BSY, followed by freeze-drying. Experimental conditions varied with respect to sorbent dosage, pH, kinetics, and initial concentration. Sorption behaviour was analysed using isotherm models (Langmuir, Freundlich, and Sips). The enriched BSY capsules were characterized by UV spectrophotometry, octanol–water partition coefficient, differential scanning calorimetry, and Fourier-transform infrared spectroscopy. As a proof of concept, yogurts were fortified with 0.1% enriched BSY capsules, and their physicochemical properties, proximate composition (pH, acidity, syneresis, moisture, peroxide value, proteins, lipids, sugars, ash, and minerals), and antioxidant potential were evaluated.

Results indicated that sorption was more effective with A.BSY. The Sips model provided the best fit, suggesting that both chemical and physical interactions underlie the adsorption of iodine and antioxidant compounds from LD and FV extracts. Experimental and theoretical iodine sorption capacities were comparable (LD: Exp = 16.11 ± 0.71 mg/g; qm = 16.81 ± 2.01 mg/g; FV: Exp = 17.23 ± 2.77 mg/g; qm = 18.81 ± 1.12 mg/g). Similar trends were observed for antioxidant potential, as determined by total phenolic content (TPC) and $ABTS^{\bullet+}$ radical scavenging activity (RSA). Stability tests showed that after 30 days, iodine, TPC, and ABTS-RSA levels in enriched A.BSY capsules decreased by 36.86 ± 4.12%, 45.32 ± 2.07%, and 25.33 ± 0.24%, respectively. Fortified yogurts displayed pseudoplastic flow and weak gel characteristics, with consumer acceptance indexes between 74.1% and 80.7%.

In summary, the findings highlight the potential of BSY as a bio-vehicle for incorporating iodine-rich seaweed extracts with antioxidant activity into functional foods.

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P60 | POWERING UP BREWING: OHMIC HEATING'S EFFECT ON THE EXTRACTION OF KEY SENSORY COMPOUNDS FROM HOP PELLETS

Gonçalo Carvalho[1*], Eduardo Coelho[1,2], Ricardo Nuno Pereira[1,2]

[1]Centre of Biological Engineering, University of Minho, Campus de Gualtar, Braga, Portugal; 2LABBELS – Associate Laboratory, Guimarães, Braga, Portugal. *gasccarvalho1996@gmail.com

Previous research by our group has demonstrated that Ohmic Heating (OH) can be successfully applied during the wort boiling stage of the brewing process. These results suggested that OH treatments achieve faster bitterness development, lower polyphenol content, and can modulate essential oil retention in beer. Moreover, OH showed potential to reduce processing time and energy consumption, positioning this technology as a promising and sustainable alternative to conventional boiling [1]. In this work, we aimed to further explore the potential of OH by applying treatments at different electrical frequencies during wort boiling. OH trials were conducted using sinusoidal waveforms at 10 V/cm and four frequencies (50 Hz, 500 Hz, 10 kHz, and 20 kHz). A conventional boiling treatment was also performed as control. The objective was to evaluate whether frequency variation influences important quality parameters of beer: bitterness (IBU), polyphenol content, and essential oil composition. Results showed no significant differences among treatments. Bitterness reached a maximum of 76.4 ± 1.4 IBU, polyphenols a maximum of 144.2 ± 3.29 mg/L, and no clear variations were observed in essential oil content. These findings indicate that, under the tested conditions, frequency variation did not impact the evaluated parameters. This study provides valuable insights into the application of OH in brewing, showing that the technology can replicate conventional boiling performance across a range of frequencies while retaining its potential benefits for process sustainability and efficiency.

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P61 | INCORPORATION OF DRIED PORTUGUESE VINIFERA GRAPE SKINS AS FUNCTIONAL INGREDIENT IN CEREAL BARS

Daisy Naomi Tan[1], Francisco Baeta[2], Sheila C. Oliveira-Alves[2,3], Marcelo A. Prado[1]

[1]FEA, UNICAMP - Universidade Estadual de Campinas, Rua Monteiro Lobato, 80, 13083-862 Campinas, Brasil; [2]INIAV, Instituto Nacional de Investigação Agrária e Veterinária, Quinta de Almoinha, 2565-191 Dois Portos, Portugal; [3]CEF, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal. *sheila.alves@iniav.pt

The growth of viticulture generates large amounts of waste, particularly grape pomace, which is often inadequately discarded. This waste, rich in bioactive compounds, can be repurposed into food products, such as cereal bars [1]. The study investigated the incorporation of dried grape skins into cereal bars, aiming to reuse the pomace and enhance nutritional value. Briefly, three different formulations of cereal bars were developed: WGB with 10% of white grape skin, RGB with 10% of red grape skin, and WRB with 5% of each skin (white and red skins), Figure 1-A. The INIAV (Dois Portos Innovation Hub, Dois Portos, Portugal) provided the dried grape (*Vitis vinifera*) skins (Verdelho and Castelão varieties) used in this research. The total phenolic content (TPC) of each bar was determined using the Folin-Ciocalteu method and the results were expressed as gallic acid equivalents (mg GAE/100 g of bars) [2]. Likewise, *in vitro* antioxidant activity (AA) of each bar was determined using DPPH method and the results were expressed as quercetin equivalents (mg QE/100 g of bars) [3]. The incorporation of dried Portuguese grape skins in cereal bars showed significant potential due to the high content of bioactive compounds, which offer nutritional and functional benefits. Among the skins, the red ones exhibited higher levels of TPC and AA compared to the white ones (Figure 1-B). By exploring, the use of grape by-products in cereal bars can contribute to the development of new food products aligned with the health and sustainability trends in the food industry.

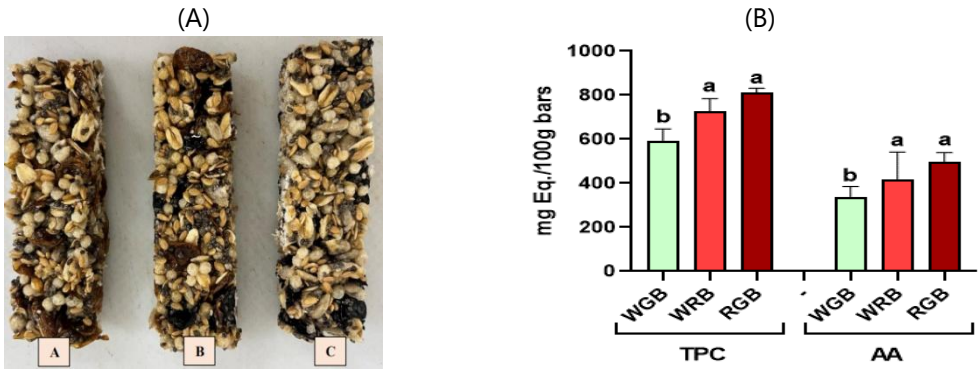

Figure 1 – Total Phenolic Content (TPC) and Antioxidant Activity (AA) of cereal bars. Results are expressed as mean values ± standard deviation (n =3). (A) Cereal bars: [A] white grape bar (WGB), [B] white and red grape bar (WRB), and [C] red grape bars (RGB); (B) Bar Graph: the different lowercase letters (a, b) in the bars indicate significant differences between cereal bars (WGB, WRB, RGB) by Tukey's test (p < 0.05).

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P62 | NUTRITIONAL AND PHYTOCHEMICAL PROFILING OF GRAPE BY-PRODUCTS: TOWARD HIGH-VALUE BIOACTIVE EXTRACTS

Hiléia K. S. Souza[1*], Ana Fernandes[1], Daniela Magalhães[1], Ana A. Vilas-Boas[1], Adma Melo[1], Débora A. Campos[1], Manuela Pintado[1]

[1]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal. *hsouza@ucp.pt

Grape by-products, generated as solid residues from winemaking, are rich in dietary fiber and phenolic compounds, mainly anthocyanins, offering strong potential for sustainable valorization. Their fiber-dominant composition, moderate protein and lipid content, and high antioxidant capacity make them suitable for applications in functional ingredients, dietary fiber enrichment, and natural pigment utilization.

Valorizing these residues contributes to circular economy strategies by transforming agro-industrial waste into high-value ingredients, reducing environmental impact, and improving resource efficiency in the wine industry. With growing demand for sustainable, biodegradable, and clean-label materials, the NOVAPACK project explores the potential of grape by-products as natural sources of antioxidants and bioactive compounds (Figure 1) to replace synthetic additives in food, nutraceuticals, and active packaging applications.

In this study, grape by-products were nutritionally characterized by AOAC methodology, revealing a low-moisture (3.9±0.0% moisture), (5.07±0.1 % ash), fiber-rich matrix comprising 68.3% total dietary fiber (64.5% insoluble), 10.1% protein, and 11.9% lipids. Phenolic compounds were extracted using environmentally friendly, food-safe, acidified water-based solvents, including ethanol, citric acid, lactic acid, and ascorbic acid. For example, during extraction with 1% citric acid, anthocyanins were detected by HPLC-DAD at 520 nm, with malvidin-3-glucoside identified as the predominant compound, while cyanidin- and delphinidin-3-glucosides appeared earlier in the chromatographic profile. Total polyphenol content was measured using the Folin–Ciocalteu method, and antioxidant activity was evaluated through, ABTS, and ORAC assays. Correlations between phenolic composition and antioxidant activity were explored further to elucidate the functional properties of the bioactive compounds and identify the most promising grape by-product extracts for valorization. These findings highlight the potential of grape pomace as a readily available, low-cost source of polyphenolic compounds, supporting its conversion into bioactive extracts for a range of industrial applications.

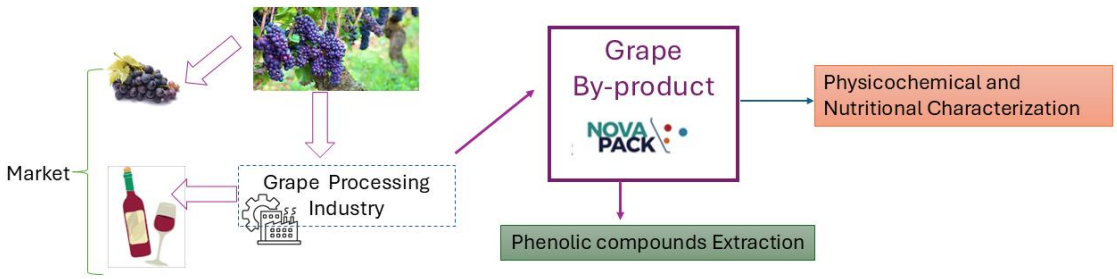

Figure 1 – Integrated Valorization Flow of Grape By-Products in NOVAPACK Project.

Acknowledgments

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P63 | BIOACTIVE PHENOLICS CONTENT FROM *CAULERPA CYLINDRACEA*: INFLUENCE OF SEASON AND EXTRACTION METHOD FOR FUNCTIONAL FOOD APPLICATIONS

Amani Tahar[1,2], Sara F. Vieira[2], Haïfa Zghida[1], Lotfi Achour[1], Lillian Barros[2*]

[1]Research Laboratory 'Bio-ressources: Integrative Biology & Valorization' (BIOLIVAL) LR14ES06, Higher Institute of Biotechnology of Monastir (ISBM), University of Monastir, Av, Taher Haddad B.P. n°74 -Monastir-5000; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *lillian@ipb.pt

Seaweeds are a rich source of bioactive compounds with numerous potential applications. Green algae of the genus *Caulerpa* are widely consumed as food in the Asian country. Interestingly, *Caulerpa cylindracea* (Sonder) has recently attracted growing interest due to its invasion in the Mediterranean Sea. This invasion presents a unique opportunity to explore its potential as a source of valuable bioactive compounds for food applications. In this line, two samples of *C. cylindracea* were collected during two seasons (summer and winter), at Kuriat Island, Monastir Tunisia, to evaluate the effects of seasonal variation on their polyphenolic profile and bioactive properties. The extracts were prepared using an innovative extraction method, ultrasound-assisted extraction (UAE), and compared with a conventional technique, maceration, employing 80% ethanol as the solvent. Extraction optimization was performed by varying sonication time (5 and 10 min) and power settings (125, 250, 300, and 500W). The optimal conditions of the liquid extracts (10 min at 500 W) were selected based on the highest total phenolic content (TPC) and maximal radical scavenging activity, as determined by the $DPPH^{\bullet}$ assay. Generally, the extraction parameters and seasonal variation influenced both TPC and antioxidant activity. In the *C. cylindracea* extracts obtained from winter samples, an increase in extraction power strongly enhanced both TPC and $DPPH^{\bullet}$ scavenging activity, while extraction time showed no significant effect on antioxidant activity. For the *C. cylindracea* extracts prepared from summer samples, both extraction time and power significantly enhanced TPC and antioxidant activity. When comparing both seasons, the two studied indicators were markedly higher in *C. cylindracea* harvested during winter. As expected, UAE extraction significantly enhanced the recovery of polyphenolic compounds from green algae in both seasons, compared to conventional maceration. In summary, UAE is an efficient and sustainable strategy for the recovery of polyphenols from *C. cylindracea*, providing higher levels of bioactive compounds and enhanced antioxidant activity. Notably, winter-harvested samples consistently yielded superior results, highlighting the importance of seasonal variation. Indeed, UAE represents a powerful approach to maximize the extraction of bioactive phenolic compounds from *C. cylindracea* with significant potential as natural food ingredients or additives. Its bioactive properties can offer both functional benefits and value-added applications in the food industry, while also aligning with ecological considerations associated with the species' invasion.

Acknowledgments

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P64 | VALORIZATION OF THE MUSHROOM BIO-RESIDUES FOR PROMOTING INNOVATION AND SUSTAINABILITY IN THE FOOD SECTOR

Cátia Mesquita[1], Jéssica Machado[1], Elizandra Ardohain[1], Lillian Barros[1], Cristina Caleja[1*], Eliana Pereira[1*], Tânia C. S. P. Pires[1,2]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Research Centre for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, Bragança, Portugal. *ccaleja@ipb.pt; eliana@ipb.pt

Mushroom bio-residues contains a diverse array of bioactive compounds, that exhibit a wide range of biological activities such as antioxidant and antimicrobial properties. Notably, certain mushroom residues retain significant quantities of these compounds post-harvest or after initial processing, making them valuable raw materials for the development of nutraceuticals, functional foods, pharmaceuticals, and cosmeceuticals [1,2]. This study investigates the potential valorization of bio-residues, with particular emphasis on the stalks of two edible mushroom species (*Lentinula edodes* (Berk.) Pegler and *Pleurotus eryngii* (DC.) Quél.), as alternative sources of bioactive compounds. To this end, total phenolic content was assessed using spectrophotometric methods, alongside the evaluation of bioactive potential, including antioxidant activity (TBARS, DPPH and Reducing Power) and antimicrobial activity (microdilution method). The results highlighted the potential of these residues as functional ingredients, with *P. eryngii* demonstrating superior antioxidant capacity (0,16 ± 0,01 mg/mL) while *L. edodes* exhibited higher concentrations of total phenolic compounds (53 ± 3 mg/g). Otherwise, the antimicrobial activity observed was limited. Given the antioxidant potential of sample *P. eryngii*, a prototype of functional food product (gummies) and nutraceutical capsules were developed incorporating the *P. eryngii* extract. The use of natural extracts in the development of food prototypes and nutraceuticals is a strategy that combines science, innovation, and socio-environmental responsibility. These extracts, obtained from agricultural by-products offer bioactive compounds with well-known health benefits, which contribute to the effectiveness of the formulated products. Reintegrating these by-products into the value chain aligns directly with the principles of innovation, technology, and food security in a changing global context, transforming potential waste into valuable resources for the development of new products and processes.

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P65 | LIGHT MANAGEMENT THROUGH PHOTOSELECTIVE NETS: EFFECTS ON PHENOLIC METABOLISM IN GOLDEN REINDERS APPLES

João David Teixeira[1,2*], Miguel Leão de Sousa[3], Carina Almeida[1,4,5], Ana Sanches-Silva[2,6,7]

[1]National Institute for Agrarian and Veterinary Research (INIAV), I.P., Rua dos Lágidos, Lugar da Madalena, Vila do Conde, Portugal; [2]Center for Study in Animal Science (CECA), ICETA, University of Porto, Porto, Portugal; [3]National Institute for Agrarian and Veterinary Research (INIAV), I.P., Alcobaça, Portugal; [4]LEPABE – Laboratory for Process Engineering, Environment, Biotechnology and Energy, University of Porto, Porto, Portugal; [5]AliCE – Associate Laboratory in Chemical Engineering, University of Porto, Porto, Portugal; [6]Faculty of Pharmacy, University of Coimbra, Azinhaga de Stª Comba, Coimbra, Portugal; [7]Associate Laboratory for Animal and Veterinary Sciences (Al4AnimalS), 1300-477 Lisbon, Portugal. *david.teixeira@iniav.pt

Photoselective nets are increasingly employed in apple orchards to modulate light incidence [1] and microclimatic conditions, with implications for secondary metabolism and fruit quality [2]. This study evaluated the influence of five distinct net types (Grey, IRIDIUM Yellow, IRIDIUM Red, Black, and Krystal) on the phenolic composition of Golden Reinders apples, focusing on peels, seeds, and pulp. A validated UHPLC-ToF-MS method [3] was applied to identify and quantify 51 phenolic compounds across these matrices.

The results indicated divergent responses among phenolic classes. While major phenolics tended to decrease under photoselective nets, several minor compounds showed increased accumulation. In peels, quercetin and quercetin-3-β-D-glucoside were the dominant compounds regardless of treatment, though their concentrations were generally reduced under the nets. Seeds revealed distinct responses, with pinocembrin and (-)-gallocatechin gallate as the major contributors, and a marked increase in flavonoids under the red net. Pulp samples showed limited changes, yet minor phenolics exhibited enhancements in net-covered fruits.

Despite these changes, no net condition resulted in overall enrichment of the total phenolic pool compared to the control. This outcome reinforces the notion that reduced solar radiation and moderated stress under protective structures can limit the induction of phenolic biosynthesis, while selectively enhancing less abundant compounds.

These findings provide biochemical insights into the modulation of phenolic metabolism in Golden Reinders apples under photoselective nets, supporting informed agronomic strategies for fruit quality optimization.

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P66 | AN INSIGHT ON THE PHENOLIC COMPOSITION OF PORTUGUESE PROPOLIS

Sandra Barbosa[1,2,4,5], Maria Fernanda Sousa[1,3], Nicolas Justus[1,3], Ana R. Circuncisão[1,4], Cristina Almeida Aguiar[5], Susana M. Cardoso[4*]

[1]Montesino – Organic Beekeeping, 5300-358 Bragança, Portugal; [2]CITAB, University of Trás-os-Montes and Alto Douro, 5000-801, Vila Real, Portugal; [3]Instituto Politécnico de Bragança, 5300-252 Bragança, Portugal; [4]LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, 3810-193, Aveiro, Portugal; [5]CBMA, Department of Biology, University of Minho, 4710-057, Braga, Portugal. *susanamcardoso@ua.pt

Propolis is a hydrophobic, sticky, resinous substance produced by bees when they collect plants' resin, mix it with salivary enzymes, semi-digest and combine it with beeswax. Its complex composition, comprising resins (50%), wax (30%), essential oils (10%), and pollen (5%), underlies a broad spectrum of bioactivities making it an attractive ingredient for several industries [1]. Although global propolis market size is projected to expand at a CAGR of 5.5% during 2025–2032, reaching USD 1.12 billion by the end of the period, its production by Portuguese beekeepers is still at an early stage. To foster competitiveness and enable highvalue applications, it is essential to characterize the phenolic profile of Portuguese propolis extracts, as phenolics are key indicators of quality and bioactivity [1]. Extraction methods strongly influence propolis' functional properties, since different solvents recover distinct bioactive compounds [2]. Characterizing solvent-specific recovery is particularly important for tailoring extracts with defined functional activities and for optimizing applications in health, food, and cosmetic sectors. In this context, the present work aimed to compare two Portuguese propolis extracts, namely monopropylene glycol (MPG) and 70% ethanol (EtOH), regarding their phenolic composition and antioxidant capacity. To achieve this, propolis samples, collected in 2022 from several beekeepers across Portugal, were cleaned and subjected to solid-liquid extraction using MPG and 70% EtOH, at a 1:2 (w/v) ratio for 30 days at room temperature. After centrifugation, soluble fractions were analyzed for total phenolic content (Folin– Ciocalteu method), total flavonoids, and antioxidant capacity (DPPH and ABTS assays), while phenolic composition was characterized by ultra-high performance liquid chromatography coupled to mass spectrometry (UHPLC–MS). The results showed that extraction with 70% EtOH recovered about 50% more total phenolics and 25% more total flavonoids than MPG. This higher recovery was reflected in the antioxidant activity, with substantially stronger radical scavenging capacity observed in the 70% EtOH extracts compared to MPG. Despite these differences, UHPLC-MS analysis revealed similar phenolic profiles for both solvents. The most abundant compounds were flavonoids (*e.g.*, chrysin, pinobanksin derivatives, galangin) and flavanones (*e.g.*, pinocembrin, naringin), followed by phenolic acids (*e.g.*, caffeic acid, *p*-coumaric acid, ferulic acid) and their esterified derivatives. Overall, the results suggest that the higher recovery with EtOH likely reflects its higher polarity, promoting co-extraction of additional compounds. Nevertheless, these results highlight the potential of Portuguese propolis extracts to be valorized as a high-quality natural product with strong prospects for different markets.

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P67 | MULTIVARIATE ANALYSIS OF VOLATILE PROFILES IN FRUIT-ADDED MEADS BY GC-FID

Ludmilla Sousa Lopes[1], Bruna Campelo Marciano[1], Bruno Gonçalves Botelho[1]

[1]Departamento de Química, ICEx, Universidade Federal de Minas Gerais. *ludmillasousalopes@gmail.com

Mead is a fermented beverage produced from honey and water, whose diversity of styles ranges from traditional formulations to those incorporating ingredients such as fruits and spices [1,2]. The incorporation of fruits into fermented beverages has been investigated not only as a strategy to enhance the sensory complexity of the product but also as an alternative to add value and reduce the waste of highly perishable raw materials [3]. Evidence indicates that such additions can significantly modify the physicochemical and volatile composition of mead, enriching the content of phenolic compounds, modulating organic acids, and reshaping the aromatic profile [4]. In this study, traditional meads (HT1–HT4) were compared with formulations containing coconut water (10–30%), passion fruit (20%), and *jabuticaba* (10–30%) (HF1–HF10). Volatile compounds were determined by GC-FID (Shimadzu GC-17A; Supelcowax 30 m × 0.53 mm × 2 µm; H_2 2.2 mL min^{-1}; 80 µL of sample + 20 µL of 0.1% v/v pentanol as internal standard; total runtime 38.3 min). The quantified compounds included acetaldehyde, ethyl acetate, methanol, 1-propanol, 2-butanol, 2-methyl-1-propanol, 3-methyl-1-butanol, acetic acid, and 2-phenylethyl alcohol. The normalized data were subjected to multivariate analysis by PCA and HCA/heatmap. PCA revealed a clear separation between HT and HF, with PC1 (38.9%) and PC2 (20.5%) jointly explaining 59.3% of the variance (Figure 1a). Traditional meads showed higher tendencies along PC1 for acetic acid/ethyl acetate and acetaldehyde/1-propanol, suggesting a greater occurrence of fermentative stress, reflected mainly by elevated volatile acidity. Conversely, fruit-added meads clustered with 3-methyl-1-butanol, 2-methyl-1-propanol, 2-phenylethyl alcohol, and methanol, indicating a distinct profile potentially more favorable to sensory differentiation. HCA corroborated the formation of two well-defined clusters and highlighted blocks of variables that supported this separation (Figure 1b). Overall, the results demonstrate that fruit addition consistently modifies the volatile profile of meads, attenuating stress-associated markers and promoting the production of compounds that enhance the aromatic complexity of the beverage.

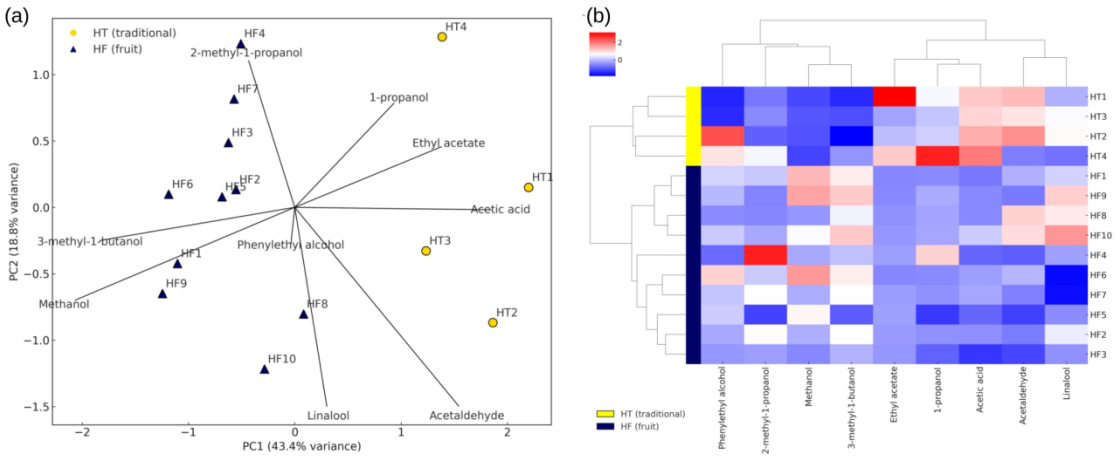

Figure 1 – Multivariate analysis of volatile compounds in traditional (HT) and fruit-added (HF) meads. (a) PCA biplot (b) HCA with heatmap.

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P68 | CHARACTERIZATION OF PROPOLIS FROM THE MONTESINHO NATURAL PARK

Maria Fernanda Sousa[1,2,3], Nicolas Justus[1,2,3], Sandra Barbosa[1,4,5,6], Cristina Almeida-Aguiar[5], Maria Carolina Ribeiro[3], Olívia Pereira[2,7], Susana M. Cardoso[6*]

[1]Montesino – Organic Beekeeping, 5300-358, Bragança, Portugal; [2]Instituto Politécnico de Bragança, 5300-252, Bragança, Portugal; [3]UTFPR,Universidade Tecnológica Federal do Paraná, 84017-220, Ponta Grossa, Brasil; [4]CITAB, University of Trás-os-Montes and Alto Douro, 5000-801, Vila Real, Portugal; [5]CBMA, Department of Biology, University of Minho, 4710-057, Braga, Portugal; [6]LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, 3810-193, Aveiro, Portugal; [7]Research Centre for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, 5300-252, Bragança, Portugal. *susanacardoso@ua.pt

Propolis is a resinous and balsamic material produced by honeybees, composed by mixing salivary secretions with plant-based natural materials, such as exudates from leaves, shoots buds, wounds, sap flowers and pollen [1,2]. Due to its particularly complex chemical composition, as it is rich in bioactive compounds, propolis has multiple biological effects, including antibacterial, anti-aging, anticarcinogenic, antifungal, anti-inflammatory, antioxidant, antiviral, and immunomodulatory, among others [1,3,4]. Therefore, its applications are numerous and diverse, as it can be used as a natural preservative, antioxidant and functional food ingredient in several industries, including food [2,4]. This study aimed to characterize the levels of key bioactive compounds, particularly phenolics, in propolis extracts from the Montesinho Natural Park, by comparing maceration and ultrasound-assisted extraction (UAE) with ethanol/water (70% and 80%, v/v) and monopropylene glycol as solvents, to evaluate their potential as functional and preservative food ingredients. The propolis extraction was conducted using a ratio of 3:10 (w/w) and an extraction kinetics was made, analysing Total Amount of Phenolic Compounds (TPC) in different time lengths to establish when the extraction reached its maximum TPC. The phenolics were analyzed by the Folin-Ciocalteu method and their results were expressed in mg of Gallic Acid per mL of extract (mgGAE/mL). The maceration method yielded the highest phenolic concentration after five days of extraction with monopropylene glycol (65.9 mg GAE/mL), followed by ethanol/water 70% (64.1 mg GAE/mL) and ethanol/water 80% (62.2 mg GAE/mL). For UAE , monopropylene glycol provided the best result, yielding 33.8 mg GAE/mL after 5 minutes of sonication at 60% amplitude. Therefore, these results indicate that the maceration method is more effective for the extraction of phenolic compounds utilizing conventional solvents. Moreover, this study demonstrates the potential of traditional extraction methods for obtaining phenolic compounds from propolis, supporting their use in functional food applications.

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P69 | USE OF EUTECTIC SOLVENTS TO OBTAIN CELLULOSE FROM GRAPE STALKS: A PRELIMINARY STUDY

Tugba Atatoprak[1], Adriana Rodrigues Machado[1,2], Gonçalo Sá[1], João Nunes[1,3], Manuela Pintado[2]

[1]Associação CECOLAB-Collaborative Laboratory towards Circular Economy, Business Centre, Rua Nossa Senhora da Conceição, 2, Oliveira do Hospital 3405-155, Portugal; [2]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, Porto 4169-005, Portugal; [3]Association BLC3 – Technology and Innovation Campus, R&D Unit Centre Bio, Rua Nossa Senhora da Conceição, 2, Oliveira do Hospital 3405-155, Portugal.

The growing demand for sustainable processes is driving the valorization of agro-industrial waste, such as stalks from the wine industry. In this study, two eutectic solvents were used (citric acid and glycerol, with 20% water (NADES 1); choline chloride and lactic acid (NADES 2) in the process of obtaining cellulose from grape stalks. The cellulose samples obtained were characterized using Fourier transform infrared spectroscopy (FTIR) and colorimetry using the CIE L*a*b* system, to investigate the influence of the solvents on the color of the material obtained. The FTIR, Figure 1, spectrum revealed bands characteristic of cellulose, such as those at ~3320 /3308cm-^{1} (O-H stretch), ~2912/2920cm-^{1} (C-H stretch), and ~1022/1028cm-^{1} (C-O-C stretch in the glucose ring structure). However, residual bands were also observed at ~1586 /1590 cm-^{1}, respectively NADES 1 and NADES 2, associated with the presence of aromatic lignin rings, suggesting incomplete extraction or residual binding of lignin to cellulose [1]. The colorimetry analysis confirms this, Figure 1, which shows that the yellowish color may be related to the residual presence of lignin or the formation of oxidized compounds during treatment to check the efficiency of lignin and hemicellulose removal [1].

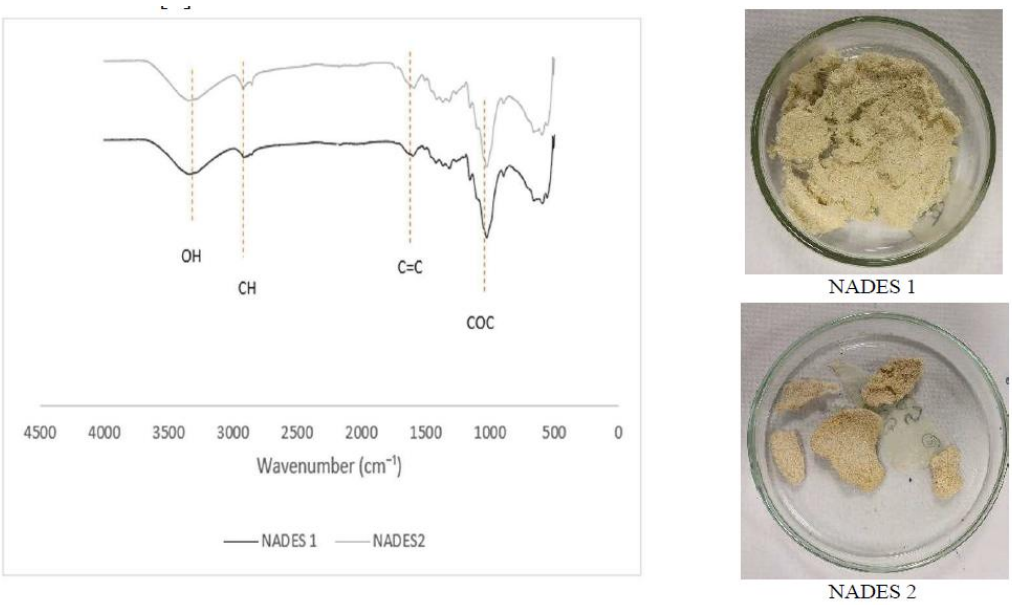

Figure 1 – FTIR and colourimetric spectra of cellulose samples extracted from stalks using two eutectic solvents: citric acid:glycerol (NADES 1); choline chloride:lactic acid (NADES 2).

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P70 | FROM ALGAE TO FUNCTIONAL FOOD INGREDIENTS: SUSTAINABLE LIPID RECOVERY AND NANOEMULSIONS FORMULATION

Francisca Marques[1*], Lorenzo Pastrana[2], Helena Cardoso[3], M. Helena Abreu[4], M. Rosário Domingues[1,5], Miguel Â. Cerqueira[2]

[1]CESAM, Department of Chemistry, University of Aveiro, Santiago University Campus, 3810-193 Aveiro, Portugal; [2]International Iberian Nanotechnology Laboratory, Av. Mestre José Veiga s/n, 4715-330, Braga, Portugal; [3]Allmicroalgae – Natural Products S.A., R&D Department, Rua 25 de Abril s/n, 2445-413 Pataias, Portugal; [4]ALGAplus – Production and Trading of Seaweeds and Derived Products S.A., 3830-196, Ílhavo, Portugal; [5]Mass Spectrometry Centre, LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Santiago University Campus, 3810-193 Aveiro, Portugal. *francisca.marques@ua.pt

Algae represent a sustainable source of bioactive lipids with potential applications in functional foods [1]. In this study, a commercial algae blend (Algaessence©) was exploited as a renewable ingredient to produce lipid-rich extracts using ultrasound-assisted extraction (UAE) with food-grade ethyl acetate, a green and efficient approach. Extracts were characterized in terms of total lipid content, esterified fatty acid (FA) profile, and antioxidant and anti-inflammatory potential, with conventional solvent extraction (CSE) employed as a benchmark for comparison. The algal extract was subsequently entrapped in nanoemulsions (NE), for potential food enrichment applications. Two formulations containing 1% and 5% (w/w) lipid phase were developed using sunflower oil as carrier and rhamnolipids (0.05 wt%) as a biosurfactant. NE were prepared via pre-homogenization followed by high-energy ultrasonication, and characterized for droplet size, polydispersity index (PDI), and zeta potential. The degree of lipid oxidation after production was assessed using the TBARS assay. Additionally, the *in vitro* digestibility of omega-3 FAs, specifically C18:3 *n*-3, was evaluated through the standardized INFOGEST protocol.

UAE with ethyl acetate significantly improved lipid yield (2.3±0.1 vs. 1.8±0.2 g/100g biomass) and extract purity (100% vs. 93.9%) compared to CSE. The major FAs identified were C18:1 *n*-9 (47.4±1.8 mg/g), C18:3 *n*-3 (37.5±3.2 mg/g), and C18:2 *n*-6 (29.6±3.0 mg/g). Moreover, the extract demonstrated antioxidant and anti-inflammatory activity, highlighting its potential as a bioactive ingredient. NE1% and NE5% exhibited small droplet sizes (163.8±2.9 nm and 208.3±6.7 nm), low PDI (0.237±0.014 and 0.254±0.013), and high negative zeta potentials (–70.2±3.3 mV and –68.5±2.6 mV), respectively, indicating good colloidal stability. Lipid oxidation, assessed by TBARS, showed values of 2.48±0.05 and 8.47±0.21 μmol MDA·L^{-1} emulsion for NE1% and NE5%, respectively, indicating a low to moderate level of oxidation. The *in vitro* digestion studies showed similar extent of C18:3 *n*-3 hydrolysis for NE1% (78.9±6.0%) and NE5% (85.3±2.2%).

These results highlight the potential of algae as a sustainable source of bioactive lipids and demonstrate ultrasound-assisted extraction coupled with nanoemulsion formulation as an integrated, green strategy to develop stable and bioaccessible lipid-based ingredients for functional foods, contributing to more sustainable food ecosystems.

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P71 | UPGRADING A LOW-VALUE FISH PRODUCT WITH BEETROOT POWDER: IMPROVING OXIDATIVE STABILITY, TEXTURE AND COLOR VIA HIGH-INTENSITY ULTRASOUND PROCESSING

Lévison da Costa Cipriano[1], Thaís R. de Castro Pereira[1], Gabrielle de Paiva Vieira[1], Bruno Soares Toledo[1], Carolina P. de Carvalho Martins[1], Sérgio Borges Mano[1], Erick A. Esmerino[1*], Eliane Teixeira Mársico[1]

[1]Universidade Federal Fluminense (UFF), Faculdade de Veterinária, Departamento de Tecnologia de Alimentos, Av. Alm. Ary Parreiras, 507 - Icaraí, Niterói - RJ, 24230-321, Brazil. *eaesmerino@id.uff.br

Valorizing underutilized fish supports circular economy and food security. While FAO recommends 14.5 kg per capita annually, Latin America averages only 9 kg, below the global 20.5 kg [1]. In Brazil, high prices, low practicality, and weak consumption habits limit intake [2], highlighting the need for products that unite acceptance and nutritional value. This study developed a cooked ham-type product from mechanically separated red porgy (*Pagrus pagrus*) (78.4%), reformulated with beetroot powder (2%) as a natural colorant and antioxidant, and partial sodium replacement (0.5% NaCl; 0.5% KCl). High-intensity ultrasound (HIU) was applied as a processing aid to enhance quality attributes and extend shelf-life. Fish emulsions were exposed to a 20 kHz ultrasonic processor (800 W nominal power) for 15 min under controlled cooling (<12 °C). Four amplitude settings were tested: 400 W (50%), 480 W (60%), 560 W (70%), and 640 W (80%). The samples were subsequently heat treated, gradually increasing their temperature (60 °C/30 min, 70 °C/30 min, 80 °C until reaching 72 °C in the core), cooled, and stored at 4 °C for 30 days. At day 0, all treatments showed low TBARS values (0.06–0.10 mg MDA/kg), typical of fresh products. After 10 days, lipid oxidation increased in all groups, yet the 640 W treatment exhibited the lowest TBARS (0.48 mg/kg) compared to 400 W (0.63 mg/kg) and was statistically similar to the control (0.50 mg/kg). This protective effect was maintained at day 20, where TBARS at 640 W remained 22% lower than at 400 W. Across storage, higher ultrasound intensities consistently enhanced oxidative stability, likely due to improved dispersion and release of bioactive beetroot compounds facilitated by acoustic cavitation [3]. Total phenolic content peaked at day 10 (2.16 mg GAE/g at 640 W vs. 1.95 mg GAE/g in control), while antioxidant activity (DPPH) was significantly retained in 560–640 W treatments, reaching 5.65–5.76% at day 30-44% higher than control (3.99%). Color attributes remained stable, particularly redness (a* ≈ 34–36), confirming the robustness of beetroot pigments under HIU-assisted processing. Texture analysis revealed that moderate ultrasound (560 W) preserved tenderness (3.24 Kgf at day 30), whereas 400 W led to hardening (6.36 Kgf). In conclusion, HIU is a green technology that improves oxidative stability, preserves natural color, and maintains texture in reduced-sodium fish products. By upgrading low-value fish into functional, value-added foods, it overcomes barriers to fish consumption and offers a replicable model for ingredient valorization, reinforcing food innovation's role in circular economy, nutritional security, and agri-food competitiveness.

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P72 | PROTEINS AS INTERFACIAL STABILIZERS - IMPACT OF STRUCTURE AND AGGREGATION ON PICKERING EMULSION FORMATION

Patrícia C. Silva[1,2*], Ricardo Pereira[2], Rui M. Rodrigues[2], Ana Isabel Bourbon[1]

[1]INL - International Iberian Nanotechnology Laboratory, Av. Mestre José Veiga s/n 4715-330, Braga, Portugal; [2]CEB- Centre of Biological Engineering (CEB), University of Minho, 4710-057 Braga, Portugal. *patricia.c.silva@inl.int

Pickering emulsions represent a promising alternative to conventional emulsions, offering stabilization through solid particles adsorbed at the oil–water interface, which form a physical barrier against coalescence. Their ability to avoid the use of synthetic surfactants has generated increasing interest in sectors such as food, cosmetics, and pharmaceuticals, particularly in the context of sustainable and natural formulations. In this study, was investigated the influence of protein structure on the formation and stability of Pickering emulsions. Two protein sources – yeast and potato – were employed, with their structures modified by ohmic heating at different temperatures (60, 90, 110, 130, 150 °C) to identify conditions that enhance stabilizing performance. Emulsions were prepared under varying protein concentrations (1 – 5%), oil concentrations (0,10 – 1%), as well as sonication times (5 – 15 minutes), and evaluated through particle size and zeta potential measurements. Stability was monitored by tracking the temporal evolution of these parameters, while protein structural changes were characterized using circular dichroism. The results provide insights into the relationship between protein structure, interfacial behavior, and emulsion stability, highlighting the potential of tailored proteins as natural stabilizers for sustainable Pickering emulsions.

P73 | THE IMPACT OF SALINITY ON THE NUTRITIONAL AND ORGANOLEPTIC QUALITIES OF THE HALOPHYTES *TRIPOLIUM PANNONICUM* AND *ATRIPLEX PORTULACOIDES* PRODUCED IN SOILLESS CULTIVATION SYSTEMS

Nicolle Prates[1], Marta Oliveira[1], Chathurika Priyadarshani[1], Susana Casal[2], Isabel Ferreira[2], Miguel Salazar[3], Luísa Barreira[1*]

[1]Grupo de Biotecnologia Marinha, Centro de Ciências do Mar (CCMAR), Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal; [2]Agro-on, Sítio do Besouro, CX 547B. 8005-421 Faro, Portugal; [3]LAQV/REQUIMTE, Departamento de Ciências Químicas, Laboratório de Bromatologia e Hidrologia, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira n.° 228, 4050-313, Porto, Portugal. *lbarreir@ualg.pt

The rising economic interest in halophyte plants as novel food sources stems from their high nutritional value and unique organoleptic qualities, which have boosted demand in fine dining cuisine [1]. Within the Xtreme Gourmet 2.0 project, two halophyte species, namely *Atriplex portulacoides* (AP) and *Tripolium pannonicum* (TP), were selected for adaptation to soilless cultivation systems. The goal was to expand the RiaFresh® portfolio, which already commercializes around ten halophyte species as fresh sea vegetables for human consumption, strengthening its presence in new markets. Therefore, in this work, both species were grown in soilless systems at RiaFresh® facilities, under three increasing levels of salinity, aiming to establish optimal cultivation conditions. Fresh samples were analyzed for moisture, while freeze-dried biomass was assessed for ash, protein, lipid, and carbohydrate contents. In parallel, sensory evaluations were performed with a panel of 12 renowned chefs, applying both hedonic and just-about-right (JAR) methods. Results showed that TP exhibited increased moisture and protein contents with rising salinity, while higher ash and lipid contents were observed only at the highest level tested. For AP, significant differences ($p<0.05$) were detected in protein and ash contents at the highest salinity. Hedonic tests revealed no significant differences ($p<0.05$) in the appreciation of plants grown with different salinities. However, statistical treatment of JAR data by Multiple Correspondence Analysis (MCA) suggested that TP grown at the lowest salinity had more attributes aligned with the ideal compared to the other conditions tested. Further work is ongoing to evaluate fiber, mineral composition, phenolic content, and antioxidant capacity, aiming to provide a more comprehensive overview of these plants' nutritional and functional properties. Together with agronomic data, these findings will be crucial in optimizing cultivation conditions for each halophyte species, supporting the transition from experimental to commercial-scale trials.

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P74 | THE GREEN SHIFT IN MAYONNAISE COMPOSITION: YEAST AND MICROALGA AS EMULSIFIERS

Pedro Coelho[1*], Carmo Serrano[1], Miguel Nascimento[2], Filipe Centeno[3], Anabela Raymundo[1]

[1]Linking Landscape, Environment, Agriculture and Food (LEAF), TERRA Associated Laboratory; School of Agriculture, Lisbon University (ISA), Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Mendes Gonçalves SA, Zona Industrial, Lote 6, 2154-909 Golegã, Portugal; [3]Proenol SA, Travessa das Lages 267, 4410-308 Canelas, Portugal. *pmcoelho@isa.ulisboa.pt

Mayonnaise stands out as one of the most consumed emulsion-based sauces worldwide, applied as a dip in sauce, a seasoning or an ingredient in recipes. Traditionally prepared with egg, colorant agent and synthetic antioxidant, among remaining ingredients [1]. Some barriers arise between product and consumers due to restrictions based on food allergies or animal welfare concerns along with a trending preference for CleanLabel products. In order to fill this gap, food industry seeks to re-adapt and reshape traditional and staple foods to answer consumers demands, as environmental concerns also reclaim sustainable sources.

National produced yeast protein extract (YPE) by Proenol has proven to be a suitable non-conventional substitute to stabilize oil-in-water emulsions, offering a solid alternative to animal origin ingredients. YPE reveals to be a valuable protein and essential aminoacids source containing 8 out of 9. On the other hand, microalga species support environmentally and economically life on earth, when considering their native function and biological role. Also national produced (Allmicroalgae), *C. vulgaris* was tested as an emulsifier, since its addition of in foods improves nutritional composition (phenolics, protein, ash, fat, and fiber) and sensorial aspects (colour, odor, taste and texture) [2]. After characterizing both ingredients singularly, a mixed system was optimized to elaborate two egg-free mayonnaise prototypes, achieving the emulsification and stabilization goal, while boosting the functional and nutritious aspect of this food product. Mayonnaise vegan analogues were a coriander prototype composed by a mixed system of YPE (0.8 %) and *C. vulgaris* White (1 %) and a green-toned prototype composed by complete neutralized YPE (1.60 %) and *C. vulgaris* Smooth (1.44 %), These were compared with commercial egg mayonnaise controls. In terms of stability coriander analogue depicted a slight lower Sauter diameter (d3,2) in comparison with its control (6.26 ± 0.20 vs 17.63 ± 0.01 µm), same behaviour was observed for the green-toned analogue (6.02 ± 0.07 vs 20.33 ± 0.29 µm). From a functionality perspective, there was an increase in the total phenolic compounds (TPC) quantification for the prototypes with the mixed system. For the coriander prototype the increase for TPC was +118.84, for Radical Scavenging Activity (RSA) was +31.29, and for Ferric Reducing Antioxidant Power (FRAP) was +35.21. The green-toned depicted major increases in comparison to its control, boosting the TPC (+131.88 ugG Aeq/g), the RSA (+401.97 ugTEAC/g), and the FRAP (+100.37 ugTEAC/g). These products were also compared based on rheology (SAOS), texture, colour, minerals composition, in vitro bioacessibility (INFOgest), and consumers' acceptance.First results indicate a noticeable improvement in the nutritious composition and a proper emulsifier alternative to withstand shelf-life stability.

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P75 | *CORDYCEPS* SPP.: NOVEL FOOD AND BIOTECHNOLOGICAL POTENTIAL

Emanuelle Naumann[1,3*], Alessandra Cristine Novak Sydney[1], Maria Luísa Cerri[2]

[1]Programa de Pós Graduação em Biotecnologia, Universidade Tecnológica Federal do Paraná, Universidade Tecnológica Federal do Paraná, Campus Ponta Grossa, Rua Doutor Washington Subtil Chueire 330, 84017-220 Paraná, Ponta Grossa, Brasil; [2]Programa de Pós Graduação em Ciência e Tecnologia de Alimentos, Universidade Estadual de Ponta Grossa, Av. General Carlos Cavalcanti, 84030-000, Paraná, Ponta Grossa, Brasil; [3]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *a67550@alunos.ipb.pt

Mushrooms of the genus *Cordyceps* spp. are endoparasites that infect insects and develop fruiting bodies from the host organism [1]. Traditionally used in Asian medicine, particularly in China, Tibet, Nepal, and India, they are prepared as medicinal beverages and valued for their adaptogenic, tonic, and immunomodulatory effects, aiding in the treatment of various diseases and in reducing fatigue [1,2]. *C. sinensis* is the most recognized and authorized species for use as a food and dietary supplement ingredient in the European Union, according to documents from the European Commission (EC) and the European Food Safety Authority (EFSA), although its health benefit claims have not been approved due to insufficient evidence [3]. Due to its natural scarcity and cultivation challenges, *C. militaris* has emerged as a promising biotechnological alternative, as it can be grown under controlled conditions and exhibits a bioactive composition similar or even superior to that of *C. sinensis* [4]. Its derivatives include extracts, capsules, and liquid formulations recommended for improving energy, memory, sexual health, and cardiac, respiratory, and renal functions [5,6]. Since *Cordyceps* spp. was recognized as a "Novel Food" by the Chinese Ministry of Health in 2009, more than 36 food products derived from this fungus, including *C. militaris* mycelium powder (Z20030034) and capsules (Z20030035), have been approved and widely consumed [6].

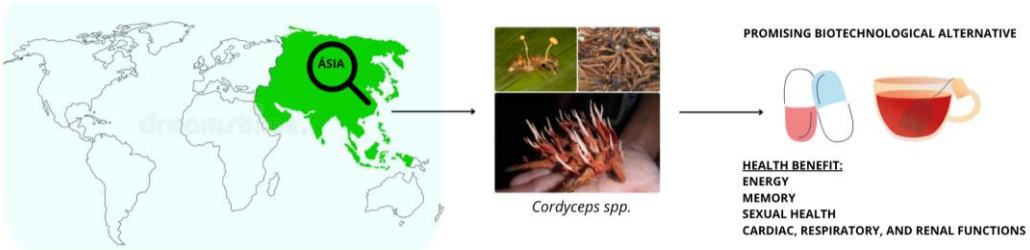

Figure 1 – *Cordyceps* spp.: geographic distribution, potential applications, and biological benefits.

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P76 | INNOVATIVE BIOPRODUCTS FROM THE VALORIZATION OF WASTE BIOMASS OF THE FLAGSHIP MEDITERRANEAN CROP "CITRUS"

Ahmed Mliki[1*], Myriam Lamine[1], Mahmoud Gargouri[1]

[1]Laboratory of Plant Molecular Physiology, Centre of Biotechnology of Borj-Cedria, BP 901, 2050, Hammam-Lif, Tunisia. *ahmed.mliki@cbbc.rnrt.tn

Pruning citrus trees annually generates the most abundant and affordable lignocellulosic biomass (2.5t/ha, or 70,000t/year) which requires substantial and innovative valorization. Thus, we initiated a research work on the phytochemical characterization of this inexpensive biomass/raw material to promote it and generate added value via its transformation and the production of "secondary raw material" with high added value. Concretely, our work on this green biomass consisted of:

1. A phytochemical study to determine the content of polyphenols and flavonoids and antioxidant activities.
2. Identification (by GC-MS) and evaluation of bioactive compounds such as quinic acid, proline, alpha-linolenic acid and alpha-amyrin known for their wide range of applications.
3. Study of the fragrant aromatic composition of petitgrain essential oil, which can serve as a promising natural source used in the development and formulation of functional foods and pharmaceuticals, in flavors, liqueurs, perfumes and medication.
4. Evaluation of the antioxidant and antifungal potential of the hydro-distillation effluent.

Thus, our work aims at an integral valorization of these under-exploited and bulky bio-residues to *i)* recover bio-sourced molecules with high added value, *ii)* reduce polluting effects, *iii)* promote sustainable development and bioeconomy via an integrated zero waste approach paving the way for green biorefineries.

P77 | SUSTAINABLE AND HEALTHY DIETS IN PORTUGAL

Sofia G. Florença[1*], Raquel P. F. Guiné[1]

[1]CERNAS-IPV Research Centre, Polytechnic University of Viseu, Campus Politécnico, Repeses, 3504-510 Viseu, Portugal. *sofiaflorenca@outlook.com

Dietary patterns are significantly influenced by culture and tradition, although they present differences according to more moderns trends that have been incorporated into the dietary habits of the populations. Also, in the present a great emphasis is given to make healthier and more sustainable food choices, both to preserve the environment while also promoting human health. Having in mind that cultural and social aspects contribute to shape dietary patterns, some examples include the Nordic Diet (ND), also knowns as Baltic Sea Diet (BSD), the Mediterranean Diet (MD), the Atlantic Diet (AD), and the specific South European Atlantic Diet (SEAD). All these dietary patterns are considered healthy and sustainable [1].

Portugal has a long tradition linked with gastronomy and use of local, seasonal foods, that comply with culinary traditions, being influenced by the Atlantic Ocean to the west and the Mediterranean Sea to the south. It is therefore not surprising that the dietary patterns in Portugal include both the MD and the AD. This work explores the characteristics of both diets, evidencing their common aspects as well as their unique features (Figure 1). While having quite a deal of similarities, like for example privileging varied, natural, local and seasonal foods, particularly those of vegetable origin like fruits and vegetables, they also have some distinct aspects, like for example the most important role attributed to socialization in the MD or the consumption of cod and chestnuts as specific elements of the AD.

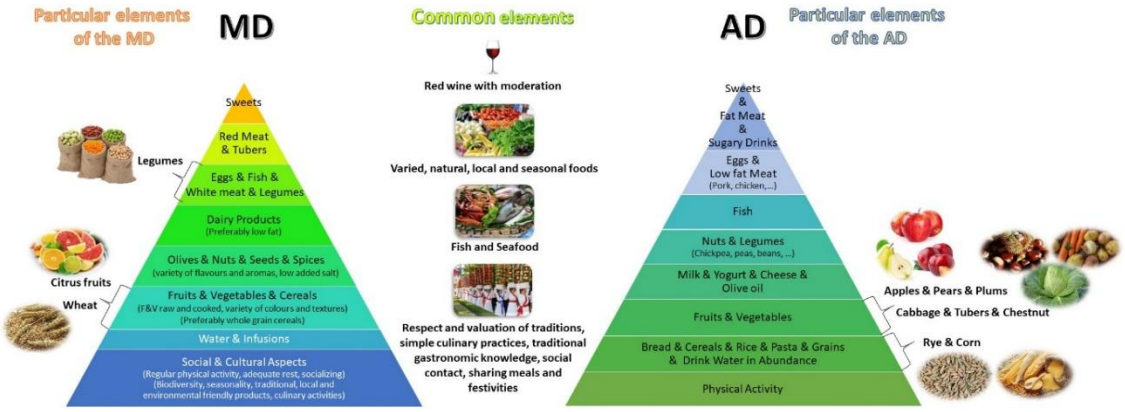

Figure 1 – Comparing the Mediterranean and the Atlantic diets.

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P78 | DEVELOPING NEUTRACEUTICAL FORMULATION FOR WOMEN HEALTH

Debarati Paul[1], Sourish Bhattacharya[1*]

[1]Process Design and Engineering Cell, CSIR-Central Salt and Marine Chemicals Research Institute, Bhavnagar, Gujarat, India. *sourishb@csmcri.res.in

Premenstrual syndrome (PMS) is a psychotic neuroendocrine disorder with biological, psychological, and social parameters [1]. Symptoms are divided into two categories: physical and psychological, and PMS can be considered as a periodic recurrence of a combination of disruptive, physical, psychological, and behavioral changes during the luteal phase of the menstrual cycle that interfere with family, social, and occupational activities [2]. Gamma-linolenic acid (GLA) appears to offer modest relief for certain PMS symptoms, especially breast tenderness, mood changes, and fluid retention. It is a relatively safe supplement for most people, but effects can vary. Efforts were made to develop an effective functional food to treat premenstrual syndrome (PMS) in women through providing them a probiotic yoghurt containing γ-linolenic acid targeting an important supplement for improving women's health. Furthermore, using ε-polylysine isolated from marine bacteria, the shelf life of the developed probiotic yoghurt was improved. Yogurt is packed with high amounts of calcium, potassium, protein, phosphorus, magnesium, zinc and vitamin B-12.

A probiotic yoghurt containing *Lactobacillus rhamnosus* and *Lactobacillus helveticus* with conjugated microalgal-based γ-linoleneic acid and astaxanthin was developed with increased shelf life. A sustainable and cost-effective process was developed for microalgal-based GLA production. The probiotic cultures present in the yoghurt will help in reduction of the BMI in PMS-affected patients, and the γ-linoleneic acid will have a therapeutic effect in treating the PMS in women.

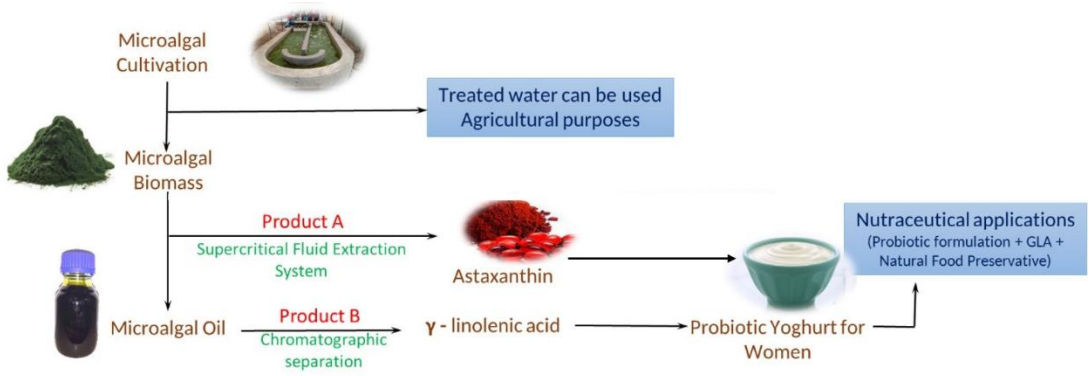

Figure 1 – ssss

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P79 | COLORED CARROT (*DAUCUS CAROTA* L.) WASTE AS A SOURCES OF FOLATES AND AMINO ACIDS

Joana P. B. Rodrigues[1,2*], Laura Domínguez[3], Patricia Morales[3], Tayse F. F. da Silveira[1], Maria Beatriz P. P. Oliveira[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Rua Jorge Viterbo Ferreira nº228, 4050-313 Porto, Portugal; [3]Nutrition and Food Science Department, Pharmacy Faculty, Complutense University of Madrid (UCM), Plaza Ramón y Cajal, s/n, E-28040 Madrid, Spain. *joanapbrodrigues@ipb.pt

The carrot (*Daucus carota* L.) is one of the most widely consumed vegetables worldwide. Orange, yellow, and black varieties exhibit significant differences in their nutritional and phytochemical composition [1]. Despite their recognized health benefits, large quantities of carrots and their by-products, such as peels, pulp and visually defective roots, are discarded throughout the production and processing chain, contributing to substantial food waste [2,3]. Recovering such waste presents a sustainable approach to nutrient and value addition within the agri-food system. In this study, the folate content (vitamin B9) and free amino acid profiles of orange, yellow, and black carrot waste were evaluated. Folate quantification was performed by converting folate derivatives into the active isoform 5-methyltetrahydrofolate (5-MTHF), followed by analysis using high-performance liquid chromatography with fluorescence detector (HPLC-FL). Free amino acids were identified and quantified via ultra-high-performance liquid chromatography coupled with electrospray ionization mass spectrometry (UHPLC-ESI-MS) using an Orbitrap analyzer. The results showed that orange carrot waste contained the highest folate content (634 µg 5-MTHF/100 g dry weight, dw), followed by black (459 µg 5-MTHF/100 g dw) and yellow (410 µg 5-MTHF/100 g dw) varieties. Among the identified amino acids, glutamine, asparagine, aspartic acid, glutamic acid, alanine and valine were present in the highest concentrations. Glutamine was the most abundant amino acid in all samples, with the highest concentration observed in yellow carrots waste (3118 mg/100 g dw), followed by orange (3019 mg/100 g dw) and black (1100 mg/100 g dw) varieties. These results highlight the nutritional potential of colored carrot waste, particularly as a source of folates and free amino acids, reinforcing its potential application in the development of functional ingredients. This approach contributes to reducing food waste and aligns with current strategies aimed at promoting sustainability and circularity within the food sector.

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P80 | EVALUATION OF ANTIOXIDANT AND PREBIOTIC POTENTIAL OF APPLE SAMPLES SUBJECTED TO *IN VITRO* GASTROINTESTINAL DIGESTION

Rafael Mascoloti Spréa[1*], Sofia Daniela Ribeiro Barros[1], João Soares Lourenço[1], Lillian Barros[1], Joana Amaral[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *rafael.sprea@ipb.pt

The valorisation of plant-based foods through simulated digestion models provides insight into the release and functionality of bioactive compounds under gastrointestinal conditions [1]. This study aimed to investigate the antioxidant activity and prebiotic potential of Pink Lady apple (*Malus domestica*) samples with and without peel, both in their in nature and lyophilized forms. The INFOGEST 2.0 protocol [2] was applied to simulate human digestion through sequential oral, gastric, and intestinal phases, generating bioaccessible (supernatant) and non-bioaccessible (residue) fractions. The antioxidant capacity was assessed using three complementary methods: DPPH radical scavenging, TBARS inhibition, and ferric reducing antioxidant power (RP). In parallel, the non-bioaccessible fractions were evaluated for prebiotic potential based on the growth stimulation of four probiotic strains: *Lactobacillus rhamnosus*, *L. casei*, *L. acidophilus* LA-5, and *Bifidobacterium animalis* Bb12.

The results demonstrated that the presence of apple peel and lyophilization significantly enhanced antioxidant potential. Lyophilized apple with peel showed the highest activity, with EC_{50} values of 11.83 ± 2.22 mg/mL (DPPH), 1.33 ± 0.02 mg/mL (TBARS), and 6.16 ± 0.51 mg/mL (RP). In comparison, samples without peel or lyophilization displayed weaker antioxidant effects: 197.18 ± 7.01 mg/mL (DPPH), 150.02 ± 8.45 mg/mL (TBARS), and 9.01 ± 0.37 mg/mL (RP). The digestion process led to a marked improvement in antioxidant activity, as seen in all bioaccessible fractions, reflecting the effective release of phenolic compounds.

The non-bioaccessible fractions, particularly those from lyophilized samples with peel, retained notable antioxidant activity post-digestion and demonstrated strong prebiotic effects. Growth curves indicated enhanced proliferation of all probiotic strains in the presence of these residues, with *L. rhamnosus* showing the highest responsiveness. These effects were often comparable to or superior to the control (fructooligosaccharides), underscoring the functional value of indigestible components such as dietary fiber and bound polyphenols.

In conclusion, apple peel and processing methods such as lyophilization positively influenced the release and retention of antioxidant and prebiotic compounds during digestion. The integration of INFOGEST and microbiological assays provides a robust framework to evaluate the functional potential of plant foods and supports the use of apple-derived materials in the development of functional ingredients.

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P81 | SOYA-BASED DRINK WITH ADDED MATCHA

M. Eduarda C. Silva[1,2*], Tayse Silveira[1], Rafael Spréa[1], Deisy A. Drunkler[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Departamento Acadêmico de Alimentos, UTFPR, Av. Brasil, 4232, Parque Independência, 85884-000, Medianeira, Brasil. *dudoacordeiro@gmail.com

There has been an increased search for vegetarian and/or vegan alternatives to replace foods of animal origin, such as soy-based drinks, rich in beneficial compounds, to replace milk. Soymilk can be a channel for other natural extracts such as matcha in a way to mitigate its beany flavor and enhance its bioactive composition [1]. Matcha is a green tea (*Camellia sinensis* L.) powder, which guarantees higher levels of beneficial compounds compared to common tea [2]. The objective of this work is to develop a soy-based vegetable drink with added matcha. Four formulations were prepared: SB (control, no matcha), SB0.4 (0.4% matcha, w/v), SB0.8 (0.8% matcha, w/v), and SB1.2 (1.2% matcha, w/v). The different beverage formulations were analyzed for their nutritional value (such as lipids, proteins, fibers, ash, carbohydrates and energy value) and their biochemical composition (sugars, organic acids, fatty acids and tocopherols). The nutritional value was evaluated through the official methods of AOAC, fatty acids were identified and quantified via gas chromatography with flame ionization detection (GC-FID), free sugars via high-performance liquid chromatography with refractive index (HPLC-RI), tocopherols via high-performance liquid chromatography with a fluorescence detection (HPLC-FL), organic acids via ultra-high-performance liquid chromatography coupled to diode array detection (UPLC-DAD) and free amino acids via ultra-high-performance liquid chromatography coupled with electrospray ionization mass spectrometry (UHPLC-ESI-MS). Furthermore, the bioactive potential of the drinks was evaluated, through the inhibition of lipid peroxidation (TBARS) and prebiotic activity based on the evaluation of optical density and growth of curves of probiotic bacteria. The nutritional value results showed that the addition of matcha increased (increase of 5 g/100g dried weight (dw)) amount of fiber in the protein drinks. The increase of fatty acids, such as linolenic acid (increase of 5.04 g/100g dw) and linoleic acid (increase of 5.37 g/100g dw) was noticed. The addition of matcha showed a big difference on the total of free sugars, almost double than without matcha (SB: 8.09, SB0.4: 14.66, SB0.8: 14.79, SB1.2: 15.29 g/100g dw). In other hand, the addition of matcha did not show any significant increase in organic acids and tocopherols. The addition of matcha also showed an increase in free amino acids, in particular, glycine, alanine, histidine and arginine (increase of 1.67, 5.62, 4.23, 22.96 mg/100g dw, respectively). Due to its antioxidant properties, the addition of matcha showed EC_{50} of 5,94; 5,57; 5,56 mg/mL, respectively, almost half when compared to without matcha (9,1 mg/mL). The prebiotic activity of soymilk with the highest amount of matcha showed the highest growth of probiotic cells, results really close to inulin, used as a prebiotic control. These results highlight the antioxidant potential of the application of matcha, can help mitigate the beany flavor of soya and at the same time work as a source antioxidant and increase the fiber and prebiotic potential of soymilk.

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P82 | WHITE BEAN FLOUR AS AN ALTERNATIVE TO ENHANCE THE NUTRITIONAL VALUE OF WHEAT BREAD: CHARACTERIZATION OF THE FLOUR

Aline Mazzola[1], Carlos Eduardo Junior[1,2], Carolina Castilho Garcia[1*], Daiane Cristina Lenhard[1], Gláucia Cristina Moreira[1], Nádia Cristiane Steinmacher[1]

[1]Academic Department of Food, Federal University of Technology - Paraná, campus Medianeira, Av. Brasil, 4232, Parque Independência, 85722-332, Medianeira, Paraná, Brazil; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *carolinacgarcia@utfpr.edu.br

Beans are pulses, sources of protein, carbohydrates, starch, fiber, vitamins, and minerals, containing phenolic compounds, flavonoids, tocopherol, amino acids, unsaturated fatty acids, and peptides [1]. In 2023, Brazil produced more than 2 million tons of beans [2]. Ramzy and Putra [1] noted that a significant number of studies have incorporated pulse flours into bread formulations to enhance the nutritional value of the final product. The present study aimed to characterize a commercial white bean flour from Brazil, evaluating its potential for bread production. White bean flour was purchased in Medianeira, BR. Moisture, ash, lipid, crude protein, and total carbohydrate contents were determined in triplicate. Flour color was also evaluated in replicates using spectrophotometry, as well as its water absorption index (WAI) and water solubility index (WSI). Particle size analysis of the flour was also performed using a vibrating sieve shaker with 25, 50, 60, 70, and 100 mesh screens, and the average Sauter diameter was determined. The composition of the white bean was: 10.95% ± 0.06 moisture, 3.85% ± 0.09 ash content, 1.03% ± 0.03 lipid content, 20.11 ± 0.56 protein content, and 64,05% ± 0,62 total carbohydrate content. The amount of water present in flour influences its durability and shelf life, as well as the products derived from it. For this reason, in Brazil, the maximum moisture content of flours should not exceed 14%. The ash content of white bean flour, at 3.85%, highlights its richness in minerals, which is attributed to the unrefined nature of the flour. Beans are rich sources of proteins, but not of lipids. Therefore, the lipid content of the flour was 1.03%, while its protein content was high. A high carbohydrate content was verified; however, the highest concentration of carbohydrates in beans is starch. Color parameters of white bean flour were: L* = 84.93 ± 0.79, a* = 0.45 ± 0.08, and b* = 11.86 ± 0.04. The color of flour influences the purchasing decision of products made with it. White bean flour was light-colored and yellowish, typical of legume flour, due to the presence of colored compounds in the raw material. White bean flour exhibited a good water retention capacity, with a WAI of 9.3 g gel/g dry matter, which may be advantageous in applications requiring dough formation, gelation, or in foods with higher consistency or moisture. The high-water absorption is particularly related to the presence of proteins with hydrophilic groups. The flour exhibited moderate water solubility, with a WSI of 4.6%, suggesting that most of the flour's structure remains insoluble in water. As WAI, the WSI of vegetable flours depends on several factors, including their carbohydrate, protein, lipid, and fiber composition. 76.97% of the flour passed through the 25-mesh sieve, indicating the predominance of 0.5 mm particles. The varied particle size distribution of the white bean flour indicated that it is suitable for use in food products requiring a lower degree of refinement. The average Sauter diameter of the flour was 0.407 mm. White bean flour has been identified as a functional ingredient due to its high ash and protein contents, demonstrating potential for replacing wheat flour in bread production with improved nutritional quality.

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P83 | WHITE BEAN FLOUR AS AN ALTERNATIVE TO ENHANCE THE NUTRITIONAL VALUE OF WHEAT BREAD: BREAD PRODUCTION AND TECHNOLOGICAL CHARACTERIZATION

Aline Mazzola[1], Maria Gabriela Leichtweis[2], Carolina Castilho Garcia[1], Daiane Cristina Lenhard[1], Gláucia Cristina Moreira[1], Nádia Cristiane Steinmacher[1*]

[1]Academic Department of Food, Federal University of Technology – Paraná, campus Medianeira, Av. Brasil, 4232, Parque Independência, 85722-332, Medianeira, Paraná, Brazil; 2CIMO, LA SusTEC, Polytechnic Institute of Bragança, Portugal. *nadiac@utfpr.edu.br

Bread is a globally accepted food and is consumed in a variety of forms and formulations. Although bread is a source of carbohydrates and energy, it is nutritionally deficient. Considering that beans are a pulse and the high production of this commodity in Brazil, incorporating white bean flour into bread formulations to enhance the nutritional value of the final product presents potential. The present study aimed to evaluate the characteristics of sliced breads produced with different ratios of wheat and white bean flours. White bean flour was purchased in Medianeira, BR, and previously characterized. Three bread formulations were produced: the control (C) with 100% wheat flour, and replacing 15% (T1) and 20% (T2) of wheat flour with white bean flour. The specific volume (SV), crumb firmness (F), crumb color (L*, a*, and b*), of the breads were determined in replicates. Water activity (aw) and pH were also determined. The effects of partially substituting wheat for white bean flour to produce sliced breads are shown in Table 1 and Figure 1. Preliminary studies have shown that white bean flour contains 20% protein. Considering the two levels of substitution of wheat flour for white bean flour (15% or 20%), it can be concluded that the breads developed have an increased protein content (3% or 4%). T1 and T2 breads presented significantly lower SV than the control, indicating denser breads with less air retained in the dough. The firmness of T1 and T2 breads was significantly greater than that of the control, pointing out that greater force is required in the chewing of T2 and T1 compared to C; and T2 presented the greatest firmness among the samples. Regarding the shelf life and food safety, the replacement of wheat with white bean flour in the highest percentage studied is interesting due to the significant decrease in the bread's aw. The pH of bread affects both its texture and flavor. The use of white bean flour in sliced breads resulted in a neutral pH, indicating a softer texture and a milder flavor than the control. Besides the possible changes in taste and flavor, the use of white bean flour is a potential alternative to obtain enriched sliced breads.

Table 1 – Characteristics of the sliced breads.

Formulation	SV (g/cm^3)	F (N)	L*	a*	b*	aw	pH
C	4,37 ± 0,12^a	6,63 ± 0,74^c	62,06 ± 2,08^a	-1,05 ± 0,01^a	11,36 ± 0,20^c	0,957	5,71
T1	2,27 ± 0,11^b	15,28 ± 0,83^b	67,19 ± 0,79^a	-0,51 ± 0,05^b	13,74 ± 0,09^b	0,959	6,49
T2	2,37 ± 0,39^c	21,97 ± 1,37^a	67,51 ± 3,03^a	-0,30 ± 0,14^b	15,20 ± 0,34^a	0,949	6,51

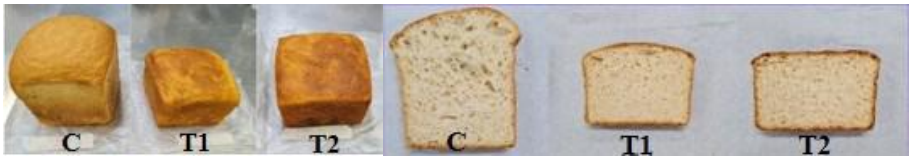

Figure 1 – External and internal (crumb) visual aspects of the breads.

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P84 | INFLUENCE OF SPROUTING ON NUTRITIONAL PROFILE OF CHICKPEAS (*CICER ARIETINUM* L.)

Ana Clara Souza[1], Antonio Roberto Giriboni Monteiro[1*]

[1]Department of Food Engineering, State University of Maringa, Brazil. *argmonteiro@uem.br

Chickpeas (*Cicer arietinum* L.) are legume crops with a balanced nutritional profile, characterised by their high levels of protein, essential amino acids, and bioactive compounds with antioxidant activity. Sprouting, through enzymatic activation, is an effective strategy to enhance these attributes, promoting improvements in the nutritional and functional value of the grains. In this study, selected and hydrated grains were germinated in four treatments at 20 and 30°C for 48 and 96 hours in a B.O.D. incubator, dried at 50°C, ground, and analysed for: protein content by the micro-Kjeldahl method [1]; amino acid profile by HPLC after acid hydrolysis [2,3]; phenolic compound composition by ultra-high-performance liquid chromatography coupled with mass spectrometry (UHPLC-MS/MS) [4]; and antioxidant activity by the ABTS and FRAP methods, expressed in µmol Trolox equivalents per gram of sample [5].

Germination promoted a significant increase in protein content, especially in the treatment carried out at 30°C for 96 hours, increasing it from 14.607 to 23.194 g/100 g, which can be attributed to the synthesis of new proteins stimulated by enzymatic activation and the reduction of carbohydrates and lipids used as an energy source, resulting in a higher relative protein concentration [6,7]. In the amino acid profile, an enrichment of both essential and non-essential amino acids was observed, with emphasis on arginine (7.736 to 9.375 mg/g), histidine (3.491 to 5.285 mg/g), valine (3.655 to 5.692 mg/g), threonine (1.780 to 4.362 mg/g), aspartic acid (8.616 to 11.610 mg/g) and serine (10.106 to 12.137 mg/g), resulting from protein hydrolysis mediated by protease enzymes [8]. The germination process also promoted considerable increases in the concentration of phenolic compounds, with emphasis on quercetin (from absent to 1.348 µg/g), fumaric acid (1.107 to 4.796 µg/g) and vanillin (2.657 to 3.721 µg/g). The total phenolic content, the sum of the identified compounds, increased from 10.642 to 20.545 µg/g after germination, resulting from the release of phenolic compounds bound by the action of hydrolytic enzymes and the intensification of phenolic biosynthesis via phenylalanine ammonia-lyase [9]. Consequently, antioxidant activity was also significantly improved, increasing from 0.246 to 0.527 µmol/g using the ABTS method and from 0.133 to 0.533 µmol/g using the FRAP method, reflecting the metabolic transformations and release of phenolic compounds mediated by endogenous hydrolytic enzymes during germination.

Based on the results obtained, it is concluded that chickpea germination at 30 °C for 96 hours is a practical approach for enhancing the nutritional and bioactive quality of the grain, favouring its use in the development of functional ingredients for healthy eating.

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P85 | COFFEE SILVERSKIN, A ROASTING BY-PRODUCT, AS A FUNCTIONAL INGREDIENT: PHENOLIC PROFILE CHANGES DURING *IN VITRO* GASTROINTESTINAL DIGESTION AND COLONIC FERMENTATION

Marlene Machado[1], Paula Roade-Pérez[2], Gerardo Álvarez-Rivera[3], Alejandra Cardelle-Cobas[2], Maria B. P. P. Oliveira[1], Helena Ferreira[4], Rita C. Alves[1*]

[1]REQUIMTE/ LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Rua Jorge Viterbo Ferreira, 228, 4050-313, Porto, Portugal; [2]LHICA, Department of Analytical Chemistry, Nutrition and Bromatology, Faculty of Veterinary Science, University of Santiago Compostela, Lugo, 27002, Spain; [3]CRETUS, Department of Analytical Chemistry, Nutrition and Food Science, University of Santiago de Compostela, Santiago de Compostela, Spain; [4]i4HB, UCIBIO, Department of Biological Sciences, Faculty of Pharmacy, University of Porto, Portugal. *rcalves@ff.up.pt

Coffee silverskin, a by-product of green coffee bean roasting, consists of a thin tegument rich in dietary fiber (60-80%), proteins (18%), and phenolic compounds, particularly chlorogenic acids with recognized bioactive properties. Its potential as a functional ingredient requires assessing the impact of gastrointestinal digestion (GID) and colonic fermentation (CF) on phenolic stability and bioaccessibility [1]. This study aimed to evaluate the changes in the phenolic profile of coffee silverskin during *in vitro* GID and CF.

Milled coffee silverskin was digested *in vitro* according to the INFOGEST protocol [2]. The bioaccessible fractions from the gastric and small intestinal phases, and the non-bioaccessible fraction obtained by dialysis, were collected and freeze-dried. The latter was used to simulate CF with human fecal microbiota (5 volunteers, 5 independent CFs) [3]. CFs were performed in vessels maintained at 37 °C, pH 6.8, under anaerobic conditions, and aliquots were collected at 0, 5, 10, 24, 34, and 48 h. The bioaccessible fractions from *in vitro* GID and CF were analysed for phenolic compounds by UHPLC-ESI(-)-QTOF-MS/MS.

After *in vitro* GID were identified 13 compounds in bioaccessible fraction distributed across four families: cinnamic acids (n=4), cinnamoylquinic derivatives (n=6), benzoic acids (n=2), and benzaldehydes (n=1). The total phenolic content of the bioaccessible fraction reached 38.92 and 33.54 mg/100 g silverskin in the gastric phase and the small intestinal phase, respectively, with no significant differences between them. In both phases, 5-feruloylquinic acid was the predominant compound. During CF, 9 phenolic compounds were detected: cinnamic acids (n=3), cinnamoylquinic derivatives (n=4), benzoic acids (n=1), and benzaldehydes (n=1). A progressive increase in total phenolics up to 48 h revealed microbial metabolism of silverskin matrix. Protocatechuic acid and protocatechuic aldehyde were the predominant metabolites at 34 and 48 h, coinciding with the maximum total phenolic content. In conclusion, phenolic compounds from silverskin can be released and transformed during *in vitro* GID and CF, supporting its potential as a promising functional ingredient for human health.

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P86 | REDUCTION OF ANTINUTRITIONAL FACTORS IN LENTIL FLOURS THROUGH VARIOUS PHYSICAL PRETREATMENTS

Ângela Liberal[1*], Isabel C. F. R. Ferreira[1], Ana Maria Vívar-Quintana[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Food Technology Area, Escuela Politécnica Superior de Zamora, Universidad de Salamanca, Zamora, Spain. *angela.liberal@ipb.pt

Lentils (*Lens culinaris* spp.) are one of the oldest cultivated leguminous worldwide. Although lentils are recognized as nutritious leguminous, which makes them a suitable option in vegetarian diets as an alternative to meat products, their composition and nutritional characteristics vary between different varieties. In addition, the overall composition and health benefits of lentils can be influenced by the presence of other components known as antinutritional factors (ANFs), which can exert effects contrary to optimal nutrition. The presence of ANFs can be modulated through various processing methods, some of which have been associated with improving the nutritional value of legumes by partial or total suppression of ANFs, as well as increasing certain nutrients, protein and fiber digestibility, and mineral bioavailability.

Thus, the aim of this work is to investigate the effect of different physical pretreatment techniques, namely soaking, cooking, germination and microwave roasting, on specific FANs (phytates, condensed tannins and trypsin inhibitors) in lentils. The results showed a significant influence ($p < 0.05$) on the total concentration of ANFs, with germination and cooking standing out as the most effective in reducing their presence in the overall lentil flours. Phytic acid was completely eliminated during germination, due to its degradation by the phytase enzyme activated during this process, while condensed tannins and trypsin inhibitors were more affected by cooking, where the catalytic enzymes and the thermolabile nature of the compounds are mainly responsible for their greater reductions.

The results obtained showed that all processing methods exerted some influence on the ANFs analyzed, allowing better inferences about the behavior of lentil flours in the formulation of new food products through different methods that can meet the current nutritional and health demands of today's society.

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P87 | SYNERGISTIC EFFECTS OF PHYSICAL PRETREATMENTS AND FERMENTATION ON THE NUTRITIONAL IMPROVEMENT OF LENTIL (*LENS CULINARIS* SPP.) FLOURS

Ângela Liberal[1*], Ângela Fernandes[1], Isabel C. F. R. Ferreira[1], Ana Maria Vívar-Quintana[2], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Food Technology Area, Escuela Politécnica Superior de Zamora, Universidad de Salamanca, Zamora, Spain. *angela.liberal@ipb.pt

Lentils are one of the oldest leguminous consumed and cultivated around the world, and despite these being established as a nutritious food, their composition and nutritional value can differ among different varieties. Various processing methods have been explored to improve legumes' nutritional value, which can enhance the concentration of micro and macronutrients, and provide better digestibility and bioavailability of proteins, fibers, and minerals present in the grains [1].
Thus, this study aims to evaluate the influence of different physical processing methods (germination and cooking), individually and in combination with lactic acid (*Lactobacillus rossiae* and *Lactobacillus brevis*) and yeast (*Saccharomyces boulardii*) fermentation, on the nutritional profile of two varieties of lentils (Beluga and Du Puy), to obtain nutritionally richer flours. Germination was carried out for 72 hours in the dark at room temperature, and, in parallel, the grains were cooked for 20 minutes after being soaked in distilled water for 12 hours. Fermentation was carried out by adding the starter cultures of each selected microorganism to the lentil flour doughs and left to ferment for 24 hours at 30°C [2]. The fermented lentil flour doughs were freeze-dried for subsequent nutritional analyses using AOAC procedures.
Our results showed significant ($p \leq 0.05$) differences in all the analyzed parameters and among the different treatments and microorganisms' combinations. Carbohydrates were the main macronutrients found, decreasing their concentration after all treatments. The concentration of fiber was different among varieties and processing methods, with an increase in its concentration after the germination and fermentation of the Beluga variety and, on the other hand, its decrease after cooking and fermentation. The concentration of proteins seems to increase after all treatments, with the highest concentration observed in the Beluga variety after germination and fermentation with *L. rossiae* and *S. boulardii* (38.4±0.5 g/100 g dry weight (dw)) compared to its raw form (26.8±0.5 g/100 g dw). In turn, the concentration of fat was reduced during isolated germination and cooking and increased after fermentation. Finally, the concentration of ashes significantly increased in the Beluga variety after germination treatments combined with fermentation.
Briefly, all the analyzed processing methods exerted some influence on the nutritional profile of the two varieties of lentils, highlighting the influence of the combination of different methods to improve the nutritional properties of lentil flours, mainly in the concentration of proteins and fibers.

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P88 | VALORIZATION OF CARROT WASTE AS A SOURCE OF BIOACTIVE COMPOUNDS

Joana P. B. Rodrigues[1,2*], Tânia C. S. P. Pires[1], Maria Beatriz P. P. Oliveira[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Rua Jorge Viterbo Ferreira nº228, 4050-313 Porto, Portugal. *joanapbrodrigues@ipb.pt

Carrots (*Daucus carota* L.) are widely consumed for their nutritional value and phytochemicals, including vitamins, minerals, carotenoids, and phenolic compounds. In 2022, global production exceeded 36 million tons [1]. However, it is estimated that a significant portion is discarded either because it does not meet aesthetic standards or during industrial processing. This material contributes to environmental and economic impacts, particularly due to the generation of organic waste [3]. Exploiting these wastes, due to their high content of bioactive compounds, presents a sustainable approach to agri-food valorization. This study aims to characterize the biochemical properties of carrot waste. Carrot samples, namely orange, yellow, and purple, were provided from a local company in Bragança, Portugal. The samples were freeze-dried and then subjected to decoction and maceration extraction using boiling water and an ethanol/water solution (80:20, v/v), respectively. Tocopherols (HPLC-FL), organic acids (UFLC-PDA), minerals (atomic absorption spectrophotometry), and total carotenoids (spectrophotometry) were identified and quantified. Antioxidant activity was assessed using the TBARS assay (inhibition of lipid peroxidation), while antibacterial activity was evaluated against food-borne bacterial strains. The orange carrot stood out with the highest organic acid content (7.3 g/100 g dried weight (dw)), while the purple variety exhibited the highest tocopherol content (14.17 mg/100 g dw) and carotenoids (0.096 mg/d gw). All samples exhibited high potassium content, ranging from 9.5 to 14.8 g/kg in purple and orange carrot samples, respectively. In terms of antioxidant activity, the orange and black decoction extracts, as well the orange hydroethanolic extract, exhibited similar activity, with EC_{50} values of 0.8 mg/mL in the TBARS assay. In the antibacterial activity assays, the hydroethanolic extract of yellow carrot exhibited the best activity, with a minimum inhibitory concentration (MIC) of 1.25 mg/mL against the bacterial strain Yersinia enterocolitica. Every year, the agrifood industry generates substantial amounts of food waste due to processing errors or consumer rejection. This study highlights the potential of such waste as a valuable source of bioactive compounds, emphasizing its application in the development of sustainable and innovative solutions, and reinforcing the principles of the circular economy.

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P89 | MONOCULTIVARS AND MIXED-CULTIVARS OF OLIVE POMACE FROM PORTUGAL: CHARACTERIZATION OF THE MINERAL AND LIPID PROFILES

Diana Melo Ferreira[1*], Liliana Espírito Santo[1], M. Antónia Nunes[1], Alida La Rocca[1], Edgar Pinto[2], Agostinho Almeida[1], M. Beatriz P. P. Oliveira[1], Rita C. Alves[1]

[1]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Jorge de Viterbo Ferreira Street 228, 4050-313 Porto, Portugal; [2]REQUIMTE/LAQV, ESS, Polytechnic of Porto, Dr. António Bernardino de Almeida Street, 4200-072 Porto, Portugal. *dimelo@ff.up.pt

The olive tree (*Olea europaea* L.) is a cornerstone of agricultural economies in Mediterranean countries. Portugal produces around 170,000 tons of olive oil per year, creating large quantities of olive pomace (OP), a phytotoxic by-product which presents several disposal challenges.

Since most studies with OP focus on its phenolic content [1], this study explored other components of OP, by determining the differences between the mineral (ICP-MS and FAAS) and lipid (GC-FID) profiles from monocultivars and mixed-cultivars of OP collected in Portugal (Figure 1).

About the mineral profile, Mix-F presented the highest ash content (8%). In the principal component analysis (PCA) plot, Mono-AQ was separated from the other OP samples because of its high manganese amount (21 µg/g), while Mix-B was separated because of its highest contents of iron (97 µg/g), aluminum (64 µg/g), and sodium (601 mg/kg), and presenting molybdenum content below the detection limit.

Regarding the lipid profile, Mono-AS presented the highest fat content (15%). Mono-K was separated from the other samples because of its high oleic acid content (75%) and the exclusive presence of C17:1. Mix-A and Mix-V clustered together because of their higher polyunsaturated fatty acids sums (12%).

All in all, Mono-K had the highest contents of essential minerals and oleic acid. When properly extracted, the minerals and fatty acids of OP can have sustainable applications in food, dietary supplements, cosmetics, and agriculture, reducing this waste and enhancing the economic viability of olive oil production.

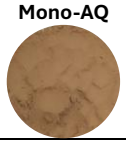
Mono-cultivars				
Sample	**Mono-AQ** 	**Mono-AS**	**Mono-K**	**Mono-O**
Origin	Ferreira do Alentejo, Alentejo, Portugal			
Cultivar	Arbequina	Arbosana	Koroneiki	Oliana
Mixed-cultivars				
Sample	**Mix-A**	**Mix-B**	**Mix-F**	**Mix-V**
Origin	Alfândega da Fé, Trás-os-Montes, Portugal	Beja, Alentejo, Portugal	Ferreira do Alentejo, Alentejo, Portugal	Valpaços, Trás-os-Montes, Portugal
Predominant Cultivars	Cobrançosa, Madural, Verdeal Transmontana, Cordovil	Cobrançosa	Arbosana	Madural, Cordovil

Figure 1 – Olive pomace samples collected in Portugal for this study. AQ: Arbequina, AS: Arbosana, K: Koroneiki, O: Oliana, A: Alfândega da Fé, B: Beja, F: Ferreira do Alentejo, V: Valpaços.

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P90 | ANALYSIS OF THE PHENOLIC PROFILES OF OLIVE POMACE EXTRACTS OBTAINED BY GREEN METHODS

Diana Melo Ferreira[1*], Thiago F. Soares[1], Susana Machado[1], M. Beatriz P. P. Oliveira[1], Rita C. Alves[1]

[1]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Jorge de Viterbo Ferreira Street 228, 4050-313 Porto, Portugal. *dimelo@ff.up.pt

Olive oil production is a key sector of the Mediterranean food industry, but it also poses environmental challenges due to the large volume of by-products it generates. Fresh olive pomace (FOP) is the most significant of these by-products, as it contains high concentrations of bioactive compounds that, while valuable, are also phytotoxic and can lead to environmental issues if not properly managed [1]. Currently, some companies extract the residual fat content from FOP, producing another by-product: extracted olive pomace (EOP).

This study aimed to analyze the phenolic profiles of different extracts from FOP and EOP from Trás-os-Montes, Portugal, using ultrasound-assisted extraction (UAE), microwave-assisted extraction (MAE), and conventional extraction (CE), with varying percentages of aqueous ethanol as solvent (Figure 1). After centrifugation, the extracts were freeze-dried and resuspended in 1 mL of methanol prior to HPLC-DAD-FLD injection and analysis.

In general, EOP extracts exhibited higher levels of phenolic compounds (Hydroxytyrosol: 771–972, Tyrosol: 442–550, Oleuropein: 128–299, Pinoresinol: 12–16, and Verbascoside: 140–223 mg/100 g of freeze-dried extract), which can be attributed to the lower water and fat content of EOP, making it an enriched source of these compounds, compared to FOP (Hydroxytyrosol: 109–163, Tyrosol: 164–196, Oleuropein: 139–197, Pinoresinol: 6–8, and Verbascoside: 83–101 mg/100 g of freeze-dried extract).

Among the tested extraction methods, CE yielded the lowest phenolic contents compared to UAE and MAE. Within CE, the use of 60% ethanol recovered slightly higher amounts of phenolics than 50% ethanol.

Overall, when efficiently extracted, these compounds show promising potential for applications in pharmaceuticals, nutraceuticals, and cosmetics, turning an environmental challenge into an opportunity for innovation and sustainability.

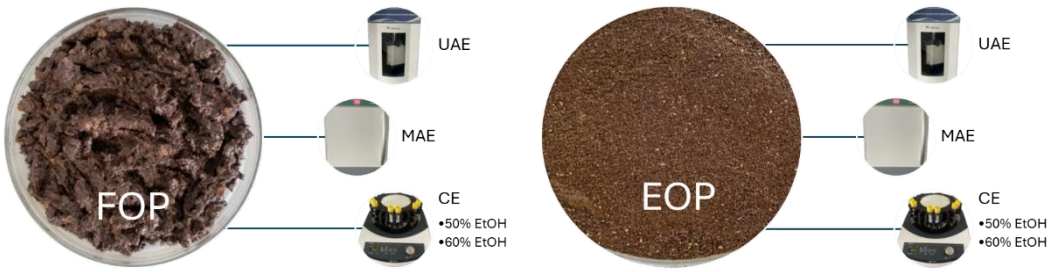

Figure 1 – Samples and methods of extraction used in this study. Fresh olive pomace: FOP, Extracted olive pomace: EOP, Ultrasound-assisted extraction: UAE, Microwave-assisted extraction: MAE, Conventional extraction: CE, Ethanol: EtOH.

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P91 | NOVEL INSIGHTS INTO THE ANTI-OBESITY POTENTIAL OF MYRICETIN USING A *DROSOPHILA* MODEL

Wanning Ma1, Jianbo Xiao[1*]

[1]University of Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Faculty of Science, E32004 Ourense, Spain. *ambermamama@163.com

Obesity is a growing global health issue linked to metabolic syndromes, including type 2 diabetes and cardiovascular diseases. Excessive energy intake contributes significantly to weight gain and systemic metabolic disruption. Flavonoids exert anti-obesity effects by modulating lipid metabolism, reducing oxidative stress, and suppressing chronic inflammation [1]. Myricetin, a flavonoid found in fruits such as bayberry (*Myrica rubra*), has been shown to possess antioxidant, anti-inflammatory, and anti-obesity properties in both in vitro and mammalian models [2]. In this study, we established a high-sugar diet (HSD) induced obesity model in *Drosophila melanogaster* to further evaluate the anti-obesity potential of myricetin. Fed a standard diet, HSD, or HSD supplemented with myricetin, flies of separate genders exhibited differently. Behavior assays and expression of genes related to lipid metabolism are tested. Myricetin-treated flies showed significantly reduced fat accumulation, and improved physical activity compared to the HSD group. RT-qPCR results also suggested that myricetin may enhance lipolysis and inhibit lipogenesis by regulating genes. Together, our data suggest that myricetin effectively alleviates diet-induced obesity in *Drosophila*, and this is consistent with its systemic metabolic benefits observed in mammals. These results highlight myricetin's potential as a natural therapeutic candidate for obesity management.

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P92 | ARTISANAL FISHING AND FOOD SECURITY: THE ROLE OF *BRYCON AMAZONICUS* IN THE SOUTHWEST AMAZON

Rafael Paiva[1], Anderson G. Prestes[1,2], José Lucas G. Prestes[1,3], Cristina V. Almeida[1,4], Eduardo C. Batista[1,5], Vinicius Rafael B. Silva[1,6], Wilson R. Martins[1,7], Marcelo P. G. Pinto[1,8], Josué G. C. Filho[1,9], Jamile A. Caetano[1,10], Marcelo Rodrigues dos Anjos*

[1]LIOP, UFAM, BRAZIL

The fish *Brycon amazonicus* (jatuarana) is one of the most important species in the Amazon basin, notable for its commercial value and importance for artisanal fishing and aquaculture [1,2]. Studies highlight that the species grows rapidly, is highly fertile, and is widely distributed throughout the Amazon basin, characteristics that make it strategic for the food and nutritional security of local communities [3]. This study analyzed *B. amazonicus* landings in the Z-31 fishing colony in Humaitá, Amazonas, between 2020 and 2023, highlighting the species' contribution to food security and the strengthening of traditional food practices. The results showed that the average individual weight was 1.06 kg, with an average length of 36 cm. Total production for the period was around 12 tons, with an average of 58 kg per fishing trip and up to 174 kg per operation. In economic terms, the average selling price was R$11.45/kg, resulting in an average revenue of R$10,000.00 in exceptional operations. The estimated revenue for the monitored period was approximately R$236,446.65, highlighting the importance of jatuarana as a source of livelihood and income for riverside communities. Analysis of *Brycon amazonicus* landings between 2020 and 2023 shows that the species plays an essential role in Amazonian food security. In addition to providing high-quality, affordable, and culturally valued protein, the species ensures regular supply and represents an important source of income for local fishing communities. Therefore, the continuity of artisanal fishing, combined with public policies and sustainable management strategies, is essential to ensure both the conservation of biodiversity and the maintenance of food sovereignty for Amazonian populations.

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P93 | DEVELOPMENT OF HIGH-FIBER, HIGH-PROTEIN BREAKFAST CEREALS FROM AGRIFOOD BY-PRODUCTS TO IMPROVE NUTRITIONAL QUALITY AND SUSTAINABILITY IN PORTUGAL

Luís M. G. Castro[1], Ema Dias[2], Manuela Pintado[1*]

[1]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal; [2]Germen - Moagem de Cereais, S.A., R. Vasco Santana, 4461-901 Sra. da Hora, Porto Portugal. *mpintado@ucp.pt

The current processing practices of agrifood products generate significant by-products and waste streams, such as pomaces and hulls/bran, which are valuable, low-cost sources of essential nutrients like dietary fiber and protein. Still, they are often underutilized, posing environmental and nutritional challenges. In Portugal, breakfast cereals (BC) often have poor nutritional profiles, characterized by high sugar, saturated fat, and salt content, as well as insufficient dietary fiber, despite their high consumption. EFSA recommends a daily intake of 25 g of fiber, but the average intake in Portugal is only 17.8 g [1-3]. This highlights the need to reformulate BC with higher fiber contents while maintaining their sensorial quality. Thus, the present work aims to develop innovative BC (with better nutritional quality and environmentally friendly), utilizing by-products from cereal milling (wheat germ and bran) enriched with chickpea, apple, and rice flours, materials selected given their fiber and protein contents. To accomplish this, all flours were characterized in terms of their nutritional profile, with chickpea flour, wheat germ, and heat-treated wheat germ exhibiting the highest protein contents (22.2%, 33.8%, and 33.2%, respectively), while coarse and fine wheat bran showed the highest dietary fiber contents (57.5% and 69.6%, respectively). Formulations were designed by mathematical optimization, combining all materials to ensure 2 key parameters: 1) ensure the resulting BC contained at least 6% dietary fiber, and 2) that the cereal formulation derived at least 20% of its total energy from its protein content. These compositions were expected to yield cereals with 18.5-28.2% dietary fiber and 18.5-30.2% protein, corresponding to 20.7-31.1% of the total energy value. BC were prepared by combining flour mixtures 1:2 (w:w) with water, cold extrusion, and drying (60 ºC overnight), with actual compositional characterization demonstrating that the resulting formulations exhibited a fiber content ranging between 19.5±1.1-25.8±1.2% and protein contents from 18.5±0.1-29.0±1.0%. This work demonstrates the benefits of valorizing agrifood by-products in a nutritionally savvy manner, i.e., addressing waste management by repurposing wheat germ and bran into healthier breakfast cereals with both high fiber and high protein content. This approach aligns with the United Nations Sustainable Development Goals and responds to the pressing needs for healthier, more sustainable food products.

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P94 | EFFECT OF NITRITE CONTENT ON THE MICROBIOLOGICAL QUALITY AND PHYSICOCHEMICAL CHARACTERISTICS OF SMOKED CHORIZO

Ana Luisa Silva[1], Paulo Fernandes[1,2], Élia Fernandes[1,2], Vitor Monteiro[1], Alberta Araújo[1,2,3,*]

[1]Escola Superior de Tecnologia e Gestão, IPVC, Viana do Castelo, Portugal; [2]CISAS Centro de Investigação e Desenvolvimento em sistemas agroalimentares e sustentabilidade, IPVC, Viana do Castelo, Portugal; [3]CEB Centre of biological engineering, University of Minho, Braga, Portugal. *alberta@estg.ipvc.pt

The aim of this study was to evaluate the effect of reducing nitrite levels in smoked chorizo in accordance with the revised limits established by Regulation (EU) 2023/2108. Published in the Official Journal of the European Union on 9 October 2023, this regulation amended Annex II of Regulation (EC) No 1333/2008 and the Annex of Regulation (EU) No 231/2012 regarding the use of nitrites and nitrates, setting the maximum residual level at 80 mg of nitrite per kg of meat product. Nitrites play a fundamental role in the production of cured meat products, as higher concentrations have traditionally been associated with improved colour stability, enhanced sensory and technological quality, and the inhibition of microbial spoilage. Nevertheless, their use has become increasingly restricted due to potential health concerns related to the formation of nitrosamines. As a result, reducing nitrite concentrations may affect not only the physicochemical characteristics but also the microbiological safety of smoked chorizo. Consequently, lowering nitrite levels may influence not only the physicochemical properties but also the microbiological safety of smoked chorizo [1].

Meat chorizo was processed in a local meat industry (Seara, S.A.) and evaluated during storage at: 0, 15, 30, 60, 90 and 120 days, using formulations containing 125 ppm (CA) and 75 ppm (CR) of nitrites, in accordance with Regulation 2023/2108. Physicochemical analyses included moisture content (AOAC 948.12-2002), chloride content (NP1422:1977), pH (AOAC 981.12-2016) and nitrite and nitrate levels (ISO 3091:1975). Water activity was determined using a LabSwift-aw water activity meter. The quantification and detection of microorganisms were performed according to standardized methods. Colour evaluation during ripening time was carried out using the CIE L*, a* and b* colour spaces system.

As expected, nitrate and nitrite contents varied inversely with microbial load, since these compounds act as inhibitors of microbial activity. The CA formulation showed higher values of moisture, chloride, and colour parameters a and L, which can be attributed to the higher nitrite concentration, directly influencing both colour development and ionic balance. In contrast, the CR formulation presented higher fat content, colour parameter b, and water activity (aw), indicating samples with a more pronounced yellow hue and lower moisture content. The increased yellowness may be associated with the higher fat percentage. The addition of only 75 ppm nitrite allows compliance with the new regulation, which limits this additive compared to previous standards, while ensuring the microbiological safety of the products in accordance with the microbiological criteria defined in Regulation (EC) No 2073/2005. Smoked chorizo maintained satisfactory quality throughout the 120-day storage period, according to the parameters analysed in this study.

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P95 | EFFECT OF NITRITE CONTENT ON THE MICROBIOLOGICAL QUALITY AND PHYSICOCHEMICAL CHARACTERISTICS OF HAM

Ana Luisa Silva[1], Paulo Fernandes[1,2], Élia Fernandes[1,2], Vitor Monteiro[1], Alberta Araújo[1,2,3*]

[1]Escola Superior de Tecnologia e Gestão, IPVC, Viana do Castelo, Portugal; [2]CISAS Centro de Investigação e Desenvolvimento em sistemas agroalimentares e sustentabilidade, IPVC, Viana do Castelo, Portugal; [3]CEB Centre of biological engineering, University of Minho, Braga, Portugal. *alberta@estg.ipvc.pt

The aim of this study was to evaluate the effect of reducing nitrite levels in ham in line with the revised limits established by Regulation (EU) 2023/2108. Published in the Official Journal of the European Union on 9 October 2023, this regulation amends Annex II of Regulation (EC) No 1333/2008 and the Annex of Regulation (EU) No 231/2012 concerning the use of nitrites and nitrates, setting the maximum residual level at 80 mg of nitrite per kg of meat product. Following a transition period ending on 9 October 2025, the new limits will apply across the European Union, with the objective of minimizing potential health risks, such as nitrosamine formation, while safeguarding the microbiological safety of meat products.

Ham was processed in a local meat industry (Seara, S.A.) using 149 ppm and 75 ppm of nitrite in the HA and HR formulations, respectively, in accordance with Regulation (EU) 2023/2108, and evaluated during storage at 0, 15, 30, 60, 90, and 120 days. Physicochemical analyses included moisture content (AOAC 948.12-2002), chloride content (NP 1422:1977), pH (AOAC 981.12-2016), ash (NP 1615:2002), protein (ISO 937:2023), and nitrite and nitrate content (ISO 3091:1975). Water activity was determined using a LabSwift-aw meter. Microbiological quantification and detection were carried out following standardized methods. Colour evaluation during ripening time was conducted using the CIE L*, a* and b* colour spaces system.

Microbiological analysis revealed that leg ham in the HR formulation had slightly higher levels of total aerobic microorganisms compared with HA. Nevertheless, by the end of the storage period, both formulations complied with the legal limits regarding the presence of pathogenic microorganisms such as *Salmonella* spp. and *Listeria monocytogenes*, as well as with widely accepted international guidelines (HSA, 2024) concerning the other microorganisms analyzed, including *S. aureus*, *Enterobacteriaceae*, *B. cereus*, *E. coli*, and sulfite-reducing *Clostridium* spp. The combined effect of low water activity and reduced pH contributed to the inhibition of microbial growth, including the suppression of the active flora observed during the initial phase. Regarding colour, the HA formulation exhibited a higher a* component, associated with nitrate addition, whereas the HR formulation showed difference in the L* and b* parameters, confirming the influence of nitrite on colour stability. No significant differences were observed between the two formulations in terms of ash, phosphorus, or protein content. Overall, these results highlight the role of nitrite in colour development and stabilization, as evidenced by the differences between the HA and HR groups. The addition of 75 ppm of nitrite to ham, in accordance with Regulation (EU) 2023/2108 on nitrate and nitrite levels and Regulation (EC) No 2073/2005 on microbiological criteria, demonstrated that the products maintained satisfactory quality throughout the 120-day shelf life, according to the parameters analysed in this study.

P96 | METABOLOMIC PROFILING OF NATIVE CERRADO FRUITS

Lorrane R. de Souza[1,2*], Lucas K. S. Casimiro[2], Danielle A. C. Rodrigues[2], Eduardo V. de B. Vilas Boas[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Departamento de Ciência dos Alimentos, UFLA, Lavras, 37200-000 Minas Gerais, Brasil. *lollaribeiros@gmail.com

The Cerrado, Brazil's second-largest biome, is one of the most biodiverse tropical savannas in the world and harbours a vast array of native species that remain scientifically and commercially underexploited [1]. Among the fruits with promising potential are cajá-manga (*Spondias mombin* L.), white aloe (*Cordia superba*), seriguela (*Spondias purpúrea* L.), and genipap (*Genipa americana* L.), all of which exhibit highly relevant nutritional, colour, and cultural attributes, and demonstrate potential applications in the food, cosmetics, and pharmaceuticals sectors. However, limited scientific knowledge constrains the full exploitation of these species' productive potential. Therefore, characterizing the phytochemical profiles of these fruits highlights their importance for food and nutritional security, particularly in local communities, while also fostering sustainability and strengthening the regional economy through agricultural and extractive practices that respect the biome. This study aims to investigate the metabolomic profiles of Cerrado fruits. Nutritional value (lipids, proteins, ashes, fibers, carbohydrates, and energetic value) will be determined according to AOAC standard procedures while free sugars will be identified and quantified by high-performance liquid chromatography with refractive index (HPLC-RI), organic acids by ultra-high-performance liquid chromatography coupled with diode array detection (UPLC-DAD), fatty acids by gas chromatography with flame ionization detection (GC-FID), tocopherols by high-performance liquid chromatography with fluorescence detection (HPLC-FL), and amino acids and phenolic compounds by ultra-high-performance liquid chromatography coupled with electrospray ionization mass spectrometry (UHPLC-ESI-MS). Their antioxidant, toxicity, and anti-inflammatory activities were evaluated through *in vitro* assays, while antimicrobial activity was assessed against food-borne bacterial strains, and prebiotic activity was determined by monitoring optical density and growth curves of probiotic bacteria. To complete the study, the fruit exhibiting the most promising bioactive compounds will be selected for the development of a functional food product, aiming to harness its nutritional and bioactive properties for potential applications. Based on the results, we aim to advance scientific knowledge of the chemical composition and bioactive potential of these fruits, providing new insights for their application in the food. The study is also expected to promote the appreciation of Cerrado fruits, promote sustainable agricultural practices, and foster the inclusion of local communities in the supply chain, thereby creating sustainable alternatives for income generation.

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P97 | EFFECT OF *IN VITRO* GASTROINTESTINAL DIGESTION ON PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY OF GENIPAPO

Lorrane R. de Souza[1*], Lucas K. S. Casimiro[1], Danielle A. C. Rodrigues[1], Ângela Fernandes[2], Eduardo V. de B. Vilas Boas[1]

[1]Departamento de Ciência dos Alimentos, UFLA, Lavras, 37200-000 Minas Gerais, Brasil; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *lollaribeiros@gmail.com

Genipapo (*Genipa americana* L.) is a native fruit distributed across Central and South America. It is a rich source of phenolic compounds and exhibits high antioxidant activity. Flavonoids and monoterpenes present in the fruit contribute in the prevention of chronic conditions, including liver and cardiovascular diseases [1]. However, the effects of these compounds in humans depends on their concentration in food and their bioaccessibility (the fraction released from the food during digestion that becomes available for intestinal absorption). Given the above, this study aimed to elucidate the effects of simulated in vitro gastrointestinal digestion on the phenolic compounds and antioxidant activity of genipap. Extracts for the analysis of total phenolics and antioxidant activity prior to digestion were obtained by diluting the freeze-dried fruit in 70% methanol (1:20 w/v). The in vitro digestion was carried out according to the standardized INFOGEST protocol [2]. Subsequently, the samples were analyzed for total phenolic compounds (TPC) and total flavonoids (TF), as well as for their antioxidant activity using the ferric reducing power antioxidant power (FRAP) and phosphomolybdenum (PHOS) assays. The bioaccessibility of bioactive compounds was calculated as the ratio of their concentration in the intestinal phase to their initial concentration in the extract. The initial genipap extract exhibited high levels of TPC (702.34 mg GAE 100 g^{-1}) and TF (426.04 mg QUE 100 g^{-1}), along with of remarkable antioxidant activity, with values of 2708.52 µmol Trolox 100 g^{-1} (FRAP) and 3547.95 mg AAE 100 g^{-1} (PHOS). However, during the oral phase of digestion, a sharp decrease was observed in the analyzed compounds, with a more pronounced reduction in TF (24.80 mg QUE 100 g^{-1}). The antioxidant activity evaluated by the FRAP and PHOS assays followed the same trend as TPC and TF, showing a significant reduction during the oral phase and reaching levels of 537.26 µmol Trolox 100 g^{-1} and 840.87 mg AAE 100 g^{-1}, respectively. The gastric phase exhibited distinct behaviours: while TPC showed the greatest reduction (78.67 mg EAG 100 g^{-1}), TF demonstrated partial recovery, reaching 79.20 mg QUE 100 g^{-1}. Antioxidant activity also exhibited distinct patterns: the FRAP assay showed consistently low values (667.88 µmol Trolox 100 g^{-1}), whereas the PHOS assay demonstrated significant recovery (2481.90 mg AAE 100 g-1). In the intestinal phase, a partial recovery of TPC (456.00 mg GAE 100 g^{-1}), TF (242.08 mg QUE 100 g^{-1}), and antioxidant capacity measured by FRAP assays (1910.43 µmol Trolox 100 g^{-1}) was observed, along with a slight reduction in PHOS values (1607.31 mg AAE 100 g^{-1}). Despite the improvement compared with the previous phases, the values remained lower than those of the initial extract. The recovery observed in the intestinal phase may be attributed to matrix breakdown and the consequent release of previously bound compounds. Despite the overall reduction in bioactive compounds throughout digestion, the final bioaccessibility remain significant: 65.06% for TPC, 56.74% for TF, 70.56% for antioxidant activity measured by FRAP, and 45.32% by the PHOS method. These results indicate that, despite significant losses during digestion, a considerable fraction of genipap´s bioactive compounds remain available, thereby reinforcing its functional potential.

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P98 | COOKING-INDUCED CHANGES IN GLUCOSINOLATES AND THEIR BREAKDOWN PRODUCTS IN BRASSICA VEGETABLES: REVIEW OF THE LITERATURE

Amina Azi Madani[1*], Franklin Chamorro[2], Naima Guendouz Boucheffa[1], Nadia Madi Bouaoudia[1,3], Miguel Angel Prieto[2]

[1]Research Laboratory of Biochemistry, Biophysics, Biomathematics and Scientometrics "L3BS" University of Bejaia "Algeria" Route Targua-Ouzemour 06000/Bejaia/Algeria; [2]Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain; [3]Department of Microbiology and Biochemistry, Faculty of Sciences, University of M'sila, 28000, M'sila, Algeria. *amina.azi@univ-bejaia.dz

Glucosinolate concentration is a well-known characteristic of vegetables of the Brassicaceae family. Many studies have focused on the anti-inflammatory, anti-cancer, and antioxidant properties of glucosesinolates and their breakdown products, as well as how they significantly lower oxidative stress. The chemical content of food may change dramatically during cooking, depending on the method, temperature, and cooking time. Overall, the literature agrees that cooking methods have a significant impact on the nutritional quality of Brassica vegetables. Steaming and other delicate cooking techniques are recommended to preserve glucosinolates and their degradation products, while boiling should be minimized due to its detrimental effects on these compounds. This study aim to analyze and synthesize information available in articles treating the subject, select the main cooking methods used for Brassica vegetables, Then evaluate the impact of each cooking method on the stability, retention and degradation of glucosinolates and their degradation product.

P99 | FORTIFICATION OF COOKIES WITH DIETARY FIBER FROM *LENTINULA EDODES*

Ângela Fernandes[1*], Luiz G. F. Ferri[1,2], Daiana Almeida[1], Rossana Cardoso[1], Eliana Pereira[1], Daiane C. Lenhard[3], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança, Portugal; [2]Universidade Tecnológica Federal do Paraná, Departamento Académico de Engenharia Química Campus Campo Mourão, Brasil; [3]Universidade Tecnológica Federal do Paraná, Departamento Académico de Alimentos, Campus Medianeira, Brasil. *afeitor@ipb.pt

Considering Mushroom production has been rapidly increasing globally, but it generates significant bio-residues. Discarded mushrooms are often considered low-value waste and frequently end up in landfills [1]. The objective of the present study was to measure the total dietary fiber (TDF) from the bio-residues of *Lentinula edodes* (Berk.) Pegler and subsequently incorporate the extracted fiber into cookies to functionally enrich them. The developed formulations were analyzed for their nutritional value, chemical parameters, and physical parameters. For the preparation of the cookies, corn flour, corn starch, sugar, vegetable butter, and the TDF at 3, 6, 9, and 12% were used, replacing the corn flour. A formulation without fiber addition was also prepared. In the cookie formulations with 0% to 12% incorporated TDF, it was observed that the protein, ash, and lipid contents did not vary significantly. There was a gradual increase in the TDF content in the cookies across the percentages of incorporated fiber, ranging from 3.0 to 8.85 g/100g dry matter (dm), respectively. There was a decrease in the carbohydrate content, ranging from 69.4 g/100g dm to 64 g/100g dm, as well as in the energy value, which ranged from 509.5 to 494 kcal/100g dm, respectively. Three free sugars were identified in the cookie formulations: fructose, glucose, and sucrose. The total sugar content slightly decreased with increasing incorporated dietary fiber, ranging from 18.2 to 17.0 g/100g dm for 0% and 12% TDF, respectively. Cookies without added TDF showed slightly higher levels of saturated fatty acids (SFAs) compared to formulations with 12% incorporation of TDF. The levels of monounsaturated (MUFAs) and polyunsaturated fatty acids (PUFAs) showed a slight increase as the percentage of incorporated TDF increased. Regarding the physical parameters of the developed cookie formulations without added TDF and with 12% incorporation, the pH decreased slightly, ranging from 5.12 to 4.85, respectively. In terms of color, a decrease was observed in the L* (lightness) and b* (yellowness) parameters with increasing percentages of incorporated TDF, ranging from 84 to 65.2 for L* and 36.7 to 29.3 for b*. Conversely, the a* (redness) parameter increased from 0.6 to 4.4, respectively. For water activity (Aw), a decrease was noted, with control cookies at 0.20 and the formulation with 12% TDF incorporation at 0.11. All fiber-incorporated formulations showed increased hardness and fracturability with higher levels of TDF incorporation. The cookies enriched with 12% dietary fiber exhibited better nutritional values, including higher contents of MUFA and PUFA fatty acids, and lower levels of sucrose and total sugars. This formulation contains 8.85 g/100g of total fiber, representing 30% of the recommended daily intake per 100 grams of the product.

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P100 | OPTIMIZING ACORN PROCESSING: EFFECTIVENESS OF LEACHING AND FERMENTATION IN TANNIN REDUCTION

Cristiano Mateus[1*], Tiane C. Finimundy[1], Pedro Babo[1,2], Tânia Pires[1], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Landratech, Lda., Largo do Esteiro 6, 2050-261 Azambuja, Portugal. *cristiano.mateus@ipb.pt

Quercus spp. produces acorns rich in proteins, fiber, starch, vitamins, minerals, and bioactive compounds, offering potential for food and pharmaceutical applications [1]. However, its high tannin content confers strong astringency, which limits consumption, impairs the absorption of nutrients, particularly proteins, and contributes to systemic toxicity. This work evaluated two approaches for tannin reduction in acorn flour of *Quercus suber* L., comparing treated flour (with removal of tannins) to untreated controls: 1) Extensive leaching with water; 2) fermentation with edible fungi. In the first study, acorn kernels harvested in Bragança, were subjected to a leaching process with water at 15 °C, dried at 45 °C and milled, using a disc mill (Oukaning, China), into acorn flour. The phenolic profiles of the flour samples were determined by high-performance liquid chromatography coupled to a mass spectrometry (HPLC-DAD-ESI/MSn) analysis. It was possible to verify that the treatment effectively decreased total phenolic compounds content from 37 mg/g to 9.6 mg/g extract. However, despite the almost total reduction of tannins from the acorn flour, other phenolic acids were also reduced, such as the major compound identified, gallic acid, which suffered a reduction in its concentration from 23 mg/g of extract to 5.5 mg/g of extract. Despite the satisfactory results regarding the reduction of tannins, it was also observable a significant impact in the nutritional composition of the flour, resulting in a decrease in protein, ash, soluble sugars and fiber.

In the second study, three acorn flour batches, obtained by grounding acorns harvested in three distinct regions of Portugal mainland (Évora, Setubal and Castelo Branco) were subjected to a fermentation process using the fungi Aspergillus oryzae (107 CFU/g, 10 days). This preliminary fermentation assay, based on a study made by Moradi *et al.* [2], proved to be an effective tannin reduction treatment, reducing tannins from 38-47 mg/g of extract to 6.9-12.3 mg/g of extract. However, the resulting flours developed black coloration and signs of environmental fungal proliferation and contamination, rendering them unsuitable for consumption. Both approaches proved effective in reducing tannins, albeit with distinct limitations. The results highlight tannin-free acorn flour as a promising functional ingredient, while emphasizing the need to further optimize processing methods to preserve nutritional value and ensure product safety.

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P101 | NUTRITIONAL AND BIOACTIVE RESPONSES OF *GYNURA PROCUMBENS* TO NITROGEN AND PHOSPHORUS-POTASSIUM LEVELS IN HYDROPONIC CULTURE

Bianca R. Albuquerque[1], Antonios Chrysargyris[2], André Marques[1], Sara F. Vieira[1*], Nikolaos Tzortzakis[2], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Department of Agricultural Sciences, Biotechnology and Food Science, Cyprus University of Technology, 3603 Limassol, Cyprus. *sara.vieira@ipb.pt

Gynura procumbens (Lour.) Merr. is a plant native to Asian countries that possesses numerous bioactivities, including anti-inflammatory, antioxidant, and antidiabetic activities. For this reason, it has traditionally been used to treat diseases such as rheumatism, diabetes, and hypertension. However, studies on its cultivation methods and nutritional properties remain scarce in the scientific field. Therefore, this study aimed to evaluate the influence of six treatments, in which two nitrogen (N) levels were combined with three phosphorus (P) and potassium (K) levels, on the nutritional composition and bioactivities of *G. procumbens* leaves grown under hydroponic conditions. The treatments combined the following macronutrient concentrations (mg/L): T1 (N100-P47-K250), T2 (N200-P47-K250), T3 (N100-P70-K350), T4 (N200-P70-K350), T5 (N100-P105-K525), and T6 (N200-P105-K525). Nutritional value was determined according to AOAC methods, while the presence of free sugars, fatty acids, and tocopherols was analyzed using chromatographic methods, namely HPLC-RI for free sugars, GC-FID for fatty acids, and HPLC-FL for tocopherols. In addition, total phenols and antioxidant activity were evaluated through reducing power, DPPH$^{\bullet}$, and TBARS assays.

As a result, the different treatments did not significantly influence the carbohydrate (63.5–66.7 g/100 g dry weight, dw), protein (17.4–19.6 g/100 g dw), or lipid (3.0–4.2 g/100 g dw) contents. However, ash content had higher values in plants grown under treatments T2, T4, and T6 (13.1–13.8 g/100 g dw), all of which had high N concentrations. Regarding the bioactive potential of the leaves, the T3 sample presented the highest total phenol content (6.4 ± 0.1 mg GAE/g dw) and, together with the T1 sample, showed the best free radical scavenging capacity (EC_{50} = 0.2 ± 0.02 mg/mL). Concerning reducing power and inhibition of lipid peroxidation, as determined by TBARS, the leaves produced under T4 exhibited the highest antioxidant activity (EC_{50} = 1.3 and 0.2 mg/mL, respectively).

These findings show that N and P–K levels did not significantly affect the macronutrient composition of G. procumbens leaves but strongly influenced their bioactive properties. Intermediate P–K levels promoted higher phenolic content and antioxidant activity, underscoring the importance of balanced nutrient management to enhance the functional quality of this species in hydroponic systems.

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P102 | UNDERUTILIZED BRAZILIAN BERRIES AS SOURCES OF BIOACTIVES: COMPARATIVE STUDY OF *EUGENIA BRASILIENSIS* AND *EUGENIA INVOLUCRATA* RESIDUES

Bianca R. Albuquerque[1*], Tiane C. Finimundy[1], José Pinela[1], Tânia C. S. P. Pires[1], Filipa Mandim[1], Josiana Vaz[1], M. Beatriz P. P. Oliveira[2], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Rua Jorge Viterbo Ferreira nº 228, 4050-313 Porto, Portugal. *bianca.albuquerque@ipb.pt

The valorization of fruit residues represents an important strategy for promoting sustainable use of biodiversity and reducing agri-food waste. In this context, the present work investigated the chemical composition and bioactivities of residues from two native Brazilian Myrtaceae species, *Eugenia brasiliensis* Lam. (EB) and *Eugenia involucrata* DC. (EI). Residues, including whole material (EBR/EIR), seeds (EBS/EIS), and peels (EBP/EIP), were analyzed using chromatographic methods: HPLC-FL for tocopherols identification, HPLC-DAD for organic acids, and HPLC-DAD-MS^n for phenolic compounds. Bioactivities were evaluated in terms of antioxidant capacity (by thiobarbituric reactive substances assay, TBARS, and cellular antioxidant activity, CAA), antimicrobial activity (by microdilution assay against eight bacteria and two microfungi), anti-inflammatory potential (by reduction of $^{\bullet}NO$ production in RAW 264.7 cells), and cytotoxicity against four tumor cell lines.

In *E. brasiliensis*, peels (EBP) showed the highest levels of organic acids (oxalic, malic, ascorbic, citric), tocopherols, anthocyanins, condensed tannins, and other flavonoids, while seeds (EBS) were richer in hydrolysable tannins. Similarly, in *E. involucrata*, peels (EIP) concentrated organic acids, tocopherols, and anthocyanins, whereas seeds (EIS) contained higher amounts of hydrolysable tannins, including bis-HHDP-glucoside isomers as the main phenolic compounds.

All fractions of both species demonstrated relevant antioxidant capacity in TBARS (EC_{50} = 0.90–11.1 µg/mL), OxHLIA (IC_{50} = 21–99 µg/mL), and CAA assays (71–80% inhibition), with EBP presenting the strongest effect in cellular antioxidant protection (80 ± 0.6%). Antimicrobial assays revealed inhibition of bacteria (MIC = 0.156–5 mg/mL) and fungi, including *Aspergillus* spp. (MIC = 0.625–1.25 mg/mL). Both species also displayed anti-proliferative activity against tumor cell lines (GI_{50} = 14.7–186 µg/mL), while anti-inflammatory effects via nitric oxide inhibition were more pronounced in EBS (IC_{50} = 98.0 ± 0.5 µg/mL) and in EIR/EIS fractions of *E. involucrata* (IC_{50} = 168–259 µg/mL). However, moderate cytotoxicity toward non-tumor cells (GI_{50} = 145–268 µg/mL) was observed for both species.

Altogether, the findings indicate that residues of *E. brasiliensis* and *E. involucrata* are promising sources of bioactive compounds with antioxidants, antimicrobial, and anti-inflammatory. Nonetheless, further studies are required to ensure safety and to elucidate the mechanisms underlying their biological activities, supporting their potential application in food, pharmaceutical, and cosmetic industries.

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P103 | NUTRITIONAL, CHEMICAL, AND BIOACTIVE CHARACTERIZATION OF APPLE BY-PRODUCTS FOR APPLICATION IN NOVEL FOOD PRODUCTS

André Lopes[1], Tayse F. F. da Silveira[1], Lillian Barros[1*], Filipa Mandim[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *lillian@ipb.pt

The increasing generation of food waste and its environmental impact represent a global challenge, demanding more sustainable solutions. Agro-industrial by-products, often discarded, are rich sources of bioactive compounds, fiber, vitamins, proteins, lipids, carbohydrates, and micronutrients, showing high potential for application in the development of new functional foods [1]. This study aimed to characterize the nutritional, chemical, and bioactive properties of apple by-products, namely pieces and flour derived from 4th-range apple processing, commercially obtained from the company Alitec, S.A (Nazaré, Portugal). The proximate composition (protein, fat, carbohydrates, and ash) was determined using the AOAC official methods of analysis. The individual profiles of tocopherols, free sugars, and organic acids were determined using chromatographic methodologies. Hydroethanolic extracts were characterized in terms of phenolic composition and cytocompatibility, and antioxidant. The phenolic composition was analyzed by HPLC-DAD-ESI/MS^n. *In vitro* gastrointestinal and liver cytocompatibility (Caco-2 and AML12 cells, respectively) was evaluated using the resazurin reduction assay. Antioxidant capacity was assessed through the lipid peroxidation inhibition (TBARS assay).

Only α-tocopherol was identified in both apple by-products (between 153 and 184 µg/mL). Regarding free sugars, fructose, glucose, and sucrose were detected in both samples, with higher concentrations in pieces. Oxalic, quinic, malic, shikimic, citric, and fumaric acids were also detected in higher quantities in the apple pieces. Ten phenolic compounds were tentatively identified in the flour and nine in apple cubes, comprising two phenolic acids and eight flavonoids. Chlorogenic acid (between 0.44 and 0.83 mg/g) and phloretin-2-*O*-glucoside (between 0.41 and 1.16 mg/g) predominated in both by-products. The flour exhibited higher total phenolic content than apple cubes (3.08 and 1.64 mg/g, respectively). In terms of bioactive properties, both samples showed the capacity to inhibit the formation of lipidic peroxidation products. The flour extract had lower IC50 values than the cubes (137 and 218 µg/mL, respectively). None of the samples demonstrated cytotoxic effects, either gastrointestinal or hepatic, at the concentrations tested (between 10 and 0.156 mg/mL), maintaining cell metabolic activity above 70%.

In conclusion, this study provides insight into the chemical composition and functional properties of apple by-products. Nonetheless, additional studies are needed to clarify the compounds and mechanisms responsible for the observed activities.

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P104 | NUTRITIONAL AND MINERAL CHARACTERIZATION OF BANANA PEEL AND INFLORESCENCE (*MUSA PARADISIACA* L.): A SUSTAINABLE APPROACH TO AGRO-RESIDUE VALORIZATION

Carlos Eduardo Junior[1,2], Bruna Moreira[1,3], Carolina Garcia[2], Lillian Barros[1], Cristina Caleja[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Universidade Tecnológica Federal do Paraná, Departamento Acadêmico de Alimentos, 85884-000 Medianeira - PR, Brasil; [3]Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain. *ccaleja@ipb.pt

The food industry faces the challenge of managing large volumes of biowaste, whose improper disposal has environmental, economic, and social consequences [1]. Among these residues, banana peels and inflorescences (*Musa paradisiaca* L.) stand out as underutilized materials despite their richness in fiber, protein, and minerals [2,3]. The sustainable valorisation of these by-products is a promising strategy to reduce waste, mitigate emissions, and develop functional ingredients aligned with conscious consumption trends and the Sustainable Development Goals (SDGs) [4]. This study aimed to characterize the nutritional and chemical composition of banana peels from Brazil and Madeira, and banana inflorescences, validating their potential use as fortifying ingredients in the food industry. Fatty acids were analysed by GC-FID, sugars by HPLC-RI, total dietary fiber by AOAC 985.29, and minerals (K, Na, Ca, Mg, Fe, Mn, Zn, and Cu) by atomic absorption spectroscopy. The banana inflorescence showed the highest dietary fiber content (48 ± 2 g/100 g dw), while peels from Brazil (37 ± 1 g/100 g dw) and Portugal (36 ± 1 g/100 g dw) presented lower values. Regarding protein, the CB sample (1.24 g/100 g) showed the highest value, followed by the CBP sample (0.73 g/100 g), while the CBB had 0.71 g/100 g. Additionally, the CBP sample showed higher carbohydrate (9.9 g/100 g), sucrose (1.27 ± 0.01 g/100 g fw), and energy (200 kJ/100 g) contents. This indicates that, although the inflorescence contains the highest amount of protein and fiber, the peel from Portugal is the most energy-dense and richest in carbohydrates. Peels were rich in PUFA, particularly CBP (57.9%, α-linolenic acid), while the inflorescence presented higher SFA (55.5%, arachidic acid). Regarding minerals, peels were richer in K (54–57 g/kg) and Mn (95–98 mg/kg), whereas the inflorescence had higher Cu (5.5 ± 0.2 mg/kg) and Zn (40 ± 2 mg/kg). These findings highlight the nutritional and functional potential of banana by-products as sustainable ingredients for food applications.

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P105 | IMPACT OF CHESTNUT FLOUR PROCESSING (BOILED, ROASTED, AND DRIED) ON THE CHEMICAL AND SENSORY PROPERTIES OF FRESH PASTA

Ana Beatris Guedes[1,2], Bruno Melgar[1], Alexandre Gonçalves[2], Luis Pinto[2], Jorge Moreira[3], Tiane C. Finimundy[1*], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]MORE - Collaborative Laboratory Mountains of Research, Brigantia Ecopark, 5300-358 Bragança, Portugal; [3]Sortegel, Produtos Congelados, SA, Rua São Mamede Nr 25, 5300-903 Sortes, Bragança, Portugal. *tiane@ipb.pt

This study aimed to characterize chestnut flour processed by different methods (roasting, boiling, and drying), evaluating its aromatic, nutritional, and functional properties for potential application in the food industry. Carbohydrates, proteins, and lipids were the most abundant macronutrients, with variations depending on the processing method. Drying (50 °C) resulted in higher protein, ash, and free sugar (sucrose) content, as well as greater total organic acid concentration, with quinic and citric acids being predominant. Palmitic, oleic, and linoleic acids were the most abundant fatty acids, and boiled flour exhibited the highest proportion of polyunsaturated (46.5 ± 1.0%) and monounsaturated (34.3 ± 0.36%) fatty acids. Volatile compound analysis by HS-SPME/GC-MS identified 66 compounds, primarily aldehydes, alcohols, and hydrocarbons, with distinct profiles for each processing method. Incorporating chestnut flour into fresh pasta formulations enhanced nutritional value, flavor, color, and texture, contributing to good sensory acceptance with over 50% purchase intention. These findings reinforce the potential of chestnut flour as a functional ingredient, supporting its commercial application in gluten-free and alternative food products.

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P106 | MIXTURE OF EDIBLE FLOWERS: FOOD ALTERNATIVE WITH BIOACTIVE PROPERTIES

Hela Ali[1], Tayse F. F. da Silveira[1], Ricardo Calhelha[1], Lillian Barros[1], Tânia C. S. Pires[1], Cristina Caleja[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *ccaleja@ipb.pt

Edible flowers are increasingly recognized as a functional food alternative due to their rich nutritional and bioactive properties positioning them as a driving force in the food industry and appealing to consumer seeking healthier and more attractive food products to enhance their diet [1]. *Calendula officinalis* L. and *Rosa canina* L. are known to be sources of different bioactive compounds which have demonstrated antioxidant and antimicrobial properties [2].

In the present study, we defined the phenolic profile and investigated the bioactive properties of different mixtures of *C. officinalis* and *R. canina* using maceration extraction. The phenolic compounds were determined by high-performance liquid chromatography coupled with a diode array detector and a mass spectrometry detector (HPLC-DAD-ESI-MSn). We also analysed several bioactivities, including antioxidant (by *in vitro* assays), antimicrobial (against a panel of bacteria and fungi selected for their importance to public health), and toxicity (using a primary cell culture line, PLP2) activities.

The major phenolic compounds identified were digalloylhexoside, galloylquinic acid, isorhamnetin-*O*-rhamnosyl-hexosyl-rhamnoside, and isorhamnetin-*O*-rutinoside. Among the mixtures tested, C25% R75% (*C. officinalis* 25% + *R. canina* 75%) and C75% R25% (*C. officinalis* 75% + *R. canina* 25%) demonstrated the most promising results. Notably, C75%R25% exhibited higher antioxidant activity, while C25%R75% showed enhanced antibacterial activity.

Our results highlight the remarkable health-promoting properties and functional potential of these edible flower mixtures, supporting their future application in the food industry for the development of innovative functional products.

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P107 | *TENEBRIO MOLITOR* AND *ZOPHOBAS MORIO*: ARE SIMILAR SUSTAINABLE SOURCES OF ALTERNATIVE PROTEINS?

Susana Machado[1,2], M. Beatriz P. P. Oliveira[1], Carolina Oliveira de Souza[3], Miguel A. Prieto[2], Rita C. Alves[1*]

[1]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA)-CITEXVI, University of Vigo, Vigo, Spain; [3]Graduate Program in Food Science/Department of Bromatological Analyses, Faculty of Pharmacy, Federal University of Bahia, Brazil. *rita.c.alves@ff.up.pt

Insects have emerged as sustainable sources of protein, lipids, vitamins, and essential minerals. The protein content is of high nutritional value, presenting complete amino acid profiles. Moreover, insect production requires fewer natural resources and generates a lower environmental impact compared to conventional livestock. These characteristics make insects a promising alternative for food and feed, contributing to food security and sustainability [1,2].

Tenebrio molitor (mealworm) and *Zophobas morio* (superworm) are beetle species from the Tenebrionidae family. *T. molitor* is officially authorized as a novel food in the European Union, while *Z. morio* is not yet approved for human consumption, although its potential as a food ingredient is being investigated. This study aimed to determine and compare the total amino acid profiles of *T. molitor* and *Z. morio*. Samples were subjected to acidic and alkaline hydrolysis for total amino acid release. Subsequently, amino acids were automatically derivatized and quantified by RP-HPLC [3].

The analysis revealed consistent differences between species, with *Z. morio* presenting higher contents than *T. molitor*. Glutamic acid was the most abundant (63.83 ± 0.81 vs. 48.88 ± 2.52 mg/g; $p < 0.05$), followed by aspartic acid (38.93 ± 0.60 vs. 34.46 ± 2.04 mg/g; $p < 0.05$). Among essential amino acids (EAAs), lysine was higher in *Z. morio* (18.56 ± 0.42 vs. 15.23 ± 0.79 mg/g; $p < 0.05$), whereas methionine showed no significant differences (6.35 ± 0.14 vs. 6.32 ± 0.31 mg/g; $p > 0.05$). The total sum of EAAs was significantly higher in *Z. morio* (166.71 ± 2.70 vs. 145.77 ± 7.86 mg/g; $p < 0.05$), reinforcing its superior nutritional value.

For branched-chain amino acids (BCAAs), *Z. morio* showed significantly higher values for valine (29.87 ± 0.56 vs. 26.26 ± 1.74 mg/g; $p < 0.05$) and isoleucine (21.09 ± 0.31 vs. 18.19 ± 1.11 mg/g; $p < 0.05$), while leucine showed no significant differences (33.17 ± 0.60 vs. 30.48 ± 1.63 mg/g; $p > 0.05$). This indicates not only a higher quantitative supply but also a potential functional advantage, given the role of these amino acids in muscle protein synthesis and energy metabolism. Total amino acids (∑AA) were also higher in *Z. morio* (463.05 ± 6.75 vs. 395.84 ± 19.88 mg/g; $p < 0.05$).

In conclusion, although both species represent high-quality protein sources, *Z. morio* stands out for its higher nutritional density, with higher absolute values of total and essential amino acids. Conversely, *T. molitor* maintains a balanced profile that may also be advantageous for food and feed formulations. Both species can be considered sustainable and a protein alternative, with strong potential for food and feed applications.

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P108 | VARIETAL INFLUENCE ON THE MINERAL COMPOSITION OF *OPUNTIA* SPP. FRUITS AND THEIR NUTRITIONAL RELEVANCE

Liliana Espírito Santo[1,2], Cláudia S. G. P. Pereira[1], Anabela S. G. Costa[1], Agostinho Almeida[1], João C. M. Barreira[3], Maria Beatriz P. P. Oliveira[1*], Ana F. Vinha[1,4]

[1]LAQV/REQUIMTE, Dep. of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA) – CITEXV, University of Vigo, 36310 Vigo, Spain; [3]Mountain Research Centre (CIMO), ESA, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [4]FP-I3ID, Research Institute, Innovation and Development Fernando Pessoa, Faculty of Health Sciences, Fernando Pessoa University, Praça 9 Abril 349, 4249-004 Porto, Portugal. *beatoliv@ff.up.pt

Opuntia fruits, commonly known as prickly pears, are widely cultivated in arid and semi-arid regions due to their adaptability and nutritional value [1]. Beyond macro nutrients, they are recognized as a relevant source of minerals, essential for human health. This study aimed to characterize the mineral composition of four *Opuntia* fruit varieties - *Opuntia robusta* red variety (OR-RV) and three *Opuntia ficus*-indica varieties (red, yellow, and green: OFI-RV, OFI-YV, and OFI-GV, respectively), providing a detailed evaluation of macro, micro, and trace elements, and assessing varietal differences that may influence nutritional and functional value. Mineral analysis followed Pinto et al. [2], being macro minerals measured by Flame Atomic Absorption Spectrometry (FAAS), and a wider element panel was analyzed via ICP-MS (iCAP™ Q). All determinations were performed in triplicate and expressed on a dry weight. Significant differences ($p < 0.05$) were observed across varieties for all quantified elements. Among macro elements, potassium ranged from 10.9 g/kg in OFI-GV to 25 g/kg in OR-RV, while magnesium peaked in OFI-GV (2.63 g/kg) and was lowest in OR-RV (1.00 g/kg). Calcium varied from 1.8 g/kg (OR-RV) to 5.7 g/kg (OFI-YV). Regarding microelements, OFI-GV and OR-RV were particularly enriched in iron (13.1 mg/kg) and copper (8.7 mg/kg), respectively. Chromium was exclusive to OFI varieties (66-147 mg/kg), whereas molybdenum appeared only in OR-RV (1.0 mg/kg). Non-essential elements such as boron (up to 34 mg/kg) and rubidium (up to 29 mg/kg) were also detected, alongside lower levels of nickel, titanium, and strontium. Overall, mineral profiles were consistent with values previously reported for *Opuntia* species. Varietal differences strongly influenced mineral composition. OFI-GV emerged as the richest source of magnesium, iron, and zinc, while OR-RV exhibited superior potassium and copper concentrations. The presence of essential micronutrients such as Mn, Zn, and Fe underlines the nutritional relevance of these fruits. Meanwhile, the detection of non-essential or potentially toxic elements such as Al and Ni, though within safe limits, emphasizes the importance of regular monitoring. In conclusion, the mineral composition of *Opuntia* fruits is highly variable among varieties, with each offering specific advantages in terms of essential macro- and microelements. These findings reinforce the role of *Opuntia* as a valuable dietary source of minerals and highlight its potential for sustainable use, particularly in resource-limited regions.

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P109 | NUTRITIONAL COMPOSITION, BIOACTIVE COMPOUNDS, AND ANTIOXIDANT CAPACITY OF *OPUNTIA* SPP. FRUITS: VARIETAL DIFFERENCES

Liliana Espírito Santo[1,2], Cláudia S. G. P. Pereira[1], Anabela S. G. Costa[1], Tânia Gonçalves Albuquerque[1,3], João C. M. Barreira[4], Maria Beatriz P. P. Oliveira[1*], Ana F. Vinha[1,5]

[1]LAQV/REQUIMTE, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA) – CITEXV, University of Vigo, 36310 Vigo, Spain; [3]Estoril Higher Institute for Tourism and Hotel Studies (ESHTE), Avenida Condes de Barcelona, 808, 2769-510 Lisbon, Portugal; [4]Mountain Research Centre (CIMO), ESA, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [5]FP-I3ID, Research Institute, Innovation and Development Fernando Pessoa, Faculty of Health Sciences, Fernando Pessoa University, Praça 9 Abril 349, 4249-004 Porto, Portugal *beatoliv@ff.up.pt

Opuntia spp., a member of the Cactaceae family, originated in Central America has become naturalized in several regions, including South Africa, India, Australia, and the Mediterranean basin. They grow both spontaneously or cultivated in arid and semi-arid areas, acquiring agricultural and nutritional relevance [1].

This study aimed to evaluate the proximate composition, bioactive profile, and antioxidant capacity of different varieties of three *Opuntia ficus-indica* varieties (red, yellow, and green: OFI-RV, OFI-YV, and OFI-GV, respectively), and *Opuntia robusta* red variety (OR-RV), highlighting their potential as sustainable foods. Nutritional composition was assessed following AOAC standard methods [2], except carbohydrates and insoluble fibre, which were calculated by difference. Vitamin C was determined by RP-HPLC [3]. Total phenolic content (TPC) and total flavonoids content (TFC) were quantified using colorimetric assays, and antioxidant capacity was evaluated by DPPH· radical scavenging method and the ferric reducing antioxidant power (FRAP) [4]. On a dry weight basis, fruits consisted mainly of carbohydrates (~90%), with fibre as a major fraction, particularly in OFI-GV (9.4 g/100 g soluble and 21.9 g/100 g insoluble fibre). Protein content was highest in the red varieties (≈6.4 g/100 g), while fat levels remained low (1.2–1.7 g/100 g). Energy values ranged between 328 and 340 kcal/100 g, consistent with previous reports. Significant differences ($p < 0.001$) were observed among varieties in bioactive compounds. OR-RV exhibited the highest ascorbic acid content (304 mg/100 g), far exceeding the other varieties (~100 mg/100 g). TPC varied between 606 and 760 mg GAE/100 g, while TFC ranged from 36 to 45 mg CE/100 g, slightly higher than literature values. Antioxidant activity followed similar trends, with OR-RV showing the strongest FRAP (11622 µmol SFE) and DPPH (192 mg TE) activities. Varietal differences strongly influenced nutritional and functional profiles. OR-RV stood out for its superior protein, ascorbic acid, and antioxidant capacity, reflecting a positive correlation between phenolics, flavonoids, and vitamin C. These findings support the use of *Opuntia* fruits, particularly OR-RV, as promising source of bioactive compounds suitable for bioeconomy-driven product development.

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P110 | *BLAPTICA DUBIA* AND *GRYLLUS ASSIMILIS*: LIPID PROFILE OF SUSTAINABLE SOURCES

Susana Machado[1,2], Daniel Lemos[1], Anabela Costa[1], Thiago F. Soares[1], M. Beatriz P. P. Oliveira[1], Carolina Oliveira de Souza[3], Miguel A. Prieto[2], Rita C. Alves[1*]

[1]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA)-CITEXVI, University of Vigo, Vigo, Spain; [3]Graduate Program in Food Science/Department of Bromatological Analyses, Faculty of Pharmacy, Federal University of Bahia, Brazil. *rita.c.alves@ff.up.pt

Insects have been increasingly recognized as sustainable and nutritious sources of lipids, providing essential fatty acids, including polyunsaturated ones, which play a vital role in human and animal health. Compared to conventional livestock, insect production requires fewer natural resources and generates lower environmental impact [1]. *Blaptica dubia* and *Gryllus assimilis* are Orthoptera insects from the families Blaberidae and Gryllidae. *B. dubia* is not authorized for human or animal consumption in the EU, while *G. assimilis* is approved only for feed. This study aimed to evaluate and compare their fatty acid profiles and assess their potential as food or feed ingredients.

Fatty acids were extracted and characterized by gas chromatography (GC-FID) [2]. The analysis revealed significant differences between the two species. *G. assimilis* presented a higher total percentage of saturated fatty acids (∑SFA, 36.44 ± 1.39 %) compared to *B. dubia* (30.12 ± 0.29 %, $p < 0.05$) with palmitic acid (C16:0, 25.87 ± 1.03 %, $p < 0.05$) and stearic acid (C18:0, 8.65 ± 0.33 %, $p < 0.05$) as the major contributors. In contrast, *B. dubia* contained higher levels of monounsaturated fatty acids (∑MUFA, 57.54 ± 0.25 % vs. 36.23 ± 0.73 %, $p < 0.05$), particularly oleic acid (C18:1n9c, 50.14 ± 0.26 %, $p < 0.05$), indicating a healthier lipid profile.

Polyunsaturated fatty acids (∑PUFA) were significantly more abundant in *G. assimilis* (29.15 ± 1.03 %) than in *B. dubia* (12.34 ± 0.04 %, $p < 0.05$) with linoleic acid (C18:2n6c, 28.41 ± 1.02 %, $p < 0.05$) as the principal component, highlighting its value as a source of essential fatty acids. Differences in individual fatty acids, including C16:1, C18:1n9c and C18:2n6c, may influence lipid functional properties such as membrane fluidity and oxidative stability.

Overall, the distinct fatty acid compositions of *B. dubia* and *G. assimilis* suggest complementary nutritional benefits. *B. dubia* is rich in MUFAs, which are associated with cardiovascular health, whereas *G. assimilis* provides higher amounts of PUFAs, particularly n-6 fatty acids, essential for physiological processes. These results indicate that both species are promising, sustainable lipid sources that can be strategically applied in foods or feed formulations, allowing to obtain diets with balanced essential fatty acids and optimized nutritional quality.

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P111 | VALORISATION OF ENDOGENOUS BIODIVERSITY OF BARROSO REGION: DEVELOPMENT OF THERMAL WATER-INFUSED FUNCTIONAL BEVERAGE FORMULATIONS USING LOCAL AROMATIC AND MEDICINAL PLANTS

André Cima[1,2,3,4,5], André Lemos[4,5], Luís Pinto[4,5], Maria J. Saavedra[6,7,8], Maria J. Alves[2,3,4,5*], Manuela Pintado[1]

[1]Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [3]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [4]AquaValor – Centro de Valorização e Transferência de Tecnologia da Água, Rua Dr. Júlio Martins, nº1, 5400-342 Chaves, Portugal; [5]Research Centre for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, 5300-253 Bragança, Portugal; [6]CITAB – Center for the Research and Technology Agro-Environmental and Biological Sciences and Inov4Agro – Associate Laboratory for Innovation, Capacity Building and Sustainability in Agri-Food Production, University of Trás-os-Montes and Alto Douro, Vila Real 5000-801, Portugal; [7]CECAV-Veterinary and Animal Research Centre and Associate Laboratory for Animal and Veterinary Science (AL4AnimalS), University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; [8]AB2Unit-Antimicrobials, Biocides & Biofilms Unit and Veterinary Sciences Department University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal. *maria.alves@ipb.pt

The use of aromatic and medicinal plants is grounded in centuries of traditional knowledge, representing a valuable source of natural and accessible therapeutic alternatives owing to their rich content of bioactive compounds [1]. Building on this foundation, the present study aims to develop innovative bio-based beverages through the integration of thermal water and endemic plant species from Portugal's Barroso region. The incorporation of plant extracts is intended to improve both the nutritional profile and functional properties of the beverages, while also enabling the exploration of their potential influence on gut microbiota dynamics and digestive health.

The nutritional and bioactive composition of the analysed species revealed distinct interspecific patterns. Leaves generally presented higher protein and mineral levels than flowers, with *Urtica dioica* L. and *Portulaca oleracea* standing out in this regard. Fibre content was particularly elevated in *Lavandula pedunculata* flowers, *Pterospartum tridentatum* flowers, and *Malva parviflora* L. roots (≈50%). Fat levels were comparatively stable across most species (≈1–2%), with the exception of *Arnica montana* L. flowers, which showed a maximum of ≈8%. Carbohydrate concentrations were more variable, ranging from 39% to 76%.

Antioxidant analyses demonstrated a reduction of 10–30% in activity when water was employed as the extraction solvent instead of ethanol. Despite this decline, *Calluna vulgaris* L. flowers, *Laurus nobilis* L. flowers, *Melissa officinalis* L. leaves, and *Cytisus multiflorus* L. flowers consistently exhibited the strongest antioxidant responses (119–258 mg/g), coupled with high levels of phenolic compounds (TPC > 88 mg/g) and flavonoids (TFC > 44 mg/g). These same species also recorded the highest sugar content (≈8–9%), primarily composed of fructose, glucose, and sucrose.

These findings support the valorisation of Barroso's biodiversity as a source of functional ingredients for bio-based beverage development, underscoring the potential of endogenous resources such as thermal water and aromatic-medicinal plants for sustainable innovation and health promotion.

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P112 | PRODUCTION OF LOENGO JAM: OPTIMIZATION OF PH AND AW

Alcides Lofa[1,2], Joana Sales[1], Ricardo Boavida Ferreira[1], Isabel de Sousa[1*]

[1]LEAF Research Centre, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda 1349-017 Lisboa; [2]Faculdade de Medicina Veterinária Universidade José Eduardo dos Santos. Huambo, Angola. *lofaalcides25@gmail.com

The consumption of fruits has a considerable contribution to the promotion of human health, as natural sources of nutrients and vitamin C, as well as of phenolic compounds. Many of these compounds have been linked to protection against different chronic pathologies associated with oxidative damage, whilst also exhibiting antimicrobial and other biological. Some edible fruits are rich sources of minerals, as well as of phenolic compounds, which are responsible for their red, violet, purple, and blue colors. They exhibit a wide range of antioxidant protective activities and other preventive benefits, including protection of genomic DNA integrity and potent cardioprotective, neuroprotective, anti-inflammatory and anticarcinogenic properties [1]. One of the most significant health advantages of these fruits is their capacity to prevent metabolic disorders, which are directly linked to dietary habits [2]. Loengo (*Anisophyllea boehmii* Engl.) is an uncultivated fruit that is widely consumed in Angola that produces an edible stone fruit, plum-shaped (drupe), dark blue and maroon or carmine in the ripening stage. Loengo, is generally consumed fresh in the production areas (Miombo forests in Africa) and there is a paucity of information regarding the texture and nutritional properties of loengo jam. As consumers highly appreciate jams, the present work aimed at the optimization of jams produced from loengo fruit to extend their shelf life, and increase the consumption of this nutritious fruit [3]. The response surface method (RSM) was used to produce jelly with favourable physicochemical and texture properties [4]. It is crucial to understand the pH and water activity (aw) levels that are ideal for preserving jams, as they significantly impact their physical and sensory qualities. Loengo jam formulations were successfully developed and their shelf life improved by adjusting the pH and water activity.

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P113 | EXTRACTION OPTIMIZATION AND BIOACTIVITY EVALUATION OF *ECHINACEA PURPUREA* EXTRACTS FOR FOOD APPLICATIONS

Renato Azevedo[1], Bianca R. Albuquerque[1], Tiane C. Finimundy[1], Sara F. Vieira[1*], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. * sara.vieira@ipb.pt

The increasing demand for natural and sustainable solutions in the food sector has intensified the exploration of plant-derived bioactive compounds as alternatives to synthetic molecules. *Echinacea purpurea* (L.) Moench, a species traditionally employed in herbal medicine, contains a diverse array of phenolic acids and associated metabolites with recognized bioactive potential. In the present study, *E. purpurea* extracts were obtained by heat-assisted extraction and, previously, optimized through response surface methodology (RSM). The parameters included variations in extraction time (5-90 min), temperature (4–100 °C), and solvent composition (0–100% ethanol in water), in order to enhance extraction yield, total phenolic content (TPC), and radical scavenging capacity ($DPPH^{\bullet}$ assay). The phytochemical characterization was performed by HPLC-DAD-ESI-MS^n and confirmed the predominance of caffeic acid derivatives, particularly chicoric and caftaric acids, consistent with the established chemical profile of the species. Optimization using RSM indicated that an extraction time of 23 min at 81 °C with 38% ethanol in water provided the optimal balance between extraction yield, phenolic recovery, and antioxidant activity. The optimized extracts exhibited marked antioxidant activity, as evidenced by their capacity to neutralize DPPH radicals and attenuate lipid peroxidation in the TBARS assay. Cytocompatibility assays with fibroblasts confirmed the safety of the extracts, supporting their suitability for food-related applications. In summary, this study demonstrated the potential of *E. purpurea* extracts to prevent oxidative deterioration in food matrices. Consequently, these extracts represent promising candidates for the food industry, either as natural antioxidants to extend shelf life or as bioactive ingredients with added nutraceutical value.

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P114 | *EVERNIA PRUNASTRI*-ENRICHED OATMEAL COOKIES: A FUNCTIONAL SNACK WITH BIOLOGICAL POTENTIAL

Dejan Stojković[1*], Jelena Živković[2], Uroš Gašić[1], Stefani Bolevich[3], Sergey Bolevich[3], Gokhan Zengin[4], Marina Soković[1,3]

[1]Institute for Biological Research "Siniša Stanković", National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia; [2]Institute for Medicinal Plants Research "Dr Josif Pancic", Tadeusa Koscuska 1, 11000 Belgrade, Serbia; [3]Department of Pathologic Physiology, First Moscow State Medical University I.M. Sechenov (Sechenov University), Moscow, Russia; [4]Department of Biology, Science Faculty, Selcuk University, Konya, Turkey. *dejanbio@ibiss.bg.ac.rs

Evernia prunastri (L.) Ach., commonly known as oakmoss, is an edible lichen historically used in ancient bread-making. In this study, we explore its potential as a modern functional food ingredient, with a particular emphasis on its incorporation into a real food matrix-oatmeal cookies enriched with lichen extract. The ethyl-acetate (EtOAc) extract of *E. prunastri*, obtained from wild specimens in southern Serbia, demonstrated significant biological activities relevant to food and health, including antioxidant, antidiabetic (via α-amylase and α-glucosidase inhibition), and antibacterial effects. The chemical composition was mainly defined by the presence of depsides such as evernic acid and atranorin, alongside phenolic acids like orsellinic acid and dibenzofurans, indicating a diverse profile of bioactive secondary metabolites.

To evaluate its practical food application, the extract was integrated into oatmeal cookies (735 mg extract per 100 g product). The resulting cookies were characterized by low fat (3.37 g/100 g dw), moderate carbohydrate content (13.47 g/100 g dw), and a low caloric value (90.98 kcal/100 g dw), making them appealing for health-conscious consumers. Sensory evaluation with 24 participants showed high acceptability, particularly for aroma (4.91/5), overall impression (4.66/5), and appearance (4.54/5), while taste and texture were also positively rated (Table 1). The extract not only enhanced the cookies' functional value but also improved their sensory quality, confirming *E. prunastri's* potential in developing nutritionally enriched, consumer-friendly food products.

This study introduces *E. prunastri* as a novel bioactive food ingredient and demonstrates its successful formulation into a palatable, health-promoting snack, providing a strong foundation for its future use in functional food innovation and nutraceuticals.

Table 1 – Nutritional value and sensorial evaluation.

	Oatmeal cookies enriched with extract
Fat (g/100 g dw)	3.37
Proteins (g/100 g dw)	1.47
Carbohydrates (g/100 g dw)	13.47
Energy (kcal/100 g dw)	90.98
Appearance	4.54±0.21
Aroma	4.91±0.71
Taste	4.25±0.55
Consistency	4.44±0.62
Overall acceptability	4.66±0.36

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P115 | *RHUS CORIARIA* L. AS A SOURCE OF BIOACTIVES

Elizandra Ardohain[1,2*], Tânia C. S. P. Pires[1], Tiane C. Finimundy[1], Elisabete Ferreira[3], Mateus Nicolau de Almeida[4], Ricardo Calhelha[1], Miguel A. Prieto[2], Lillian Barros[1], Ângela Fernandes[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança, Portugal; [2]Universidade de Vigo, Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain; [3]Pão de Gimonde®, 5300-553 Gimonde, Bragança, Portugal; [4]Quinta do Monte Xisto, Caminho Curral de Teles, Apartado 43 5150-636, Portugal. *elizandra.ardohain@ipb.pt

Rhus coriarua L., commonly known as sumac, is a shrub traditionally used as a spice, particularly in Middle Eastern cuisine [1]. This study aimed to characterize the nutritional and chemical composition of the fruit and evaluate the bioactive potential of hydroethanolic extracts from the fruits, leaves, and stems of the shrub collected in the Foz Côa, Portugal. AOAC procedures, spectrophotometric and chromatographic techniques were used to determine the fruits' nutritional value and chemical profile. Bioactive properties were also evaluated through *in vitro* assays for antioxidant, cytotoxicity, and antimicrobial activities of hydroethanolic extracts from the fruits, leaves, and stems. The fruit contained 13.9 g/100 g dry weight (dw) of lipids, 3.6 g/100 g dw of proteins, 49 g/100 g dw of fiber, and an energy value of 365 kcal/100 g dw. It also presented 17.9 mg/100 g dw of β-carotene, 2.1 mg/100 g dw of tocopherols, 29% saturated, 38% monounsaturated, and 33% polyunsaturated fatty acids. The total phenolic compounds were 23.6, 22.7, and 19.3 mg/g extract for fruits, leaves, and stems, respectively. Among the samples, leaf extracts exhibited the highest antioxidant activity, with EC_{50} values of 1.63 µg/mL for $DPPH^{\bullet}$, 5.47 µg/mL for reducing power, and 2.02 µg/mL for TBARS, outperforming both stem and fruit extracts. Leaf extracts also demonstrated the most effective antimicrobial activity, with MICs as low as 0.15 mg/mL against *Salmonella enterica*. In contrast, stem and fruit extracts exhibited moderate activity, with MICs ranging from 0.3 to 5 mg/mL. No toxicity was observed in any of the hydroethanolic extracts tested. The characterization of different parts of sumac expands scientific knowledge about this shrub and paves the way for its sustainable and innovative use in the food industry, adding economic value and promoting the development of new functional and healthy products.

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P116 | ENHANCING HONEY AND BEEKEEPING THROUGH A GLOBAL NETWORK

Marta Leite[1*], Helena Rodrigues[2,3], Maria Beatriz P.P. Oliveira[2], Andreia Freitas[1,3]

[1]REQUIMTE/LAQV, Praça Coronel Pacheco, Porto, Portugal; [2]University of Porto, Faculty of Pharmacy, R. de Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]National Institute for Agricultural and Veterinary Research (INIAV), Rua dos Lágidos, Lugar da Madalena, 4485-655 Vila do Conde, Portugal. *martasofia.22@gmail.com

BeSafeBeeHoney, is a COST Action focused in "Beekeeping Products Valorisation and Biomonitoring for the Safety of Bees and Honey" (CA22105). Honey is a highly valued functional food. Its antioxidant, antimicrobial and anti-inflammatory properties are well known. However, concerns about contaminants from urbanisation, intensive farming and pharmaceuticals highlight the need for hive-based environmental monitoring. Research highlights the role of bee products in detecting pollutants and antimicrobial resistance, reinforcing their potential in food safety and policy development.

This COST Action brings together diverse scientific areas - chemistry, food and nutrition, ecology, veterinary medicine, beekeeping, agricultural engineering, economics, and policy – with the aim to create innovative scientific evidence to protect bees and contribute for sustainable beekeeping. This COST Action has been a promoting a wide collaboration including non-scientist stakeholders and guaranteeing the focus on the European Green Deal, and the "Farm to Fork" strategy in a "One Health" approach to:

1. Investigate the nutritional and medicinal properties of hive products.
2. Assess environmental contaminants using hive products as bioindicators.
3. Address diseases and stressors threatening honeybee colonies.
4. Evaluate the role of pollinators in agriculture and ecosystem stability.
5. Support policy research and market development in beekeeping.

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P117 | MUSHROOM B-GLUCANS: LINKING PREBIOTIC ACTIVITY TO GUT MICROBIAL BALANCE

Eva Olo-Fontinha[1,2*], Juliana Garcia[1,3,4], Cátia Fidalgo[1,4], Manuela E. Pintado[2], Maria José Alves[1,4,5,6]

[1]AquaValor - Centro de Valorização e Transferência de Tecnologia da Água-Associação,Rua Dr. Júlio Martins n.º 1, 5400-342 Chaves, Portugal; [2]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina, Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327,4169-005 Porto, Portugal; [3]CITAB—Centre for the Research and Technology of Agro-Environmental and Biological Sciences and Inov4Agro, University of Trás-os-Montes e Alto Douro, 5000-801 Vila Real, Portugal; [4]Research Centre for Active Living & Wellbeing (LiveWell), Instituto Politécnico de Bragança, Bragança; [5]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [6]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *evafontinha@hotmail.com

β-glucans are indigestible polysaccharides widely distributed in cereals, yeasts, algae, and fungi. Their structure, composed of different combinations of β-(1→3), β-(1→4), and β-(1→6) linkages, determines fundamental properties such as solubility, viscosity, and fermentability. Although all sources of β-glucans exhibit functional potential, those derived from mushrooms are of particular relevance due to their structural complexity and their impact on gut microbiota modulation.

Their configuration, consisting of a β-(1→3)-D-glucan backbone with β-(1→6) branches, provides these polymers with resistance to enzymatic digestion in the small intestine, allowing them to reach the colon almost intact. In this environment, they serve as fermentable substrates for specific microbial communities, selectively promoting the growth of beneficial genera such as *Bifidobacterium*, *Lactobacillus*, and *Akkermansia*, which are associated with greater microbial diversity and ecological stability [1, 2].

During the fermentation process, short-chain fatty acids (SCFAs) are produced, particularly acetate, propionate, and butyrate, which are key metabolites in the regulation of the intestinal ecosystem. Butyrate stands out as the main energy source for colonocytes, strengthening the epithelial barrier, regulating luminal pH, and creating an environment unfavorable to pathogenic microorganisms [3].

Beyond these metabolic effects mediated by SCFAs, experimental research has consistently shown that mushroom-derived β-glucans exert a direct impact on the composition and functionality of the gut microbiota. *In vitro*, *in vivo*, and clinical studies indicate that species such as *Lentinula edodes* (lentinan), *Ganoderma lucidum*, and *Pleurotus ostreatus* enhance microbial diversity, stimulate cross-feeding mechanisms, and contribute to the restoration of dysbiosis states. These effects are reflected in improvements in metabolic parameters related to obesity, insulin resistance, and dyslipidemia, reinforcing the role of mushroom β-glucans as high-value prebiotic agents [4].

In summary, the ability of fungal β-glucans to selectively interact with the gut microbiota and enhance the production of bioactive metabolites positions them as promising compounds in nutritional and therapeutic strategies aimed at promoting intestinal health and preventing diseases associated with dysbiosis.

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P118 | CHESTNUT SHELL FLOUR: A NUTRITIONALLY-RICH, SUSTAINABLE FUNCTIONAL INGREDIENT WITH HIGH FIBRE AND ANTIOXIDANT PROPERTIES

Ana C. Gonçalves[1,2*], André Lemos[2,3], Daniela M. Correia[2,3], Maria J. Alves[2,3,4]

[1]Vigo University, Faculty of Law, Ourense Campus, Espanha; [2]Research Centre for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, 5300-253 Bragança, Portugal; [3]AquaValor-Centro de Valorização e Transferência de Tecnologia da Água, Rua Dr. Júlio Martins, nº1, 5400-342 Chaves, Portugal; [4]CIMO-Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, 5300-271 Bragança, Portugal. *acqgoncalves@gmail.com

The Portuguese chestnut (*Castanea sativa*), particularly when processed with its shell, emerges as a functional ingredient of high nutritional value. Chestnut shells, typically regarded as by-products, contain substantial lignocellulosic fibre fractions (significant cellulose, hemicellulose, and lignin content) and a rich profile of bioactive phenolic compounds with demonstrated antioxidant and bioaccessibility properties [1-3]. Regional Portuguese studies show that cooking processes such as roasting increase insoluble dietary fibre in chestnuts, while fat contents decrease, reinforcing the nutritional advantage [4]. Compared to other functional flours-such as from banana, apple, almond, acorn, and flaxseed-chestnut shell flour offers a more balanced nutritional profile: banana peel provide high dietary fibre (≈52–55 g/100 g) [5], dried apple peel powder contains approximately 41% total dietary fibre [6], almond and acorn flours more modest amounts (≈10–14 g/100 g), while flaxseed flour, though fibre-rich (≈27 g/100 g), has high lipid levels (≈40–42 g/100 g), which may limit its use in low-fat formulations [7,8]. In contrast, chestnut shell flour combines high insoluble fibre with low lipid content and relevant phenolic content, making it particularly suited for formulations seeking high fibre, low fat, and antioxidant properties. Additionally, the traditional practice of cooking chestnuts in mineral-rich thermal waters from Chaves (Portugal) and Ourense (Spain) is posited to improve mineral bioavailability of the resulting product. Overall, chestnut shell flour integrates nutritional, technological, and environmental benefits, standing as an innovative and sustainable option that, in specific parameters surpasses many currently used functional flours.

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P119 | INFLUENCE OF AMMONIUM AND NITROGEN TREATMENT ON THE NUTRITIONAL QUALITY AND BIOACTIVE PROPERTIES OF *GYNURA PROCUMBENS*

Sara F. Vieira[1], Antonios Chrysargyris[2], Beatriz Silva[1], Bianca R. Albuquerque[1*], Nikolaos Tzortzakis[2], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Department of Agricultural Sciences, Biotechnology and Food Science, Cyprus University of Technology, 3603 Limassol, Cyprus. *bianca.albuquerque@ipb.pt

The Food and Agriculture Organization of the United Nations estimates that 780 million people globally suffer from hunger. The World Health Organization (WHO) highlights the urgency of reshaping the entire food system, ensuring healthier and more sustainable foods. With advances in biotechnology and new sustainable agricultural practices (*e.g.*, hydroponic cultivation), it is possible to achieve this goal. Moreover, *Gynura procumbens* (Lour.) Merr. is widely recognized for its medicinal and nutritional potential, attributed to the presence of potent bioactive compounds such as phenolic acids. Therefore, this study addresses the influence of different nitrogen (N) concentrations and ammonium to total nitrogen (Nr) ratios on the hydroponic cultivation of *G. procumbens*, evaluating its nutritional and bioactive properties. Two experiments were conducted. In the first, four N levels (N50, N100, N200, N300) were tested, while in the second, four Nr ratios (0.01, 0.05, 0.1, 0.15) were studied. In Experiment 1, the results showed that carbohydrates were the most abundant macronutrient in the leaves, followed by proteins, lipids, and ashes. Samples treated with N50 presented a higher energy value and greater carbohydrate content. Higher nitrogen concentrations increased the content of phenolic compounds and antioxidant capacity, particularly in the N200 and N300 samples. Regarding Experiment 2, the different Nr ratios did not significantly influence the nutritional composition of the leaves. However, fatty acids and free sugars were impacted, with a higher content of fructose and sucrose observed in the Nr 0.15 ratio. The different Nr ratios significantly influenced the antioxidant capacity, although no clear linear trend could be established between higher concentrations and bioactivity. In conclusion, different nitrogen concentrations significantly affect the bioactivity of *G. procumbens* leaves, while the Nr ratios have less impact on the nutritional value. These findings suggest that optimizing nitrogen management in the hydroponic cultivation of *G. procumbens* can enhance its nutritional and bioactive properties, contributing to the development of healthier, more sustainable foods that may help address global hunger.

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P120 | OPTIMIZED EXTRACTION OF PHENOLIC COMPOUNDS FROM *MYRTUS COMMUNIS* L. BERRIES: ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL

Sara F. Vieira[1], Sarra Mechergui[1], Tânia C. S. P. Pires[1], Bianca R. Albuquerque[1*], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *bianca.albuquerque@ipb.pt

Myrtus communis L., commonly known as myrtle, is a plant found in Mediterranean regions, traditionally used to treat various ailments such as respiratory infections and gastrointestinal disorders due to its anti-inflammatory, antimicrobial, and antioxidant properties. Studies in the literature report the chemical composition of its leaves and berries, identifying bioactive compounds responsible for its therapeutic properties [1]. However, few studies have investigated optimized extraction methods to obtain specific bioactive compounds from its berries [2]. In this context, the present study aimed to develop and evaluate extraction methodologies to maximize the yield of bioactive compounds, particularly phenolic compounds, from *M. communis* berries, highlighting their potential as antioxidant and antimicrobial agents. To this end, two extraction methodologies were tested, heat-assisted extraction (HAE) and microwave-assisted extraction (MAE), evaluating the extraction yield, total phenolic content, and antioxidant activity. Response surface methodology (RSM) was used to optimize extraction parameters, such as time, temperature, and ethanol concentration. The optimized extract was assessed for its antioxidant and antimicrobial capacity, and its phenolic profile was determined by HPLC-DAD-ESI/MS. As a result, HAE demonstrated superior efficacy in preserving phenolic integrity and antioxidant capacity. The optimal extraction conditions were determined to be 90 minutes at 100 °C with 39% ethanol, resulting in a yield of 47.2 ± 0.2%, with the extract containing 50 ± 8 mg GAE/g and capable of scavenging 50% of the DPPH radical at a concentration of 0.041 ± 0.003 mg/mL. The optimized extract also showed the ability to inhibit lipid peroxidation through the TBARS assay, with an EC_{50} value of 0.045 ± 0.006 mg/mL. Moreover, it was effective in inhibiting the growth of 16 bacteria, including 8 clinical strains and 8 strains associated with food contamination. In its phenolic composition, four myricetin derivatives and one quercetin derivative were identified, with the most abundant compound being myricetin-*O*-hexoside (3.60 ± 0.04 mg/g extract). In conclusion, *M. communis* berries can be a powerful source of beneficial molecules to be included in food applications, providing a sustainable resource and an eco-friendly substitute for artificial compounds.

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P121 | INNOVATIVE ALGAE-ENHANCED PLANT-BASED CHEESE SPREADS

Sara Paulo[1], José Matheus[1], Anabela Raymundo[1], Catarina Prista[1], Maria Cristiana Nunes[1*]

[1]LEAF – Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal. *cristiananunes@isa.ulisboa.pt

Plant-based cheese alternatives are rapidly gaining popularity, yet most commercial options remain nutritionally limited, particularly due to their low protein content compared to dairy cheeses [1]. Many of these products also rely heavily on coconut oil or starches, which can compromise texture, flavour, and overall sensory appeal, or depend on cashew, a widely used but non-European dried fruit. A large proportion are not fermented, limiting both consumer acceptance and potential benefits for gut microbiota. Recent analyses of plant-based cheese-like products further highlight that while some provide favourable fibre content and reduced saturated fat, protein deficiency and lack of fermentation remain common limitations. Macroalgae, on the other hand, represent an extraordinary yet underexplored ingredient in this sector, offering protein, essential minerals, antioxidants, and dietary fibre [2,3].

This study aimed to address these gaps by developing innovative fermented cheese-like spreads enriched with dried fruits, legumes, and algae, designed to combine improved nutrition with sensory appeal. A blend of almond (*Prunus dulcis*) and lentil (*Lens culinaris*) was selected as the substrate due to its high protein content, while the red alga *Codium tomentosum* and the green alga *Ulva rigida* (both from Alga+, Portugal), at a 2% level, contributed functional and sensory benefits. Fermentation trials with different lactic acid bacteria consortia were conducted to monitor pH, acidity, sugar consumption, and organic acid evolution, allowing the selection of the most suitable fermentation pathway. Final products were evaluated for nutritional profile, antioxidant potential, texture, rheology (viscoelastic behaviour), colour, and sensory acceptance, and compared to algae-free and/or unfermented controls.

Findings demonstrate that algae inclusion requires formulation adjustments but significantly enhances nutritional and functional quality. Overall, this study highlights the potential of legume–algae fermentation to produce protein-rich, nutritious, and sustainable cheese alternatives that are appealing to consumers and supportive of health and environmental goals.

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P122 | NUTRITIONAL AND PHYSICAL CHARACTERIZATION OF ALMONDS IN MOROCCAN INTERCROPPING SYSTEMS

Bruna Moreira[1,2], Ermelinda Silva[1,3], Alexandre Gonçalves[1,3], Sara Najjari[4,5], Oussama Moussaoui[4,5], Adnane El-Yaacoubi[5], Hakim Outghouliast[6], Jamal Charafi[7], Miguel A. Prieto[2], Márcio Carocho[1], Cristina Caleja[1*], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain; [3]MORE - Laboratório Colaborativo Montanhas de Investigação, Brigantia Ecopark, 5300-358 Bragança, Portugal; [4]University Sultan Moulay Slimane, Faculty of sciences and techniques, Beni Mellal 23000, Morocco; [5]University Sultan Moulay Slimane, Higher School of Technology of Khenifra, PB 170, Khenifra 54000, Morocco; [6]National Institute of Agronomic Research, Beni Mellal 23000, Morocco; [7]National Institute of Agronomic Research, Meknes 50000, Morocco. *ccaleja@ipb.pt

Almond (*Prunus dulcis* (Mill.) D.A. Webb) cultivation plays a central role in Mediterranean agriculture, with nutritional quality being a key aspect for both producers and consumers [1]. Intercropping systems represent a sustainable strategy to optimize soil use and crop productivity, with potential effects on almond nutritional profile and texture, thereby improving overall quality [2-4]. This study assessed the nutritional composition and textural properties of almonds collected during two consecutive years from Azilal and Ain-Taoujdate (Haut-Atlas, Morocco), where intercropping trials with faba bean (*Vicia faba* L.) and lentil (*Lens culinaris* L.) were implemented by National Institute of Agronomic Research (INRA). Nine almond samples from the first year and eleven from the second year were analysed, including control orchards and intercropped systems. The proximate composition of almonds, including moisture, fat, protein, ash, carbohydrates, and energy, was determined. Regarding physical parameters, instrumental texture profile analysis was carried out to evaluate hardness, fracturability, adhesiveness, springiness, cohesiveness, gumminess, chewiness, and resilience. In addition, colour analysis of the almond samples was performed using the CIELAB colour space, evaluating the parameters *L* (lightness), *a** (red-green axis), and *b** (yellow-blue axis). Results indicated variations across cultivation systems: intercropped almonds exhibited slightly lower fat but higher carbohydrate contents in some blocks, while protein remained relatively stable. Energy values ranged between 561-608 kcal/100 g. Regarding the texture analysis, control almonds exhibited greater hardness and gumminess, whereas intercropped samples showed lower cohesiveness and chewiness. Colour parameters were not significantly affected, although control almonds appeared slightly darker in the first year. Overall, the findings suggest that intercropping systems can influence both the nutritional composition and technological properties of almonds. These insights highlight the potential of intercropping as an agronomic practice with implications for product quality and consumer acceptability.

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P123 | FROM JUICE CO-PRODUCT TO VALUE-ADDED FOODS: UNLOCKING THE POTENTIAL OF APPLE AND PEAR PULP

Ândria Viegas[1*], Maria João Alegria[1,2], Anabela Raymundo[1]

[1]LEAF - Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]SumolCompal, Rua Dr. António João Eusébio, 24, 2790-179 Carnaxide, Portugal. *andriaviegas@isa.ulisboa.pt

Apple and Rocha pear production play a key role in the Ribatejo and Oeste regions of Portugal. While most of this fruit is consumed fresh, a significant share is processed into juice. Fruit processing, however, generates substantial secondary streams, particularly pulp, which represents a valuable opportunity for upcycling. Reintegrating these co-products into the value chain can enhance sustainability by reducing food waste, while also contributing to the development of nutritionally balanced and sensory appealing products that encourage healthier eating habits. The aim of this work is to explore innovative strategies for the valorization of apple and pear pulp, either by reintroducing this by-product into food systems or by developing alternative applications that maximize its nutritional and economic potential, while addressing the growing demand for convenient, safe, and appealing foods.

In the category of snacks and accompaniments, a sugar-free apple pulp jam was developed, packaged in squeezable tubes to ensure convenience. This study investigated how hydrocolloids, temperature, and time affect the gelation process. Results showed that increasing time and temperature enhanced gelation, significantly improving viscosity, firmness, and elasticity. Hydrocolloids such as xanthan gum and pectin improved gel texture and consistency, while apple pulp fibers reinforced the structure, enabling the production of sugar-free jams with desirable consistency. In parallel, the effect of pulp concentration on crunchy snacks was evaluated. Higher apple pulp content increased the elastic modulus (G') of the dough, mainly due to its high fiber and water-holding capacity, which improved network formation and reduced molecular mobility of the dough. Pear pomace, on the other hand, demonstrated strong potential due to its antioxidant properties. A functional smoothie was also developed, showing an in vitro antioxidant activity (TIVD) of 76.93%. After simulated gastrointestinal digestion, a significant decrease ($p < 0.05$) in total phenolic content (TPC) was observed, while antioxidant activity significantly increased ($p < 0.05$), suggesting the release of bound antioxidants by digestive enzymes [1].

Overall, this study highlights that fruit by-products can be successfully upcycled into innovative, nutritious, and appealing products such as jams, snacks, and smoothies. These findings demonstrate not only the nutritional benefits of revalorizing pomace but also its contribution to environmental sustainability through efficient resource use and food waste reduction.

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P124 | IMPACT OF INTERCROPPING ON THE NUTRITIONAL COMPOSITION OF FABA BEANS AND LENTILS IN MOROCCO: A TWO-YEAR ASSESSMENT

Bruna Moreira[1,2], Ermelinda Silva[1,3], Alexandre Gonçalves[1,3], Sara Najjari[4,5], Oussama Moussaoui[4,5], Adnane El-Yaacoubi[5], Hakim Outghouliast[6], Jamal Charafi[7], Miguel A. Prieto[2], Márcio Carocho[1], Cristina Caleja[1*], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain; [3]MORE - Laboratório Colaborativo Montanhas de Investigação, Brigantia Ecopark, 5300-358 Bragança, Portugal; [4]University Sultan Moulay Slimane, Faculty of sciences and techniques, Beni Mellal 23000, Morocco; [5]University Sultan Moulay Slimane, Higher School of Technology of Khenifra, PB 170, Khenifra 54000, Morocco; [6]National Institute of Agronomic Research, Beni Mellal 23000, Morocco; [7]National Institute of Agronomic Research, Meknes 50000, Morocco. *ccaleja@ipb.pt

Legumes and oilseeds occupy a major position in the diet of many countries, especially in the Mediterranean region, due to their nutritional value, their ability to improve soil fertility, and their contribution to agricultural sustainability [1–3]. Crops such as faba beans (*Vicia faba* L.) and lentils (*Lens culinaris* L.) are particularly valued for these attributes. Intercropping systems with tree crops, such as almonds, have been proposed as an ecological strategy to optimize land use efficiency and improve crop quality [4]. This study aimed to evaluate the impact of intercropping with almond trees on the nutritional composition of faba beans and lentils cultivated over two consecutive production years in different regions of Morocco. Samples were collected from intercropped and control plots in Azilal and Ain Taoujdate, within trials established by University Sultan Moulay Slimane and the National Institute of Agronomic Research (INRA). Nutritional composition - including protein, fat, ash, carbohydrates, moisture, and energy - was determined, according to AOAC Official Methods. Analyses of lentils revealed consistent patterns across the two years: intercropped plots presented lower protein and higher carbohydrate contents compared to controls, while moisture increased and crude fat decreased in the second year. In faba beans, clear regional differences were observed. In Azilal, protein levels increased markedly in the second year (up to 24 g/100 g), accompanied by reduced carbohydrate contents and higher energy values. In contrast, in Ain Taoujdate, protein remained stable or slightly lower, while carbohydrate levels were comparatively higher. Overall, the study shows that intercropping with almond trees affects the nutritional quality of legumes, with responses strongly influenced by local conditions, highlighting the need for region-specific management to improve sustainability and nutritional value.

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P125 | EVALUATION OF THE CHEMICAL COMPOSITION AND ANTIOXIDANT EFFECTS OF DIFFERENT NUTRIENT SOLUTIONS IN THE HYDROPONIC CULTIVATION OF *SONCHUS OLERACEUS* L.

Beatriz H. Paschoalinotto[1], Antonios Chrysargyris[2], Mikel Añibarro-Ortega[1], Nikolaos Tzortzakis[2], Lillian Barros[1], Maria Inês Dias[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal; [2]Department of Agricultural Sciences, Biotechnology and Food Science, Cyprus University of Technology, 3603, Limassol, Cyprus. *maria.ines@ipb.pt

The genus *Sonchus* is abundantly distributed in the Mediterranean region. *Sonchus oleraceus* L. (common sowthistle) is one of the most important species in this genus, widely harvested in the wild by traditional natives due its nutraceutical properties [1]. Hydroponic cultivation offers precise control of growth conditions and nutrient supply. Nitrogen, phosphorus, and potassium (NPK) are essential macronutrients that regulate metabolic pathways and strongly influence both primary metabolites and the biosynthesis of phytochemicals [2]. This study evaluated the impact of hydroponic nutrient solutions (NS) on the nutritional attributes and antioxidant properties of *S. oleraceus* leaves. Plants were grown in a greenhouse under a nutrient film technique system supplied with solutions varying in NS in terms of N (100-200 ppm), P (47-105 ppm), and K (250-525 ppm). Leaves were analysed for centesimal composition and chromatographic methods were applied to evaluate fatty acids, free sugars, organic acids, tocopherols and phenolic metabolites. The hydroethanolic extracts of the leaves were tested for their antioxidant properties *in vitro* through the lipid peroxidation inhibition assay (TBARS) and protection against oxidative haemolysis (OxHLIA). Macronutrients were not significantly affected by NPK ratios, although leaves from S6 (200-105–525 ppm) were identified as a source of dietary fibre (>3 g 100 g^{-1} fresh weight). In fatty acid profiles, S5 (100-105-525 ppm) had the highest SFA proportion. Oxalic acid was lowest in S2 (200-70-350 ppm), reinforcing its safety for consumption. The highest α-tocopherol and total tocopherol contents were detected in S5, while phenolic compounds, especially flavonoids, predominated in S1 (100-70-350 ppm). Antioxidant assays revealed that S6 exhibited the strongest inhibition of lipid peroxidation, with concentrations capable of inhibiting 50% of the chain reaction lower than Trolox, while S5 showed consistent effects in the TBARS and OxHLIA assays. Overall, hydroponic NPK modulation effectively influenced the phytochemical profile and antioxidant activity of *S. oleraceus*. The results highlight this underutilised leafy vegetable as a promising fibre-rich functional food, reinforcing its potential for sustainable cultivation and dietary diversification.

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P126 | REINTRODUCING LENTIL CULTIVATION IN TRÁS-OS-MONTES: COMPARATIVE EVALUATION OF COMMERCIAL SEEDS AND THEIR LOCAL COUNTERPARTS

Ouarda Della[1], Tayse F. F. da Silveira[1*], Isadora M. M. Torres[1], Manuel Ângelo Rodrigues[1], Lillian Barros[1], Rossana V. C. Cardoso[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300 253 Bragança, Portugal. *tayse.silveira@ipb.pt

Lentil (*Lens culinaris* spp.) is recognised as one of the most relevant legume crops cultivated worldwide, playing an important role in agricultural systems and human nutrition [1]. Its value comes from the favourable nutritional profile, providing plant-derived protein, dietary fibre, and essential micronutrients. In addition to their nutritional benefits, lentils also contain antinutritional factors that may affect nutrient absorption [2]. However, the composition is not uniform, as it can be influenced by variety and growth conditions. This study compared seeds of two commercial lentil cultivars (Gilda and Red Crimson) and their local counterparts cultivated in Trás-os-Montes. Samples were analysed for ash, moisture, and crude fat using AOAC official methods, trypsin inhibitor activity using BAPNA, and free amino acids by LC-ESI-HRMS. The analysis revealed clear differences between the four samples: commercial seeds (C1: Gilda; C2: Red Crimson) and local counterparts (L1: Gilda; L2: Red Crimson). Local counterparts showed higher ash content, with 2.87 ± 0.05 g/100 g dw (L1) and 2.71 ± 0.04 g/100 g dw (L2), compared with the commercial samples, 1.89 ± 0.03 g/100 g dw (C1) and 2.19 ± 0.02 g/100 g dw (C2). These differences in ash content may be related to variations in mineral composition. Moisture content was higher in the commercial samples, 11.21 ± 0.12% (C1) and 11.27 ± 0.10% (C2), than in the local ones, 9.05 ± 0.09% (L1) and 8.67 ± 0.08% (L2). Commercial samples showed higher lipid content than their local counterparts, ranging from 0.903 ± 0.092 g/100 g dw (C1) to 1.793 ± 0.507 g/100 g dw (C2), while the local samples varied between 0.519 ± 0.180 g/100 g dw (L1) and 1.347 ± 0.153 g/100 g dw (L2). Trypsin inhibitor activity was consistently low across all samples, indicating minimal antinutritional effects. Amino acid profiling revealed the presence of both essential and non-essential amino acids in all lentil samples. In summary, local cultivars, especially Gilda, had higher ash and lower moisture, indicating advantages in nutritional quality and shelf life, while commercial samples contained slightly more lipids but at low levels. Overall, the satisfactory results for locally growth cultivars support the reintroduction and valorisation of lentils in Trás-os-Montes as a form to diversify and promote sustainable agriculture in the region.

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P127 | GLUTEN-FREE BROWNIES WITH LUPIN FLOUR: DEVELOPMENT AND CHARACTERISATION

Isadora M. M. Torres[1], Rossana V. C. Cardoso[1*], Ouarda Della[1], Manuel Ângelo Rodrigues[1], Lillian Barros[1], Tayse F. F. da Silveira[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300 253 Bragança, Portugal. *rossana@ipb.pt

The global demand for gluten-free products has increased by approximately 16% between 2018 and 2022, making them one of the top 10 existing food trends nowadays [1]. For the development of these products, legume flour can be used as a wheat substitute. In this context, lupin (*Lupinus albus* L.) has a high nutritional value, particularly rich in protein [2], and can be an interesting alternative to replace traditional wheat flour in various products, such as bakery goods. Thus, this study aimed to produce and characterise a novel brownie formulation made with lupin flour. For the flour preparation, the seeds were soaked in water for 12 hours at room temperature, then cooked for 1–2 hours, followed by a leaching process in cold water every 2 hours for a period of 3 days. Afterwards, the seeds were oven-dried (50 ºC for 48 h) and ground into flour (0.8 mm). The brownie formulation consisted of 29% eggs, 32% sugar, 18% oil, 9% cocoa, and 12% flour. Two recipes were prepared: one control (B1), with traditional wheat flour, and another with total replacement of wheat by lupin flour (B2). For nutritional analyses, the official AOAC 2023 methods [3] were used: moisture in an oven at 105 ºC, total lipids by Soxhlet extraction, protein by the macro-Kjeldahl method, and ash by muffle incineration. Carbohydrates were determined by difference. The texture profile analysis (TPA) was conducted using a Stable Micro Systems TA.XTPlus analyser and the water activity (aw) was measured using an Aqualab system. The brownie formulations had moisture contents of 56.92 ± 4.07% and 55.72 ± 4.46%, lipid levels of 31.51 ± 5.10 g/100 gdw and 33.96 ± 0.62 g/100 gdw, and protein content of 9.80 ± 0.62 g/100 gdw and 14.61 ± 0.21 g/100 gdw, for B1 and B2, respectively. For ash, both samples had similar values of 0.25 ± 0.00 g/100 gdw, while carbohydrates were 58.45 ± 5.57 g/100 gdw (B1), 51.18 ± 0.50 g/100 gdw (B2). The aw remained stable, with values of 0.82 ± 0.00 (B1) and 0.83 ± 0.00 (B2), which favors microbiological safety and preservation. These results indicate that replacing wheat with lupin flour contributed to a protein increase in the brownie while maintaining the other parameters. Nevertheless, for TPA, B2 exhibited lower chewiness, hardness and cohesiveness values compared with B1, indicating structural changes in the brownie due to lupin incorporation. Therefore, the results suggest that lupin flour can successfully replace wheat in brownie formulations, showing satisfactory results from a nutritional and technological perspective.

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P128 | YOGURT ICE-CREAM PROTOTYPE FORMULATED WITH WILD BARBERRY EXTRACT AS NATURAL FOOD COLORANT

Lorena González-Zamorano[1*], Alicia Monjas Blasco[1], Patricia Guerrero[2], Fátima Chamizo-Calero[2], Erika N. Vega[1], Elena Cebadera[1], Montaña Cámara[1], Patricia Morales[1]

[1]Complutense University of Madrid, Plaza Ramón y Cajal s/n., 28040, Spain; [2]National AgriFood Technological Center "Extremadura" (CTAEX), Carretera Villafranco-Balboa Km 1.2, 06195. *lorego06@ucm.es

Given the well-documented link between red-blue food synthetic colours and children health concerns, basically associations with hyperactivity and other adverse effects [1], and despite the lower stability of natural colours compared to synthetic ones [2], the demand for natural options continues to grow.

This study is aimed to evaluate the effect of incorporating a natural food colourant derived from wild Barberry fruits (*Berberis vulgaris* L.) described in patent ES2990137B2 [3], on an ice-cream prototype and its color stability during the food product shelf-life.

First, the natural food colour was extracted from mature wild Barberry (*Berberis vulgaris*) berries collected in Spain in 2023 with the appropriate harvesting permits (ref. PN-NC_022022 and ABSCH-IRCC-ES-262067-1 issued by the Spanish Ministry of Agriculture, Fisheries and Food). The extraction process was carried out as described in patent ES2990137B2. The ice-cream was produced at the pilot plant of the National AgriFood Technological Center "Extremadura" (CTAEX), using yogurt (as the base ingredient), commercial ice cream base powder, ascorbic acid, citric acid, flavourings and Barberry extract as a natural colourant. The ice-cream was analysed in terms of colour parameters (CIELAB) and the total monomeric anthocyanin content (TAC) using the QUENCHER methodology [4], over a nine-month shelf-life, at four time points three months apart. The ice-cream had a pink colour, with initial colour values of L* = 69.94, a* = 22.21 and b* = -0.77. Then, these values remained relatively stable over the study period, with measurements after three months showing L* = 63.29, a* = 21.16 and b* = -1.36.

Similarly, the TAC values remained constant at all four stability time points: 17.56 ± 1.40, 17.15 ± 1.14, 17.02 ± 2.06 and 17.57 ± 2.36 mg cya-3-glu/100 g, dw.

In conclusion, the natural extract of wild Barberry demonstrated suitable properties as a food colourant, especially for frozen products. The stability study confirmed that the colourant maintained its colour parameters and anthocyanin content over a nine-month shelf-life, supporting its potential as a natural alternative to synthetic colours in the formulation of ice-cream and other frozen foods.

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P129 | NUTRITIONAL AND CHEMICAL PROPERTIES OF RED RICE: A POTENTIAL SUPERFOOD WITH DIFFERENT HEALTH BENEFITS

Eugénia Baptista[1,2*], Ângela Liberal[1,3], Rossana V. C. Cardoso[1,2,3], Ângela Fernandes[1,3], Pablo A. García[2], and João C. M. Barreira[1,3]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Departamento de Ciencias Farmacéuticas, Facultad de Farmacia, Instituto de Investigación Biomédica de Salamanca-Centro de Investigación de Enfermedades Tropicales de la Universidad de Salamanca (CIETUS-IBSAL), University of Salamanca, 37007 Salamanca, Spain; [3]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *eusanba@gmail.com

Rice (*Oryza sativa* L.) is a staple whole grain recognized for its high nutritional value and is consumed globally by over half of the world's population. Its importance is particularly evident in Asia, where nearly 95% of rice production takes place. Across many regions, rice serves as a fundamental component of daily diets, not only for direct human consumption but also as a key source of animal feed, positioning it among the most significant cereal crops worldwide [1]. In recent years, pigmented rice varieties have gained increasing interest among consumers due to the rising global demand for nutritious and premium-quality foods, mainly due to their richness in bioactive compounds, dietary fibre, essential fatty acids, phytosterols, and antioxidants, among other components. These attributes contribute to their significance, as they are associated with various beneficial effects on human health [2]. Accordingly, the proximate composition (AOAC), sugars (HPLC-RI), organic acids (UFLC-PDA), fatty acids (GC-FID), and tocopherols (HPLC-FD) profiles were evaluated in red rice samples. Carbohydrates were identified as the predominant macronutrient (87.2 g/100 g dw), followed by proteins (9.1 g/100 g dw), fats (2.6 g/100 g dw), and ash (1.1 g/100 g dw). Only sucrose and raffinose were detected among sugars, with sucrose showing the highest concentration (0.74 g/100 g dw). In terms of fatty acids, monounsaturated (MUFAs, 40.7%) and polyunsaturated fatty acids (PUFAs, 31%) were the most abundant, while γ-tocopherol (0.67 mg/100 g dw) predominated over α-tocopherol, the two identified tocopherol isoforms [3]. The characterized nutritional and chemical profiles highlight red rice as a potential super food with multiple health benefits.

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P130 | LUPIN SEEDS GERMINATION VS COOKING: EFFECTS ON ANTIOXIDANT ACTIVITY, PHENOLIC COMPOUNDS, AND FREE AMINO ACIDS

Isadora M. M. Torres[1], Tayse F. F. da Silveira[1*], Ouarda Della[1], Manuel Ângelo Rodrigues[1], Lillian Barros[1], Rossana V. C. Cardoso[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300 253 Bragança, Portugal. *tayse.silveira@ipb.pt

Lupin (*Lupinus albus* L.) is a legume highly valued for its elevated protein content, comparable to that of soybean, and for containing all essential amino acids and important dietary minerals [1]. Although cooking is the most common method of preparing lupin, germination has emerged as an alternative capable of enhancing the nutritional and functional properties of lupin seeds [2]. During seed germination, internal metabolic processes are intensified, leading to the transformation, degradation, or synthesis of various compounds [3]. Thus, this study aimed to investigate the effect of different treatments, namely cooking and germination, on bioactive compounds, antioxidant activity, and free amino acid content in lupin seeds. A raw lupin sample (A1), dried and ground into flour, was compared with three other treatments: cooked lupin (A2), and seeds germinated for 24 h (A3) and 48 h (A4), all oven-dried at 50 °C for 48 h and milled. Cooking consisted of soaking the grains for 12 h, cooking for 1–2 h, and subsequent lixiviation in running water for 3 days with periodic changes (every 2 h). For germination, seeds were soaked for 32 h with water replacement (every 3 h), then placed on moist filter paper in the dark at ~25 °C until reaching the desired germination time. The resulting flours were analysed for phenolic compounds (LC-DAD-ESI-MSn), antioxidant capacity (ORAC), and free amino acids (LC-ESI-HRMS). Total phenolic compounds were 7.97 ± 0.10 mg/g (A1), 8.50 ± 0.11 mg/g (A2), 8.07 ± 0.04 mg/g (A3), and 7.58 ± 0.43 mg/g (A4), with Apigenin-C-hexoside-C-hexoside-pentoside predominating in the samples. These values indicate that the treatments had no significant effect on the total phenolic content. On the other hand, for ORAC, the flours showed the following values: 212.58 ± 9.70 ET/g (A1), 275.40 ± 12.00 ET/g (A2), 328.86 ± 21.55 ET/g (A3), and 302.08 ± 11.28 ET/g (A4), indicating that germination may promote an increase in the antioxidant capacity compared with raw and cooked seeds. In the amino acid analysis, both essential and non-essential amino acids were identified in all samples, with Proline being the most abundant. Additionally, the results indicated that germination may promote an increase in the content of free amino acids, as germinated samples showed higher content of these compounds. Hydrolytic enzymes, such as proteases, acting during germination may have contributed to this result. Taken together, the findings demonstrate that germination may promote significant biochemical improvements, representing a promising alternative to conventional cooking for enhancing the nutritional and functional properties of lupin seeds.

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P131 | NATURAL COLORANT INGREDIENT FROM WILD EDIBLE FRUITS: DEVELOPMENT, CHARACTERIZATION AND TECHNOLOGICAL VALIDATION IN JELLY DESSERTS

Erika N. Vega[1], Lorena Gonzalez-Zamorano[1*], Patricia Guerrero[2], Elena Ordiales[2], Elena Cebadera[1], Montaña Camara[1], Lillian Barros[3], Virginia Fernandez[1], Patricia Morales[1]

[1]Complutense University of Madrid, Plaza Ramón y Cajal s/n., 28040, Spain; [2]National AgriFood Technological Center "Extremadura" (CTAEX), Carretera Villafranco-Balboa Km 1.2, 06195; [3]Centro de Investigação de Montanha (CIMO), LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *lorego06@ucm.es

Artificial food colourants are widely used to improve the visual appeal of foods. However, several studies have reported a strong association between the consumption of azoic colourants and some side health effects, including ADHD in children [1]. The aim of our study was to develop novel anthocyanin-based food colour ingredients, extracted from wild edible fruits, that could provide magenta colour in a low pH food matrix without the use of azoic colourants, as in the case of jellies. For achieving this goal, ripe wild *Berberis vulgaris* (BV) and *Myrtus communis* (MC) fruits, collected in Spain according to the harvesting permission Ref. PN-NC_022022/ABSCH-IRCC-ES-262067-1, were used for novel colorants extraction development according to the process described in patent ES2990137B2 [2]. In order to validate the technological application of the novel colorants, different jellies prototypes were manufactured at CTAEX pilot plant (using the novel colorant ingredients or commercial E124 and E163 as food colourants). The new colour ingredients were fully characterized in terms of anthocyanins (UHPLC-DAD, [3] total phenolic content, antioxidant and antimicrobial properties [4,5]. Jelly prototypes were analysed in terms of CIELAB parameters, total anthocyanins, total phenolics [6] and consumer acceptability [7]. BV extract stood out due to delphinidin-3-*O*-glucoside content while MC extract due to malvidin-3-*O*-glucoside. Both extracts showed high total phenolic content (290.72 and 271.18 mg GAE/g dw, respectively) and good antioxidant and antimicrobial activity, specially against *Salmonella enterica* and *Bacillus cereus*. Jellies exhibited red hues, except the one formulated with BV-MC colorant, which exhibited a unique magenta hue (22.6; 36.6 and 13.6 values, *L**, *a** and *b** parameters), currently achievable only by the use of synthetic colorants. Jellies formulated with the new colorants had the highest total anthocyanins and phenolic content (4.61 mg cya-3-glu/100 g and 85.95 mg GAE/100g, fw). These jellies received higher consumer acceptance compared to those formulated with commercial colorants. The novel food colour ingredients shows great potential as substitute for synthetic colourants replacement. Provides a unique and stable magenta hue while offering added health value, it represents a promising and functional alternative for food industry applications.

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P132 | ARTIFICIAL INTELLIGENCE-DRIVEN DISCOVERY OF NATURAL ANTIDIABETIC INGREDIENTS TARGETING PTP1B

Carlos S. H. Shiraishi[1,2*], Marcus T. Scotti[3,4], Eugene Murakov[4], Miguel A. Prieto[2], Sandrina A. Heleno[1], Rui M. V. Abreu[1]

[1]CIMO-ESA, Instituto Politécnico de Bragança, Campus de Sta Apolónia, Apartado 1172, 5301-855 Bragança, Portugal; [2]Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Faculty of Science, E-32004 Ourense, Spain; [3]Department of Chemistry, Federal University of Paraíba, João Pessoa, Brazil; [4]Laboratory for Molecular Modeling, UNC Eshelman School of Pharmacy, The University of North Carolina at Chapel Hill. *shiraishi@ipb.pt

Diabetes *mellitus* is a major global health challenge, requiring innovative strategies for prevention and treatment. Protein Tyrosine Phosphatase 1B (PTP1B, EC 3.1.3.48) is a validated therapeutic target due to its role in the negative regulation of insulin signaling. Natural Products (NPs) represent a valuable source of bioactive compounds, yet their chemical diversity complicates conventional screening. To address this, we applied an AI-driven pipeline (Figure 1). A curated dataset of 4,664 PTP1B inhibitors from ChEMBL with reported IC_{50} values was standardized and encoded using 1,245 RDKit-derived 2D descriptors and molecular fingerprints. Both regression (- $LogIC_{50}$ calculated by molar concentration) and classification (active/inactive) models were trained with feature selection and 5-fold cross-validation, while the Applicability Domain was assessed using PCA, leverage, and Mahalanobis distance. The final models were applied to the ZincNP library comprising 51,901 compounds. This workflow identified 10 potential candidates with predicted probabilities of activity greater than 0.68. Among them, 3 secondary metabolites: Lobaric Acid (0.9), Jatamansin (0.8), and G28937MW (0.8) as the most promising, originating from *Flavoparmelia caperata* [1], *Nardostachys jatamansi* [2], and *Musineon divaricatum* [3]. These findings highlight the potential of AI-assisted NPs discovery for developing novel antidiabetic therapeutics and functional food ingredients targeting, opening opportunities for diabetes management.

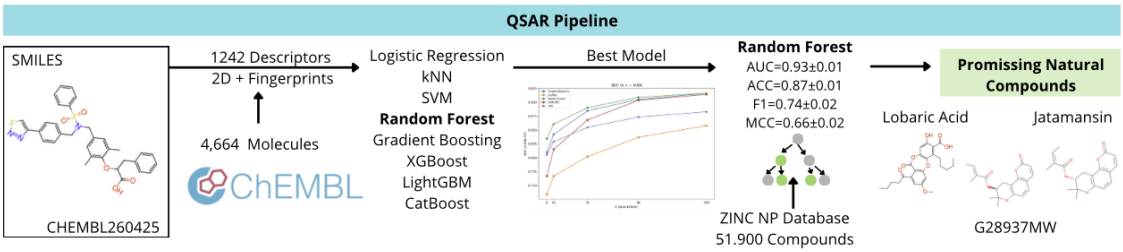

Figure 1 – QSAR workflow for screening PTP1b inhibitors.

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P133 | FROM TRADITION TO INNOVATION: VALORISING TRÁS-OS-MONTES' CROPS FOR SUSTAINABLE, FUNCTIONAL, AND INNOVATIVE PLANT-BASED FOOD PRODUCTS

Daiana Almeida[1*], Ana Maria Vívar-Quintana[2], Ângela Fernandes[1], Lillian Barros[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança, Portugal; [2]Food Technology Area, Higher Polytechnic School of Zamora, Universidad de Salamanca, Spain. *daiana@ipb.pt

Rising health awareness promotes balanced diets rich in fibres, proteins, vitamins, minerals, and bioactive compounds with potential health benefits. At the same time, demand for bio-based foods replacing dairy and meat is growing, driven by intolerances, ethics, and religion. While soy still dominates, positive perceptions of alternative ingredients create opportunities to diversify and expand plant-based options [1]. The Trás-os-Montes region, in northeastern Portugal, has a rich gastronomic heritage shaped by the interplay of natural resources, cultural practices, and ecological cycles. Renowned for its unique ingredients and distinctive products, including meat, cheese, nuts, legumes, fruits, vegetables, and mushrooms, the region plays a crucial role in Portuguese cuisine and, by extension, influences diets beyond national borders [2]. With the growing demand for sustainable alternatives to animal-based foods, local ingredients from Trás-os-Montes could offer promising, nutritious, and flavorful options for bio-based protein alternatives, catering both to individuals seeking a healthier diet and to those aiming to reduce their consumption of animal-based products. In this context, the present work focuses on evaluating the functional and technological potential of emblematic local matrices, namely nuts (*Castanea* spp., *Juglans regia* L. and *Corylus avellana* L.), legumes (*Lupinus albus* L., *Phaseolus vulgaris* L., *Cicer arietinum* L., *Vigna unguiculata* L., and *Vicia faba* L.), and mushrooms (*Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm., *Agaricus bisporus* (J.E.Lange) Imbach and *Lentinula edodes* (Berk.) Pegler), for the development of innovative, value-added, and health-promoting food products. These alternative sources of proteins, fibres, and bioactive compounds will be integrated into the diet through their incorporation into analogues of traditional foods, such as bio-based versions of smoked meats (*e.g.*, chouriço and alheira) and dairy-free cheeses, while also exploring the valorisation of bio-residues generated along the production chain. This initiative seeks to foster economic opportunities for local producers, promote sustainable food innovation, and enhance the visibility and appeal of Trás-os-Montes region.

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P134 | BREAD WITH SALICORNIA: A NATURAL STRATEGY FOR SODIUM REPLACEMENT AND NUTRITIONAL IMPROVEMENT

Zuzanna Eliza Lazuga[1], Rossana V. C. Cardoso[1*], Elisabete Ferreira[2], Ana Paula Pereira[1,3], Fatima Tomé[1,3], Alexandre Gonçalves[1,3], Lillian Barros[1], Tayse F. F. da Silveira[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300 253 Bragança, Portugal; [2]Pão de Gimonde, M. Ferreira & Filhas, LDA, EN218, n° 3798, 5300-553, Gimonde, Portugal; [3]MORE - Collaborative Laboratory Mountains of Research – Association, Edifício do Brigantia Ecopark, Av. Cidade de Leon 506, 5300-358 Bragança, Portugal. *rossana@ipb.pt

Salicornia (*Salicornia ramosissima*) is a halophyte rich in minerals, particularly sodium, as well as bioactive compounds. Its use in breadmaking offers a natural alternative to conventional salt (NaCl), reducing added sodium while enriching the product with nutrients [1]. This study developed a bread with 2.5% of salicornia (S2.5) as a complete salt replacer, compared with a control containing 1% of NaCl (C1). The samples were analysed for proximate composition using AOAC official methods, including moisture, ash, lipids, proteins, carbohydrates (by difference), fibre, and energy value. Free sugars were quantified by HPLC-RI, and the fatty acid profile was determined by GC-FID after transesterification. Sodium chloride concentration was determined by argentometric titration according to Mohr's method. The S2.5 bread presented higher moisture (41.68 ± 1.66% vs. 38.69 ± 1.98%) and ash contents (1.23 ± 0.05 vs. 0.97 ± 0.04 g/100 g fw), but lower lipid levels (1.13 ± 0.00 vs. 1.31 ± 0.13 g/100 g fw). Protein (7.21 ± 0.04 vs. 6.85 ± 0.53 g/100 g fw) and fibre (5.53 ± 0.58 vs. 5.45 ± 1.56 g/100 g fw) contents were slightly higher, while carbohydrates were lower (43.22 ± 1.66 vs. 46.71 ± 1.98 g/100 g fw). Consequently, the energy value was lower in S2.5 bread.

Free sugars were similar between formulations, with maltose as the predominant sugar (1.33 ± 0.10 vs. 1.29 ± 0.04 g/100 g fw), followed by glucose (0.085 ± 0.00 vs. 0.078 ± 0.00 g/100 g fw) and fructose (0.12 ± 0.00 vs. 0.11 ± 0.01 g/100 g fw). Regarding fatty acids, S2.5 bread showed a lower proportion of total saturated fatty acids (39.4 ± 0.10% vs. 42.4 ± 1.16%), mainly due to lower palmitic acid (26.6 ± 0.23% vs. 29.1 ± 0.16%). The monounsaturated fraction was similar between breads (43.6 ± 0.47% vs. 44.9 ± 1.72%), with oleic acid as the major contributor (44.4 ± 1.87% vs. 42.5 ± 0.45%). In contrast, the polyunsaturated fraction was higher in S2.5 bread (17.2 ± 0.07% vs. 13.0 ± 1.57%), particularly linoleic (10.4 ± 0.22% vs. 8.7 ± 0.21%), linolenic (4.6 ± 0.54% vs. 2.8 ± 0.18%), and eicosadienoic acids (3.2 ± 0.04% vs. 1.5 ± 0.02%). Sodium chloride contents were similar between formulations. Overall, the incorporation of 2.5% of Salicornia as a natural salt substitute in bread was shown to be viable, providing formulations with improved mineral content, slightly higher protein and fibre, and a more favourable fatty acid profile. Sodium chloride levels were comparable to the control, supporting its potential as a sustainable salt replacer in bakery products, reducing added NaCl without compromising quality.

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P135 | ITALIAN BIODIVERSITY: A SOURCE OF PLANT EXTRACTS WITH ANTIOXIDANT, ANTI-INFLAMMATORY, AND ANTIGLYCATION POTENTIAL FOR NUTRACEUTICAL FORMULATIONS

Francesca Birolini[1,2], Sara F. Vieira[1], Tayse F. F. da Silveira[1], Paola Perugini[2], Lillian Barros[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança, Portugal; [2]Department of Drug Sciences, University of Pavia, Via Taramelli 12, Pavia, Italy. *lillian@ipb.pt

World Health Organisation emphasises plant biodiversity as a valuable source of natural molecules with potential relevance for human well-being. In particular, the plant-derived secondary metabolites can strongly modulate several pathophysiological processes (*e.g.*, inflammation, protein glycation), which are closely associated with aging and chronic degenerative diseases [1]. *Plantago lanceolata* L. (PL), *Agrimonia eupatoria* L. (AE), *Achillea millefolium* L. (AM), and *Hypericum perforatum* L. (HP) are four native Italian species traditionally used for their medicinal properties. In this context, the present study aimed to evaluate their antioxidant, anti-inflammatory, and antiglycation activities to develop a nutraceutical ingredient capable of modulating these key biological processes. The PL leaves and flowering tops of AE, HP, and AM were subjected to a traditional hydroethanolic maceration extraction (80%, *v/v*). The resulting dry extracts, chemically characterised and quantified by HPLC-DAD-ESI-MS^n, were found to be rich in rutin (HP, 37.5 ± 0.5 mg/g dry extract), B-type procyanidin trimer (AE 6.2 ± 0.6 mg/g), 3,5-dicaffeoylquinic acid (AM, 56.4 ± 5.2 mg/g), and acteoside (PL, 10.4 ± 0.5 mg/g). A screening of different bioactivities was firstly performed. In the $DPPH^{\bullet}$ assay, AE showed the highest antiradical activity, followed by HP, AM, and PL, demonstrating its potential for biological applications. All the extracts were able to reduce the formation of malondialdehyde in a lipid peroxidation model, being AE and AM the most promising plants. The extracts also showed the capacity to neutralize the peroxyl radical ($ROO^{\bullet}$), being AE the most antioxidant mixture. Furthermore, the cytocompatible extracts (200 µg/mL) exhibited strong anti-inflammatory activity (AM > HP > AE > PL), observed by the reduction of IL-6 (ranging from 61.2 ± 0.5% to 85.2 ± 0.5%) in LPS-stimulated macrophages (THP-1 cell line). Moreover, they were also able to reduce the intracellular ROS/RNS production, with a bioactivity ranging from 26.9 ± 5.8% to 47.5 ± 9.7% (AE > HP > AM > PL). In preliminary antiglycation assay, AE, HP and PL showed significant inhibitory activity in the formation of AGEs (both Argpyrimidine and Versperlysine-like), with IC_{50} values below 1 mg/mL.

In summary, the Italian species *A. eupatoria* and *H. perforatum* represent a valuable source of natural bioactive compounds able to modulate oxidative, inflammatory, and glycation pathways. Their phytocomplexes show promising potential as functional ingredients for the formulation of innovative nutraceuticals aimed at supporting healthy aging and reducing risk factors associated with chronic conditions. Nevertheless, further investigations on their bioaccessibility are required to confirm their efficacy and support their potential incorporation into food-based applications.

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P136 | MINERAL PROFILING OF *PHYTOLACCA AMERICANA* L. BERRIES: NUTRITIONAL POTENTIAL AND SAFETY ASSESSMENT

Cláudia S. G. P. Pereira[1*], Liliana Espírito Santo[1,2], Agostinho Almeida[1], João C. M. Barreira[3], Ana F. Vinha[1,4], Maria Beatriz P. P. Oliveira[1]

[1]LAQV/REQUIMTE, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA) – CITEXV, University of Vigo, 36310 Vigo, Spain; [3]Mountain Research Centre (CIMO), ESA, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [4]FP-I3ID, Research Institute, Innovation and Development Fernando Pessoa, Faculty of Health Sciences, Fernando Pessoa University, Praça 9 Abril 349, 4249-004 Porto, Portugal. *claudia.guimaraes.pp@gmail.com

Phytolacca americana L., commonly known as pokeweed, is an herbaceous plant native to temperate regions of the Americas, Asia, and Africa. In Portugal, it is found throughout the mainland as well as in the Madeira and Azores archipelagos. Traditionally, its berries have been utilized for dyeing purposes (*e.g.*, as a natural adulterant in pale red wines), while the young shoots, when properly prepared, have been consumed as a vegetable [1].

This study analyzed the elemental composition of *P. americana* berries using an iCAP™ Q ICP-MS (Thermo Fisher Scientific, Bremen, Germany) [2]. The results indicate that the berries are rich in essential trace elements, including iron (87.15 ± 11.63 µg/g), manganese (13.75 ± 0.15 µg/g), zinc (10.8 ± 0.3 µg/g), and copper (4.33 ± 0.03 µg/g). Additionally, potassium is the most abundant macroelement, present at 21.63 ± 0.28 mg/g, while sodium levels are minimal (0.0023 ± 0.005 mg/g).

Analysis of non-essential and toxic elements revealed low levels of arsenic (0.12 ± 0.01 µg/g), cadmium (0.03 ± 0.01 µg/g), and lead (103.48 ± 0.03 ng/g), with mercury and selenium below the detection limit. These findings suggest that *P. americana* berries are a significant source of essential minerals, with generally low levels of toxic elements.

This preliminary mineral profiling provides a basis for exploring the nutritional potential of the species and its possible incorporation into food products.

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P137 | ASSESSMENT OF LOW-TEMPERATURE DRYING ON THE ANTIOXIDANT ACTIVITY OF PARSLEY AND CORIANDER: TOTAL PHENOLIC AND FLAVONOID COMPOUNDS

Joana Solinho[1,2*], Élia Fernandes[1,2], Manuel Vázquez[3], Rita Pinheiro[1,2]

[1]School of Technology and Management, Polytechnic Institute of Viana do Castelo, Viana do Castelo, Portugal; [2]Center for Research and Development in Agrifood Systems and Sustainability (CISAS) of the Polytechnic Institute of Viana do Castelo, Viana do Castelo, Portugal; [3]Department of Analytical Chemistry, Faculty of Veterinary, Campus Terra, University of Santiago de Compostela, Lugo, Spain. *jsolinho@ipvc.pt

Drying is one of the most widely used methods for food preservation and has a significant impact in determining product quality [1].
Traditional drying techniques, often based on high temperatures, can lead to substantial losses of valuable bioactive compounds and negatively affect antioxidant capacity [2]. In response to the growing demand for sustainable preservation techniques, this study explores a low-temperature drying process aimed at retaining the nutritional and functional potential of aromatic herbs. By evaluating the total phenolic content (TPC) and flavonoid content (TFC) after this non-invasive drying approach, this research was designed to minimize the bioactive compounds degradation and enhance the functional value of these products for potential use in food matrices.
The study focused on parsley (*Petroselinum crispum*) and coriander (*Coriandrum sativum*), two widely consumed aromatic herbs, assessing the impact of drying at 20 °C for up to 72 hours on their antioxidant properties. Fresh samples were subjected to forced-air drying under controlled conditions, and extracts were prepared and analyzed every 24 hours for TPC and TFC.
The results showed that both total TPC and TFC increased up to 48 hours, likely due to moisture loss and concentration effects. Specifically, TPC increased by 2.7 times in parsley and 3.4 times in coriander, while TFC increased by 10.8 times in parsley and 8.2 times in coriander. However, after 72 hours, both parameters showed a decrease, suggesting the onset of degradation of bioactive compounds caused by prolonged exposure to the drying process. This reinforces that prolonged drying times may result in the loss of these important functional properties, emphasising the need to optimise drying time in order to preserve the quality of the final products.
Although low-temperature drying allows partially preservation of the antioxidant compounds in parsley and coriander, the method presents practical limitations. The extended drying period results in a considerable energy consumption, raising operational costs and challenging its sustainability at industrial scale. Moreover, maintaining equipment dedicated exclusively to such a long drying period is complex and impractical in large-scale production environments.

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P138 | PRESERVING THE GOOD FATS: THE IMPACT OF COOKING METHODS ON THE HEALTHPROMOTING LIPIDS OF *SCOMBER SCOMBRUS*

Marta Neves[1], Madalena Antunes[1,2], Wilson Fernandes[3], Carla Tecelão[1*]

[1]MARE - Marine and Environmental Sciences Centre & ARNET—Aquatic Research Network, Politécnico de Leiria, 2520-641, Peniche, Portugal; [2]LEAF - Linking Landscape, Environment, Agriculture and Food Research Centre, Instituto Superior de Agronomia, Universidade de Lisboa, 1349-017 Lisboa, Portugal; [3]Escola Superior de Turismo e Tecnologia do Mar, Politécnico de Leiria, 2520-614 Peniche, Portugal. *carla.tecelao@ipleiria.pt

As agrifood Mackerel (*Scomber scombrus*) stand out as one of the most intensively harvested marine species in Portugal, accounting for an average annual capture of 23,653 tons over the past five years [1]. This fatty fish is rich in n-3 polyunsaturated fatty acids (PUFA), namely eicosapentaenoic acid (EPA, C20:5 n-3) and docosahexaenoic acid (DHA, C22:6 n-3), which are essential fatty acids (FA) with health-promoting benefits, particularly in preventing cardiovascular diseases. Therefore, it is important to encourage mackerel consumption while adopting cooking methods that preserve the integrity of its fatty acid profile, particularly PUFA, which are readily prone to oxidation. This study aimed to contribute to the valorisation of this marine resource by evaluating the effect of different cooking methods: boiling (for 5 min), steaming (for 5 min), sous-vide (under vacuum at 55 ºC, for 17 min), and deep frying (using sunflower oil, at 165 ± 5 °C for 4 min), on the fatty acid profile of mackerel fillets. Fatty acid methyl esters (FAME) were prepared by direct acid transmethylation of fish samples, followed by GC-FID analysis [2]. Fried samples showed increased contents of oleic (C18:1 n-9) and linoleic (C18:2 n-6) FA, primarily due to the migration of sunflower oil to the food surface during frying. Conversely, these samples exhibited the lowest PUFA content, particularly EPA, resulting in a reduced nutritional quality of the fish fillets. Boiled and sous-vide samples had a similar fatty acid profile, characterized by highest values of EPA and monounsaturated fatty acids (MUFA), namely of palmitoleic (C16:1 n-7), gondoic (C20:1 n-9), and nervonic (C24:1 n-9) FA. They also exhibited the lowest content of saturated fatty acids (SFA) and DHA. Steaming samples showed the highest values of PUFA, particularly DHA, and the lowest MUFA. Broadly, steaming was the cooking method that best preserved the integrity of the fatty acid profile, yielding results very similar to those of the raw samples. The estimated health lipid parameters, including n3/n6 ratio, hypocholesterolemic/hypercholesterolemic (h/H) and atherogenic (AI) indices, showed values within the recommended range for cardiovascular disease prevention, for all analysed samples. Therefore, it may be concluded that *Scomber scombrus* remains a health-promoting lipid source, regardless of the cooking method used.

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P139 | SUSTAINABLE RECOVERY OF FUCOXANTHIN FROM *FUCUS SPIRALIS*: PROCESS OPTIMIZATION BY ULTRASOUND-ASSISTED EXTRACTION

Cláudia S. G. P. Pereira[1], María Carpena Rodríguez[2], João C. M. Barreira[3*], M. Beatriz P. P. Oliveira[1], Miguel A. Prieto[2]

[1]REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Porto, Portugal; [2]Nutrition and Bromatology Group, Department of Analytical and Food Chemistry, Faculty of Food Science and Technology, University of Vigo, Ourense Campus, E32004 Ourense, Spain; [3]Mountain Research Center (CIMO), Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *jbarreira@ipb.pt

Fucoxanthin, a marine carotenoid with diverse bioactive properties, has gained increasing attention for applications in the food, pharmaceutical, and nutraceutical sectors. However, its efficient extraction from natural sources remains challenging, as yield and purity are strongly influenced by the applied operational conditions. Among the available techniques, ultrasound-assisted extraction (UAE) has emerged as a sustainable and effective method to enhance the recovery of bioactive compounds from marine biomass [1].

In this study, response surface methodology was applied to optimize the UAE conditions to extract fucoxanthin from *Fucus spiralis*. Three different extraction variables were tested: time (t: 5 to 55 min), power (P: 100 to 500 W), and temperature (T: 35 to 100 ºC). These conditions corresponded to the analyzed independent variables X_1 (t), X_2 (P), and X_3 (T) (with five levels for each variable), included in the optimization process. A circumscribed central composite design was employed, generating 28 experimental runs: 22 factorial points (resulting from the interaction of the selected independent variables) and 6 central points. The extraction yield and the fucoxanthin content (quantified by HPLC-DAD) were used as response variables. The optimized model successfully identified the operational conditions (t, P, and T) that maximize fucoxanthin recovery, demonstrating the potential of UAE as a green and efficient technique. These findings contribute to the valorization of *F. spiralis* as a sustainable source of this bioactive carotenoid.

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P140 | VALORIZATION OF THE FIBROUS FRACTION OF JACKFRUIT (*ARTOCARPUS HETEROPHYLLUS*): NUTRITIONAL COMPOSITION, ANTIOXIDANT CAPACITY, AND PREBIOTIC POTENTIAL OF *IN VITRO* DIGESTION FRACTIONS

Aliza Taketomi[1,2], Rafael M. Spréa[1*], Leandro Herculano[1,3], Eliana Pereira[1], Cristiane Canan[2], Otávio A. Sakai[3], Shirlei H. S. Sarraff[3], Lillian Barros[1], Joana S. Amaral[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal; [2]Departamento Acadêmico de Alimentos, Universidade Tecnológica Federal do Paraná, Câmpus Medianeira, Brasil; [3]Departamento Acadêmico de Física, Universidade Tecnológica Federal do Paraná, Câmpus Medianeira, Brasil; [4]Instituto Federal do Paraná, Câmpus Umuarama, Rodovia PR 323 km 130, Umuarama, Paraná, Brasil. *rafael.sprea@ipb.pt

The increasing demand for sustainable functional ingredients has driven the valorization of plant-based by-products and residues as alternative sources of dietary fiber and bioactive compounds. Jackfruit (*Artocarpus heterophyllus*), a tropical fruit widely cultivated in Asia and Latin America, generates a significant amount of fibrous waste during processing [1]. These fibrous residues, often discarded, are rich in insoluble fibers and represent a promising matrix for the development of ingredients with prebiotic and antioxidant properties. The application of standardized *in vitro* methodologies, such as the INFOGEST 2.0 protocol, enables the assessment of the release and stability of bioactive compounds during simulated gastrointestinal digestion and allows for the separation of bioaccessible (potentially absorbable) and non-bioaccessible (undigested) fractions [2].

Jackfruit fibrous fraction was evaluated for its proximate composition, antioxidant activity, and the prebiotic potential of the non-bioaccessible fraction using standardized methodologies. The nutritional profile was determined according to AOAC official methods, revealing high contents of dietary fiber, with insoluble fibers being predominant (44.8 ± 0.2 g/100 g dry weight), followed by soluble fibers (24.5 ± 0.4 g/100 g dw). Proteins represented the second most abundant macronutrient (7.1 ± 0.1% dw), followed by lipids, ash, and carbohydrates. The INFOGEST 2.0 standardized static *in vitro* digestion model was applied to simulate human gastrointestinal digestion and to separate the bioaccessible and non-bioaccessible fractions.

The bioaccessible fraction was assessed for antioxidant capacity using DPPH radical scavenging and ferric reducing power assays, yielding EC_{50} values of 20.1 ± 0.1 mg/mL (DPPH) and 3.5 ± 0.7 mg/mL (reducing power), respectively. The non-bioaccessible fraction was tested for prebiotic activity against three Lactobacillus strains and one Bifidobacterium strain. The results demonstrated that both the non-bioaccessible fractions and jackfruit flour exhibited strong prebiotic activity, surpassing the performance of positive controls such as fructooligosaccharides and inulin across all tested strains.

These findings highlight the potential of jackfruit fiber as a sustainable source of functional ingredients with antioxidant and prebiotic properties, supporting its application in the formulation of novel functional foods.

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P141 | VALORIZATION MEDICINAL PLANTS OF ANGOLA: BIOLOGICAL DIVERSITY, BIOACTIVE COMPOUNDS AND THERAPEUTIC APPLICATION

Emília Joana F. Vieira[1,2*], Luísa Brito[2,3], Maria M. Romeiras[2,3,4], Vitor Alves[2,3]

[1]Centro Nacional de Investigação Científica (CNIC) do MESCTI, Av. Hochi Min, Luanda, Angola; [2]Linking Landscape, Environment, Agriculture and Food (LEAF), Instituto Superior de Agronomia (ISA), Universidade de Lisboa, Tapada da Ajuda, 1340-017 Lisboa, Portugal; [3]Associated Laboratory TERRA, Instituto Superior de Agronomia (ISA), Universidade de Lisboa, Tapada da Ajuda, 1340-017 Lisboa, Portugal; [4]Centre for Ecology, Evolution and Environmental Changes (cE3c) and Change-Global Change and Sustainability Institute, Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal. *vieiraemilia@gmail.com

Over the past decades, research into plants traditionally used in medicine has proven to be a promising avenue for identifying new therapeutic agents based on their bioactive compounds. However, indigenous African medicinal plants, particularly in Angola, remain largely un explored [1]. Among the studies that address the plant diversity of Angola, ethnobotanical surveys in the provinces of Bengo and Uíge [2, 3], stand out, as well as research focused on specific plant families such as Leguminosae [4] and Annonaceae [5]. The present study focused on the ethnobotanical uses and antibacterial, and antioxidant activities of medicinal plants collected in Angola, in the provinces of Bengo and Uíge. The same plants, are also sold in local markets in the capital of Angola, Luanda. Ethnobotanical data were compiled through fieldwork, complemented by in vitro assays that evaluated the antioxidant and antibacterial activities of extracts of 20 selected plant species. The antioxidant capacity of the extracts was assessed using DPPH, ABTS and FRAP methods, along with the quantification of phenolic compounds using the Folin-Ciocalteu method. The antibacterial activity of the extracts was evaluated by the agar diffusion assays against four bacterial strains: *Escherichia coli* B, *E. coli* O157:H7, *Staphylococcus epidermidis*, and *Staphylococcus aureus*. The three methods used confirmed the antioxidant activity of the extracts (DPPH values ranging from 0,15 to 25 µg of Trolox per mg of dry extract). Phenolic content (0.12 to 5.58 mg of GAE per gram of dry extract) correlated positively with antioxidant activity, suggesting the role of phenolic compounds as bioactive compounds. Particularly, the obvious antibacterial activity of extracts from two plants (*Adenia digitata* and *Chromolaena odorata*), against pathogenic strains highlighted the promising antibacterial potential of these extracts.

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P142 | OPTIMIZING TANNIN EXTRACTION CONDITIONS IN VINE BIOMASS: A KEY POINT FOR VALORIZATION AND SUSTAINABLE PRODUCTION

Edite Cunha[1], Tarik Sebbah[1], Liliana Espírito Santo[1,2], Alberto N. Araújo[1], M. Conceição Branco[1], Ana F. Vinha[1,3], M. Beatriz P. P. Oliveira[1*]

[1]LAQV/REQUIMTE, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA) – CITEXV, University of Vigo, 36310 Vigo, Spain; [3]FP-I3ID, Research Institute, Innovation and Development Fernando Pessoa, Faculty of Health Sciences, Fernando Pessoa University, Praça 9 Abril 349, 4249-004 Porto, Portugal. *beatoliv@ff.up.pt

Tannins are phenolic compounds, abundant in nature, and recognized for their potential applications in the food, pharmaceutical and cosmetic industries due to their bioactivity [1]. Agro-industrial residues, including vine biomass (stems and leaves), have recently been valorized as sources of tannins, providing promising sustainable alternatives to synthetic compounds [2]. This work proposes an extraction process with different solvents, during 1 h, at 40 °C, on a heating plate under constant stirring (600 rpm). To maximize the recovery of tannin compounds a total of 5 solvent mixtures were tested: 100% water, 60% water/40% ethanol, 50% water/50% ethanol, 40% water/60% ethanol, and 100% ethanol.

Identification and quantification of catechin (CAT), epigallocatechin gallate (EGCG), gallic acid (GA), ellagic acid (EA), and 3-*O*-methylellagic acid (3-MEA) were performed by high-performance liquid chromatography (HPLC) with an ultraviolet multi-diode detector (DAD) [3]. The best solvent condition was ethanol/water 60:40 (*v/v*), followed by 50:50 (*v/v*), and 40:60 (*v/v*), respectively. The ethanolic extract proved to be the least suited for the recovery of these compounds, with recovery values between 31% to 40.0% for 3-MEA and CAT, respectively. GA was the compound with the highest recovery, ranging from 55.2 % to 98.3%. Based on the results obtained, the ethanol/water 60:40 (*v/v*) resulted in higher tannins recovery for vine leaves: EA (96.5%), CAT (98.7%), GA (75.9%), 3-MEA (91.8%), and EGCG (90.2%). The use of hydroalcoholic mixtures as extracting solvents provides environmentally friendly alternatives to obtain tannins from grapevine biomass, adding value to this residue. Thus, these preliminary findings highlight the possibility of using vine leaves as a long-term resource to obtain valuable products for the food, medicine and/or cosmetics industries. This study contributes to the advancement of waste valorization strategies and circular bioeconomy approaches.

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P143 | PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY OF SUNFLOWER OIL SUPPLEMENTED WITH *JUNIPERUS TURBINATA* BIOACTIVE COMPOUNDS

Madalena Antunes[1,2*], Carla Tecelão[1], Vítor D. Alves[2,3], Suzana Ferreira-Dias[2,4]

[1]MARE – Marine and Environmental Sciences Centre, ARNET—Aquatic Research Network, Politécnico de Leiria, 2520-641 Peniche, Portugal; [2]LEAF – Linking Landscape, Environment, Agriculture and Food Research Centre, Instituto Superior de Agronomia, Universidade de Lisboa, 1349-017 Lisboa, Portugal; [3]Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, 1349-017 Lisboa, Portugal; [4]Laboratório de Estudos Técnicos, Instituto Superior de Agronomia, Universidade de Lisboa, 1349-017 Lisboa, Portugal. *madalena.f.antunes@ipleiria.pt

Halophytic plants are exposed to abiotic constraints and, as a result, often experience oxidative stress, developing a strong antioxidant system. Moreover, vegetable oils are prone to oxidation, and while synthetic antioxidants can have harmful effects on human health, natural antioxidants from halophytes, combined with green extraction methods, offer a safer and effective alternative. In this context, the aim of this study was to evaluate the effect of ultrasound (US) assisted supplementation of sunflower oil with the halophyte *Juniperus turbinata* on phenolic content and antioxidant activity of the oil. The effects of US exposure time and biomass percentage on antioxidant extraction were assayed following a Central Composite Rotatable Design (CCRD). The total extraction time was 120 min, being the agitation period equal to 120 min minus the US time. Total phenolic content (TPC) was measured using the Folin–Ciocalteu method, and the antioxidant activity was assessed via FRAP and DPPH assays. TPC ranged from 12.76 to 54.52 µg GAE/g, while FRAP and DPPH values ranged from 129.41 to 443.58 µg BHT eq/g and 75.71 to 360.97 µg BHT eq/g oil, respectively. In all assays, higher biomass percentages enhanced phenolic extraction and antioxidant activity. Additionally, the use of biomass percentages ≥ 6%, for FRAP assay, or ≥9% for DPPH assay, promoted antioxidant levels in the supplemented oils exceeding 200 µg BHT eq/g, which is equivalent to the maximum allowed BHT addition in edible oils.

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P144 | NUTRITIONAL AND BIOACTIVE PROPERTIES OF *ANISOPHYLLEA QUANGENSIS*: INFLUENCE OF DEHYDRATION

Luísa Dovala[1,2], Maria Manuel Romeiras[1], Joana Sales[1], Vitor Alves[1], Margarida Moldão[1*]

[1]Linking Landscape, Environment, Agriculture and Food Research Center (LEAF), Associated Laboratory TERRA, Instituto Superior de Agronomia (ISA), Universidade de Lisboa, Tapada da Ajuda, 1340-017 Lisboa, Portugal; [2]Instituto Politécnico, Universidade 11 de Novembro, Rua das Mangueiras, Bairro 4 de Fevereiro, Cabinda, Angola. *mmoldao@isa.ulisboa.pt

Cabinda is a province of Angola characterized by diverse physiography, climate, and biodiversity, which support a wide variety of wild fruits with unique sensory qualities [1]. These fruits play a crucial role in the diet and traditional medicine of local populations [2]. However, their high perishability and seasonality limit their availability and utilization. As such, dehydration emerges as a simple and cost-effective preservation strategy [3], although sun-drying remains challenging due to the region's high relative humidity. Therefore, the impact of controlled air-drying (55–65°C, 24–46 h) on the nutritional and functional composition of *Anisophyllea quangensis* fruits was evaluated in this study. The effects of drying conditions on proteins, minerals, soluble sugars, lipids, and antioxidant capacity (FRAP, DPPH, ABTS) were assessed. Results showed that *A. quangensis* fruits possess high antioxidant capacity and are rich in minerals, particularly Calcium (Ca), Magnesium (Mg), and Zinc (Zn). Importantly, dehydration under the tested conditions did not significantly affect ($p > 0.05$) most of the evaluated parameters.
Overall, controlled dehydration proved to be an effective method to extend the shelf life of *A. quangensis* fruits while preserving their nutritional and bioactive properties.

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P145 | FROM WASTE TO RAW MATERIAL: NUTRITIONAL AND FUNCTIONAL POTENTIAL OF BERRY BY-PRODUCTS

Bárbara Menezes[1,2], Tiane Finimundy[1], Tânia C. S. P. Pires[1], Lillian Barros[1], Manuel Goméz[2], Alexandre Gonçalves[1,3], Eliana Pereira[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]UVa, University of Valladolid, Department of Agricultural and Forestry Engineering, Higher Technical School of Agricultural Engineering, Palencia, Spain; [3]MORE – Mountains of Research Colaborative Laboratory – Association, Bragança, Portugal. *eliana@ipb.pt

Reuse agro-industrial by-products represents a sustainable and innovative approach to developing functional ingredients with potential health benefits. Despite being rich sources of nutrients and bioactive compounds, berry seeds and strawberry by-products are commonly discarded during processing [1]. In this study, the nutritional profile, phenolic composition, and bioactive properties of three such by-products, blackberry seeds (SMAM), raspberry seeds (SMFB), and strawberry residues (SBMG), were systematically analyzed and characterized. The nutritional composition in proteins, total fat, ash, carbohydrates and energetic value was evaluated using AOAC official methodologies, the individual profile of phenolic compounds, fatty acids, sugars, and organic acids were determined using different chromatographic techniques, and bioactive action was tested through antioxidant and antimicrobial methods.

The results showed that SMFB contained the highest fat content (13.4 ± 0.6 g/100 g dw) and energetic value (465.5 ± 2.9 kcal/100 g dw). In contrast, the SBMG exhibited the highest levels of protein (11.1 ± 0.2 g/100 g dw), ash (3.77 ± 0.01 g/100 g dw), and carbohydrates (83.9 ± 0.2 g/100 g dw), but the lowest fat (1.28 ± 0.01 g/100 g dw) and energy (391.3 ± 0.01 kcal/100 g dw). Phenolic profiling revealed SBMG as particularly rich in total phenolics, proanthocyanidins, and anthocyanins. SMAM emerged as a notable source of hydrolyzable tannins and ellagic acid derivatives, whereas SMFB exhibited comparatively lower concentrations of phenolic compounds. Antioxidant assays showed higher activity in SMAM and SMFB, compared to SBMG reflecting the differences in bioactive compound composition. In terms of antimicrobial activity, SMAM demonstrated the broadest spectrum of inhibition, effectively targeting Yersinia enterocolitica and *Aspergillus* spp.. SMFB showed selective efficacy against Gram-positive bacteria, particularly *Bacillus cereus* and *Staphylococcus aureus*. Meanwhile, SBMG exhibited moderate inhibitory effects against *Escherichia coli* and *Salmonella enterica*.

These results highlight the distinct nutritional and bioactive properties of berry seeds and strawberry by-products, reinforcing their potential for valorization as functional ingredients in the industry. This strategy aligns with key Sustainable Development Goals, particularly SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action), by promoting health, minimizing food waste, and advancing circular economy practices.

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P146 | SUSTAINABLE UTILIZATION OF MUSHROOM BIORESIDUES IN THE PRODUCTION OF NUTRIENT-RICH FLOUR

Yahia Hammadi[1], Bruna, Moreira[1], Lillian Barros[1], Cristina Caleja[1*], Eliana Pereira[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *ccaleja@ipb.pt

Mushrooms are recognized as functional foods due to their bioactive compounds, which offer a range of health benefits. However, because of organoleptic preferences and market standards, a substantial portion of fresh mushrooms is discarded annually. These bio-residues, represent a natural source of high-value ingredients [1]. In this context, the agri-food sector urgently needs to adopt more sustainable and competitive strategies to meet current consumer demands without compromising the needs of future generations [2]. Therefore, this work aimed to prepare a flour using bio-residues from different mushroom species commonly consumed in the Iberian Peninsula (*Boletus edulis* Bull., *Amanita ponderosa* Malençon & R. Heim, and *Lentinus edodes* (Berk.) Pegler), to carry out the chemical and nutritional characterization of the flour obtained from a mix of these mushroom bio-residues, and evaluate its bioactive potential.
Nutritional composition (protein, total fat, ash, carbohydrate, and energy content) was evaluated using official analytical methodologies established by the AOAC (Association of Official Analytical Collaboration). The chemical composition, specifically the individual profiles of free sugars and organic acids, were determined using chromatographic techniques. Bioactivity was tested through *in vitro* assays, namely antioxidant activity was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay and the TBARS (thiobarbituric acid reactive substances) assay.
The use of mushroom bio-residues for flour production proved to be a promising strategy within the context of the circular economy and the valorisation of agri-food by-products. The results obtained demonstrated that the flour developed from different mushroom species presents a relevant nutritional composition, in addition to containing bioactive compounds with antioxidant potential. Therefore, this product can be considered a value-added ingredient suitable for use in the formulation of functional foods. Moreover, the reuse of these residues contributes to waste reduction and promotes more sustainable practices in the agri-food sector.

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P147 | RECONSTRUCTING ANCIENT FISH SAUCES: EXPERIMENTS AT TRÓIA

Joana Sales[1*], Joana Braga[2], Victor Vicente[2], Sally Grainger[3], Inês Vaz Pinto[4], Anabela Raymundo[1], Catarina Prista[1]

[1]LEAF–Linking Landscape, Environment, Agriculture and Food Research Center, Associated Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Selo de Mar, Setúbal, Portugal; [3]University of Reading, Department of Archaeology, UK; [4]Troia Resort / CEAACP - Universidade de Coimbra, Portugal. *joanasales@isa.ulisboa.pt

Fermented fish sauces, such as garum, were highly valued in Greco-Roman antiquity. This study aims to revitalize these products by recreating garum in Tróia, following a recipe from the Greek agricultural manual Geoponica, under the natural summer temperatures and replicating the original conditions. Stainless steel drums, tightly sealed, were used: sardine and salt (D1); sardine and brine (D2); sardine, salt and water (D3). Trials were fermented for 5 months. After 3 months, the D1 and D2 were subdivided into variants: D1.1 (unchanged), D1.2 (diluted with wine), D2.1 (unchanged), D2.2 (diluted with brine), D2.3 (diluted with wine). The fermentation process was followed by measuring pH, total soluble solutes and titratable acidity. Based on the results of pH, TSS and titratable acidity, the recipe with brine showed the most promising performance. Chemical characterization was also carried out after 2 weeks, and 3 and 5 months regarding, the production of organic acid, protein, antioxidant capacity, moisture, ash, and mineral content. An initial decrease in protein content was observed, due to alkaline fermentation and proteolysis [1]. After the addition of wine or brine, protein levels remained stable, suggesting a decrease in the metabolic activity of bacteria. HPLC analysis showed lactic and acetic acid were the dominant organic acids in all samples. Wine addition significantly altered the metabolic profile, increasing citric and lactic acid concentrations, suggesting enhanced activity of lactic acid bacteria and inhibition of alternative fermentation pathways [2]. Antioxidant activity measured by FRAP increased in all samples over time, more markedly after wine addition. In contrast, $DPPH^{\bullet}$ and $ABTS^{\bullet+}$ assays showed a decreasing trend, indicating degradation of specific antioxidant compounds [3]. Regarding minerals, no significant differences were observed between formulations. Sodium and potassium being the most abundant elements, directly related to the presence of salt in the recipes. Ash content generally increased, likely due to the loss of organic matter by decomposition during fermentation. In conclusion, this experiment demonstrated that it is possible to recreate a fish sauce very similar to Roman garum, both in its method of preparation and in its final quality. The fermentation process proceeded naturally and successfully, the best results being obtained with the brine formulations. The final product displayed the intense aroma characteristic of garum and proved safe for consumption.

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P148 | COMPREHENSIVE ANALYSIS OF *PRUNUS DULCIS* LEAVES AND SHELLS: TRANSFORMING WASTE INTO BIOACTIVE

Beatriz Queijo[1], Tayse F. F. da Silveira[1], Sara F. Vieira[1], Filipa Mandim[1], Eliana Pereira[1], Lillian Barros[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *lillian@ipb.pt

The growing accumulation of agricultural and forestry residues contributes to environmental risks, such as wildfires. Among these, almond tree (*Prunus dulcis* (Mill.) D. A. Webb) by-products represent over 70% of the fruit's total weight, remain underexploited despite their potential as sources of bioactive compounds [1]. This study aims to characterize the almond tree by-products' chemical composition and bioactive properties.

Almond tree leaves and shells were collected in Vila Nova de Foz Côa, Portugal (October 2024), lyophilized, ground, and stored in the dark until analysis. Chromatographic techniques were applied to characterize the individual profile of organic acids, tocopherols, fatty acids, and free sugars, while the polyphenolic composition of hydroethanolic extracts was assessed by HPLC-DAD-ESI/MS^n. Antioxidant activity was evaluated using the TBARS assay, and the cytocompatibility was assessed with HFF-1 fibroblasts through the resazurin reduction assay over 3 days of culture. Considering the organic acids evaluation, oxalic, quinic, malic, shikimic, citric, and fumaric acids were identified in both matrices, with leaves showing higher concentrations. Regarding tocopherols, α- and γtocopherols were detected in both leaves and shells. Eleven fatty acids were detected in leaves and eight in shells, with palmitic (26% in leaves and 30% in shells) and α-linolenic (40% in leaves and 24% in shells) being predominant. Leaves exhibit a higher proportion of saturated fatty acids and polyunsaturated fatty acids, while shells were richer in monounsaturated fatty acids. In the evaluation of the free sugar profile, fructose, glucose, sucrose, and trehalose were detected in both samples, with shells containing a higher total sugar content (6.5 g/100 g dw) than leaves (5.1 g/100 g dw). Eighteen phenolic compounds were tentatively identified in almond leaves, with type B proanthocyanidin trimer being the most abundant (2.8 mg/g dw), and ten in shells, with catechin having the highest concentration (4.5 mg/g dw). Bioactive assays demonstrated stronger antioxidant activity for leaf extracts (IC_{50} = 4.4 µg/mL) compared to shells (IC_{50} = 24.3 µg/mL). Both extracts were cytocompatible with fibroblasts for concentrations up to 100 µg/mL.

Overall, *P. dulcis* leaves and shells, a commonly considered agricultural waste, are rich in molecules that contribute to their strong bioactivity. Moreover, their validated safety highlights their potential as sustainable sources of bioactive compounds for use as food additives or novel ingredients.

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P149 | OLIVE TREE PRUNING RESIDUES AS SUSTAINABLE SOURCES OF BIOACTIVE COMPOUNDS: PHYTOCHEMICAL PROFILE AND BIOLOGICAL ACTIVITIES

Beatriz Queijo[1], Filipa Mandim[1], Tayse F. F. da Silveira[1], Sara F. Vieira[1], Eliana Pereira[1], Lillian Barros[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *lillian@ipb.pt

The accumulation of agricultural and forestry residues, intensified by rural abandonment, presents environmental challenges, but also offers opportunities for resource valorization [1]. This study explores the potential of olive tree (*Olea europaea* L.) pruning residues - leaves and stems- through detailed chemical and biological characterization.

Samples collected in Vila Nova de Foz Côa, Portugal (October 2024), were analyzed for organic acids, tocopherols, fatty acids, and free sugars using appropriate chromatographic techniques. To obtain extracts for the assessment of phenolic compound composition and associated bioactivities, a maceration process using EtOH:H_2O was performed. The individual profile of phenolic compounds was also investigated by HPLC-DAD-ESI/MS^n. The bioactive potential was evaluated through antioxidant capacity assessed with the TBARS assay, while cytocompatibility was evaluated with fibroblasts (HFF-1 cell line) using the resazurin reduction assay.

According to the results, oxalic, malic, and citric acids were presented in olive tree leaves, while only oxalic and malic acids were determined in the stems. Both tissues exhibited the presence of tocopherols, with αand γ-isophorms predominating in leaves and α- and Δ-isophorms in stems. Regarding the fatty acids profile, thirteen molecules were detected in the leaves and fourteen in the stems, with palmitic and α-linolenic acids predominating. Saturated fatty acids were more abundant in the stems (40,8%), while the leaves were characterized by elevated levels of polyunsaturated fatty acids (72,50%). Fructose, glucose, and sucrose were identified as free sugars in both leaves and stems, whereas trehalose was present only in the leaves. A total of eighteen phenolic compounds were tentatively identified in olive leaf extracts, with protocatechuic acid (1.46 mg/g dw) and apigenin-*O*-rutinoside (1.09 mg/g dw) being the most abundant. In stem extracts, fourteen phenolic compounds were identified, with oleuropein glucoside (13.5 mg/g dw) and hydroxylariciresinol hexoside (9.5 mg/g dw) present in the highest concentrations. Both extracts exhibited significant antioxidant activity, with stems showing slightly stronger activity (IC_{50} = 11.9 µg/mL) compared to leaves (IC_{50} = 13 µg/mL). Cytocompatibility assays confirmed the safety of the extracts up to 50 µg/mL for leaves and 200 µg/mL for stems, maintaining cell metabolic activity above 70% in the tested cell line.

Overall, olive tree biomass emerges as a promising and safe source of bioactive compounds with antioxidant potential, reinforcing its value as a sustainable raw material for food applications.

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P150 | MAJOR POLYPHENOLIC COMPOSITION IN GALICIAN GRAPE BY-PRODUCTS

Javier Echave[1,2], Franklin Chamorro[1], Miguel A. Prieto[1*], Lillian Barros[2*]

[1]Instituto de Agroecoloxía e Alimentación (IAA), Universidade de Vigo, Nutrition and Food Group (NuFoG), Campus Auga, 32004 Ourense, Spain; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal.*mprieto@uvigo.es; lillian@ipb.pt

Grape (*Vitis vinifera* L.) is one of the most extensively cultivated crops in temperate climates, with its primary fate being wine production, which is paired with a great generation of grape pomace (GP), which accounts for approximately 20 to 30% of the harvested grapes. In this sense, Spain and Portugal are wine producers of great relevance in the European context, with some grape varieties being of great economic relevance in the regions of Galicia (NW Spain) and North of Portugal. At the same time, GP is well known to be a rich source of antioxidant phenolic compounds (PC), which have various functional applications in food, cosmetics and health. In this work, the polyphenolic composition of Galician-cultured varieties of GP were studied, namely two whites as Caiña (CAI) and Albariño (ALB); as well as two red varieties as Mencia (MEN) and Brencellao (BRE). GP samples were subjected to hydroethanolic maceration, followed by analysis by LC-MS/MS to elucidate the major PC present in the pomace of these varieties. The analysis revealed that the major PC found in all varieties was catechin, with CAI displaying the highest levels. Regarding flavanols, besides catechin, the major component found were procyanidin B1 and B3, with ALB being the variety with the highest levels. Additionally, epigallocatechin was found in especially high levels in MEN. For flavonols, the major one found in all varieties was quercetin. On the other side, the major group of PC were phenolic acids, all varieties showed sinapic acid as the main one, although MEN and BRE also displayed significant levels of cinnamic acid. Considering anthocyanins, both red varieties display petunidin-3-glucoside as a major one; however, MEN also showed greater levels of pelargonidin 3-glucoside. Overall, although all studied varieties shared many similarities regarding PC composition, varietal differences were apparent as also noted in the concentrations. This may support a more focused and directed exploitation of regional varieties of GP as a source of PC for functional applications.

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P151 | CHARACTERIZATION OF THE DIETARY FIBER CONTENT FROM DIFFERENT EDIBLE MUSHROOMS

Andreia Padrão[1*], Ana Paula Pereira[1,2], Fátima Martins[1,2], Ermelinda Silva[1,2], Luís Pinto[3,7], Rafaela Guimarães[3,7], André Lemos[3,7], Eleomar Pires Júnior[2,4,5], Maria Assunção Rosinha[4], Marco Alves[6], Telma Orvalho[6], Viviana Monteiro[6], Maria José Alves[2,3,7], Alexandre Gonçalves[1,2]

[1]MORE-Laboratório Colaborativo Montanhas de Investigação-Associação, 5300-358 Bragança, Portugal; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [3]AQUAVALOR – Centro de Valorização e Transferência de Tecnologia da Água (CoLAB), 5400-342 Chaves, Portugal; [4]Fumeinor - Dom Fumeiro – Indústria de Fumeiro e Conexos Lda, 5460-210 Boticas, Portugal; [5]Grupo de Nutrição e Bromatologia, Departamento de Química Analítica e Alimentar, Faculdade de Ciência e Tecnologia de Alimentos, Universidade de Vigo, C. Ourense, E-32004 Ourense, Espanha; [6]INOV.LINEA/TAGUSVALLEY - Parque de Ciência e Tecnologia, 2200-062 Abrantes, Portugal; [7]Research Center for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253, Bragança Portugal. *apadrao@morecolab.pt

Dietary fiber (DF) is characterized by carbohydrate polymers that are not hydrolysed by the endogenous enzymes in the small intestine [1]. The DF may contain both a soluble (gums, mucilages, pectins, betaglucans, polysaccharides, and oligosaccharides) and an insoluble fraction (cellulose, hemicellulose, and lignin) of dietary fiber or a mixture of several portions of both fractions. Edible mushrooms and their residues have been gaining prominence as natural sources of dietary fiber and are considered to have great potential for application in the food industry. They are rich in β-glucans and chitin, which offer proven benefits for digestive health, glycemic control, and lowering cholesterol levels [2].

Considering sustainability issues and focusing on the use of by-products resulting from the mushroom production process as fiber-rich food ingredients, this study aimed to characterize different dietary fiber fractions from by-products of two mushroom species: *Pleurotus ostreatus* (Jacq.) P. Kumm and *Lentinula edodes* (Berk.) Pegler, to be used as a food ingredient. The mushroom production by-products, mycelium (vegetative part of the fungus not suitable as fresh product), and feet (stems) were cleaned to remove foreign bodies (dust and small particles), then dehydrated in an oven at 75°C and ground to a powder, before analysis.

The measurement procedure was carried out according to AOAC Official Method, using a rapid integrated procedure. This process enables the measurement of total dietary fiber by summing the quantities of higher molecular weight dietary fiber, which includes insoluble dietary fiber and soluble dietary fiber that precipitates in the presence of 78% aqueous ethanol, as well as soluble dietary fiber that remains soluble in 78% aqueous ethanol. The by-products of the two mushrooms species presented a different profile of dietary fiber content, and this characterization allows their valorization, as well as a food ingredient to be used in the formulation of new products.

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P152 | DIVERSITY MATTERS: CHEMICAL VARIABILITY OF CHICKEN MUSHROOM (*LAETIPORUS SULPHUREUS*) ACROSS DIFFERENT HOSTS AND ITS IMPLICATIONS FOR FUTURE FOOD SYSTEM

Ewa Zapora[1,2*], Monika Kalinowska[2,3], Marek Wołkowycki[1], Marcin Stocki[1]

[1]Department of Silviculture and Forest Utilization, Bialystok University of Technology, Wiejska 45E Str., 15351 Bialystok, Poland; [2]Department of Chemistry, Biology and Biotechnology, Bialystok University of Technology, Wiejska 45E Str., 15351 Bialystok, Poland; [3]natureTECH Centre for Natural Product Research, Bialystok University of Technology, Wiejska 45E Str., 15351 Bialystok, Poland. *e.zapora@pb.edu.pl

The edible polypore *Laetiporus sulphureus*, commonly known as the chicken mushroom, is increasingly attracting attention as a promising source of functional ingredients. While traditionally considered a wild food, its rich repertoire of bioactive metabolites offers opportunities for future food innovation and sustainable nutrition. Yet, the ecological context, particularly the tree host, may shape its metabolite composition [1,2]. This study aimed to evaluate the chemical variability of *L. sulphureus* fruiting bodies collected from six different hosts: *Populus tremula*, *Robinia pseudoacacia*, *Salix caprea*, *Fraxinus excelsior*, *Carpinus betulus*, and *Quercus robur* using GC–MS profiling.

The analysis revealed substantial differences in metabolite profiles depending on the host. Fatty acids and their derivatives dominated, but their proportions varied markedly. For example, methyl linoleate reached up to 25.2% in samples from *Populus*, compared to a mean of 6.6% across all hosts, suggesting this tree as a particularly promising source of polyunsaturated fatty acids [3]. Similarly, linoleic acid peaked at 16.2% in *Populus*, while oleic acid reached 15.6% in the same host, highlighting *Populus* as a key reservoir of essential lipids [2]. In contrast, trehalose, a disaccharide with recognized prebiotic and stress-protective roles, was most abundant in *Robinia*, accounting for 20.8% compared to an overall mean of 5.3% [4]. Minor compounds with potential functional relevance also displayed host-specific patterns: scyllo-inositol (linked to neuroprotection) was enriched in Quercus (0.56%), aspartic acid peaked in *Fraxinus* (0.99%), and ergosterol derivatives were also highest in *Quercus* (1.71%) [5]. Although present in lower amounts, these metabolites expand the nutritional and pharmacological potential of this species. The variability suggests that targeted selection of host–fungus combinations could optimize specific bioactive profiles.

By demonstrating how host-driven variability impacts the accumulation of key compounds, this study introduces a novel ecological dimension to the valorization of edible fungi. The findings highlight that *Populus* may be prioritized for lipid-rich extracts, while *L. sulphureus* collected from *Robinia* represents an important source of functional sugars. Such insights support biodiversity-driven strategies for developing functional foods, enhancing sustainability and consumer health [1]. *L. sulphureus*, therefore, emerges as a model species linking fungal biodiversity, targeted metabolite production, and innovation in future food systems.

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P153 | HYBRID DAIRY-PLANT YOGURTS AS SENSORY AND EMOTIONAL BRIDGES FOR SUSTAINABLE DIETS: EVIDENCE FROM BRAZILIAN CONSUMERS

Igor Souza de Brito[1], Elson Rogério Tavares Filho[1], Mônica Marques Pagani[2], Eliane Teixeira Mársico[1], Carolina Pinto de Carvalho Martins[1], Erick A. Esmerino[1*]

[1]Universidade Federal Fluminense (UFF), Faculdade de Veterinária, Departamento de Tecnologia de Alimentos, Av. Alm. Ary Parreiras, 507 - Icaraí, Niterói - RJ, 24230-321, Brazil; [2]Universidade Federal Rural do Rio de Janeiro (UFRRJ), Departamento de Tecnologia de Alimentos, Rodovia BR 465, Km 07 - Zona Rural, Seropédica - RJ, 23890-000, Brazil. *eaesmerino@id.uff.br

The global shift toward sustainable diets requires food innovations that integrate sensory familiarity with health and environmental responsibility. Hybrid yogurts, combining dairy and plant-based ingredients, emerge as promising candidates to bridge these demands [1]. This study explored Brazilian consumers' expectations, emotions, and perceptions of traditional, hybrid, and fully plant-based yogurts using a multimethod design: online focus groups (n=33), text highlighting [2] (n=321), emotional profiling with the Circumplex-inspired Emotion Questionnaire [3], and attribute associations via CATA. Results highlighted distinct consumer responses across product categories. Traditional yogurt was most strongly associated with emotional comfort (secure/at ease; χ^2=54.9, p<0.001). Dairy-coconut hybrids performed intermediately, statistically aligning with the traditional product in emotional safety and satisfaction, and outperforming both dairy-nut hybrids and nut-based plant yogurts in the expected acceptance. Correspondence analysis (86% of variance) positioned the coconut hybrid with positive emotions (happy/satisfied, relaxed/at ease), whereas the nut-based plant yogurt was associated with negative ones (unhappy/dissatisfied; p=0.024). Cognitive evaluations revealed six latent dimensions: nutrition, resistance/unfamiliarity, compatibility, environmental responsibility, flavor/texture, and appearance. Traditional yogurt held the strongest nutritional associations ("source of calcium": 0.57; "source of protein": 0.62), while hybrids stood out for "source of vitamins" (0.64) and "source of fiber" (0.52). Plant-based products excelled in environmental attributes, particularly "reduces carbon emissions" (loading=0.87; p<0.001). Attribute-based correspondence reinforced the bridging role of the coconut hybrid, closely aligned with traditional yogurt on the sensory axis while sharing sustainability associations with plant-based options. Effect size estimates (partial η^2) confirmed strong influences of product type on emotional comfort (η^2=0.21) and environmental responsibility (η^2=0.18), both high within consumer science standards. Findings show that sensory familiarity and dairy associations remain central, but dairy–coconut hybrids can act as 'sensory and emotional bridges,' easing resistance to plant ingredients and supporting gradual dietary shifts. Communication should emphasize familiarity and tangible benefits, minimizing negative comparisons with traditional products. Though based in Brazil, the study has global relevance, with cross-cultural research needed to clarify how different markets weigh environmental, nutritional, and emotional attributes.

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P154 | MIXTURE DESIGN AS AN INNOVATIVE TOOL TO OPTIMIZE ANTIBACTERIAL ACTIVITY OF THREE SELECTED ESSENTIAL OILS IN DAIRY PRESERVATION

Jovana Petrović[1*], Jelena Živković[2], Dejan Stojković[1], Dejan Pljevljakušić[2]

[1]Institute for Biological Research "Siniša Stanković" (IBISS), University of Belgrade, Bulevar despota Stefana 142, 11108 Belgrade, Serbia; [2]Institute for Medicinal Plants Research Dr. Josif Pančić, Tadeuša Košćuška 1, 11000 Belgrade. *jovana0303@ibiss.bg.ac.rs

Foodborne diseases remain a global health challenge, with dairy products frequently implicated in outbreaks caused by pathogenic bacteria such as *Listeria monocytogenes* and *Escherichia coli* O157:H7 [1, 2]. In response, growing concerns over the safety and consumer acceptance of synthetic preservatives have increased interest in natural antimicrobial alternatives for food preservation.

This study introduces an innovative approach using mixture design methodology to optimize the antibacterial activity of three essential oils (EOs) derived from *Petroselinum crispum*, *Helichrysum plicatum*, and *Origanum vulgare*. The essential oils were chemically characterized using GC-MS: *H. plicatum* EO was rich in α-pinene, neryl acetate, and sylvestrene, with italidione also detected; *P. crispum* EO contained 1,3,8-p-menthatriene, α-pinene, and β-pinene, along with phenylpropanoids such as myristicin; *O. vulgare* EO was dominated by carvacrol and thymol, while o-cymene and γ-terpinene were present in lower amounts. Using a simplex mixture design, 12 combinations of the essential oils were formulated, and tested for their antimicrobial properties, revealing proportion-dependent inhibitory effects. Simultaneous optimization was conducted to determine the best compromise for enhancing antimicrobial responses against tested *L. monocytogenes* and *E. coli* strains, resulting in a tertiary combination consisting of 17.03% of *P. crispum* EO, 9.78% of *H. plicatum* EO, and 73.19% of *O. vulgare* EO. The method was used to overcome potential sensory limitations in dairy products as well as to enhance antimicrobial efficacy at reduced concentrations.

Optimized formulation offers a natural approach to dairy preservation that aligns with clean-label consumer preferences and regulatory limits on synthetic additives. By combining mixture design with traditional plant compounds and modern modeling, this work promotes safer, more sustainable innovation in food technology.

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P155 | PHENOLIC PROFILES AND SUSCEPTIBILITY OF PLUM CULTIVARS TO BROWN ROT CAUSED BY *MONILINIA* SPP.

Jelena Božunović[1*], Jovana Hrustić[2], Milica Mihajlović[2], Brankica Pešić[2], Danijela Mišić[1], Suzana Živković[1]

[1]Department of Plant Physiology, Institute for Biological Research "Siniša Stanković" - National Institute of the Republic of Serbia, University of Belgrade, Bulevar despota Stefana 142, 11108 Belgrade, Serbia: [2]Laboratory of Phytopathology, Institute of Pesticides and Environmental Protection, Banatska 31b, 11000 Belgrade, Serbia. *jelena.boljević@ibiss.bg.ac.rs

Stone fruits are the most important fruit crops in Serbia, with plums (*Prunus domestica* L.) significantly contributing to the overall fruit production. With an annual yield of around 400,000 tons, Serbia is the second largest plum producer in Europe [1]. However, plum production is significantly threatened by brown rot, a widespread disease caused by three *Monilinia* species: *Monilinia laxa*, *Monilinia fructicola*, and *Monilinia fructigena*. *M. laxa* and *M. fructigena* have been known to affect stone fruits in Serbia for a long time, whereas *M. fructicola* was recorded for the first time in 2011 [2]. The study aims to assess the susceptibility of different fruit developmental stages of two plum cultivars ('Stanley' and 'Čačanska rodna') to these pathogens, analyse their phenolic profiles, and explore possible correlations between phenolic content and brown rot incidence. Results indicate similar phenolic profiles of healthy fruits across cultivars, while early in brown rot development, some phenolic compounds correlated with lesion size. As the disease progressed, severity of lesions was negatively correlated with compounds such as quercitrin, rutin, naringin, isoferulic acid, polydatin, and catechin, but positively correlated with naringenin and aesculetin. The strongest correlations occurred during pit hardening and fruit colour change, suggesting that these compounds directly influence plum susceptibility to *Monilinia* infections.
These findings suggest that specific phenolic compounds are a keys determinant of the susceptibility of plum fruits to infections caused by *Monilinia* species. Cultivars exhibiting higher levels of flavonol glycosides at the commercial maturity stage may exhibit enhanced resistance to brown rot, thereby extending postharvest shelf life. Taking into account bioactive and nutraceutical properties of flavonol glycosides, cultivar selection may also offer additional benefits for human and animal health, with broader implications for the food and beverage industry.

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P156 | PLANT-DERIVED BIOSTIMULANTS: A SUSTAINABLE ALTERNATIVE TO ENHANCE CROP PERFORMANCE

Matilde Rodrigues[1,2,3], M. Beatriz P.P. Oliveira[2], Celestino Santos-Buelga[3], José Pinela[1,4*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Bragança, Portugal; [2]LAQV/REQUIMTE, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, Porto, Portugal; [3]Grupo de Investigación en Polifenoles (GIP-USAL), Facultad de Farmacia, Universidad de Salamanca, Salamanca, Espanha; [4]National Institute for Agricultural and Veterinary Research (INIAV, I.P.), Vairão, Vila do Conde, Portugal. *jose.pinela@iniav.pt

Modern agriculture faces unprecedented challenges from climate change, soil degradation, and the overuse of synthetic agrochemicals, all of which contribute to environmental pollution, biodiversity loss, and the emergence of resistant pests and diseases. In this context, plant-derived biostimulants have emerged as a sustainable alternative to enhance crop productivity while minimizing ecological footprints [1]. Unlike conventional fertilizers that primarily supply nutrients, these biostimulants function through multifaceted physiological and molecular mechanisms, including phytohormonal regulation (*e.g.*, auxin-like effects), activation of antioxidant defenses, and modulation of the soil microbiome. These actions improve nutrient use efficiency, tolerance to abiotic stresses (*e.g.*, drought and salinity), and overall crop quality traits. Plant extracts rich in bioactive compounds such as polyphenols and signaling molecules have shown remarkable efficacy in promoting root development and enhancing photosynthetic performance in crops like tomato and wheat, while improving soil health [2]. However, several challenges hinder their widespread adoption, including extract standardization, consistent field performance across diverse edaphic conditions, and the absence of harmonized regulatory frameworks. This review highlights successful applications of plant-derived biostimulants in various food crops and explores recent advancements in their production from agri-food by-products, with emphasis on innovative extraction techniques (*e.g.*, enzyme-assisted hydrolysis, microwave- and ultrasound-assisted processes) and formulation strategies (*e.g.*, emulsification). Overall, this work underscores the potential of plant-derived biostimulants to support sustainable food production systems, offering ecologically sound solutions aligned with global food security and safety objectives.

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P157 | UNLOCKING THE POTENTIAL OF GRAPE POMACE: PHENOLIC FINGERPRINTING FOR CIRCULAR BIOECONOMY APPLICATIONS

Teresa Abreu[1], Catarina Luis[1,4], José S. Câmara[1,3], Juan Teixeira[2], Rosa Perestrelo[1*]

[1]CQM – Centro de Química da Madeira, Universidade da Madeira, Campus da Penteada, 9020-105, Funchal, Portugal; [2]Justino's Madeira Wines, S.A., Parque Industrial da Cancela, Caniço, 9125-042, Santa Cruz, Portugal; [3]Departamento de Química, Faculdade de Ciências Exatas e Engenharia, Universidade da Madeira, Campus da Penteada, 9020-105, Funchal, Portugal; [4]Projeto Medicina, Faculdade de Ciências da Vida, Universidade da Madeira, Funchal, Portugal. *rmp@staff.uma.pt

Grape pomace (GP), a major by-product of the wine industry, is a rich source of bioactive molecules including phenolic compounds and anthocyanins with recognized health benefits. This study evaluated GP from eight *Vitis vinifera* L. varieties grown in Madeira, using a µQuEChERS extraction and UHPLC-PDA (Figure 1) analysis to profile phenolic content and assess functional properties. Phenolic compounds were identified and quantified in GP extracts, with gallic acid (ranging from 10.4 to 12.9 g/100 g), catechin (2.97 to 5.08 g/100 g), quercetin (2.17 to 2.85 g/100 g), and trans-resveratrol (0.28 to 1.82 g/100 g) being the most prominent. The extracts, particularly from the Complexa variety exhibited the highest levels of total anthocyanin content (TAC, 6.67 mg CGE/100 g), total phenolic compounds (TPC, 4727 mg GAE/100 g), and antioxidant activity (DPPH, 9472 mg TE/100 g), while the Tinta Negra variety had the highest total catechin content (TCC, 947 mg CATE/100 g), and antibacterial activities most notably against *Staphylococcus aureus*. Key compounds such as gallic acid, catechin, quercetin, and trans-resveratrol were identified as major contributors to these effects, with significant correlations observed between phenolic content and bioactivity [1]. The valorization of GP supports the circular bioeconomy model, potential as a sustainable, value-added ingredient, for functional foods, supplements, and cosmetics, by transforming agro-waste into products, while ensuring quality, food safety, and environmental responsibility.

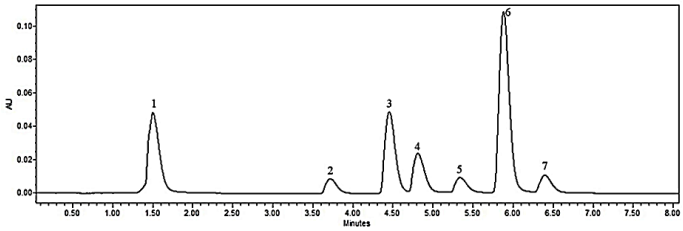

Figure 1 – Typical chromatogram (λacquisition = 280 nm) of phenolic compounds from GP of Verdelho variety, spiked with target analytes at medium level, by µQuEChERS/UHPLC-PDA methodology. Peak number identification: 1: gallic acid; 2: sinapic acid; 3: o-coumaric acid; 4: trans-resveratrol; 5: quercetin; 6: cinnamic acid; 7: kaempferol.

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P158 | UNVEILING THE VOLATILOMIC PROFILE OF GRAPE POMACE: A STRATEGIC APPROACH FOR ITS VALORIZATION

Teresa Abreu[1], Gonçalo Jasmins[1], José S. Câmara[1,3], Juan Teixeira[2], Rosa Perestrelo[1*]

[1]CQM – Centro de Química da Madeira, Universidade da Madeira, Campus da Penteada, 9020-105, Funchal, Portugal; [2]Justino's Madeira Wines, S.A., Parque Industrial da Cancela, Caniço, 9125-042, Santa Cruz, Portugal; [3]Departamento de Química, Faculdade de Ciências Exatas e Engenharia, Universidade da Madeira, Campus da Penteada, 9020-105, Funchal, Portugal. *rmp@staff.uma.pt

The wine industry generates substantial volumes of grape pomace (GP), a by-product that is frequently undervalued despite its rich composition in bioactive compounds with promising applications across food, pharmaceutical, and cosmetic sectors. The accumulation and improper management of GP, especially in Europe, pose significant economic and environmental challenges, underscoring the urgent need for sustainable valorization strategies. This study addresses these concerns by establishing the volatilomic fingerprint of GP derived from diverse *Vitis vinifera* L. grape varieties cultivated on the Island of Madeira. Using headspace solid-phase microextraction (HS-SPME) coupled with gas chromatography-mass spectrometry (GC-MS), 52 volatile organic metabolites (VOMs) were identified, spanning alcohols, esters, carbonyl compounds, terpenoids, acids, and hydrocarbons (Figure 1), with 18 VOMs common to all samples analyzed. The findings reveal that several dominants VOMs in GP exhibit antioxidant, anti-inflammatory, and antimicrobial activities, positioning them as natural alternatives to synthetic additives [1]. These properties support the integration of GP-derived compounds into food products, cosmetics, and pharmaceuticals, contributing to enhanced product quality and safety while responding to consumer demand for natural ingredients. The implementation of advanced extraction and analytical techniques ensures the safety and traceability of these natural additives. This research offers a scalable model for the sustainable management of agri-food by-products, supporting the development of resilient and responsible food ecosystems for the future.

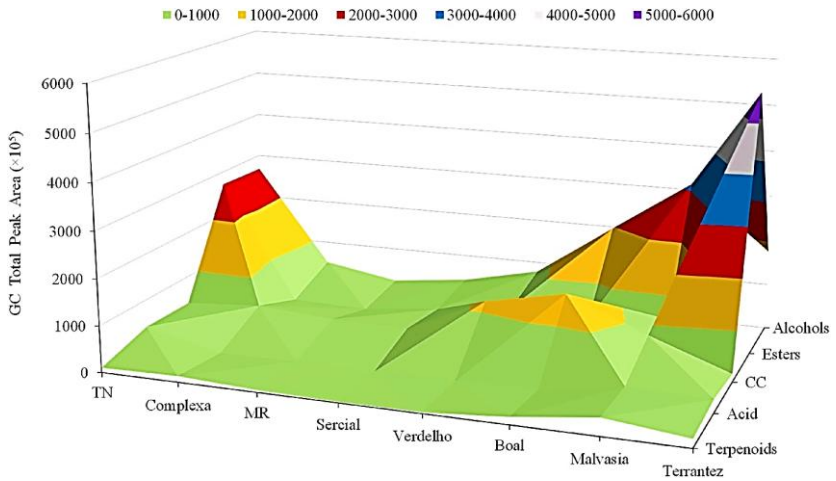

Figure 1 - The total peak area of chemical families identified in GP of investigated grape varieties. MR: Malvasia Roxa, CC: Carbonyl compounds.

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P159 | BIODEGRADABLE FILM WITH ARTEMISIA WASTE ENHANCES LIPID OXIDATION INHIBITION IN MEAT BURGERS DURING REFRIGERATED STORAGE

Solange Teresinha Carpes[1*], Patrick Guilherme Roza[1], Ushieli Valeria Sanguino[1], Luciano de Souza Ramos[1], Natalia Lopes dos Santos[1], Bruno Henrique Fontoura[2], José Abramo Marchesi[2], Michelle Fernanda Faita Rodrigues[2], Ofelia Anjos[3], Fabiola Azanha de Carvalho[4], Fabio Yamashita[4]

[1]Department of Chemistry, Universidade Tecnológica Federal do Paraná (UTFPR-PB), 85503-390, Pato Branco, Brasil; [2]Department of Agronomy, Universidade Tecnológica Federal do Paraná (UTFPR-PB), Pato Branco, Brasil; [3]Instituto Politécnico de Castelo Branco, Castelo Branco, Portugal; [4]Department of Food Science and Technology, Universidade Estadual de Londrina (UEL), Londrina, Brasil. *carpes@utfpr.edu.br

The valorisation of agro-industrial waste has emerged as a sustainable strategy for producing biodegradable packaging materials and reducing environmental impacts. This study investigated the antioxidant activity of *Artemisia annua* waste (AW) and its application in developing a biodegradable film (BFAW) for packaging meat burgers, evaluating their oxidative stability during 30 days of refrigerated storage at –1 °C. A biodegradable film was produced via blown extrusion using polybutylene adipate terephthalate (PBAT), cassava starch, glycerol, and AW. The antioxidant activity (AA) of AW was assessed using DPPH and ABTS assays. Three burger treatments were prepared: T1 – burgers packaged with BFAW; T2 – burgers packaged with a biodegradable control film (BCF) without AW; and T3 – burgers packaged with low-density polyethylene (LDPE). Lipid oxidation (LO) was monitored using the thiobarbituric acid reactive substances (TBARS) assay. All analyses were performed in triplicate. AW exhibited antioxidant activities of 0.22 ± 0.01 mmol Trolox/g (DPPH) and 189.48 ± 8.80 mmol Trolox/g (ABTS). Across storage, LO increased from 0.18 ± 0.04 to 5.39 ± 0.24 mg malondialdehyde/kg meat. No significant differences among treatments were observed during the first two weeks. However, storage time significantly influenced LO, explaining 89.6% of the total variance. Throughout storage, burgers packaged with BFAW consistently exhibited lower ($p < 0.001$) TBARS values compared to those packaged with BCF and LDPE. After 12 days, burgers wrapped with BFAW had significantly lower malondialdehyde levels ($p < 0.001$), indicating enhanced oxidative stability. These findings suggest that BFAW exerts a protective effect, likely due to the gradual release of bioactive compounds from the film. This study demonstrates the potential of a PBAT and cassava starch-based biodegradable film incorporated with Artemisia annua waste for food packaging applications. The BFAW effectively inhibited lipid oxidation in meat burgers during refrigerated storage, extending shelf life and enhancing product safety. Utilising agro-industrial residues, the AW offers an eco-friendly alternative to conventional plastic packaging, contributing to waste valorisation and environmental sustainability.

Acknowledgments

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P160 | APPLICATION OF A PROPOLIS-ENRICHED BIODEGRADABLE FILM FOR THE OXIDATIVE STABILITY OF MEAT BURGERS CONTAINING DANDELION

Solange Teresinha Carpes[1*], Ushieli Valeria Sanguino[1], Luciano de Souza Ramos[1], Patrick Guilherme Roza[1], Natalia Lopes dos Santos[1], Bruno Henrique Fontoura[2], Fabiola Azanha de Carvalho[3], Fabio Yamashita[3]

[1]Department of Chemistry, Universidade Tecnológica Federal do Paraná (UTFPR-PB), 85503-390, Pato Branco, Brasil; [2]Department of Agronomy, Universidade Tecnológica Federal do Paraná (UTFPR-PB), Pato Branco, Brasil; [3]Department of Food Science and Technology, Universidade Estadual de Londrina (UEL), Londrina, Brasil. *carpes@utfpr.edu.br

Polybutylene adipate terephthalate (PBAT), cassava starch, glycerol, and a propolis by-product were used to prepare a biodegradable plastic film (BFBP) extruded by a single-screw extruder to package meat burgers containing dandelion (*Taraxacum officinale*). This study evaluated the oxidative stability, pH, and water activity of these burgers stored for 30 days at -2 °C. The antioxidant activity (AA) of dandelion extract was assessed using the DPPH, ABTS, FRAP, and Folin–Ciocalteu methods. Four treatments of burgers were prepared: T1 – burger without the addition of a natural antioxidant, packaged with BFBP; T2 – burger with dandelion, packaged with BFBP; T3 – burger without antioxidants and packaged with polyvinyl chloride (PVC); T4 – burger with dandelion, packaged with PVC. The burgers' malondialdehyde (MDA) production was evaluated using the thiobarbituric acid reactive substances assay. All analyses were performed in triplicate. The antioxidant activity of the dandelion extract was 393.42 mmol Trolox g^{-1} by the ABTS method. Slight variations were observed in the water activity (0.91) and pH (5.68) of the burgers. Lipid oxidation increased from 4.83 ± 0.25 to 9.59 ± 0.26 mg MDA/kg over the storage period. Lipid oxidation inhibition improved when the natural antioxidant (dandelion) was combined with the BFBP packaging. Burgers packaged with PVC (T3 and T4) underwent more intense oxidation than those packaged with BFBP. After 6 days, the treatment with dandelion and BFBP (T2) showed the lowest MDA content (t = 6; 3.16 ± 0.20 mg MDA/kg), maintaining this trend until the end of the experiment (t = 30; 5.57 ± 0.47 mg MDA/kg), and was statistically different from the other treatments ($p < 0.05$). These results indicate a strong antioxidative effect of dandelion in meat burgers due to the gradual release of its bioactive compounds. The findings support the potential application of the biodegradable film based on PBAT and cassava starch, enhanced with a propolis by-product. The BFBP film appears to be a promising and safe alternative for inhibiting lipid oxidation in burgers stored under refrigerated conditions. Incorporating antioxidant-rich plants like dandelion into meat products packaged with BFBP may extend shelf life, improve safety, and prevent lipid oxidation-related quality degradation.

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P161 | VALORIZATION OF ALGERIAN MONOFLORAL HONEYS THROUGH SENSORY AND CHEMICAL CHARACTERIZATION

Rifka Nakib[1]*, Asma Ghorab[1], Sonia Harbane[1], Yasmine Saker[1], María Shantal Rodríguez-Flores[1], María Carmen Seijo[1], Olga Escuredo[1]

[1]Universidade de Vigo, Faculty of Sciences, Department of Plant Biology and Soil Science, Ourense 32004, Spain. *nakib.rifka@gmail.com

Adding value to local honey varieties contributes to sustainable food systems by promoting biodiversity and regional agro-resources. Algeria offers under-exploited monofloral honeys with differentiation potential based on their botanical origin and chemical profiles. In this study, twenty-two honey samples were collected from arid and semi-arid regions and classified into three floral origins: *Atractylis serratuloides*, *Eruca sativa*, and *Retama sphaerocarpa*. Sensory analyses were carried out by a panel trained according to ISO 8586:2023 methodology. Physicochemical characterization included water content, sugar composition, electrical conductivity, mineral content (by atomic absorption spectroscopy) and volatile compounds identified by HS-SPME/GC-MS. Data were statistically processed using ANOVA and principal component analysis (PCA). Results showed a clear sensory and compositional differentiation between honeys. *A. serratuloides* honeys were light-colored, crystallized and had sweet vanilla-like aromas. *E. sativa* honeys were darker, with vegetal and animal notes and high moisture content, associated with sulfur-containing volatiles such as dimethyl trisulfide. *R. sphaerocarpa* honeys had a dark amber color, a salty-sweet taste, high potassium levels and were characterized by lilac-like aldehydes. PCA revealed strong correlations between sensory attributes, volatile markers and mineral profiles. These results demonstrate the specificity of Algerian monofloral honeys and support their valorization on sustainable and functional food markets.

Acknowledgments

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P162 | COLD PLASMA TREATMENT AS A NON-THERMAL STRATEGY TO ENHANCE CHICKPEA FLOUR FOR PLANT-BASED FOODS

Mahsa Farrokhi[1], Giada Pasotti[2], Alessia Ceccarelli[2], Teresa R. S. Brandão[1], Elsa M. Gonçalves[3,4], Cristina L. M. Silva[1*]

[1]CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Diogo Botelho 1327, 4169-005, Porto, Portugal; [2]Department of Agriculture and Food Sciences, Alma Mater Studiorum University of Bologna, Piazza Goidanich 60, 47521 Cesena, Italy; [3]INIAV - Instituto Nacional de Investigação Agrária e Veterinária, Unidade de Tecnologia e Inovação, 2780-157 Oeiras, Portugal; [4]GeoBioTec - Geobiociências, Geoengenharias e Geotecnologias, FCT-UNL, 2829-516 Caparica, Portugal. *clsilva@ucp.pt

Plasma is a medium of free positive and negative particles that is overall electrically neutral. Non-thermal plasma has emerged as a sustainable technology in food processing, with potential to improve quality and microbial safety. As starch is a major food component, there is growing interest in using plasma to tailor its functionality through interactions with reactive species [1].
This study examined the effect of short cold plasma treatments (5 and 10 s), applied at a fixed distance of 4 cm from the plasma source using the *Blown Arc*™ system, on the thermal, structural, and pasting properties of chickpea flour. Differential Scanning Calorimetry (DSC) was used to assess starch gelatinization, Fourier Transform Infrared Spectroscopy (FTIR) to evaluate short-range structural changes, and rheology was performed with a controlled-strain under temperature sweep conditions. The aim was to explore cold plasma as a green, non-thermal modification method for chickpea flour in plant-based (Pb) applications.
During heating, both elastic (G′) and viscous (G″) moduli increased above ~95 °C, consistent with starch gelatinization (Figure 1). Plasma altered this response: the 5 s treatment reduced G′ and G″ relative to the control, while the 10 s treatment increased them, suggesting stronger gel formation [2]. ATR-FTIR spectra showed no visible differences among samples, and band-ratio analysis (1047/1022, 1022/995 cm^{-1}) indicated only minor variations, implying no significant changes in short-range molecular order. DSC revealed higher onset, peak, and end set gelatinization temperatures in plasma-treated flours, indicating greater thermal stability and delayed gelatinization [3].
In conclusion, cold plasma modified the thermo-rheological behavior of chickpea flour without major structural disruption, highlighting its potential as a sustainable tool to enhance functionality in Pb systems.

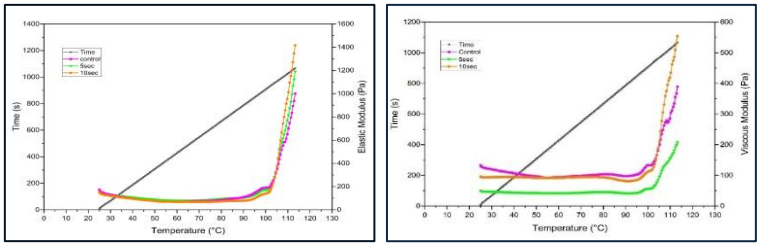

Figure 1 – Pasting properties of plasma-treated chickpea flours. Left: Elastic modulus (G′); Right: Viscous modulus (G″). Purple line: control; green line: 5 s treatment; orange line: 10 s treatment.

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P163 | USE OF EUTECTIC SOLVENTS TO OBTAIN PHENOLIC EXTRACTS FROM VINHÃO GRAPE POMACE: TOWARDS CIRCULAR ECONOMY

Adriana Rodrigues Machado[1,2*], Silvia Melissa Garcia[2*], Gonçalo Sá[1], João Nunes[1,3], Manuela Pintado[2]

[1]Associação CECOLAB-Collaborative Laboratory towards Circular Economy, Business Centre, Rua Nossa Senhora da Conceição, 2, Oliveira do Hospital 3405-155, Portugal; [2]Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, Porto 4169-005, Portugal; [3]Association BLC3 – Technology and Innovation Campus, R&D Unit Centre Bio, Rua Nossa Senhora da Conceição, 2, Oliveira do Hospital 3405-155, Portugal. *adriana.machado@cecolab.pt

Grape pomace is the main by-product of winemaking, obtained after pressing grapes during red wine fermentation. It is rich in polyphenols with technological, antioxidant, and antimicrobial properties. Green chemistry-based extraction methods have been applied to recover them efficiently and sustainably. This study assessed the total phenolic content of aqueous extracts from Portuguese Vinhão grape pomace using eutectic solvent. The grape pomace (2023 harvest, Quinta de Azevedo, Portugal) was processed (dried at 50 °C for 36 h, ground, and sieved) and extracted with quaternary eutectic solvents (choline chloride, lactic acid, glycerol, and citric acid in a 1:1:1:0.5 M ratio). The resulting material was used for the determination of total polyphenols. The total phenolic content was measured by the Folin–Ciocalteu method in a 96-well microplate, using gallic acid as a standard. Results were expressed as milligrams of gallic acid equivalents per gram of dry matter (mg GAE g^{-1} DM), and all analyses were performed in triplicate. The results obtained in this study indicate that the grape pomace of the Portuguese cultivar Vinhão, extracted with eutectic solvents, yielded 73.66 ± 0.26 mg GAE g^{-1}.

Thus, the study reported a total phenolic content of approximately 74 mg GAE g^{-1}, a value considerably higher than those reported in the literature for the same grape pomace variety. For example, extraction with 80% ethanol yielded 35.35 ± 3.61 mg GAE g^{-1} [1]. In another study using grape pomace from a mixture of three portuguese varieties (Trincadeira, Baga, and Alfrocheiro), conventional solvent extraction yielded 38.70 mg GAE g^{-1} in samples from a producer in central Portugal [2]. These findings suggest that the extraction conditions applied in the present study, combined with the use of eutectic solvents, were more effective for recovering phenolic compounds compared to traditional solvents. Therefore, the results demonstrate that the use of green extractive technologies, such as eutectic solvents, was effective for obtaining total phenolic compounds, in line with the United Nations 2030 Agenda Sustainable Development Goals.

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P164 | ACORN PRE-DRYING: IMPLICATIONS FOR THE FOOD INDUSTRY

Bernardo Farrero[1,2*], Luis Frölén Ribeiro[1*], Antonio Famiglietti[2], Pedro Babo[3]

[1]GICoS, Instituto Politécnico de Bragança, Bragança, Portugal; [2]Universidad Politécnica de Madrid, Madrid, España; [3]Landratech, Barcelos, Portugal. *bernardo.farrero@ipb.pt

In industry, 74% of the energy consumed is used in the form of heat. The food sector is characterised by a high share of processes that rely on industrial heat [1]. However, 90% of this thermal energy currently comes from fossil fuels, and only 9% is supplied by renewable sources [2]. The adoption of solar thermal technologies in the food industry offers multiple benefits that support its viability as an energy alternative to overcome this caveat. Firstly, by relying on a renewable and stable source. Manufacturers can reduce production costs and limit their exposure to the volatility of fossil fuel prices, thereby ensuring greater longterm price stability and predictability [3]. These reductions in energy costs may also be reflected in lower prices for the end consumer. Solar-assisted dehydration enables a decrease in moisture content, thereby limiting microbial growth and food spoilage [3]. In this regard, Solar Heat for Industrial Processes (SHIP) may also address food security concerns as storage losses are estimated to reach up to 20%, posing a critical challenge to food security [4].

The installation of in-situ pre-dehydration systems near harvesting zones provides clear benefits for energy efficiency and product quality. The Iberian Peninsula, notably, benefits from very high solar radiation, with many clear-sky days and extended sunlight periods, making it particularly suitable for solar-based predehydration systems. By lowering produce weight and moisture before transportation, these systems decrease fossil energy demand during both industrial drying and large-scale transport [5]. This approach reduces the final product cost, as demonstrated by an in-situ solar dryer used for acorns in Alentejo holm oak groves. The passive, indirect mobile dryer, fitted with hanging bags, reduces acorn moisture content by 15% after 72 hours of drying, delays fruit spoilage, and cuts large-scale industrial heat input [4,6]. Thermal energy data from a factory case at Landratech, an acorn food producer involved in the MEDACORNET project, indicate that 15% in-situ pre-dehydration cuts thermal energy use by 52% during both initial and final drying stages of acorn flour manufacture [3]. This combined method lowers fossil fuel use, reduces losses, improves energy efficiency, and supports sustainability in the food processing sector.

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P165 | VALORISATION OF FERMENTED GRAPEVINE LEAVES FOR MICROBIAL CONTROL IN WINE

Maira Ogg[1*], Luís G. Dias[1,2], Letícia M. Estevinho[1,2]

[1]Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal. *mairaogg@ipb.pt

Grapevine (*Vitis vinifera* L.) is one of the most relevant perennial crops in the agri-food sector, not only due to the economic value associated with wine production but also due to its nutraceutical potential. Recent studies have highlighted the importance of grapevine by-products, such as leaves, which account for approximately 30% of the agricultural biomass generated [1,2]. Although they are a rich source of phenolic compounds with antioxidant, antimicrobial, antifungal, and anti-inflammatory properties, grapevine leaves remain underutilised and are often discarded as agricultural waste. The valorisation of these by-products through biotechnological processes represents an opportunity to reduce waste and promote sustainable practices in the wine industry, in line with the principles of the circular economy [3].

This study aims to evaluate the potential of fermented grapevine leaf extracts as bioactive agents for controlling microorganisms responsible for wine spoilage. Initially, leaves from different harvests were characterised in terms of total phenolic content, flavonoid content, and antioxidant activity, allowing the identification of the most suitable period for the extraction of bioactive compounds. The most promising harvest was subjected to fermentation, conducted either with or without *Saccharomyces cerevisiae*, while monitoring critical process parameters. The resulting extracts will be assessed for their antimicrobial activity against six microorganisms associated with wine spoilage, including *Brettanomyces bruxellensis*, *Zygosaccharomyces bailii*, *Pichia anomala*, and lactic acid bacteria. It is expected that the use of fermented grapevine leaves will reduce the reliance on synthetic additives, enhance microbiological safety, and improve wine quality. This approach promotes the circular economy by valorising agricultural by-products and highlights the potential of scientific innovation to deliver functional, sustainable, and high-value-added solutions for the wine industry.

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P166 | FROM NATURE TO SKIN: A COMPARATIVE STUDY OF POLYPHENOL DELIVERY FOR SAFER COSMETIC DEVELOPMENT

Mariana Marques[1,2,3], Filipa Teixeira[2,3,4,5], Mónica Vieira[1], Berta Nogueiro Estevinho[6,7], Francisca Rodrigues[2,3*]

[1]ESS, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 400 4200 - 072, Porto, Portugal; [2]Associate Laboratory i4HB - Institute for Health and Bioeconomy, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal; [3]UCIBIO – Applied Molecular Biosciences Unit, MedTech-Laboratory of Pharmaceutical Technology, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal; [4]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 4249-015 Porto, Portugal; [5]ICBAS, University of Porto, Rua de Jorge de Viterbo Ferreira 228, 4050-313 Porto; [6]LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal; [7]ALiCE - Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal *frodrigues@ff.up.pt

Polyphenols are bioactive compounds with strong antioxidant and anti-aging potential, yet their cosmetic application remains limited due to their instability and poor solubility [1]. Encapsulation in biopolymeric carriers has emerged as a promising strategy to improve their stability and controlled delivery [2]. In this work, microencapsulation of catechin, epicatechin, chlorogenic acid (CGA), neochlorogenic acid (NCGA), and their mixture in sodium alginate was performed by spray-drying, to address these limitations, achieving product yields between 37 and 53%. Morphological analysis by Scanning Electron Microscopy (SEM) revealed a spherical form and surface indentations as well as some degree of agglomeration, confirmed by the size distribution curves. Encapsulated polyphenols also displayed enhanced thermal stability, while FTIR analysis indicated the physical entrapment of the bioactive compounds within the matrix. Moreover, encapsulation enhanced the antioxidant and antiradical activities, particularly for catechin, epicatechin, and CGA. Synergistic effects were detected for the phenolic mixture, with Ferric Reducing Antioxidant Power (FRAP) values increasing from 109.08 to 262.23 µmol Fe^{2+}/g in the encapsulated form (Figure 1). *In vitro* biocompatibility assays revealed viabilities above 60% in keratinocytes and above 80% in fibroblasts, whereas pure polyphenols displayed dose-dependent reductions for both cell lines. These findings demonstrate that encapsulation by spray-drying improves the stability, bioactivity, and safety profile of polyphenols, supporting their future application as cosmetic ingredients in topical formulations.

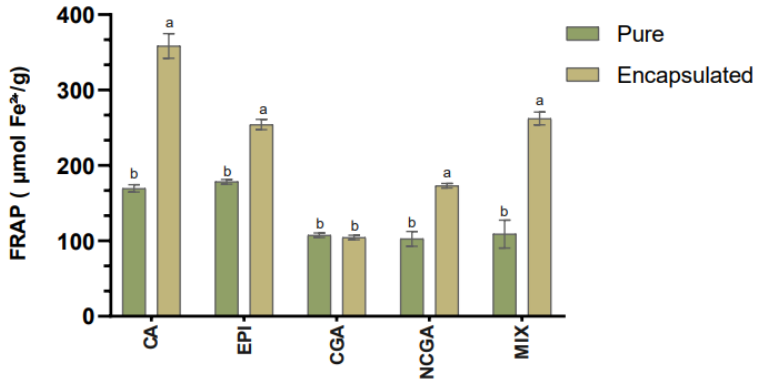

Figure 1 – Antioxidant activity of pure and encapsulated polyphenols measured by FRAP, expressed as µmol Fe^{2+} equivalents per gram of sample. Results are expressed as mean ± standard deviation (n=3). Different letters (a,b) indicate significant differences between the compounds (p<0.05).

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P167 | INTEGRATING 3D *IN VITRO* AND *EX VIVO* MODELS FOR THE EVALUATION OF POLYPHENOLS IN COSMETICS

Mariana Marques[1,2,3], Filipa Teixeira[2,3,4,5], Mónica Vieira[1], Stefano Dall'Acqua[6], Francisca Rodrigues[2,3*]

[1]ESS, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 400 4200 - 072, Porto, Portugal; [2]Associate Laboratory i4HB - Institute for Health and Bioeconomy, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal; [3]UCIBIO – Applied Molecular Biosciences Unit, MedTech-Laboratory of Pharmaceutical Technology, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal; [4]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 4249-015 Porto, Portugal; [5]ICBAS, University of Porto, Rua de Jorge de Viterbo Ferreira 228, 4050-313 Porto; [6]Department of Pharmaceutical and Pharmacological Sciences, University of Padova, Via Marzolo 5, 35121 Padova, Italy. *frodrigues@ff.up.pt

Polyphenols such as catechin, epicatechin, chlorogenic acid (CGA), and neochlorogenic acid (NCGA) have strong cosmetic potential, but their use is limited due to low solubility and stability. The European Cosmetic Regulation (CE) No. 1223/2009 completely bans the animal testing in cosmetics, increasing the demand for improved *in vitro* skin models [1]. Although commercial reconstructed human epidermis models (*e.g.*, SkinEthic™) are validated, they lack dermal components and are highly expensive. In contrast, full-thickness models integrate epidermal and dermal components, representing an advanced approach for cosmetic testing [2]. In this work, a 3D co-culture skin *in vitro* model was constructed with dermal fibroblasts (HDF) and keratinocytes (HaCaT) under air-liquid interface conditions. The model was exposed to the samples, and at different time points, aliquots were removed and quantified by LC-DAD-MS. The results were compared with an *ex vivo* model performed in Franz cells coupled to human skin. The *ex vivo* data revealed negligible permeation of catechin and epicatechin, while CGA, NCGA, and the polyphenol mix (composed by catechin, epicatechin, CGA, and NCGA) achieved permeation rates of nearly 50% and skin retentions > 60%. The cell viability of the 3D co-culture model was assessed by an MTT assay and revealed that epicatechin (500 µg/mL) significantly increased the viability (>130%, $p<0.05$), while the remaining compounds and the mix maintained the values close to the control (Figure 1). These results demonstrate the importance of combining 3D in vitro testing with ex vivo approaches for the safety evaluation of potential cosmetic ingredients, while complying with the European regulations.

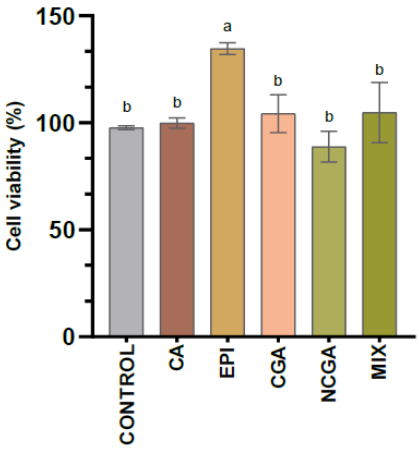

Figure 1 – MTT assay with 3D co-culture model after exposure to polyphenols (500 µg/mL). Results are expressed as mean ± standard deviation (n=3). Different letters (a,b) indicate significant differences ($p<0.05$).

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P168 | EVALUATION OF HEPATIC AND RENAL FUNCTION FOLLOWING ORAL EXPOSURE TO AN AQUEOUS ACORN SHELL EXTRACT IN MICE

Pedro Correia[1†], João Pedro Pinto[1†], Tiago Azevedo[1,2,3], Elisabete Nascimento-Gonçalves[1], Catarina Medeiros[1], Luís Félix[1], Fernanda Seixas[2], Paula A. Oliveira[1*]

[1]CITAB, Inov4Agro, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; [2]CECAV, AL4AnimalS, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; [3]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. [†]these authors contributed equally to this work. *pamo@utad.pt

The valorisation of natural by-products as sources of bioactive compounds requires not only the characterization of their potential benefits but also the assessment of their safety. Acorn shell, derived from *Quercus suber* L., is rich in phenolic compounds with recognized antioxidant and anti-inflammatory properties, but its toxicological profile remains poorly defined. This study aimed to evaluate the hepatic and renal effects of oral administration of an aqueous acorn shell extract in FVB/n mice. Nineteen female FVB/n mice (8–10 weeks old) were randomly distributed into four groups (n=4–5/group) and exposed for 25 days to drinking water containing 0 (control), 100, 200 or 500 µg/mL of extract. All procedures were approved by the Portuguese competent authority (approval no. 014139). Animal welfare was monitored daily, and body weight, food, and water intake were recorded weekly. At the end, animals were euthanized by an overdose of ketamine and xylazine (i.p.), followed by cardiac puncture, and liver and kidney tissues were collected and weighed. Both organs were routinely processed for histological analysis and stained with haematoxylin–eosin. For biochemical analysis, tissues were homogenized and evaluated for a comprehensive panel of oxidative stress and damage markers. These included reactive oxygen species production, activities of antioxidant enzymes (superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase, glutathione S-transferase), levels of non-enzymatic antioxidants (reduced and oxidized glutathione), indicators of lipid peroxidation (TBARS), protein carbonylation, DNA strand breaks, and lactate dehydrogenase activity. Results demonstrated that oral administration of acorn shell extract did not negatively influence food or water intake and, while body weight remained largely stable across groups, a slight decrease was observed in the 200 µg/mL group ($p < 0.05$). Relative organ weights showed significant differences, particularly for the spleen, left kidney and liver of the 200 µg/mL group compared with the remaining groups ($p < 0.05$). Biochemical analysis of oxidative stress markers revealed no consistent differences between treatments, aside from reduction in TBARS at 200 µg/mL in comparison with the control ($p < 0.05$). Histological evaluation of liver and kidney confirmed preserved tissue architecture, without evidence of lesions associated with extract intake. Overall, the aqueous acorn shell extract did not demonstrate signs of hepatic or renal toxicity under the tested conditions, supporting its safety for further exploration as a sustainable source of functional bioactives with potential applications in food and health sectors.

Acknowledgments

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P169 | FROM BY-PRODUCT TO INGREDIENT: ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL OF OLIVE POMACE EXTRACTS

Tiago Azevedo[1,2,3], Sara F. Vieira[1], Bianca R. Albuquerque[1], Rossana V. C. Cardoso[1], Adelina Gama[2], Paula A. Oliveira[3], Lillian Barros[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]CECAV, AL4AnimalS, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; [3]CITAB, Inov4Agro, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal. *lillian@ipb.pt

The food industry is increasingly focused on adopting natural and sustainable alternatives to conventional additives, with the goal of improving food quality, ensuring safety, and extending shelf-life. Olive pomace (OP), a by-product of olive oil production, is rich in phenolic compounds such as hydroxytyrosol, oleuropein, and tyrosol, recognized for their antioxidant and health-promoting properties. Its valorization addresses environmental concerns while meeting the demand for natural and sustainable sources of bioactive compounds. Therefore, this study aimed to compare seven OP extraction methodologies and evaluate the antioxidant and antimicrobial activities of the resulting extracts. The OP extracts were prepared using aqueous or hydroethanolic solvents through maceration (ME), heat-assisted extraction (HAE), ultrasound-assisted extraction (UAE) and forced percolation extraction (FPE). Hydroxytyrosol, oleuropein, and tyrosol contents were determined by High Performance Liquid Chromatography with UV-DAD detector (HPLC-UV-DAD). Antioxidant activity was assessed through the ability of the extracts to reduce the lipid peroxidation (thiobarbituric acid reactive substances – TBARS assay) and by the neutralization of the peroxyl radical ($ROO^{\bullet}$) scavenging activity. Antimicrobial activity was assessed against food safety-relevant microorganisms, namely *Staphylococcus aureus*, methicillin-resistant *S. aureus* (MRSA), *Aspergillus brasiliensis* and *A. fumigatus* using the microdilution method to determine the minimum inhibitory concentration. Results showed that, among the three compounds analyzed, hydroxytyrosol was the most abundant (7.4–10.7 mg/g extract), followed by oleuropein (1.9–2.6 mg/g extract), and tyrosol (1.5–2.0 mg/g extract), with FPE extracts showing the highest levels of all three compounds. All OP extracts were able to reduce the malondialdehyde levels in the TBARS assay (IC_{50}: 22.4–45.7 µg/mL) and the $ROO^{\bullet}$ (IC_{50}: 30.4–43.7 µg/mL), presenting, therefore, strong antioxidant bioactivities. FPE was the most effective in preventing lipid peroxidation and ME showed the strongest neutralization of $ROO^{\bullet}$, while UAE consistently displayed the weakest bioactivity. In addition, all extracts showed similar inhibitory activity against *S. aureus* (2.5–5 mg/mL) and MRSA (0.3125–1.25 mg/mL), while antifungal activity was moderate (10 mg/mL) against *A. brasiliensis* and *A. fumigatus*, except for ME against A. fumigatus (5 mg/mL). Overall, OP extracts, especially those obtained by FPE, demonstrated strong potential as natural antioxidants and antimicrobial agents for application in food preservation. These findings support their use as bioactive ingredients in the food industry, aligned with a sustainable strategy that contributes to circular economy goals.

Acknowledgments

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P170 | IMPACT OF GAMMA RADIATION ON POLYSACCHARIDE COMPOSITION AND BIOACTIVE PROPERTIES OF *PLEUROTUS OSTREATUS* BIOWASTE

Ana Rita Pereira[1], Rossana V. C. Cardoso[1], Sandra Cabo Verde[2], Lillian Barros[1], Eliana Pereira[1*], Filipa Mandim[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Centro de Ciências e Tecnologias Nucleares (C2TN), Campus Tecnológico e Nuclear, Instituto Superior Técnico, Universidade de Lisboa, Portugal. *eliana@ipb.pt

Mushroom bioresidues have been gaining increasing attention due to their rich composition of functional compounds, particularly polysaccharides. These biomolecules exhibit diverse bioactivities, including antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory effects, among others [1]. Innovative processing approaches such as gamma radiation may enhance both the efficiency of extraction and functionality of polysaccharides, as this technology has the capacity to disrupt cell walls and induce chemical modifications in the biomass [2].

In this study, *Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm. bioresidues were subject to gamma radiation in both fresh and lyophilized forms at different doses (1, 2, and 3 kGy for fresh samples; 3, and 11 kGy for lyophilized samples). Non-treated samples by gamma radiation followed all the assays (0 kGy). Polysaccharides were extracted through aqueous extraction at 100 ºC for 6 h, and the total content was quantified by the phenol-sulfuric acid colorimetric method. Regarding bioactive properties, the antioxidant activity was evaluated through the lipid peroxidation inhibition (TBARS assay), and gastrointestinal and liver cytocompatibility was assessed using the resazurin reduction assay (Caco-2 and AML12 cell lines, respectively). The antibacterial and antifungal activities were evaluated by the broth microdilution method using strains with relevance in the food sector.

The obtained results demonstrated that lyophilized samples combined with moderate irradiation (3 kGy) maximized polysaccharide extraction. Lyophilized samples irradiated at 3 kGy and fresh biomass irradiated at 2 kGy exhibited the highest antioxidant activity (IC50 values of 1.38 and 0.79 mg/mL, respectively). Regarding cytocompatibility, all tested concentrations (between 20 and 2.5 mg/mL) maintained cell metabolic activity above 70%, with no evidence of gastrointestinal or hepatic toxicity. The extracts did not exhibit significant antimicrobial activity, showing similar activities. However, *Yersinia enterocolitica* showed higher susceptibility (MIC between 2.5 and 10 mg/mL), as did the fungus *Aspergillus brasiliensis* (MIC between 5 and 10 mg/mL).

Overall, the study demonstrates that gamma radiation represents a promising strategy to enhance the recovery of polysaccharides and other bioactive molecules from mushroom bioresidues, potentially improving their functional applications.

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P171 | TOWARD A CIRCULAR ECONOMY: SUSTAINABILITY ASSESSMENT OF INNOVATIVE LIGNIN EXTRACTION FROM FOOD BY-PRODUCTS

Lisa Mersmann[1*], Carla Dias[1], João Pires[2], Ana Luísa Fernando[1]

[1]MEtRiCS, Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, NOVAFCT, Campus de Caparica, 2829-516 Caparica, Portugal; 2Bio4Plas - Biopolímeros, Lda, Cantanhede, Portugal. *l.mersmann@campus.fct.unl.pt

The transition toward sustainable food systems requires circular strategies that transform processing residues into valuable resources. Food by-products such as oat hulls, brewer's spent grain, castor de-oiled seed cake, walnut shells, coffee husks, and Jerusalem artichoke stalks are abundant yet underutilized lignocellulosic streams with potential for lignin recovery. Lignin represents a renewable and economically valuable platform for producing fine chemicals, such as vanillin, and bio-based materials relevant to food and allied sectors. Despite frequent claims of "green" processing, the sustainability of emerging extraction routes remains insufficiently characterized.

Here, six food by-product systems were systematically evaluated using green chemistry metrics. The Path2Green framework, which condenses twelve sustainability principles into a composite score ranging from –1 (least sustainable) to +1 (most sustainable), was applied to benchmark innovative extraction methods [1]. Representative cases included DES applied to oat hull biomass and brewer's spent grain (Score: –0.020) [2], DES applied to castor de-oiled cake (Score: –0.071) [3], and a catalytic β-zeolite process applied to walnut shells (Score: +0.240) [4]. The analysis revealed that DES- and IL-based methods, while often labeled as green, perform only neutrally or negatively. This outcome stems from reliance on synthetic solvent systems, high energy intensity, and the absence of recycling strategies, although these methods hold high potential for improvement since many of the solvents are, in principle, readily recyclable. In contrast, catalytic flow-through systems employing ethanol-water mixtures demonstrated higher scores due to their use of benign solvents, inherent recycling potential, and improved scalability.

These findings underline the importance of integrating circular economy principles with quantitative sustainability metrics. The results will be illustrated using Path2Green pictograms, highlighting both opportunities and critical limitations of current lignin valorization strategies. Ultimately, comprehensive life cycle assessments (LCA) are required to capture the full environmental profile, but qualitative green metrics such as Path2Green provide a practical and informative first step for early-stage comparisons.

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P172 | ENSURING HONEY SAFETY: DEVELOPMENT OF ELECTROCHEMICAL GENOSENSORS TO AUTHENTICATE THE BOTANICAL ORIGINAL OF COMMERCIAL HONEYS

Stephanie L. Morais[1,2], Michelle Castanheira[1,2,3], Eduarda Pereira[1,2], Marlene Santos[3], Valentina F. Domingues[1], Cristina Delerue-Matos[1], M. Fátima Barroso[1*]

[1]REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal; [2]Departamento de Química, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal; [3]REQUIMTE|LAQV, E2S, Escola Superior de Saúde, Instituto Politécnico do Porto, Porto, Portugal. *mfb@isep.ipp.pt

The Food fraud is a growing issue with significant public health, economic and environmental implications that affect the food and beverage industries, quality control authorities, and consumers alike [1]. Valued for its natural sweetness, rich nutritional profile, and numerous health benefits, including its low glycaemic index, honey is one the most sought-after food products found in the current global market. Nonetheless, its high demand also makes honey a prime target for fraudulent practices [2,3]. Some common adulterations include blending premium honeys with sugar, syrups or inferior honeys, applying heat treatments to alter its properties and misrepresenting its geographic or botanical origin [3]. These practices not only jeopardize the consumers well-being but also undermining the honey industries reputation [2,3]. Thus, there is clear need for the development of rapid and cost-effective analytical methods to ensure honeys authenticity and safety. In this work, two electrochemical genosensors were developed to detect the enzymatic hybridization reaction between the complementary probes of two honey-specific plant species in the north of Portugal: *Erica arborea* (heather flower) and *Castanea sativa* (chestnut tree flower). For this, a synthetic DNA-target probe for *E. arborea* and *C. sativa* were selected and designed, and their complementary probes were both modified with a thiol group and a fluorescein enzyme and cut in two to generate the enzymatic amplification of the electrochemical signal. To further enhance the hybridization efficiency, a mixed self-assembled monolayer of the heather- and chestnut-specific DNA-capture probes and mercaptohexanol was applied to the respective sensors' surface. The developed genosensors were then successfully applied to detect both plants and ten commercial honey samples. Therefore, electrochemical genosensors are a promising and costeffective analytical tool to authenticate the botanical origin of honeys, thus guaranteeing its quality, safety and authenticity.

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P173 | SAMBUCUSAFE PROJECT - REDUCTION OF CAPTAN AND ITS METABOLITES IN ELDERBERRY MUST AND CONCENTRATE

Ermelinda Silva[1,2], Luana Fernandes[1,2*], Luís Silva[1], Cesar Pereira[3], Oswaldo Trabulo[4], Fernando Nunes[5], Fernanda Cosme[5], Tayse F. F. da Silveira[2], Ângela Fernandes[2], Lillian Barros[2], Alexandre Gonçalves[1,2]

[1]MORE-Laboratório Colaborativo Montanhas de Investigação-Associação, Brigantia Ecopark, Avenida Cidade de Leon, 506 530-358 Bragança, Portugal; [2]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [3]RÉGIEFRUTAS - Cooperativa Agrícola de Interesse Público Távora - Varosa, CIPRL, Lugar da Perlonga, 3610-013 Dalvares - Tarouca, Portugal; [4]INDUMAPE, S.A., Parque Industrial Manuel da Mota, Lote F, 3100-354 Pombal; [5]CQ-VR - Food and Wine Chemistry Laboratory, Chemistry Research Centre - Vila Real, University of Trás-os-Montes e Alto Douro, 5000-801 Vila Real, Portugal. *lfernandes@morecolab.pt

The extensive use of pesticides is a major source of environmental pollution, causing biodiversity loss and leading to pest resistance. However, the agricultural sector remains highly dependent on pesticides to protect crop yields and their dispersal to other crops, which are constantly affected by harmful organisms. The persistence of pesticide residues in the soil, groundwater, and their dispersal to other crops through wind threaten both the environment and food safety. In the particular case of elderberries, typically located on the borders of other crops, there is a high probability of berries being contaminated with pesticides, such as captan, applied to other fruit trees. This situation results in captan levels above the maximum permitted limits in elderberry must and concentrates. Furthermore, processing different fruits in the same factory, with different maximum pesticide residue limits, can increase the presence of captan through cross-contamination. To face this challenge, the SambucuSafe project was created with the goal of developing an innovative technology to reduce captan and its metabolites in elderberry must and concentrate, without compromising the quality characteristics of the products. SambucuSafe is a 36 months project, started in July 2025, which brought together a multidisciplinary consortium with extensive experience in the field that includes two companies, REGIEFRUTAS and INDUMAPE S.A. and three non-business R&D entities, Polytechnic Institute of Bragança (IPB), University of Trás-os-Montes and Alto Douro (UTAD), and MORE (Montanhas de Investigação - Associação).
The main objectives of the project are *i)* study the physicochemical properties of the must and concentrate of elderberries; *ii)* validate the process for determination of captan and its metabolites; *iii)* evaluate the levels of captan and its metabolites of elderberry concentrate and must of different origins; *iv)* study and optimize the fining process for elderberry must and concentrate; *v)* investigate the effect of binding agents on reducing the levels of captan and its metabolites, as well as on the quality characteristics of elderberry must and concentrate; *vi)* demonstrate on a relevant scale the process to reduce the levels of captan and its metabolites in elderberry must and concentrate. The SambucuSafe project is composed of 5 activities, that will allow develop and optimize a bonding process that allows the reduction of captan and its metabolites in must and concentrate of elderberry.

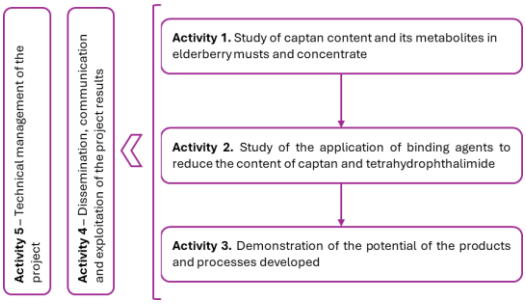

Figure 1 – Activities of the SambucuSafe project.

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P174 | SYSTEMATIC REVIEW ON FUNGICIDE REDUCTION IN PREDICTIVE MODELS OF THE POTATO LATE BIGHT (PLB) PATHOSYSTEM

Jonathan S. Castaño Serna[1,2*], Laura Meno Fariñas[1,2], M. Carmen Seijo Coello[1,2], Olga Escuredo[1,2]

[1]GISA, Grupo de Investigación en Sistemas Agroambientales. Biología Vegetal y Ciencias del Suelo, UVigo, Ourense, Ourense, España. [2]Instituto de Agroecoloxía e Alimentación (IAA), Universidade de Vigo, Campus Auga, 32004, Ourense, 9 España. *jonathans.castano@uvigo.gal

Phytophthora infestans (Mont.) de Bary, commonly known as late blight, is the main pathogen of potato crops, responsible for significant production losses globally [1]. In response to this threat, predictive analysis techniques have been developed to estimate disease severity and optimize its management in potato cultivation.

This work analyzes the reduction in fungicide use by predictive models applied over the last 100 years in different countries. Through a structured systematic search - based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines - models implemented in various countries and decades were identified, covering a wide variety of agroclimatic contexts. Predictive modeling is largely based on the combination of environmental variables such as temperature and relative humidity that can predict disease behavior and, therefore, the need for phytochemical use.

Some of the models evaluated are: the Irish Rules of Van Everdingen and Lönis, the Blitecast computational model of Krause *et al.*, the negative prognosis of Schrödter & Ullrich, and the NegFry model of Leonard and Dowley. The fungicide reductions in these models were extracted from the original studies by comparing routine treatments with the treatments recommended by the predictive model.

The observed variability is discussed in relation to biogeographical and ecological factors of the Potato late blight pathosystem (PLB), including the possible replacement of strains or lineages more adapted to local conditions.

The results suggest a growing need for local recalibration of models and their integration with current data on the genetic diversity of *P. infestans*, especially in the context of climate change and increasing meteorological instability [2].

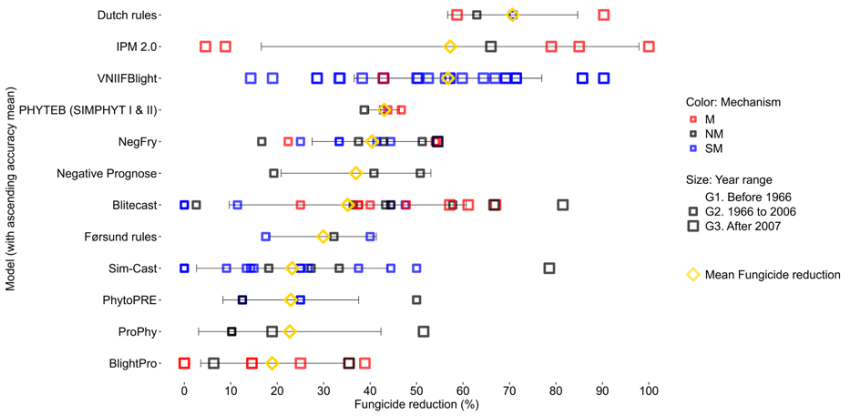

Figure 1 – Temporal consistency in the "fungicide reduction".

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P175 | ANTIMICROBIAL ACTIVITY OF SPANISH MONOFLORAL HONEYS: INFLUENCE OF BOTANICAL ORIGIN AND BIOCHEMICAL COMPOSITION

Sonia Harbane[1*], Julia Carballo[2,3], María José Pérez[2,3], Maria Shantal Rodriguez-Flores[1], Maria Carmen Seijo[1], Olga Escuredo[1]

[1]Universidade de Vigo, Faculty of Sciences, Department of Plant Biology and Soil Science, Ourense 32004, Spain; [2]Área de Microbioloxía, Facultade de Ciencias, Universidade de Vigo – Campus de Ourense; [3]Grupo ByCIAMA, Instituto de Agroecoloxía e Alimentación (IAA), Universidade de Vigo – Campus Auga, 32004 Ourense. *sonia.harbane@uvigo.gal

Honey is a natural product with proven therapeutic properties, notably for its antimicrobial activity, which Depends on its botanical and geographical origin [1]. The aim of this study was to evaluate the antimicrobial effect of 48 samples of Spanish monofloral honey on three human pathogens: *Escherichia coli*, *Staphylococcus aureus*, and *Candida albicans*. Floral origin was determined by pollen analysis, which identified 57 pollen types. The analysis revealed a dominance of *Erica* spp., *Castanea sativa* and *Eucalyptus*. Physico-chemical analyses such as pH, color Pfund, polyphenol and flavonoid were carried out. The results of polyphenol and flavonoid concentration in the studied honey revealed that *C. sativa* honey had the highest concentration of polyphenols (254.2 mg/100 g), while *Erica* spp. stood out for its richness in flavonoids, at 14.1 mg/100 g. pH analysis revealed a range of variation from 3.38 to 5.03, while color showed an amplitude from 64 to 150 mm Pfund. Evaluation of antimicrobial activity, using the well method, revealed variable results, chestnut honey (*C. sativa*) showed significant inhibition of 24.5 mm against *S. aureus* and notable activity against E. coli of 14.5 mm. On the other hand, its efficacy against *C. albicans* remained moderate, ranging from 0 to 12 mm. These results confirm the hypothesis that the biochemical composition of honey, influenced by its botanical origin, exerts an influence on its antimicrobial efficacy. They also highlight honey's potential as a natural therapeutic agent.

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P176 | FERMENTED POLLEN IN YOGURTS: SAFETY AND SUSTAINABILITY

Elena Barra[1*], Luís G. Dias[1,2], Letícia M. Estevinho[1,2]

[1]Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [2]Centro de Investigação de Montanha (CIMO) Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal. *elenapfbarra@gmail.com

The consumption of yogurts has significantly increased due to their recognized nutritional value and the benefits associated with the presence of probiotic cultures. Simultaneously, the growing demand for clean label foods has driven the industry to replace synthetic additives with natural alternatives that ensure product quality, safety, and sustainability [1].

In this context, fermented bee pollen emerges as an innovative and sustainable alternative, derived from a natural and renewable endogenous resource, rich in phenolic compounds, flavonoids, and enzymes with antioxidant and antimicrobial properties [2,3]. This study investigated the potential of fermented bee pollen extract as a natural preservative in yogurt, without compromising its microbiological safety or sensory characteristics, while promoting the valorization of beekeeping by-products and their application as functional ingredients.

The pollen underwent a fermentation process with *Saccharomyces cerevisiae*, following a Plackett-Burman experimental design (19 trials), varying inoculum, pH, and pollen mass. The optimized trial (10^5 CFU/mL; pH 4.9; 5 g) resulted in a significant increase in total phenolic content and antioxidant activity compared to non-fermented pollen. The extract was incorporated into yogurts and compared to a control containing potassium sorbate.

After 28 days of storage, the formulation with the highest percentage of extract showed superior phenolic and antioxidant stability compared to the synthetic preservative, while maintaining an adequate microbiological profile. All formulations exhibited lactic acid bacteria counts above 10^7 CFU/mL and the absence of pathogenic microorganisms. In sensory evaluation, the incorporation of a lower percentage of extract did not compromise overall acceptability, whereas the higher percentage reduced consumer acceptance, particularly in flavor, texture, and aroma attributes.

The results highlight the applicability of fermented bee pollen as a natural preservative, demonstrating its relevance for sustainable innovation and the promotion of safe, healthy foods aligned with the current clean label market demands.

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P177 | IGAPÓ EXPEDITION AND THE STRENGTHENING OF FOOD SECURITY THROUGH ITINERANT SCIENCE IN SOUTHWEST AMAZONIA

Anderson Gahú Prestes[1], Cristina Vieira de Almeida[1], José Lucas Gahú Prestes[1], Eduardo da Costa Batista[1], Josué Gomes Coelho Filho[1], Vinicius Rafael Batista da Silva[1], Wilson Ramos Martins[1], Rafael Barroso dos Santos Paiva[1], Jamile Albuquerque Caetano1, Carlos S. H. Shiraishi[2,3*], Marcelo Rodrigues dos Anjos[1]

[1]Universidade Federal do Amazonas – UFAM, Instituto de Educação, Agricultura e Ambiente – IEAA, Laboratório de Ictiologia e Ordenamento Pesqueiro do Vale do Rio Madeira - LIOP, Brasil; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [3]Laboratório Associado Para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *anderson.liop2022@gmail.com

The Amazon, recognized as one of the most biodiverse regions on the planet, faces the challenge of reconciling the conservation of natural resources with the social and economic demands of the local and global population [1]. In this scenario, traveling science initiatives emerge as strategic tools for integrating academic and traditional knowledge, promoting environmental education, cultural appreciation, and sustainable management of fishery resources [2]. The objective of the Igapó Expedition was to bring science and riverside communities closer together through itinerant scientific dissemination, promoting environmental education, debate on fishing, and strengthening food security. The expedition took place between March 22 and 29, 2025, carried out by the Laboratory of Ichthyology and Fisheries Management of the Madeira River Valley (LIOP/UFAM), aboard the boat Yane José IV, acquired under the Surface Water Advisory and Integrated Control Bank (BACIAS) project. The route covered the Amazonian municipalities of Nova Olinda do Norte, Borba, Novo Aripuanã, and Manicoré, integrating research, teaching, and extension activities with funding from CNPq and support from national and international institutions. The methodology involved scheduled visits, during which the boat, adapted for teaching, research, and outreach, was open to the public, encouraging direct dialogue between scientists and riverside, indigenous, and traditional communities. During the activities, LIOP research results were presented in Humaitá, in addition to debates on the future of fishing on the Madeira River, participatory monitoring workshops, and interactive games on fish and snake biodiversity. There were also cultural exhibitions, such as a traveling cinema showing the film Flow, which promoted playful reflections on cooperation, tolerance, and climate change. The results show that direct contact between researchers and communities strengthens the perception of the relevance of biodiversity to the quality of life, food, and cultural identity of the Amazonian population [3]. The expansion of LIOP's scientific collection, associated with educational practices, contributes to environmental monitoring, promotes sustainable management practices, and strengthens the environmental responsibility of local communities. It can be concluded that traveling science acts as a bridge between knowledge, promoting the popularization of science and encouraging conservation and food security strategies in territories of high socio-environmental vulnerability.

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P178 | THE REUSE OF COCONUT SHELLS (*COCOS NUCIFERA* L.) TO PROMOTE THE SUSTAINABILITY OF THE FOOD ECOSYSTEM

Emmanuel Oliyide[1], Bruna Moreira[1], Ricardo Calhelha[1], Tânia C. S. P. Pires[1], Lillian Barros[1], Eliana Pereira[1*], Cristina Caleja[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *eliana@ipb.pt

Global coconut production generates large amounts of waste, with the shell accounting for up to 85% of the fruit and often being improperly discarded, thus aggravating environmental and economic impacts [1]. Despite the presence of bioactive compounds with potential antimicrobial, antioxidant, and anti-inflammatory effects [2], studies about composition and applications remain limited. Recent research highlights the growing interest in the valorisation of coconut (*Cocos nucifera* L.) shell, particularly in the food, cosmetic, and pharmaceutical sectors, underscoring its potential as a sustainable and multifunctional resource [3]. Therefore, this study aimed to evaluate coconut shells' various nutritional and chemical components, as well as their bioactive potential. Nutritional studies included the determination of protein, total fat, ash, carbohydrate, and energy content, applying official AOAC analytical methodologies. Chemical composition studies focused on determining the individual profiles of free sugars, organic acids, fatty acids, and phenolic compounds using chromatographic techniques. Bioactivity was assessed through in vitro assays. The antioxidant activity was tested using the DPPH and TBARS tests, the antimicrobial activity was tested by the microdilution method, and cytotoxicity was tested using the sulforhodamine B (SRB) assay. The results revealed that coconut shell extract contains significant concentrations of phenolic compounds, carbohydrates, lipids, and essential fatty acids, such as lauric, palmitic, oleic, and linoleic acids. Additionally, it exhibited significant antioxidant activity, and antimicrobial results indicated a broader inhibitory effect against foodborne and clinical Gram-positive pathogens, particularly *Staphylococcus aureus*, *Listeria monocytogenes*, and MRSA. Cytotoxic assays showed that the extract exerted a moderate antiproliferative effect on cancer cell lines such as MCF-7 and CaCo-2. In summary, this study provides robust evidence for the value of coconut shells as a source of functional ingredients, contributing to circular bioeconomy strategies and the sustainable development of natural products.

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P179 | BARBELA AND SPELT WHEAT: FUNCTIONAL AND MICROBIOLOGICAL POTENTIAL

Alexandra Teixeira[1,2*], Diana Amendoeira[1,2], Laís Freitas[1,2], Luís G. Dias[1,2], Letícia Estevinho[1,2]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Portugal; [2]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Portugal. *alexandrateixeira99@hotmail.com

Traditional wheat varieties, such as Spelt (*Triticum spelta*), are distinguished by their high content of phenolic compounds, particularly phenolic acids, which are associated with antioxidant and antimicrobial properties. The profile of these metabolites may vary among cultivars and harvest years and is also influenced by technological processes such as germination and milling [1-4].

In this study, the chemical, antioxidant, and antimicrobial properties of hexane extracts obtained from Barbela (*Triticum aestivum*) and Spelt wheat were characterized. Microbiological quality parameters (in accordance with ISO and European standards), extraction yield, antioxidant capacity via the DPPH assay, antimicrobial activity by microdilution in microplates, total phenolic content (Folin-Ciocalteu method), and flavonoid content (aluminum chloride complexation) were evaluated.

Microbiological tests confirmed the absence of pathogenic or spoilage microorganisms (molds, yeasts, *Escherichia coli*, total coliforms, and *Bacillus cereus*). Mesophilic aerobic counts were low (Barbela: 1.132 log CFU/g; Spelt: 1.181 log CFU/g) and were completely eliminated after pasteurization (0 log CFU/g), ensuring the safety and stability of the extracts.

Regarding bioactivity, both extracts showed comparable antioxidant activity (Barbela: 2.44 mg TE/g; Spelt: 2.74 mg TE/g). However, the Spelt extract exhibited a substantially higher total phenolic content (5.83 mg gallic acid eq./g) compared to Barbela (2.50 mg gallic acid eq./g). Flavonoids were not detected in either sample, suggesting that phenolic acids are the main contributors to the observed antioxidant effect.

Antimicrobial assays revealed greater efficacy of the Spelt extract against *Staphylococcus aureus* and *Candida albicans* (MIC: 0.0125 mg/mL), whereas Barbela extracts presented higher MIC values (0.050 mg/mL and 0.025 mg/mL, respectively). Against *E. coli*, both extracts showed the same MIC (0.050 mg/mL), indicating a similar microbiostatic effect.

In summary, the results confirm the functional potential of traditional wheat varieties, highlighting Spelt as a relevant source of phenolic compounds with antioxidant and antimicrobial capacities. These findings reinforce the applicability of such cereals, particularly Spelt wheat, in food and pharmaceutical formulations, contributing to the valorization of underexplored wheat species and the development of natural functional ingredients.

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P180 | BASIC METHYLATION FOR FATTY ACID ANALYSIS IN WHEAT

Alexandra Teixeira[1,2*], Diana Amendoeira[1,2], Laís Freitas[1,2], Letícia Estevinho[1,2], Luís G. Dias[1,2]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Portugal; [2]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Portugal. *Alexandrateixeira99@hotmail.com

The fatty acid profile is an essential parameter in the assessment of the nutritional and functional quality of cereals, being particularly relevant in traditional varieties such as Barbela wheat (*Triticum aestivum*) and Spelt wheat (*Triticum spelta*). Accurate characterization of these compounds requires the conversion of fatty acids into methyl esters (FAME) followed by analysis through gas chromatography with flame ionization detection (GC-FID). However, traditional basic methylation methods, although widely applied, present limitations, namely the generation of chromatograms with higher background noise, the presence of impurities, and a consequent reduction in accuracy and reproducibility of results [1].

In this context, the present study aimed to compare the efficiency of two distinct methods for FAME preparation: the classical base-catalyzed procedure and an optimized method, developed through the combination of methylation with 2 M KOH in methanol and a simplified extraction and purification process. This approach sought to minimize analytical artifacts, improve extract clarity, and enhance the reliability of chromatographic results.

The findings demonstrated that the optimized method produced clearer and more homogeneous extracts, with a significant reduction in chromatographic noise and improved reproducibility between replicates. Quantitative analysis revealed relevant differences in fatty acid recovery between the two methods. The optimized procedure allowed greater recovery of saturated fatty acids, particularly palmitic acid (Spelt: 28.3% vs. 14.6%; Barbela: 22.1% vs. 17.3%) and stearic acid (Spelt: 3.9% vs. 1.07%; Barbela: 3.1% vs. 1.27%). In contrast, a slight decrease was observed in the levels of polyunsaturated fatty acids, such as linoleic acid (Spelt: 47.6% vs. 57.7%; Barbela: 64.9% vs. 65.3%) and α-linolenic acid (Spelt: 2.5% vs. 3.2%; Barbela: 4.1% vs. 4.7%). Oleic acid content, however, maintained the previously reported varietal difference (Spelt > Barbela), confirming that, despite methodological variations, the overall lipid composition trends between species remained consistent.

Overall, the results confirm that the optimized basic methylation method represents a robust, cleaner, and more reproducible alternative for the analysis of cereal lipid profiles. This procedure not only ensures a significant improvement in chromatographic quality but also allows for a more accurate characterization of nutritional and functional differences between wheat varieties. Beyond its methodological contribution, this study highlights the importance of valorizing traditional species such as Barbela and Spelt, recognizing their potential as differentiated food sources, with relevance both for human nutrition and for the development of functional products.

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P181 | A LIFE CYCLE ASSESSMENT PERSPECTIVE ON BAGASSE-BASED BIOMASS IN A BRAZILIAN SUGARCANE BIOREFINERY

Fabiana Ramos[1*], Artur Gonçalves[2], José Ramón Rey[3], Ronney Boloy[4]

[1]Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, Rio de Janeiro, Brasil; [2]CIMO, Instituto Politécnico de Bragança, Bragança, Portugal; [3]Politécnico de Portalegre, Portalegre, Portugal; [4]Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, Rio de Janeiro, Brasil. *a67201@alunos.ipb.pt

The growing demand for renewable energy and sustainable materials highlights the potential of sugarcane bagasse as a strategic feedstock for biorefineries, particularly in Brazil, the world's largest sugarcane producer and a global reference in bioenergy [1]. Based on data from a Brazilian sugar-ethanol mill, this ongoing study applies Life Cycle Assessment (LCA) methodologies to analyze the environmental impacts associated with bagasse conversion into energy and bioproducts, covering stages from agricultural production to industrial processing. The aim is to identify potential hotspots related to greenhouse gas emissions, energy consumption, and resource use, as well as to assess the possible contribution of bagasse to reducing fossil fuel dependency. The analysis will also incorporates EESG (Environmental, Economic, Social, and Governance) perspectives, recognizing the economic relevance of the sugar-energy sector, the social benefits in terms of job creation and regional development, and the importance of governance practices that promote transparency and sustainability. By integrating these dimensions, this research seeks to support eco-efficiency strategies, optimize biomass valorization pathways, and strengthen the role of Brazilian biorefineries in advancing the circular bioeconomy, directly contributing to the Sustainable Development Goals related to clean energy, responsible production, and climate action.

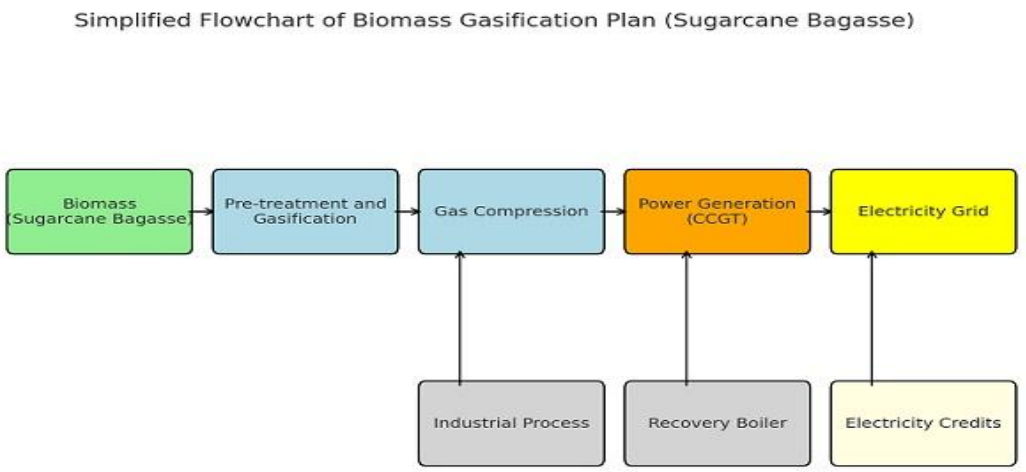

Figure 1 – Simplified biomass gasification flowchart, based on LCA approach methodologies.

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P182 | OPTIMIZING HARVEST TIME FOR *SORBUS AUCUPARIA*

Natália L. Seixas[1,2,3*], José Fresno Baro[1], Letícia M. Estevinho[2,3], Luís G. Dias[2,3]

[1]Doctoral School, University of León (ULE), Campus de Vegazana, León, Spain; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal; [3]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Bragança, Portugal. *natalia.seixas@ipb.

The growing demand for sustainable food solutions has encouraged the use of fruit in fermentation processes. The mountain ash (*Sorbus aucuparia*) stands out as a promising raw material, containing sugars such as glucose and sorbitol and bioactive compounds with antioxidant and antibacterial properties, which can be used in fermentation [1-3].

The present study aimed to optimise the conditions of the rowanberry fermentation process, using a Central Composite Design (CCD) to evaluate the impact of variables such as initial pH(3.5, 4.0, and 4.5), salt concentration (0.020, 0.025, 0.030) and glucose supplementation (2.0, 2.5, 3.0).

The fermentation process was monitored through rigorous physical-chemical analyses. Among the parameters evaluated, the quantification of soluble sugars, daily pH measurements and microbial viability assessments based on colony forming units (CFU/mL) stand out. This set of analyses allowed the dynamics of fermentation to be monitored, providing detailed information on microbial activity and the evolution of chemical characteristics over time.

The results obtained indicated that there were no statistically significant differences between the conditions tested in the experimental design, suggesting that any combination of initial pH, salt concentration and glucose supplementation can be used to conduct fermentation effectively. This observation is relevant because it simplifies the practical application of the fermentation process and increases flexibility in the formulation of derivative products.

In addition, it was found that *S. aucuparia* fruits have a remarkable buffering effect, maintaining a relatively constant pH (between 3.0 and 3.5) throughout the fermentation process. This buffering behavior is particularly important as it contributes to the stability of the microbiological environment, reducing sharp variations that could compromise the quality and consistency of the final product.

The conclusions obtained reinforce the potential of the wild tree as an underutilised food resource and support its valorisation in industrial and biotechnological contexts. By demonstrating that fermentation can be conducted in a robust and stable manner, this study paves the way for the development of innovative functional food products, exploiting the fruits of S. aucuparia as a source of bioactive compounds and as a versatile ingredient in fermented formulations.

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P183 | MATURATION DYNAMICS OF WILD ROWAN

Natália L. Seixas[1,2,3*], José Fresno Baro[1], Letícia M. Estevinho[2,3], Luís G. Dias[2,3]

[1]Doctoral School, University of León (ULE), Campus de Vegazana, León, Spain; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal; [3]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Bragança, Portugal. *natalia.seixas@ipb.pt

The rowan tree (*Sorbus aucuparia*), a member of the Rosaceae family, is widely distributed across temperate regions, including the mountainous areas of northern Portugal. Its vibrant red-orange fruits are notable for their high content of bioactive compounds, such as polyphenols, flavonoids, and organic acids, which are associated with antioxidant properties and potential health benefits [1-3]. This research, conducted within the framework of the Tramonte project – Valorization of Biological Resources from Northern Inland Regions: The Transmontane Rowan as a Case Study, focused on characterizing the chemical and functional properties of *S. aucuparia* fruits during their maturation process.

The study employed high-performance liquid chromatography (HPLC) to quantify sugars (glucose, fructose, sucrose, and sorbitol), using a Varian system with a C18 column, a refractive index detector, and an aqueous sulfuric acid solution as the mobile phase. Phenolic compounds were analyzed through the Folin-Ciocalteu and $AlCl_3$ methods, while antioxidant activity was assessed using DPPH and FRAP assays. To complement these analyses, innovative techniques such as cyclic voltammetry and an electronic nose (E-nose) were applied. Cyclic voltammetry provided insights into the variations of electroactive compounds, offering a rapid method to evaluate fruit maturation. The E-nose, on the other hand, analyzed volatile organic compounds to identify changes in aroma profiles associated with different developmental stages.

The findings revealed the optimal harvest period for *S. aucuparia* fruits, balancing sugar content and bioactive compound levels. Additionally, the results underscored the potential of rowan fruit pulp as a valuable ingredient for the development of functional food products. This study not only highlights the nutritional and functional potential of *S. aucuparia* but also emphasizes its role in promoting the sustainable use of wild species and fostering innovation in the food industry.

Figure 1 – XXXX.

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P184 | SIMCA-BASED AUTHENTICATION OF BARBELA WHEAT USING NIR AND PHYSICOCHEMICAL LIPID PROFILE DATA FUSION

Diana P. Amendoeira[1*], Alexandra Teixeira[1,2], Laís Freitas[1,2], Letícia Estevinho[1,2], Luís G. Dias[1,2]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal; [2]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Bragança, Portugal.*dianapaulo2014@gmail.com

Barbela wheat (*Triticum aestivum* L. em. Thell) is a traditional Portuguese variety, adapted to poor soils and adverse environmental conditions, standing out for its robustness in winter and drought tolerance [1,2]. This genetic diversity makes Barbela a relevant candidate for flour authentication studies, with implications for the conservation of agricultural biodiversity and the promotion of sustainable practices.

In this study, the objective was to verify whether Barbela wheat (BW) can be robustly identified in comparison with a subset of cereals: CI (whole rye), CB (white rye), TI (whole wheat), T (white wheat), MIX (mixture), and AI (whole oats). Three sources of information were evaluated: *(i)* physicochemical characterization (PC: % nitrogen, % moisture, % ash, % fat), including the lipid profile; *(ii)* NIR spectroscopy; and *(iii)* data fusion PC+NIR.

The data were organized into pairwise comparisons of BW vs AI, CI, CB, T, TI, and MIX. Multiple NIR preprocessing techniques were tested (smoothing, SNV, derivatives, and normalizations). Modeling was performed using SIMCA (Soft Independent Modeling of Class Analogy), adjusting PCA models only for the BW class. Class membership was assessed using Hotelling's T^2 and Q residuals. Performance was summarized by Specificity (correct rejection of "others"), Sensitivity (correct acceptance of BW), F1, Accuracy, and InsideRate_Other (proportion of "others" accepted by the BW model).

The overall results were:

- NIR alone: mean Specificity 86.1%, Sensitivity 87.3%, F1 0.835, Accuracy 84.8%, and InsideRate_Other 13.9%.
- PC+NIR fusion: Specificity 97.7%, Sensitivity 86.9%, F1 0.912, Accuracy 91.8%, and InsideRate_Other 2.3%.

At the class level, fusion achieved perfect rejection for AI, CB, and MIX (InsideRate_Other ≈ 0; Specificity ≈ 1.00) and near-perfect performance for CI (InsideRate_Other ≈ 0.85%; Specificity ≈ 99.15%). Some residual similarity with BW persisted in T (≈ 6.8%) and TI (≈ 6.1%).

Considering the groups CI, CB, TI, T, MIX, and AI, SIMCA confirmed the identification of BW relative to these cereals, with acceptable performance using NIR alone and clearly superior results with PC+NIR fusion (including the lipid profile). Fusion increased Specificity by ~11.6 percentage points and reduced by ~6× the erroneous acceptance of non-BW samples. For practical implementation, multivariate data fusion with robust preprocessing is recommended, in order to maximize the rejection of non-BW while preserving the correct acceptance of BW.

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P185 | NUTRITIONAL QUANTIFICATION OF WHEAT, RYE, AND OAT FLOURS BY NIR SPECTROSCOPY: A RADIAL SVM APPROACH

Diana P. Amendoeira[1], Alexandra Teixeira[1,2], Laís Freitas[1,2], Letícia Estevinho[1,2], Luís G. Dias[1,2]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal; [2]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Bragança, Portugal. *dianapaulo2014@gmail.com

Flour is a central ingredient in the production of doughs, bread, cakes, and other processed products, being determinant for final quality, food safety, and consumer satisfaction [1]. Traditional determination of quality parameters, such as nitrogen, moisture, ash, and fat content, relies on time-consuming, destructive, and costly laboratory methods. In this context, near-infrared spectroscopy (NIR) emerges as a fast, non-destructive, and economical analytical technique, capable of simultaneously estimating multiple parameters with high reliability [2,3].
The present study aimed to evaluate the potential of NIR to simultaneously predict the main quality parameters in wheat (*Triticum aestivum*), rye (*Secale cereale*), and oat (*Avena sativa*) flours, using machine learning models to improve the accuracy and robustness of the estimates.
A total of 34 samples were analyzed, characterized according to official AOAC methods, and spectral measurements were obtained with a portable spectrometer (900–1700 nm). NIR spectra were preprocessed using a systematic grid of pipelines combining smoothing with scatter corrections (SNV, MSC), intensity normalizations (area, length), centering and scaling (mean-centering, unit-variance, min–max, Pareto), and first/second derivatives. Composite variants were also included to establish the best predictive SVM radial model.
The predictive model based on Support Vector Machines with radial kernel (radial SVM) successfully estimated nitrogen, moisture, ash, and fat contents, showing high predictive capacity in training ($R^2 > 0.99$) and robustness in testing ($R^2 > 0.840$) [3].
The results demonstrate that NIR is an efficient, fast, and non-destructive tool for real-time flour quality control, with high industrial application potential, contributing to the production of more consistent, safer, and higher-quality foods.

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P186 | APPLICATION OF A BIO-BASED COATING ON KRAFT PAPER FOR FOOD PACKAGING

Jorge M. Vieira[1,2*], Joana T. Martins[1,2], Miguel S. Coelho[3,4], Inês G. Zanguilo[3,4], José A. Teixeira[1,2]

[1]CEB - Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal; [2]LABBELS – Associate Laboratory, Braga/Guimarães, Portugal; [3]RAIZ - Forest and Paper Research Institute, Aveiro, Portugal; [4]The Navigator Company. *d8778@uminho.pt

Coating with bio-based polymers applied to the paper surface can be a viable and environmentally friendly alternative to petroleum-based polymers for packaging applications [1]. This study explores the potential application of emulsions containing polysaccharides (P), plant proteins (PP1 and PP2) natural waxes (W1 and W2) as a bio-based coating material on the kraft paper (60 g/m^2) surface (Figure 1) for food contact packaging. Rheological behaviour and contact angle of the developed coating formulations were analysed. Air and water vapor permeability, grease resistance, and mechanical properties of the coated kraft paper were assessed in terms of their barrier performance. The grease kit test yielded a result of 12/12 for the optimized coated paper versus 1/12 for uncoated, and oil Cobb value showed a ~90 % improvement. The minimum air permeability of the coated paper reached over 1410 s/100 mL (Gurley's test). Water vapor permeability decreased. while the mechanical barrier properties (bursting strength, tearing resistance, tensile strength, elongation at break, and Young's modulus) increased (Table 1). Overall, the P-PP1-PP2-W1-W2 based emulsion yielded promising evidence for sustainable packaging development.

Figure 1 – Gravure coating method to coat the 60 g/m^2 kraft paper.

Figure 1 – Rheological properties (apparent viscosity at 0 s-1 (Ƞ0 s-1) and 1000 s-1 (Ƞ1000 s-1), flow index (*n*), consistency index (*k*), and storage modulus (*G'*) of optimized coating emulsion (F1) after three cycles through the high-pressure homogenizer and barrier properties (tensile strength – TS –, elongation at break – EB –, Young's modulus – YM – bursting strength – BT –, tearing resistance – TR –, water vapor transmission rate – WVTR –, Gurley's method. Cobb-Unger30 – CU –, and KIT test) of the coated paper.

	Rheological Parameters					Mechanical barrier					Air/Vapor Permeability		Grease resistance	
	η_0 s^{-1} cP	η_{1000} s^{-1} cP	*n*	*k* Pa.s^n	*G'* Pa	TS N	EB %	YM MPa	BT KPa	TR mN	GT s/100ml	WVTR	KIT	CU
C	-	-	-	-	-	-	2.4 ± 0.2	-	279 ± 2	365 ± 10	63.3 ± 1.8	109.1 ± 6.3	1	8.84 g/cm^3
F1	303 ± 1.2	86 ± 1.0	0.8 ± 0.1	0.04 ± 0.01	0.2 ± 0.0	63 ± 1	7.4 ± 0.2	4948 ± 219	293 ± 3	423 ± 20	∞	35.8 ± 2	12	0.93 g/cm^3

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P187 | INTEGRATION OF HPLC AND ELECTRONIC NOSE IN THE MONITORING OF BARBELA WHEAT BEER

Hugo Goes[1*], Nuno A. Sousa Dias[1], Letícia Estevinho[1], Luís. G. Dias[1]

[1]Polytechnique Institute of Bragança, IPB, Campus de Santa Apolónia 5300-253 Bragança. *hugoggoes@gmail.com

The use of traditional cereals in craft beer production has gained renewed interest, particularly for their impact on flavor, mouthfeel and nutritional value. This preliminary study investigates the application of *Triticum aestivum* subsp. *Barbela*, Barbela wheat, an ancient Portuguese wheat variety, in beer production, with a focus on fermentation monitoring [1]. This study explores the integration of Barbela wheat into beer production with a focus on fermentation monitoring using a high-performance liquid chromatography (HPLC) and electronic nose (E-nose). HPLC was used to quantify key carbohydrates, including sucrose+maltose, glucose and fructose, as well as ethanol and glycerol providing a detailed profile of sugar consumption in time by *Saccharomyces cerevisiae* [2]. The E-nose system, equipped with metal oxide sensors, was employed to continuously assess volatile organic compounds (VOCs) generated throughout the fermentation process. This dual analytical approach offered real-time insights into both metabolic activity and flavor progression during fermentation [3]. HPLC analysis revealed a rapid utilization of simple sugars, with fructose (T_0=0.78 g/L) and glucose (T_0=3.48 g/L) completely consumed by day 2, and maltose+sucrose (T_0=70.08 g/L) fully depleted by day 10. In parallel, ethanol production increased progressively, reaching 37.48 g/L by day 15, while glycerol accumulated to 37.48 g/L, demonstrating an efficient fermentation. It was also possible to correlate VOCs signals from the E-nose with the changes occurring during the fermentation period, allowing monitoring of the response to these alterations and the evolution of compounds throughout the fermentation. The findings support the potential of Barbela wheat as a valuable ingredient in specialty beer production and highlight the relevance of combining smart sensor systems with chromatographic techniques for enhanced quality control and innovation in brewing with heritage grains. The incorporation of these heritage grains significantly enhances the organoleptic and sensory profile of beer, shaping its uniqueness as a final product.

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P188 | A FLOW-BASED METHOD AS A MORE SUSTAINABLE TOOL FOR TOTAL PROTEIN MONITORING IN INDUSTRIAL PROCESSES

Raquel Teixeira[1*], Tânia C. F. Ribas[1], André Almeida[2], Manuela Pintado[1], António O. S. S. Rangel[1]

[1]Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, R. de Diogo Botelho 1327, 4169-005 Porto, Portugal; [2]I.T.S. – Indústria Transformadora de Subprodutos S.A, Loures, Portugal. *arteixeira@ucp.pt

The growing interest in protein hydrolysates highlights the need for fast and reliable analytical methods to assess their nutritional and functional properties. Total protein quantification is a key parameter for characterizing by-products, monitoring hydrolysis processes, and evaluating hydrolysates. In this work, a sustainable flow-based spectrophotometric method was developed and optimized using the Biuret method [1]. The flow injection analysis (FIA) system employs a double injection strategy in a continuous stream, significantly reducing reagent consumption compared to the conventional procedure, with a 75% decrease in Biuret reagent and an 83% reduction in sodium hydroxide, while maintaining analytical accuracy (Figure 1). Optimization of flow and chemical parameters enabled robust performance across different matrices used during enzymatic hydrolysis. The dynamic range of the method was 0.100–2.00 mg mL^{-1}, presenting a limit of detection and quantification of 0.069 and 0.290 mg mL^{-1}, respectively. The results were in agreement with those obtained with the reference method (<10% deviation). Additionally, the herein proposed method reduced the analysis time from 30 to 3 minutes per sample (triplicate). The proposed protocol offers a faster, greener, and reliable tool for the food industry, supporting sustainability in quality control and nutritional evaluation.

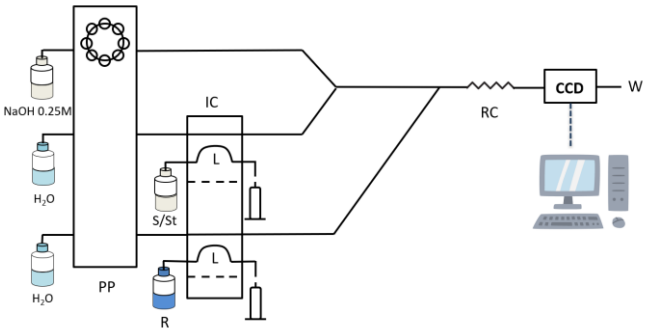

Figure 1 – Flow injection manifold for the quantification of total protein content; PP, peristaltic pump; IC, Injector commutator; L, Loop (400 µL); S/St, sample/standard; R, Biuret reagent ($CuSO_4$ 0.027 mol L^{-1}; $C_6H_5Na_3O_7.2H_2O$ 0.15 mol L^{-1}; Na_2CO_3 0.24 mol L^{-1}); RC, reaction coil 100 cm; CCD, detector (λ= 554 nm); W, waste.

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P189 | ENDOPHYTIC FUNGI IN MAIZE: ASSESSMENT OF DIVERSITY AND TOXIGENIC POTENTIAL

Lais Freitas[1,2,3*], Maria Eugénia Tornadijoa[1], Letícia M. Estevinho[2,3], Luís G. Dias[2,3]

[1]Doctoral School, University of León, Campus de Vegazana, 24007 León, Spain; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [3]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal. *laisfreitas@ipb.pt

Maize (*Zea mays*) is one of the major agricultural crops in Europe, being particularly relevant in countries such as France, Hungary, Romania, and Italy. However, its yield and quality can be affected by pathogenic fungi, notably *Aspergillus flavus*, which is responsible for the synthesis of aflatoxins, highly toxic and carcinogenic mycotoxins classified as Group 1 by the International Agency for Research on Cancer (IARC) [1,2]. Recent studies have demonstrated that aflatoxin contamination can occur both in the field and during grain storage, with investigations carried out in France reporting a high prevalence of *Aspergillus* section *Flavi* strains in maize, underscoring the need for continuous monitoring [3,4].

In this context, the present study aimed to isolate and characterize endophytic fungi associated with traditional maize varieties cultivated in Portugal, analyzing fungal community composition and evaluating their toxigenic potential. Isolates were identified through PCR-based DNA amplification and sequencing, with data processed using statistical and multivariate methods. Aflatoxin production screening was initially performed on selective and differential media, and subsequently confirmed by extraction and chemical analysis of fungal metabolites.

A total of 18 distinct species were identified, with occurrence patterns correlating with the geographical origin of the samples. Most isolates belonging to the genera *Aspergillus* and *Penicillium* exhibited fluorescence on selective medium, indicating their capacity for secondary metabolite synthesis. Chemical analysis confirmed aflatoxin production in several isolates, with variable levels across species.

The results highlight the importance of systematic monitoring of the microbiota associated with traditional maize varieties, not only to characterize their diversity but also to assess the risks of mycotoxin contamination, with direct implications for food safety and public health.

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P190 | CHEMOMETRIC CHARACTERIZATION OF FATTY ACID PROFILE IN PORTUGUESE MAIZE: VERDEAL AND PIGARRO IN CONTEXT

Lais Freitas[1,2,3*], Maria Eugénia Tornadijoa[1], Pedro Mendes Moreira[4,5], Isabel Dinis[4,5], André Pereira[4,5], Ana Sofia Bagulho[6,7], Nuno Pinheiro[6,7], Fernanda Simões[6], Ângela Lopes[6], Diogo Mendonça[6], Letícia M. Estevinho[2,3], Luís G. Dias[2,3]

[1]Doctoral School, University of León, León, Spain; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal; [3]Laboratório SusTEC, Instituto Politécnico de Bragança, Bragança, Portugal; [4]Polytechnic University of Coimbra, Coimbra, Portugal; [5]Research Center for Natural Resources, Environment and Society (CERNAS), Polytechnic University of Coimbra, Coimbra, Portugal; [6]Instituto Nacional de Investigação Agrária e Veterinária (INIAV), Portugal; [7]GeoBioTec, Universidade Nova de Lisboa, Costa da Caparica, Portugal. *laisfreitas@ipb.pt

Maize (*Zea mays* L.) is one of the most relevant cereals worldwide, playing a strategic role in human and animal nutrition as well as in the agri-food industry. The lipid fraction, particularly the fatty acid profile, is among the key factors contributing to the nutritional and technological value of this cereal. Within the framework of the CERTRA project, aimed at valorizing traditional cereal varieties, 30 maize samples were analyzed to characterize their lipid composition and identifying differences among genotypes. Recent studies highlight the importance of understanding the genetic and environmental variability in maize lipid composition, with implications for food security and agricultural sustainability [1,2].

In this study, particular emphasis was given to the Portuguese open-pollinated varieties Verdeal and Pigarro, aiming to highlight their distinctive fatty acid profiles within maize diversity. Fatty acid profiling was performed by gas chromatography (GC) following alkaline derivatization for the formation of methyl esters, using the Supelco 37-component FAME Mix as reference standard. The system employed was a DANI GC1000, equipped with a split/splitless injector and a flame ionization detector (FID). Complementary genetic and technological analyses were also conducted to provide a comprehensive characterization of the samples. Recent studies suggest that the use of advanced chromatographic techniques and multivariate analysis allows a better understanding of the influence of genetic and environmental factors on lipid composition [3,4].

Multivariate analysis revealed statistically significant differences in fatty acid content among samples, allowing the formation of groups with similar lipid profiles. These variations reflect the interaction between genetic factors and cultivation conditions, corroborating previous studies that emphasize the influence of the environment on the phenotypic expression of lipid traits [5,6]. Such data provide valuable evidence for the valorization and selection of traditional maize varieties cultivated in Portugal, based on distinctive lipid characteristics, thereby contributing to the promotion of agricultural biodiversity and the development of value-added products.

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P191 | ALTERNATIVE FLOURS IN GLUTEN-FREE BAKERY: PORTUGUESE MAIZE

Maria Clara Abreu[1*], Lais Freitas[1,2], Vanessa B. Paula[1,2], Luís G. Dias[1,2], Leticia M. Estevinho[1,2]

[1]Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal. *cacagulopes96@outlook.com

The development of gluten-free bakery products is essential to meet the needs of consumers with (celiac) disease and those who are gluten-intolerant, whilst also promoting the use of local raw materials with nutritional and technological potential. Maize flour emerges as a promising ingredient, which can be combined with alternative flours to enhance physicochemical and sensory properties [1-3].

In this study, the feasibility of different gluten-free cake formulations was evaluated by comparing a control (100% maize) with mixtures of maize and coconut, maize and cassava starch, and maize and rice. Samples were assessed for physicochemical parameters, microbiological quality, colour, texture, and sensory acceptability by a panel of 80 consumers, both on day 0 and after three days of storage.

The results revealed significant differences among the formulations: the maize–coconut cake exhibited the highest fat content (24.15 ± 0.29 %), whereas the control (100% maize) presented the lowest (21.20 ± 0.35 %). Sensory evaluation demonstrated greater acceptance of the maize–coconut formulation, which was distinguished by a softer texture and a more favorable sensory profile.

These findings demonstrate that maize flour constitutes a key ingredient for the development of distinctive gluten-free cakes. Its combination with other flours, such as coconut, allowed optimization of nutritional and sensory attributes, thereby increasing consumer acceptance. The relevance of employing traditional cereals, as a basis for innovation in gluten-free bakery contributes both to the diversification of food options and to the valorization of local raw materials.

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P192 | APPLICATION OF FERMENTED GRAPEVINE LEAF EXTRACT AS A NATURAL PRESERVATIVE IN GLUTEN-FREE CAKES

Maria Clara Abreu[1*], Lais Freitas[1,2], Vanessa B. Paula[1,2], Luís G. Dias[1,2], Leticia M. Estevinho[1,2]

[1]Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal. *cacagulopes96@outlook.com

The growing demand for gluten-free bakery products with functional properties has driven research into natural ingredients with high nutritional value. Grapevine leaves (*Vitis vinifera* L.), recognized for their richness in phenolic compounds and antioxidant properties, emerge as a promising bioactive source [1,2]. Fermentation, in turn, represents an effective strategy to enhance the release and bioavailability of these compounds, while also improving the sensory attributes of food products [3].

In this context, the present study aimed to evaluate the feasibility of incorporating fermented grapevine leaf extract into gluten-free cakes formulated with corn flour. The approach included the physicochemical characterization of the flour, with the determination of total phenols, flavonoids, and antioxidant activity, as well as microbiological analyses to ensure the hygienic and sanitary quality of the raw material. The preliminary results of the fermented grapevine leaf extract showed increased phenolic content, rising from 85.15 ± 2.31 mg/g at the initial stage to 230.55 ± 33.50 mg/g after fermentation, demonstrating the effectiveness of the process in enhancing the release of bioactive compounds.

This research is expected to contribute to the development of nutritionally enriched gluten-free cakes, microbiologically safe and with enhanced functional potential, thus promoting innovation in the bakery sector and offering healthier alternatives.

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P193 | BIO4MED PROJECT: CHARACTERIZATION AND VALORIZATION OF HONEYS COLLECTED IN OLIVE GROVES

Guilherme Vaz[1], Elsa Ramalhosa[1], Ermelinda Pereira[1], Paulo Russo-Almeida[2], Fátima Leitão[1], Nicole Gonçalves[1], Paula Baptista[1], Soraia I. Falcão[1*]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal; 2Laboratório Apícola–LabApis, Departamento de Zootecnia, Universidade de Trás-os-Montes e Alto Douro (UTAD), 5300-801 Vila Real, Portugal. *sfalcao@ipb.pt

Honey is a complex product made predominantly by sugars, but also containing proteins, phenolic compounds and vitamins in smaller amounts [1]. Beyond honey production, bees play an essential role in the pollination of various numbers of plants species, which many of them are fundamental for human food production [2]. Beekeeping is relevant from an economic point of view but also from an ecological perspective, specially under the current challenges of climate change. The Bio4Med project aims to implement sustainable strategies in Mediterranean climate perennial crops, namely olive groves, by installing beehives along their borders. With this approach, high-quality honeys production can be enhanced with unique features while contributing to biodiversity conservation and regional economic development. This study is focused on the physicochemical, pollen and rheological characterization of honeys collected from olive groves. In more detail, fifteen samples were analysed from three olive groves in the "Terra Quente" region in Trás-os-Montes, Portugal. Additionally, to valorise this honey, granola formulations were developed and characterized in terms of physicochemical, sensory and microbiological properties. The honeys presented very similar results in various parameters. All of them showed extra-light amber colour, relative low moisture (14.16 to 14.60%) and electrical conductivity levels (0,193 to 0,290 mS/cm). The pollen analysis revealed polyfloral honeys with predominance of *Jasione montana*, *Cytisus striatus* and *Rubus* sp.. Concerning the rheological behaviour, all honeys presented Newtonian behaviour, while the temperature dependence of viscosity was better explained by an empirical equation rather than by the Arrhenius model. For the granola production, three formulations were made, differing only in the spice used (carob, cinnamon and ginger). Nutritional analysis showed that protein content (9.80 to 11.70 g/100g) stood out, being higher than other commercial granolas. All of them presented balanced sensory profiles. The granolas also showed no significant microbiological growth after two months of storage at room temperature.

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P194 | BIOACTIVE COMPOSITION AND HEALTH-PROMOTING POTENTIAL OF HONEY FROM MONTESINHO NATURAL PARK

Sónia Soares[1], Clara Grosso[1*], Aurora Silva[1,2], Cristina Soares[1], Manuela M. Moreira[1], Olena Dorosh[1], M. Fátima Barroso[1], Miguel A. Prieto[2], Cristina Delerue-Matos[1]

[1]REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Portugal; [2]Universidade de Vigo, Nutrition and Food Group (NuFoG), Vigo, Spain. *claragrosso@graq.isep.ipp.pt

Honey is widely recognized for its nutritional and therapeutic properties, which depend on its botanical and geographical origin [1]. Montesinho Natural Park (MNP), in Northeast Portugal, is a protected area known for its rich biodiversity and for producing honey with Protected Designation of Origin status. However, its health-promoting potential remains underexplored.

This study aimed to characterize the bioactive composition and health-related properties of multifloral honey from different apiaries within MNP and to compare them with the well-known Manuka honey.

Eight apiaries with different locations within the MNP were previously selected, aiming to include a wide range of territories within the park. Thus, a total of 16 MNP honey samples (8 from each 2021 and 2022 campaigns) and one commercial Manuka sample were analyzed. Their phenolic and amino acid profiles were determined by HPLC-DAD and HPLC-FLD, respectively. Antioxidant capacity was assessed by FRAP, $DPPH^{\bullet}$, $ABTS^{\bullet+}$, $^{\bullet}NO$, $O_2^{\bullet-}$ and $^{\bullet}OH$ assays [2]. Enzyme inhibition (AChE, BuChE, tyrosinase, α-glucosidase) and antimicrobial activities against six bacterial strains were also evaluated [2].

MNP honeys showed a wide range of total phenolic content (55.6-225 mg GAE/100 g), generally higher than Manuka (57.2 mg GAE/100 g), and were rich in gallic acid, neochlorogenic acid, and catechin. They contained high levels of essential amino acids, notably phenylalanine, lysine, and valine, and in some cases high proline content. MNP samples exhibited strong antioxidant and antimicrobial activities and moderate enzyme inhibitory effects. Significant variability among apiary locations and sampling years was observed, highlighting the influence of environmental and botanical factors.

Overall, honey from Montesinho Natural Park demonstrates remarkable nutritional and bioactive properties, comparable or superior to Manuka honey. These findings support its potential as a high-value natural product with health-promoting benefits and may enhance its commercial and therapeutic relevance.

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P195 | MONITORING *TRANS* FATS IN EDIBLE OILS FROM MOROCCO: A PRELIMINARY ASSESSMENT

Mafalda Alexandra Silva[1,2], Helena Soares Costa[1,2], Tânia Gonçalves Albuquerque[2,3], Rachel Kouwe[4], Liz Drummond[4], Nada Benajiba[5], Clara Abou Samra[6], Carla Motta[1*]

[1]Department of Food and Nutrition, National Institute of Health Dr. Ricardo Jorge, Av. Padre Cruz, 1649-016 Lisbon, Portugal; [2]REQUIMTE-LAQV/Faculty of Pharmacy from University of Porto, R. de Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [3]Estoril Higher Institute for Tourism and Hotel, Av. Condes de Barcelona, n.º 808, 2769-510 Estoril, Portugal; [4]Resolve to Save Lives, 1520 Belle View Blvd., #4036, Alexandria, VA 22307, USA; [5]Joint Research Unit in Nutrition and Food RDC-Nutrition AFRA/IAEA, Ibn Tofail University-CNESTEN, Kenitra 14000, Morocco; [6]Department of Health Management and Policy/K2P Center, American University of Beirut, P.O. Box: 11-0236, Bliss Street, Beirut, Lebanon. *carla.motta@insa.min-saude.pt

Trans fatty acids (TFAs) can be classified according to their two main sources: industrial (iTFAs) and natural (nTFAs). iTFAs are generated during partial hydrogenation or through heat treatments in the refining of vegetable oils and during the frying process. However, they pose some health risks as they raise low-density lipoprotein cholesterol while decrease high-density lipoprotein cholesterol, thereby increasing the risk of coronary heart disease. To support a healthy diet, the recommended intake of TFAs is less than 1% of total energy intake [1]. In this context, a collaboration between Resolve to Save Lives, the National Institute of Health Doctor Ricardo Jorge (INSA) and partners from 10 African and Asian countries was established to assess the prevalence of elevated TFA levels in refined vegetable oils and olive oil through a multi-country assessment. This abstract focused on evaluating the fatty acids composition in commonly consumed edible oils from Morocco, one of the ten participating countries.

In 2025, from a survey presenting 86 individual oils available in the country, identified from 6 different types of vendors, we selected eight types of edible oils was collected from local vendors. Most samples are single oils, while four were blends of two or more oils. Specifically, the collected samples included: Soybean, Sunflower and Rapeseed oil (A and B); Soybean and Sunflower oil (C); Soybean and Corn oil (D); Soybean oil (E and F); Sunflower oil (G and H); Rapeseed oil (I); Olive pomace oil (J), Olive oil (K and L). In total, 12 samples were analyzed, including 11 commercially branded samples and 1 unbranded sample (olive oil, L). Preparation of FAMEs was performed in accordance with the WHO Simplified protocol for measuring trans-fatty acid content as a percentage of total fatty acids in food products [2]. Fatty acids determination was performed using Gas Chromatography with flame ionization detector.

The fatty acid composition of the analyzed samples showed that eight of the samples were predominantly rich in polyunsaturated fatty acids, whereas four samples were mainly composed of monounsaturated fatty acids. Saturated fatty acid levels were relatively low across all samples, indicating a favorable lipid profile. TFA content varied between 0.0193 and 0.746 g/100 g of total fatty acids. These values are comparatively low and suggest good quality with respect to industrially produced trans fats.

The findings provide critical insights into the dietary sources of trans fat, aiming to support regulatory changes in the countries. Overall, fatty acid profiles observed are consistent with what is expected for commercial edible oils, where a predominance of unsaturated fatty acids is desirable for nutritional and health considerations. The low TFA levels further highlight the positive quality attributes of the analyzed oils.

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P196 | IMPACT OF HYDROLOGICAL VARIATIONS ON ARTISANAL FISHING OF THE JATUARANA (*BRYCON MELANOPTERUS*): PERSPECTIVES FOR FOOD SECURITY IN SOUTHWEST AMAZONIA

José Lucas Gahú Prestes[1*], Josué Gomes Coelho Filho[1], Cristina Vieira de Almeida[1], Vinicius Rafael Batista da Silva[1], Eduardo da Costa Batista[1], Anderson Gahú Prestes[1], Marcelo Pebles Gomes Pinto[1], Wilson Ramos Martins[1], Rafael Barroso dos Santos Paiva[1], Carlos S. H. Shiraishi[2], Marcelo Rodrigues dos Anjos[1]

[1]Universidade Federal do Amazonas – UFAM, Instituto de Educação, Agricultura e Ambiente – IEAA, Laboratório de Ictiologia e Ordenamento Pesqueiro do Vale do Rio Madeira - LIOP, Núcleo regional do PPBio em Humaitá-AM; [2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia; Laboratório Associado Para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia. *jose.prestes@ufam.edu.br

Artisanal fishing for Jatuarana (*Brycon melanopterus*) is an essential component of the subsistence of communities in the southwestern Amazon, contributing both to food supply and local income generation. The ecology of this species is closely associated with the flood pulse, a natural phenomenon that determines periods of abundance and scarcity of fish in the region [1]. This study aimed to investigate the effects of hydrological variations on Jatuarana fish production and its implications for food security in Humaitá, Amazonas. Between January 2019 and December 2023, data was collected through systematic monitoring of landings at Colônia Z-31, supplemented by direct interviews with fishermen. A total of 496.31 kg of fish were recorded, with an average individual weight of 0.35 kg, average length of 24.58 cm, average price of R$ 7.08/kg, and CPUE of 2.40 kg. The largest catches occurred in lakes (271.1 kg), followed by streams (26.06 kg) and rivers (10.62 kg). Catches were concentrated mainly during the flood season (492.27 kg) and were not recorded during the dry season or ebb tide, highlighting the strong dependence of fishing activity on the hydrological regime. These findings reinforce previous studies that indicate the vulnerability of artisanal fishing to climate and hydrological changes in the Amazon [2,3]. The results suggest that preserving the flood pulse is essential to ensure the sustainability of Jatuarana fishing and food security for local communities.

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P197 | BEE BREAD SUGAR CONTENT EVALUATION: A COLLABORATIVE WORK WITHIN THE COST ACTION CA 22105 "BESAFEBEEHONEY"

Soraia I. Falcão[1*], Sarah Rodrigues[1], Ester Ordonez[2], Marian Hýbl[3], Naceur M'Hamdi[4], Adel Hatem[5], Dılhun Keriman Arserim-Uçar[6], Marco Ciulu[7], Ceren Mutlu[1], Carolina Nebot[8]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Agrupación Apícola de Galicia, Ourense, Spain; 3Biology Centre, Czech Academy of Sciences, Branisovska 3, Ceske Budejovice, Czechia; [4]Institut National Agronomique de Tunisie, Avenue Charles Nicolle 43, Tunis, Tunisia; [5]The Agricultural Research Center, El Gamaa St 9, 12619 Giza, Egypt; [6]Bingöl University, Selahaddin-i Eyyubi Neighborhood, University Street, 12000 Bingöl, Türkiye; [7]University of Verona, Strada le grazie 8, 37134 Verona, Italy; [8]Laboratorio de Higiene, Inspeccion y Control de Alimentos (LHICA), Departamento de Química Analítica, Nutricion y Bromatología, Campus Terra, Universidade de Santiago de Compostela, Campus Lugo, Lugo 27002, Spain. *sfalcao@ipb.pt

Bee bread, a naturally fermented product derived from the enzymatic and microbial transformation of bee pollen by honey bees (*Apis mellifera*), has attracted increasing scientific and commercial interest due to its nutritional and functional properties. The chemical composition of bee bread is strongly influenced by the botanical origin of the pollen collected by honey bees, which varies significantly according to regional floral diversity and the season of harvest. In addition to its high protein content and essential amino acids, bee bread contains a wide range of bioactive compounds, including sugars, vitamins (C, B1, B2, E, and H), phenolics, pigments, lipids, dietary fiber, enzymes, and numerous minerals such as calcium, iron, magnesium, and phosphorus, among others [1]. One of the critical aspects of its quality evaluation lies in the characterization of its sugar profile, which reflects both the floral origin of the pollen and the metabolic activity of the hive microbiota. The aim of this work was to evaluate the sugar content of samples from different regions with the purpose of assessing bee bread quality, authenticity, and potential health benefits. For that, a total of 24 samples from different countries such as Portugal, Spain, Czechia, Germany, Poland, Lithuania, Tunisia, Türkiye and Egypt, collected in 2024 were analysed. The sugar profile was determined through HPLC-RI. Simple sugars, including fructose and glucose, dominate the carbohydrate fraction with values between 16.14 - 24.21 g/100g and 8.73 - 15.75 g/100g respectively. Disaccharides such as sucrose presented values between 0 - 4.80 g/100g. Variations in sugar composition are influenced by botanical diversity, regional factors, and the extent of lactic acid fermentation, which collectively determine the product's stability and bioactivity. The analyses enable precise quantification and differentiation of these sugars, offering reliable criteria for quality control. Comprehensive profiling of bee bread sugars it's an important tool to support standardization, authenticity verification, and valorization of this unique apicultural product within functional food markets.

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P198 | OCCURRENCE OF AFLATOXINS AND OCHRATOXIN A IN DRIED FIGS FROM THE ALGARVE REGION

Cíntia Mendes[1*], Luís Abrunhosa[1,2]

[1]CEB - Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal; 2LABBELS – Associate Laboratory, Braga/Guimarães, Portugal. *b13740@cmems.uminho.pt

Figs are highly susceptible to fungal contamination and, consequently, dried figs may contain mycotoxins such as aflatoxins (AFLs) and ochratoxin A (OTA). These compounds are mainly produced by mycotoxigenic species of the genera *Aspergillus* and *Penicillium*. In the European Union, the legal limit for AFLs in dried figs is 10 µg/kg, while the limit for OTA is 8 µg/kg [1]. Therefore, regular analytical control of these mycotoxins in dried figs is necessary. In Portugal, dried figs are mainly produced and commercialized in the southern region of the country, the Algarve, as the Mediterranean climate there is more favorable to fig cultivation and traditional sun-drying practices. The occurrence of these mycotoxins in dried figs from Spain has been reported, with 10 to 12.5% of samples contaminated above legal limits [2]. Contamination of figs depends on the local mycobiota, climatic conditions, agricultural practices, drying methods, and storage conditions.

This study aimed to evaluate the contamination levels of AFLs (aflatoxins B1, B2, G1, and G2) and OTA in dried figs commercialized in the Algarve. About 250 g of 14 different types of dried figs were purchased from two traditional local markets (Alzejur and Loulé). From each sample, 100 g were weighed and finely blended. Then, 25 g were weighed and mixed with 5 g of NaCl before extraction with 100 mL of 80% methanol for 30 minutes with vigorous agitation. After filtration, the mycotoxins were cleaned up using AFLAOCHRA RHONE® WIDE immunoaffinity columns, following the manufacturer´s protocol for dried fruits, and analyzed by HPLC with a fluorescence detection. The method was validated using a dried fig matrix (T04449QC from FAPAS) containing 9.34 µg/kg of total AFLs and 10.4 µg/kg of OTA.

The recovery of OTA was 88.6 ± 1.5 % (RSD) and that of AFLs was 97.0 ± 4.5%. OTA was detected in 11 of the 14 samples (78.6%), while AFLs were only detected in 4 of the samples (28.6%). Four samples contained both mycotoxins (28.6%). Contamination levels ranged from 0.269 to 4.497 µg/kg for AFLs and 0.010 to 7.317 µg/kg for OTA. In conclusion, OTA was the predominant mycotoxin in dried figs from the Algarve and no sample exceeded the European legal contamination limits.

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P199 | BIODEGRADABLE WHEY PROTEIN FILMS WITH CARDOON EXTRACT AS NATURAL ALTERNATIVES TO NATAMYCIN IN CHEESE PRESERVATION

Cássia H. Barbosa[1,2], Mariana A. Andrade[1,3], Fernanda Vilarinho[1], Ana Sanches Silva[4,5,6], Ana Luísa Fernando[2*]

[1]National Institute of Health Doutor Ricardo Jorge, Department of Food and Nutrition, Av. Padre Cruz, 1649-016 Lisbon, Portugal; [2]MEtRICs, Department of Chemistry, NOVA School of Science and Technology, Universidade NOVA de Lisboa, Campus de Caparica, 2829-516 Caparica, Portugal; [3]REQUIMTE/LAQV, Rua D. Manuel II, Apartado 55142, Porto, Portugal; [4]University of Coimbra, Faculty of Pharmacy, Coimbra, Azinhaga de Santa Comba, 3000-548 Coimbra, Portugal; [5]Centre for Study in Animal Science (CECA), ICETA, University of Porto, Porto, Portugal; [6]Associate Laboratory for Animal and Veterinary Sciences (AL4AnimalS), 1300-477 Lisbon, Portugal. *ala@fct.unl.pt

Nowadays, consumers demand more natural foods with fewer synthetic additives, which drives research into biodegradable active packaging enriched with plant extracts, essential oils, or agro-industrial by-products rich in bioactive compounds. Cardoon (*Cynara cardunculus* L.) is a multipurpose crop whose flower is traditionally used in cheesemaking, while its leaves, a major by-product, are rich in antimicrobial and antioxidant compounds. Whey, another by-product of the cheese industry, can be used to produce biodegradable films and coatings, whose functionality can be enhanced by incorporating natural extracts. In cheesemaking, natamycin is widely applied to prevent fungal growth, but concerns over its excessive use highlight the need for safer, natural alternatives. This study aimed to evaluate the potential of whey protein-based films incorporated with cardoon leaf extract (0.5, 1.0, and 2.0 % w/v) to extend the shelf life of cheese in order to understand if it can be a substitute to natamycin. Cheeses were wrapped in the active films and stored at 5 ± 2 °C for 30 days. Samples were analysed for microbial growth, physicochemical parameters (moisture, pH, titratable acidity), and lipid oxidation. Results indicate that active films, particularly the whey protein film with 2.0 % cardoon extract, were effective in delaying microbial development in both rind and interior, presenting the lowest counts of total viable microorganisms (6.77 ± 0.52 Log CFU/g), moulds and yeasts (5.38 ± 0.12 Log CFU/g), and Enterobacteriaceae (4.26 ± 0.10 Log CFU/g) compared to control samples (untreated and without extract). The films also helped retain rind moisture and limited titratable acidity increases, indicating delayed microbial metabolism. Lipid oxidation remained at low levels, with films containing 2.0 % cardoon extract showing the strongest antioxidant effect. Overall, the incorporation of cardoon-based extracts into whey protein films demonstrated antimicrobial and antioxidant properties, contributing to improved cheese preservation during refrigerated storage. This sustainable approach reduces reliance on synthetic preservatives while valorising agro-industrial by-products.

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P200 | *PHYTOLACCA AMERICANA* L. BERRIES AS A SOURCE OF BIOACTIVE PHENOLICS FOR SUSTAINABLE USE

Cláudia S. G. P. Pereira[1*], Edite Cunha[1], Liliana Espírito Santo[1,2], Anabela S. G. Costa[1], João C. M. Barreira[3], Ana F. Vinha[1,4], M. Conceição Branco[1], Maria Beatriz P. P. Oliveira[1]

[1]LAQV/REQUIMTE, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira 228, 4050-313 Porto, Portugal; [2]Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxia e Alimentación (IAA) - CITEXV, University of Vigo, 36310 Vigo, Spain; [3]Mountain Research Centre (CIMO), ESA, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [4]FP-I3ID, Research Institute, Innovation and Development Fernando Pessoa, Faculty of Health Sciences, Fernando Pessoa University, Praça 9 Abril 349, 4249-004 Porto, Portugal. *claudia.guimaraes.pp@gmail.com

The invasion of ecosystems by non-native plant species represents a major threat to biodiversity and sustainability. *Phytolacca americana* L., commonly known as pokeweed, has been classified in Europe as an invasive species with harmful ecological impacts. Despite its invasive character, its berries are a potential source of bioactive compounds of interest to the food and pharmaceutical industries. This study aimed to characterize the polyphenolic profile of *P. americana* berries, focusing on their potential valorization in functional and sustainable applications [1]. Berry powders (0.5 g) were extracted with ethanol-water (50:50 v/v) and analyzed by HPLC-DAD under optimized chromatographic conditions [2]. The quantification targeted ellagic acid, rutin, catechin, quercetin, gallic acid, epigallocatechin gallate, and 3-*O*-methyl ellagic acid. The results revealed high levels of ellagic acid (139.95-159.04 mg/g) and quercetin (18.49-18.59 mg/g), along with relevant amounts of rutin (4.21-4.23 mg/g), gallic acid (1.37 mg/g), and catechin (0.88 mg/g). Neither epigallocatechin gallate nor 3-*O*-methyl ellagic acid were detected. These findings confirm *P. americana* berries as a rich source of phenolic antioxidants, particularly ellagic acid and quercetin, compounds well-recognized for their bioactive potential. The valorization of invasive *P. americana* through the recovery of health-promoting phytochemicals offers a dual benefit: mitigating environmental impacts while providing new sustainable ingredients for food and pharmaceutical applications.

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P201 | CHARACTERIZATION OF VOLATILE COMPOUNDS IN HONEY BY SPME-GC-MS/MS: OPTIMIZATION OF EXTRACTION

Maria Beatriz Marmelo[1], Tayse F. F da Silveira[1*], Soraia Falcão[1], Lillian Barros[1], Joana S. Amaral[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal. *tayse.silveira@ipb.pt

Honey is a natural product with a complex composition, whose aroma and flavor are mainly determined by its volatile organic compounds (VOCs). These compounds not only contribute to the organoleptic profile but also serve as important chemical markers for authenticity, thereby contributing to botanical origin discrimination and the detection of adulteration [1,2]. Solid-phase microextraction (SPME) combined with gas chromatography coupled to tandem mass spectrometry (GC-MS/MS) represents a powerful analytical approach for VOC profiling, providing sensitivity, reproducibility, and solvent-free extraction [1].

This work aimed to optimize the extraction conditions for VOC analysis in honey, including fiber selection and main extraction parameters. For this purpose, a quality control (QC) mixture was prepared by pooling different honeys (orange blossom, rosemary, chestnut, heather, lemon, eucalyptus, arbutus, acacia, thyme and multifloral honey) and used throughout the optimization study. After optimizing the chromatographic separation and establishing the best conditions regarding salt addition, ratio of sample to NaCl solution, homogenization velocity and fiber desorption time, two SPME fibers (DVB/PDMS, 65 µm, and DVB/CWR/PDMS, 50/30 µm) were compared using an incubation step of 50 ºC during 30 min. A t-Student statistical test revealed no significant differences between fibers (p = 0.6 > 0.05) regarding total chromatographic area and number of detected peaks. Despite this statistical equivalence, the triple fiber (DVB/CWR/PDMS) was selected due to its broader efficiency reported in the literature and its capacity to retain a wider range of chemical classes.

A central composite rotatable design (CCRD) was applied to further optimize extraction conditions by systematically evaluating incubation temperature (30–70 °C) and extraction time (5–40 min). The results indicated that higher extraction efficiencies were achieved at elevated temperatures, particularly at 63.9 °C and 70 °C, as evidenced by an increased number of peaks and greater total chromatographic area. Based on these findings, the optimal conditions using the DVB/CWR/PDMS fiber were defined as 40 min of extraction at 70 °C, followed by 2 min of thermal desorption, using a ratio of 1:1 sample to NaCl solution. The developed methodology will be applied to the analysis of Portuguese monofloral honey samples, aiming to obtain robust and reproducible VOC profiles for honey characterization, with potential applications in authenticity control and quality assessment.

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P202 | OPTIMIZATION OF MICROWAVE-ASSISTED EXTRACTION OF PHENOLIC COMPOUNDS FROM YERBA MATE (*ILEX PARAGUARIENSIS* A. ST.-HIL.)

Mariane de Paula Souza[1,2], Rafael Mascoloti Spréa[1,2], Bianca Albuquerque[1], Tayse F. F. da Silveira[1], Lillian Barros[1], Marinês Corso[2], Ângela Fernandes[1*], Joana S. Amaral[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]Departamento Acadêmico de Alimentos, UTFPR, Av. Brasil, 4232, Parque Independência, 85884-000, Medianeira, Brasil. *afeitor@ipb.pt

Yerba mate (*Ilex paraguariensis* A. St.-Hil.) is widely consumed in South America and is recognized as an important source of phenolic compounds, particularly chlorogenic acids, which are associated with antioxidant, anti-inflammatory, and antimicrobial activities [1,2]. In this context, the present study aimed to optimize the microwave-assisted extraction (MAE) of phenolic compounds from yerba mate leaves by evaluating the effect of three independent variables: power (W), extraction time (min), and solvent ratio (ethanol:water, %). A central composite rotatable design (CCRD) coupled with response surface methodology (RSM) was employed. The experimental design comprised 28 runs with varying combinations of power (50 to 1000 W), extraction time (1 to 20 min), and solvent percentage (0-100% ethanol). The evaluated responses included the contents of total phenolics (TPC), 3-caffeoylquinic acid, and 3,5- dicaffeoylquinic acid determined by HPLC-DAD-ESI-MS/MS, and antioxidant activity assessed using the TBARS assay. The polynomial models showed a good fit to the experimental data, enabling the determination of the optimal extraction conditions. The results indicated that power exerted a significant negative effect on the responses, whereas solvent percentage was the most influential factor in extraction efficiency. The global optimal conditions predicted by the model were 50 W of power, 13 minutes of extraction, and 3% ethanol solvent. Under these conditions, the model predicted values of approximately 360 mg/g extract for TPC, 74 mg/g for 3-caffeoylquinic acid, 78 mg/g for 3,5-dicaffeoylquinic acid, and an EC_{50} of 1.39 µg/mL for antioxidant activity. The optimization of MAE proved to be an effective strategy to maximize the recovery of bioactive phenolic compounds from yerba mate, reinforcing its potential as a natural source of functional ingredients for the food and pharmaceutical industries. These findings highlight the relevance of optimization methodologies, contributing to enhanced efficiency and sustainability at the industrial scale.

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P203 | MOLECULAR IDENTIFICATION OF BALKAN *SALVIA* SPECIES AND VALORIZATION OF *SALVIA NEMOROSA* INFLORESCENCES FOR FUNCTIONAL FOOD APPLICATIONS

Dejan Stojković[1]*, Jelena Božunović[1], Uroš Gašić[1], Tijana Banjanac[1], Branislav Šiler[1], Mladen Rajaković[1], Ana Stupar[1], Marina Soković[1], Yang Ye[2], and Danijela Mišić[1]

[1]Institute for Biological Research "Siniša Stanković", National Institute of the Republic of Serbia, University of Belgrade, Bulevar despota Stefana 142, 11000 Belgrade, Serbia; [2]State Key Laboratory of Drug Research and Department of Natural Product Chemistry, Shanghai Institute of Materia Medica, Chinese Academy of Sciences, 555 Zu-Chong-Zhi Road, Zhangjiang Hi-Tech Park, Shanghai 201203, China. *dejanbio@ibiss.bg.ac.rs

The genus *Salvia* includes numerous species traditionally used in food and herbal preparations due to their aromatic, medicinal, and preservative properties. Accurate identification of *Salvia* taxa is essential to ensure safe use and to trace bioactive compounds relevant for functional food applications. Traditional taxonomy, based primarily on morphological traits, often lacks precision for distinguishing closely related species. In this study, molecular barcoding combining plastid DNA markers (*matK*, *trnL-F*, *rbcL*, *psbA-trnH*) was applied to six *Salvia* taxa commonly found in the Balkan region: *S. nemorosa*, *Salvia nemorosa* × *pratensis* (hybrid), *S. pratensis*, *S. verticillata*, *S. aethiopis*, and *S. officinalis*. The obtained sequences were integrated with publicly available data to clarify taxonomic boundaries, providing a reliable genetic basis for further food and nutraceutical research.

Building on the molecular characterization, *S. nemorosa* was evaluated for its potential as a source of bioactive ingredients relevant to food and health. Inflorescences were extracted using different solvents, yielding 14 extracts with diverse chemical profiles and biological properties. Extraction yields ranged from 3.03% to 15.75%, with epigallocatechin gallate and rosmarinic acid as dominant constituents. Most extracts were non-cytotoxic to HaCaT human keratinocytes, confirming their safety for potential use in food-related applications. Butanol extraction enhanced wound healing potential, while combined ethanol-water extraction produced the highest antioxidant activity, attributed to its high polyphenol content. Furthermore, butanol extracts exhibited strong inhibition of enzymes linked to type 2 diabetes and demonstrated potent antimicrobial and antibiofilm effects, including over 90% inhibition of *Staphylococcus lugdunensis* biofilms. The most active extract also reduced bacterial adhesion to keratinocytes and showed immunomodulatory properties, with the antibacterial mechanism linked to moderate membrane disruption and reduced bacterial mitochondrial activity.

This integrated study highlights the dual importance of accurate molecular identification and functional profiling of *Salvia* species for food and nutraceutical innovation. *S. nemorosa* inflorescences were shown to be a valuable source of polyphenol-rich extracts with potent antioxidant, antidiabetic, and antimicrobial activities. These findings support the potential of Balkan *Salvia* species for the development of natural additives, functional foods, and health-promoting products, while ensuring authenticity and safety through robust molecular authentication.

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P204 | APPLE POMACE – AN INGREDIENT OF A FUNCTIONAL FOODS – RESEARCH TRENDS AND APPLICATIONS

Monika Kalinowska[1,2*]

[1]Department of Chemistry, Biology and Biotechnology, Bialystok University of Technology, Wiejska 45E, 15–351 Bialystok, Poland. [2]natureTECH, Centre of Natural Product Research, Bialystok University of Technology, Wiejska 45E, 15–351 Bialystok, Poland. *m.kalinowska@pb.edu.pl

Apple pomace, a by-product of apple processing, has gained significant attention in recent years as a valuable ingredient in the development of functional foods. Rich in dietary fiber, polyphenols, vitamins, and other bioactive compounds, apple pomace presents promising potential for enhancing the nutritional and health-promoting properties of various food products. Recent research trends in the utilization of apple pomace, with particular focus on its antioxidant, anti-inflammatory, and prebiotic effects will be presented. Moreover, current applications in bakery products, dairy alternatives, beverages, and meat analogues are analyzed, highlighting both functional benefits and sensory challenges. Advances in processing technologies, such as drying, fermentation, and microencapsulation, are also discussed as methods to improve the stability and bioavailability of active compounds in apple pomace. The growing interest in sustainable food systems and circular economy further positions apple pomace as a key ingredient in next-generation functional foods. It will provide a comprehensive overview of the state of the art, identify research gaps, and propose future directions for the application of apple pomace in food innovation.

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P205 | NUT PROCESSING BY-PRODUCTS AS SOURCES OF NUTRIENTS AND BIOACTIVES: RISKS, CHALLENGES, AND VALORIZATION STRATEGIES

Alexandra Ferreira[1], Inês Amaro[1], Fernando Ramos[1,2], Ana Sanches Silva[1,3,4*]

[1]University of Coimbra, Faculty of Pharmacy, Health Sciences Campus, Azinhaga de St. Comba, 3000-548 Coimbra, Portugal; [2]REQUIMTE/LAVQ, Health Sciences Campus, Azinhaga de St. Comba, 3000-548 Coimbra, Portugal; [3]Centre for Animal Science Studies (CECA), University of Porto, 4501-401 Porto, Portugal; [4]Associate Laboratory for Animal and Veterinary Sciences (Al4AnimalS), 1300-477 Lisbon, Portugal. *asanchessilva@ff.uc.pt

The industrial processing of nuts commonly involves the removal of outer layers such as skins or peels, producing substantial amounts of by-products that are often underexploited. Rather than being considered waste, these materials present valuable opportunities for promoting sustainability and circular practices within the agri-food chain. In Portugal, the most relevant nuts include almonds (*Prunus dulcis* Mill. D. A. Webb, walnuts (*Juglans regia* L.), chestnuts (*Castanea sativa* Mill), and acorns (*Quercus rotundifolia* Lam.; *Quercus ilex* L.). Proper valorization of their shells and other residues requires specialized analytical and extraction techniques to characterize and recover bioactive constituents with antioxidant, antibacterial, anticancer, and prebiotic properties, among others.

The primary aim of this study was to compile the most valuable information on recent scientific literature regarding the by-products of these nuts in terms of their nutrients, bioactive compounds and possible contaminants in order to evaluate their potential for various applications. Special attention was given to precautions required to guarantee both the effectiveness and the safety of the new products. Nut by-products are rich sources of structurally diverse compounds. Almond hulls contain high levels of chlorogenic, cryptochlorogenic, and neochlorogenic acids. The almond's hard shell peel is particularly abundant in cellulose, hemicellulose, and lignin, highlighting its potential for structural or material-based applications. Meanwhile, the almond skin is a source of flavonoids such as quercetin-3-*O*-galactoside, catechin, and naringenin, which possess potent antioxidant activities. Such compositional diversity supports both health-related and technological applications.

Nonetheless, the degree of available information varies greatly among nut by-products. While almonds, chestnuts, and walnuts have been extensively studied, providing a robust basis for conclusions, data on acorn shells, acorn cupules, and chestnut skins remain scarce, limiting our understanding of their components and possible uses. Additionally, research on antinutritional compounds in nuts is still limited and underestimated, demanding further attention.

Comparative studies suggest variability in bioactive potential among different nuts, depending on factors such as genotype, environmental conditions, and methodological differences across studies. Some evidence indicates chestnuts as particularly rich in total phenolics, whereas other reports highlight higher levels in walnuts. This inconsistency emphasizes the need for standardized methods and varietal identification to draw reliable conclusions.

Altogether, advances in nut by-product valorization point toward multiple sectors including pharmaceuticals, cosmetics, food packaging, adhesives, and even environmental applications. By fully exploiting the composition and bioactive richness of nut residues, the agri-food sector can move closer to circularity, reducing waste and fostering innovation for a more sustainable future.

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P206 | CITIZEN SCIENCE AS AN INNOVATION DRIVER FOR FOOD SYSTEM MONITORING: INSIGHTS FROM A PILOT FOCUS GROUP STUDY

Sofia G. Florença[1*], Ana Luísa Amaral[2], Filipa P. Costa[1*], Cristina A. Costa[1]

[1]CERNAS-IPV Research Centre, Polytechnic University of Viseu, Campus Politécnico, Repeses, 3504-510 Viseu, Portugal; [2]ESAV - Agrarian School, Polytechnic University of Viseu, 3504-510 Viseu, Portugal. *filipa.pereira@esav.ipv.pt

Technological innovation and participatory methodologies are key to transform food systems towards sustainability and resilience. Citizen science (CS) – the active involvement of citizens in scientific research – emerges as a powerful approach to connect technological tools, societal engagement, and evidence-based decision-making. This pilot study explored the perceptions of university students toward CS and the food system, as a first step in designing a digital citizen science tool for food system monitoring in Portugal.

A focus group was conducted with six students from agriculture, nursing, and social education from the Polytechnic University of Viseu. Although none had prior experience with CS, participants identified knowledge generation and social change as main motivators for participation in collaborative projects. Regarding the food system, the participants highlighted major challenges such as unhealthy diets, low food and health literacy, economic barriers and limited access to healthy foods. Proposed solutions included clearer food labelling, support for local food production and low-income population and intersectoral awareness campaigns. Some of the suggested solution can be achieved through the development of CS projects and digital tools aimed to strengthen public participation and data collection.

Findings demonstrate the potential of CS as a driver of technological and social innovation within the food sector. Integrating digital citizen science platforms with food system monitoring could enhance data accessibility, foster community-driven solutions, and support policy design aligned with sustainable and healthy diets. This study reinforces the value of co-created approaches in the transition toward intelligent and inclusive food systems.

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P207 | DIABETES PROTEIN TARGET DATABASE (DPTD): A REFERENCE LIBRARY FOR METABOLIC PROTEIN TARGETS

Carlos S. H. Shiraishi[1,2], Arthur B. Taques[1], Eduardo Carvalho Nunes[3], Miguel A. Prieto[2*], Sandrina A. Heleno[1], Rui M. V. Abreu[1]

[1]CIMO-ESA, Instituto Politécnico de Bragança, Campus de Sta Apolónia, Apartado 1172, 5301-855 Bragança, Portugal; [2]Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Faculty of Science, E-32004 Ourense, Spain; [3]Department of Engineering, University of Trás-os-Montes and Alto Douro 5000-801, Vila Real, Portugal. *shiraishi@ipb.pt

The Protein Target Database (DPTD) is a scientific platform developed to provide a curated library of 29 reference human proteins (Figure 1) with central roles in glucose homeostasis, insulin signaling, and energy metabolism. Unlike general-purpose repositories, the PTD offers a focused and integrated resource, where each protein entry combines structural and functional data, prepared for seamless use in molecular docking, virtual screening, and computational workflows. The library includes key enzymes (α-amylase, α-glucosidase, GCK, HK2, FBP1, PYGL), signaling regulators (PTP1B, PI3K, AKT1, GSK-3β, AMPK, mTOR, PIN1, PDK2, PDK4), transporters and receptors (GLUT1, IR, GCGR, SLC37A4, PPARγ), as well as additional modulators such as 17β-HSD, STLG-2, GAPDH, AKR1B1, FKBP51, and monooxygenases.A distinctive feature of the PTD is its concentrated availability of validated antidiabetic protein targets, covering the entire axis of glycemic regulation: from digestive enzymes involved in carbohydrate hydrolysis, to proteins in the insulin signaling cascade, membrane receptors, and metabolic modulators directly implicated in insulin resistance, hyperglycemia, and associated complications. This specialized curation ensures that researchers can access, within a single repository, the principal targets explored in the development of drugs and bioactive ingredients against diabetes. By consolidating these validated targets into a structured and interactive resource, the DPTD facilitates rational investigation of molecular mechanisms, accelerating the discovery of inhibitors, bioactive compounds, and functional ingredients. The platform was designed to be intuitive, scientifically robust, and easily integrable into computational pipelines, while remaining adaptable to future needs. Progressive updates will expand both the number of proteins and the range of functionalities offered, reinforcing DPTD as an essential and evolving reference tool for research in drug discovery, biotechnology, and molecular sciences.

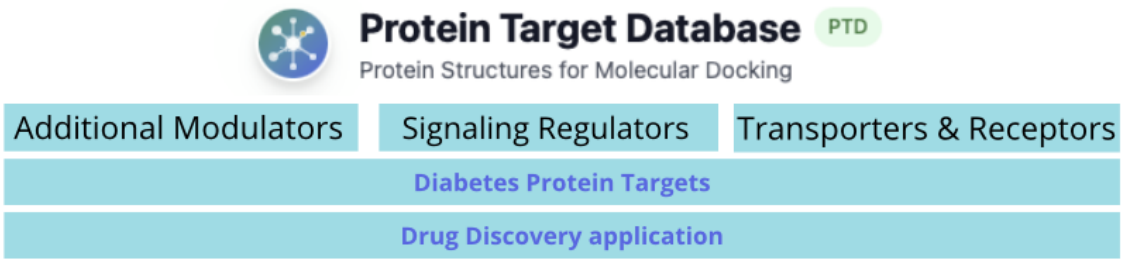

Figure 1 – Layout for Protein Target DataBase (PTD).

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P208 | SKILLS GAPS AND INNOVATION NEEDS IN INDUSTRIAL FOOD PROCESSING: EVIDENCE FROM PORTUGAL'S PERMANENT SKILLS OBSERVATORY

Joana Solinho[1,2*], Ricardo Pereira-Pinto[1,2], Ana Paula Vale[2], Rita Pinheiro[1,2]

[1]School of Technology and Management, Polytechnic Institute of Viana do Castelo, Viana do Castelo, Portugal; [2]Center for Research and Development in Agrifood Systems and Sustainability (CISAS) of the Polytechnic Institute of Viana do Castelo, Viana do Castelo, Portugal. *jsolinho@ipvc.pt

The industrial food processing sector is undergoing rapid transformation, driven by technological innovation, sustainability demands, and evolving food safety regulations. Addressing these challenges requires a comprehensive understanding of both current and future workforce skill needs [1]. Evidence highlights that bridging competency gaps, particularly in digital literacy, sustainability and entrepreneurship is essential for strengthening sector resilience and accelerating the transition towards more circular and sustainable food systems [2]. Anticipating and recognising skills gaps is therefore critical for fostering innovation and sustainable growth in the food industry.

This study presents findings from a permanent observatory focusing on the evolving needs of students and employees in industrial food processing in Portugal. The objective was to identify training, technology and sustainability gaps among students and employees, providing evidence to inform targeted educational and organisational strategies for sector advancement.

Among students, 61.1% reported receiving some training food processing training, while 38.9% had none, underscoring the urgency of more inclusive educational pathways. Although sustainability awareness is generally high (88.9%), only 27.8% described themselves as "very aware", pointing to the need for deeper engagement with sustainable practices. Although 94.4% recognised the importance of entrepreneurship in tackling food waste, only 16.7% had considered launching a business, suggesting untapped potential in entrepreneurial education. Digital readiness remains limited, with 55.6% only "somewhat familiar" with digital tools. Interest in waste reduction strategies, especially side-stream creation (61.1%), align well with current circular economy trends but require broader adoption.

Among employees, regulatory challenges were less pronounced (16.67%) but still requiring occasional localised improvements. Digital tools for waste monitoring were moderately used (66.7%), yet only one-third adopted real-time solutions, underscoring the need for greater digital transformation. Lack of structured waste reduction training was evident (16.7%), while strong collaboration on circular economy initiatives was observed (83.3%). However, resilience measures require better metrics and quantification, as only half of the employees quantifying their waste output.

Overall, the findings emphasise the pressing need for practical training, digital upskilling, and enhanced focus on entrepreneurship and sustainability. Closing these gaps will foster a more resilient, innovative, and future-ready industrial food processing sector, supporting the long-term goals of circularity and sustainability.

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