

Book of Abstracts

Innovation in Mediterranean Traditional Foods: Novel Products and Processes

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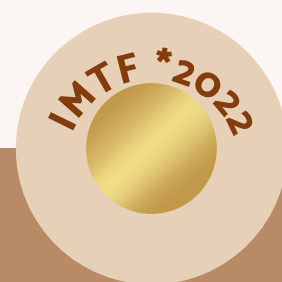
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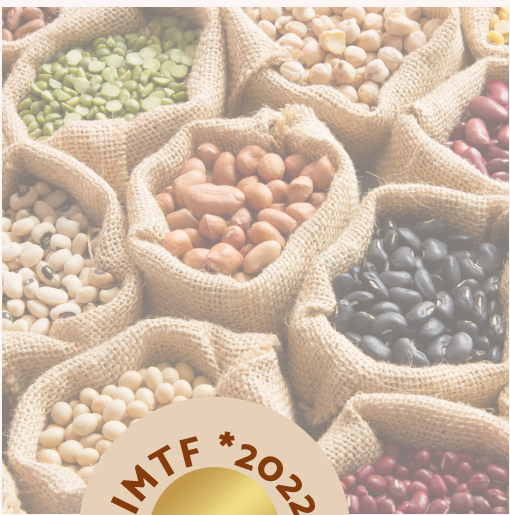
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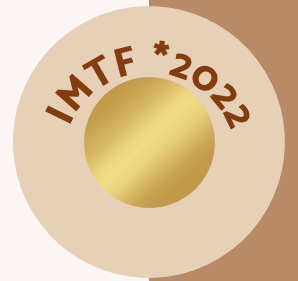
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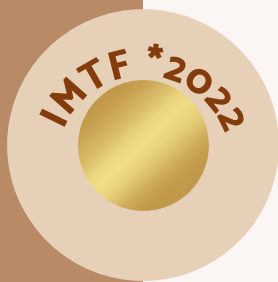






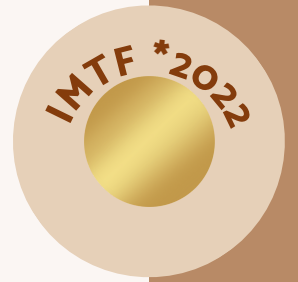
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(Fraunhofer Gesellschaft Zur Forderung Der Angewandten Forschung EV, Germany)
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- **Valerie Gagnaire**
(Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement, France)
- **Cristina Alamprese**
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ABOUT

The Mediterranean diet involves a set of skills, knowledge, rituals, symbols and traditions concerning crops, harvesting, fishing, animal husbandry, conservation, processing, cooking, and particularly the sharing and consumption of food. Food is key but does not stand alone. Hence, how can we innovate in mediterranean traditional foods, introducing new products, and process, and still maintain our intangible cultural heritage of (for) humanity? This international conference brought together researchers, industry, professionals, and consumers to share innovative ideas in this field and share results from the research and innovative work being developed across the Mediterranean region with a special focus on the development of:

- Innovative plant-based dairy analogues;
- Plant and nut-based flours and development of bakery products and pasta;
- Innovative added-value traditional ready-to-eat meals.

The IMTF - 2022 team would like to thank you for your application to the congress, contributing to its success. The submitted works were received, processed, divided into two main categories (Oral Communications and Posters), and later distributed according to the aforementioned topics. In total, 19 Oral and 24 Panel Communications were presented, joined by 6 Keynotes and 3 Plenary lectures. Once again, we would like to thank you all for attending our congress, and we hope to see you again at future research events.

The IMTF team.



PLENARY/KEYNOTES INFORMATION



Innovative plant-based dairy analogues

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Andrea Hickisch

Dr. Andrea Hickisch has extensive experience in the fermentation of plant-based raw materials both for the production of dairy alternatives and in the use of starter cultures for the production of fermented dairy alternatives. Ms Hickisch completed her doctoral thesis in this field in 2020. Since 2020, she has been a group leader at the Fraunhofer IVV for fermented foods. In this role, Ms Hickisch coordinates and works on national and international research projects such as, in which various plant-based raw materials are fermented to produce sensorially attractive products.



Gwénaél Jan



Dr. Gwénaél Jan is a senior research scientist working at the French National Institute for Agricultural Research (INRAE). He dedicates his scientific career to the microbiology of fermented foods, with a particular interest in “2-in-1” bacteria, which exhibit both technological and probiotic abilities. He originally studied Microbiology, as well as Molecular and Cell Biology, up to a PhD in science, in The French University of Rennes. He then moved to the Institute of Medical Sciences in Aberdeen, Scotland, for a Post-Doc in Human Cell Biology. Being interested in both Microbiology and Human Cell Biology, he joined INRAE to work on interaction between food beneficial bacteria and human cells. His research activity, in collaboration with French and international academics, stakeholders, and technical centers, focuses on both probiotic and technological abilities of beneficial bacteria found in fermented food products. Mining this biodiversity revealed the ability, in selected strains of such bacteria, to modulate key parameters of human physiology such as proliferation, differentiation, apoptosis, inflammation and mucosal immunity. This exciting field of research opens new perspectives for the development of functional fermented foods for target populations.

Innovative plant-based dairy analogues

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Guillaume Moreau



An Engineer by training, Guillaume Vannier Moreau joined the company La Mandorle, chaired by Arnaud Vannier Moreau, more than 10 years ago. His missions were essential to integrate the production methods (vegetable drinks and infant formulas) in the Sablé sur Sarthe factory, and to ensure the development of various innovation projects in the field of vegetable nutrition for adults, babies and athletes. He is currently Managing Director of the company.

Dr. Valérie Gagnaire is a senior researcher, based at INRAE, UMR1253 INRAE institut Agro, Science et Technologie du Lait et de l'Œuf, at Rennes in France. Her general research area relates to the biochemistry of milk proteins and their hydrolysis, i.e. proteolysis, through the action of milk endogenous enzymes or enzymes from lactic acid bacteria, and led to over 55 scientific publications. Her current research topics aim to understand how lactic acid bacteria can be associated to functionalize hard-type cheeses and matrices that mix milk with legumes and/or nuts in terms of texture, nutritional and health benefits. A peculiar aspect concerns the proteolytic enzymes and especially those from lactic acid bacteria involved in texture quality and biological activities of various dairy and mixed matrices. This will make possible to establish relationships between the in-situ proteolysis and the changes in structure of these matrices during transformation process and to design the proteolysis at long-term perspectives to ensure the required techno-functional and health properties in a context of global food transition.



Plant and nut-based flours and development of bakery products and pasta

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Cristina Alamprese



Cristina Alamprese (PhD in Food Biotechnology) is an associate professor in Food Science and Technology at the Department of Food, Environmental and Nutritional Sciences (DeFENS) of the University of Milan. Her research activity covers mainly the optimization of food formulations and processing conditions; the technological, rheological, mechanical, and ultrastructural characterization of ingredients and food products; the application of NIR and MIR technology in the food sector, especially for food authentication and process control; the modelling of phenomena by using Design of Experiments techniques and uni- and multivariate statistical methodologies. She has been involved in many national and international projects as responsible of research units and participant, and she has been the principal investigator of several research activities funded by food factories and industrial associations. She is the author/co-author of 77 publications indexed in Scopus, with more than 1700 citations and an h-index of 23. She is the Scientific Head of the library of the Agricultural and Food Sciences Faculty, the Quality Assurance Manager of DeFENS, member of the teaching board of the PhD school in Food Systems of the University of Milan, and the chairperson of the working group WG4 of WPSA (Quality of eggs and egg products).



Plant and nut-based flours and development of bakery products and pasta

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Elisabete Ferreira



CEO of Imperativo Estrategico and Pão de Gimonde, Elisabete Ferreira is an entrepreneur that has been managing the family business for years. Thanks to her academic qualifications and constant management skills upgrading, she has successfully led the company to a sustainable growth based on innovation built upon the traditional products know how that her family has developed for decades. Passionate about the art of bread and bakery, she made and continues to undergo training at the Richemont School in Lucerne, in bakery, sourdough, learning the importance of processes, in the preparation of tasty, sustainable, healthy bread. President of Portugal Richemont Club, member of International Richemont Club.

Sibel Uyar

Born in İzmir in 1971, Sibel Uyar is the founder and head of the Urla women's producer cooperative. She has graduated from Egean University Department of Food Engineering, and she also holds a college of Justice and a master's degree in political science and international relations. Sibel Uyar was a city council member between 2009 and 2014. From 2014 to 2019 she was the Mayor of Urla and the United Cities of Local Government's representative of the union of municipalities of Turkiye.



Innovative added-value traditional ready-to-eat meals

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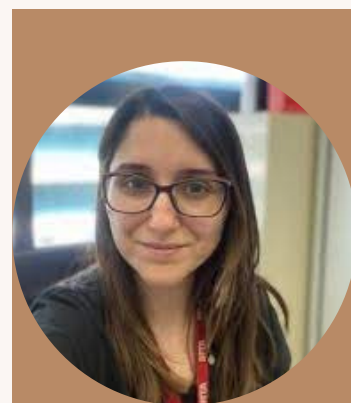
Ana Novo Barros



Ana Novo Barros is an Assistant Professor with Habilitation from the University of Trás-os-Montes e Alto Douro and a researcher from the Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB) and of Institute for Innovation, Capacity building and Sustainability of Agri-Food production (Inov4Agro). She is also 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, with an ultimate goal to extract high added-value molecules and re-use them in the food chain. In the last years, was awarded with several prizes and distinctions. Has published more than 100 scientific documents, including research articles, reviews and editorials, within the highest impact factor journals in the Food Science and Technology field (25 h-index, SCOPUS). She is the coordinator from the European project WATELESS|TOPIC ID: HORIZON-CL6-2022-FARM2FORK-01-08.

Ingrid Aguiló-Aguayo

Dr. Ingrid Aguiló is a Ramón y Cajal researcher in the Research group of Processed Fruits and Vegetables that belongs to the Postharvest Program of IRTA in Lleida. She has a PhD in Agricultural Engineering from the University of Lleida specialized in the field of new technologies for the processing of plant-based foods. She carried out different postdoctoral stays in international centres such as INRA (France) and Teagasc (Ireland). She is closely linked to projects focused on the valorisation of surpluses or co-products of the fruit and vegetable chain through the development of new ingredients that allow their integration into the food value chain. Among the different projects managed, the EU-Agrimax project stands out, in which different by-products from the tomato, cereal and olive industry have been valued, obtaining valuable food ingredients. Few years ago, she began the exploration of new sources of protein through the exploration of legumes and microalgae and their incorporation into the reformulation of foods. She is currently the coordinator of an EU-PRIMA (LOCALNUTLEG) project that explores the legumes and nuts of the Mediterranean region to develop products of high nutritional and gastronomic value rich in protein.



Innovative added-value traditional ready-to-eat meals

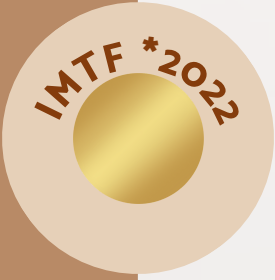
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Ram Reifen



Ram Reifen currently works at the School of Nutritional Sciences, Hebrew University of Jerusalem. Ram does research in Gastroenterology, Nutritional Biochemistry and Pediatrics. New projects include microRNA in breast milk minerals in breast milk, allergy to milk and more. Alongside the basic science research Ram is the Founder of Chick.P which is a start up focusing on production of high-quality isolate of protein from Chickpea with a neutral taste and odor.







SCHEDULE





Schedule

OCTOBER 13TH, MORNING

9:00-9:30	OPENING SESSION Andrey Romanenko (CEO of MORE - Laboratório Colaborativo Montanhas de Investigação) Lillian Barros (CIMO-IPB Vice-Coordinator-IMTF Conference Chair)
9:30-13:00	SECTION 1: INNOVATIVE PLANT-BASED DAIRY ANALOGUES CHAIRS: Luís Pinto and Manuel Ayuso Vilaboa
9:30-10:00	PLENARY SESSION 1 Andrea Hickisch - IVV (DE) Process development of milk alternatives based on plant raw materials
10:00-10:30	KEYNOTE SESSION 1 Gwénaél Jan and Valérie Gagnaire - INRAE (FR) Using bacterial starters to develop fermented innovative plant-based dairy analogues
10:30-11:00	ORAL SESSION 1
10:30-10:45	Catarina Vila Real - UCP (PT) Plant-based cheese-type analogues: a review on nutrition and functional challenges
10:45-11:00	Martinha Costa - Yogan Creamery (PT) Challenges in the fermentation and aging of vegan cheeses
11:00-11:15	DISCUSSION PANEL
11:15-11:45	COFFEE BREAK AND POSTER SESSION
11:45-12:15	KEYNOTE SESSION 2 Guillaume Vannier Moreau - LA MANDORLE (FR) High Nutritional Value of instant vegetal drink
12:15-12:45	ORAL SESSION 2
12:15-12:30	Oren Shelef - ARO (IL) Evaluation of <i>Malvaceae</i> species and other wild plants as novel food: lessons for innovative traditional meals
12:30-12:45	DISCUSSION PANEL
12:45-14:30	LUNCH TIME

Schedule

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OCTOBER 13TH, AFTERNOON

14:30-18:00

SECTION 2: PLANT AND NUT-BASED FLOURS AND DEVELOPMENT OF BAKERY PRODUCTS AND PASTA

CHAIRS: Sandrina Heleno and Márcio Carochó

14:30-15:00

PLENARY SESSION 2

Cristina Alamprese - UMIL (IT)

Legume and nut flours in bakery products and pasta production: challenges and opportunities

15:00-15:30

KEYNOTE SESSION 3

Elisabete Ferreira - PÃO DE GIMONDE (PT)

Innovation in bakery: an opportunity for sustainability

15:30-16:00

ORAL SESSION 3

15:30-15:45

Maria Beatriz Oliveira - FFUP (PT)

Cladodes flour – an innovative ingredient for traditional Mediterranean bakery products

15:45-16:00

Ilgin Dogruer - IZTECH (TR)

Properties of pre-cooked and germinated chickpea flours and gluten-free cookies baked

16:00-16:30

COFFEE BREAK AND POSTER SESSION

16:30-17:00

KEYNOTE SESSION 4

Sibel Uyar - UKKOOP (TR)

Artichoke meatball and chickpea flour cookies

17:00-17:30

ORAL SESSION 4

17:00-17:15

Ayca Tuna - IZTECH (TR)

Legume and nut-based flours with fruit powders in sponge cakes: Spectroscopic and textural properties

17:15-17:30

Maria Helena Gomes - COLAB4FOOD (PT)

Mediterranean traditional snacks with a twist to meet consumer needs

17:30-17:45

DISCUSSION PANEL

20:00

SOCIAL DINNER



Schedule

OCTOBER 14TH, MORNING

9:00-12:00

SECTION 3: INNOVATIVE ADDED-VALUE TRADITIONAL READY-TO-EAT MEALS

CHAIRS: Cristina Caleja and Eliana Pereira

9:00-9:30

PLENARY SESSION 3

Ingrid Aguiló-Aguayo - IRTA (SP)

Legumes and nuts: an innovative and healthier option for daily ready-to-eat foods

9:30-10:00

KEYNOTE SESSION 5

Ram Reifen - CHICKP (IL)

Leveraging traditional crops for better nutrition and health - the case of chickpea

15:30-16:00

ORAL SESSION 5

10:00-10:15

Hernandez-López Israel - IRTA (SP)

Incorporating microalgae and chickpea protein isolate for a healthier 3D food printed product

10:15-10:30

Rafaela Geraldo - UPC (PT)

Lentil-based snack: development and nutritious properties

10:30-10:45

DISCUSSION PANEL/ BEST POSTER AWARD

Ricardo Malheiro (CEO of ReadyToPub)

10:45-11:15

COFFEE BREAK AND POSTER SESSION

11:15-11:45

KEYNOTE 6

Ana Barros - CITAB/Mesosystem (PT)

New approaches for the development of alternative foods based on vegetable and ocean sources

11:45-12:00

CLOSING SESSION

Alexandre Gonçalves (MORE- Innovation Diretor - IMTF Conference Chair)

Luís Pais (Vice President of IPB)

Isabel Ferreira, Secretary of State for Regional Development



PLENARY SESSION





Plenary Session

- | | |
|--|----|
| PS-01: Process development of milk alternatives based on plant raw materials
Andrea Hickisch | 16 |
| PS-02: Legume and nut flours in bakery products and pasta production: challenges and opportunities
Cristina Alamprese | 17 |
| PS-03: Legumes and nuts: An innovative and healthier option for daily ready-to-eat foods
Ingrid Aguiló-Aguayo | 18 |

Process development of milk alternatives based on plant raw materials

Andrea Hickisch^{1*}, Andreas Stäbler¹

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*andrea.hickisch@ivv.fraunhofer.de

The market for dairy alternatives is becoming increasingly diverse and is steadily growing. According to estimates, the global market volume of dairy alternatives will reach approx. 34.6 billion USD by 2029, which is double the amount in comparison to 2019 (Statista 2022). Milk alternatives still have the largest share of this category (GFI, 2022). It is therefore of great importance to continuously search for local, underestimated and hitherto unused varieties and to investigate their suitability for the development of milk alternatives.

Different Mediterranean legumes and nuts, such as common bean, fava bean, lentil and chickpea, as well as almond and hazelnut, of high nutritional value were selected for this study. The peeled legumes were processed in such a way so that the main components of the legumes, the protein and starch, could be extracted, while undesired coloured and aroma-intensive substances were removed. This was achieved by soaking, fine grinding, emulsifying and starch gelatinization and hydrolysis. The nuts were processed with a wet and dry procedure. The soaked or dried nuts were grinded, emulsified, separated from solid particles and formulated into drinks.

Milk analogues with different compositions, sensory profiles and particle sizes were obtained. This study contributes to the extension of the product portfolio of milk alternatives based on different raw materials. The next step will be to develop fermented products, such as yoghurt and cheese alternatives, from these milk alternatives.

Keywords: Milk alternatives; Legumes; Nuts

Legume and nut flours in bakery products and pasta production: Challenges and opportunities

Cristina Alamprese^{1*}, Valeria Imeneo¹, and Carola Cappa¹

¹DeFENS, Department of Food, Environmental and Nutritional Sciences, University of Milan, Milan, Italy.

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Bakery and pasta products are staple foods consumed all over the world, thus they represent ideal systems for enrichment with functional ingredients to meet the growing consumers' demand for products with enhanced nutritional properties. Legume and nut flours, rich in proteins and fiber and gluten-free, are well suited to improve nutritional value of pasta and bakery products while reducing possible adverse reactions to gluten-forming proteins. The successful application of these plant flours in new bakery and pasta product design mainly depends on their technological functionalities (e.g., emulsifying, gelling, whipping, water absorption properties, oil binding capacity, etc.), which greatly affect structural properties of the end products. Besides the botanical origin, other important factors (e.g., protein hydrophobicity and structural flexibility; system pH and ionic strength; chemical, enzymatic, and physical treatments) can affect techno-functionality. The presentation gives an overview of the recent scientific literature about these aspects, focusing especially on technological treatments that can modify legume and nut flour properties. Moreover, results on the technological functionalities of legume and nut flours from the Mediterranean area will be shown (i.e., chickpea, lentil, pea, almond, chestnut, and hazelnut flours) with the aim of valorizing each flour for specific applications.

Keywords: Legume flour; Nut flour; Bakery products; Pasta; Techno-functionality

Legumes and nuts: An innovative and healthier option of daily ready- to-eat foods

Ingrid Aguiló-Aguayo^{1*}

¹IRTA, Postharvest Programme, Parc Científic i Tecnològic Agroalimentari de Lleida, Parc de Gardeny, Edifici Fruitcentre, 25003, Lleida, Catalonia, Spain.

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Dietary habits of population have been changing during the last decades for the strong growth in vegetarianism or the high demand of plant-based meat analogs having a significant impact in the development of prepared plant food and the increase of launching products to cover metabolic diseases and allergies such as lactose and gluten intolerance or cow's milk protein allergy. In view of this growing demand, the development of innovative food products or the re-design of traditional recipes and ingredients in order to satisfy consumer demand has led to explore alternative-protein and plant-based products. In this sense, the nuts and legumes have a high proportion of fat and protein content being potentially explored as raw vegetable ingredients for different food categories including high-protein meals, meat and sea analogues or other alternative ready-to-eat products. This presentation will revise some of the ready-to-eat launches in the market made with legumes and nuts and present some insights and drawbacks of the future of these alternative proteins.

Keywords: Legumes; Nuts; Alternative protein; Plant-based; Ready-to-eat products





KEYNOTE SESSION





Keynote Session

- KS-01: Using bacterial starters to develop fermented innovative plant-based dairy analogues** 22
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Guillaume Vannier Moreau
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- KS-05: Leveraging traditional crops for better nutrition and health - The case of chickpea** 26
Ram Reifen
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Using bacteria starters to develop fermented innovative plant-based dairy analogs

Gwénaél Jan^{1*} and Valérie Gagnaire¹

¹INRAE Institut Agro, Science et Technologie du lait et de l'Œuf, Rennes, France.

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Fermentation has been used for millennia to preserve edible raw materials from animal or plant origin. This process of transformation has renewed interest with the emergence of crucial need for new ways to fulfill the current food transition. Actually, food production has to be more sustainable, i.e. minimally processed, address ethical concerns and have to reduce negative impact on the environment. Moreover, food products should be safe, healthy and good in order to reach customers' demands. In line with this, less animal-sourced products, and more plant-based one, are used. Fermentation of plant-based dairy substitutes offers a promising perspective, as fermentation is well known to confer not only hedonic, hygienic properties, but also health benefits, through bacteria probiotic properties, to fermented dairy products. In this presentation, we will focus on the challenges that have to be faced to select appropriate bacteria and to combine them to develop fermented innovative plant-based dairy analogs. In this aim, many strains of lactic acid and propionic acid bacteria have been screened for their ability to utilize carbohydrates that are present in the various dairy analogs. Moreover, these strains are screened for their ability to use proteins present in different plant-based products. In parallel, they are screened for their probiotic properties such as the preservation of a healthy gut barrier. Combination of strains with complementary properties leads to the design of bacterial consortia aiming at safe, healthy, and good innovative fermented foods.

Keywords: Lactic acid bacteria; Propionibacteria; Probiotics; Plant-based fermented products



High nutritional value of instant vegetal drink

Guillaume Vannier-Moreau^{1*}

¹La Mandorle, French manufacturer specialized in high nutritional value vegetal drinks.

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Specialist in almond milk with high nutritional value, La Mandorle is a French family business created in 1989 by Arnaud Vannier Moreau. Sensitive to the benefits of dried fruit and aware of the problems of allergies and intolerances to animal milk, Arnaud Vannier Moreau has developed a patented process to enhance the benefits of dried fruit in an instant vegetable drink. Thanks to essential steps and a process that respects nutrients, La Mandorle plant drinks are recognized for their nutritional richness, their high digestive tolerance, and their ecological interest. As a precursor in the plant-based drinks market, La Mandorle has been a major player in the field of plant-based alternatives for over 30 years.

Keywords: Almond drink; High nutritional value; Patented process; Nutrients; Ecological interest



Innovation in Bakery: an opportunity for sustainability

Elisabete Ferreira^{1*}

¹Pão de Gimonde, Bragança, Portugal.

*eferreira@paodegimonde.com

Both circularity and sustainability must be incorporated at all stages of value chains to achieve a fully circular economy: from design to production and from production to consumer. Bread and similar products are the most wasted in supermarkets and in our homes, behind fruits and vegetables. We have to turn around to change the way we do things, to consume them, to transform them, where innovation and creativity come in.

Artichoke meatball and chickpea flour cookies - A Local Women Cooperative in a PRIMA Project

Eda Yildiz¹, and Sibel Uyar^{1*}

¹Urla Women Cooperative, Urla-Izmir, Turkey.

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Urla Women Cooperative was established by women to support local women and encourage them to participate in socio-economic activities in 2014 and located in a small town, Urla near the 3rd largest city of Turkey, Izmir. Various textile and food products including canned and dried vegetables, sauces, jams of local importance and bakery products are produced by the cooperative. In Turkey, such cooperations are supported by the State and non-governmental organizations which provided equipments and technical personnel fundings to Urla Women Cooperative. We support local agricultural production; as a result, we have the privilege to obtain the best quality raw material. We have products having geographical indication such as artichoke and okra.

As a partner of LOCALNUTLEG project, we are working on formulation of cookies having chickpeas and hazelnut flours, vegetable patties with artichoke and chickpeas flours and Turkish ravioli from chickpeas flour having artichoke puree. Urla Women Cooperative provides a lot of benefits to local women power by helping them to participate into work force and obtaining their financial freedom. In this way, we prepare women for working life. Our main goal is to leave the individualistic approach and adopt a holistic approach, not just for commercial purposes, but as a social cooperative.

In this respect, LOCALNUTLEG project increased the recognition and visibility of this local foundation.

Keywords: Women cooperative; Local production; SME

Leveraging traditional crops for better nutrition and health - The case of chickpea

Ram Reifen^{1,2}

¹School of nutritional sciences The Hebrew university of Jerusalem, Israel;

²ChickP – Food tech start up – Israel Nes Ziona Israel.

On the global scale, chickpea consumption is steadily increasing in recent years. In developing countries, chickpea brings a variety of taste and texture to the cereal-based diet, as well as high-quality protein, fiber, carbohydrates and minerals, thereby ensuring a balanced diet and improving the nutritional status of the population. In developed countries, chickpea may be an ultimate source of protein for the increasing vegetarian/vegan populations. On top of that, allergenicity issues, content of phytoestrogens and more, are negligible in chickpea. For all these reasons, this crop should be considered as an outstanding source of protein, the ultimate alternative to soybeans, as well as the next health-food for human consumption.

I shall describe the nutritional and functional properties of chickpea isolate (92% protein) the major product of chickP, the potential use in food applications and the contribution to the challenge of feeding the world in coming years as well as to well-being and health.

Keywords: ChickP; Nutritional value; Functional properties; Meeting protein needs; Contribution to health



New approaches for the development of alternative foods based on vegetable and ocean sources

Irene Gouvinhas¹, Rita Beltrão-Martins¹, Rui Costa¹, Joana Campos², Javier Fidalgo , Ana Casas², Ana Novo Barros^{1,2*}

¹Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes and Alto Douro (CITAB)/ Institute for innovation, capacity building and sustainability of agri-food production (Inov4Agro), Vila Real, Portugal;

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Mediterranean diet has been extensively reported, once it is associated with a promising health outcome and a better quality of life. Over the years, many evidences on the relationship between nutrition and chronic degenerative diseases have been leading researchers to search for the feeding pattern most suitable to the preservation of an optimal health status. It is well known, in fact, that nutrition is able to substantially modify the risk profile of population at both primary and secondary levels of prevention. Furthermore, it is well recognized that consumer fidelity can only be achieved through the production of food products with optimal organoleptic and safety qualities, and in the last few years, a special emphasis has been put on the production of food products with optimal nutritional qualities. Modern nutrition is not only concerned with providing to consumers a nutritional balanced diet, but also with the identification of food components and ingredients that when present in a balanced diet can contribute to the improvement of consumer's health and wellbeing. Ethical and economic reasons have changed the way food producers deal with the by-products resultant from their economic activity. In this sense, several by-products such as acorn or grape pomace, have been used to develop new gluten-free breads or muffins. Also, cowpea immature beans puree has been applied to elderly residing in nursing homes to assess its ability to increase plasma amino acids availability that could favour skeletal muscle mass, to delay or improve sarcopenia, reduce depression symptoms, improve sleep quality and concomitantly increase life quality and autonomy in daily activities. And yet other healthy natural ingredients found in many organisms from different ecosystems, marine or terrestrial, included within food supplements which can be ingested either in capsule, powder or tablet format.

Keywords: Mediterranean diet; By-products; Food supplements

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Plant-based cheese-type analogues: a review on nutrition and functional challenges

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The search for, and the development of, plant-based alternatives have been increasing worldwide, with the main drivers being sustainability, health or ethical reasons. In the dairy sector, the development of cheese-like products underwent an increase of almost 90% from 2019 to 2021. Nevertheless, the complexity harboured around the manufacturing of a cheese analog makes the production of a sensory-well accepted alternative with an interesting protein content, like that of cheese, very challenging. This is primarily due to the plant-based matrices used for this purpose, which composition and structure makes it hard to mimic cheese manufacturing. Within polysaccharides, which are important for gelatinization, retrogradation and the formation of a polysaccharides network, tapioca, potato, corn and waxy starches are the most used. Regarding protein sources, legume protein, such as soy, pea, or lupin, potato protein, nuts and seeds protein, such as almonds or cashews, and zein are among the most cited ingredients in cheese analog formulation. Proteins have an important role, including on structure and mechanical strength and impacts emulsification, flavor precursor properties among others. Lastly, sunflower, corn, canola, sesame, soybean, coconut and palm oils are the most selected fats, which contribute to texture, sensory quality and emulsification. The aim of this review is to provide an up-to-date overview of the most recent trends in the development of cheese analogs, focusing on the composition and processing, which are designed to overcome issues related to nutrition (balanced composition, nutrient bioavailability) and functionality.

Keywords: Cheese substitutes; Plant-based; Dairy free; Vegan cheese



Challenges in the fermentation and aging of vegan cheeses

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There are a lot of history, studies and experiments in cheese making. It goes from finding the best curd, appropriated ripening cultures, set the preferable cure chamber temperature and humidity to get the best flavor and water activity and the right packaging to keep the flavor and shelf life as long as possible. In plant-based cheese or the tentative to recreate animal milk cheese using plant based ingredients, the challenges are many and a lot of variables are still in the early stages of experimenting. At this presentation we talk about our experience and what as working for us so far, when creating a plant-based Camembert.

Keywords: Plant Based; Vegan; Cheese; Vegan Cheese

Evaluation of *Malvaceae* species and other wild plants as novel food: lessons for innovative traditional meals

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Reduction of diversity in agriculture exposes food systems to vulnerability. To address this challenge, we explore the use of wild plants native to Mediterranean ecosystems as novel food crops. This approach aims at diversified agriculture that will enhance resilience in food systems. Specifically, diversification of local food production can streamline resilience of supply chains, and ultimately increase food security. Thus, we studied two *Malvaceae* species as potential food crops. These plants are traditionally harvested in natural systems, but not commercially cultivated. The plants were experimentally cultivated, their leaves were collected, and nutritive values were analysed. The leaves showed similar or better nutritive value to that of spinach, used here as a reference product. While *Malvaceae* leaves are an edible safe ingredient, other wild plants require processing before they can be consumed. We are studying the use of wild Mediterranean lupins as a rich protein source and will share initial insights to the ways we suggest may fasten their use as ready-to-eat food. Cultivation of lupins may bar opportunities to both Mediterranean agriculture and cuisine. However, their alkaloid richness challenges this opportunity. Novel food from wild native plants can enhance food security, enrich diet with health-promoting ingredients, and diversify agriculture.

Keywords: Novel Crop; Wild plants; Local food; *Malvaceae*; Legumes



Cladodes flour – an innovative ingredient for traditional Mediterranean bakery products

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Nowadays, consumers are opting for more sustainable diets. The production of prickly pear (*Opuntia ficus-indica*) has been gaining more expression in Portugal. The cladodes are an agro- industrial residue (by-product) which is still not used in the Portuguese diet. In this work, a novel flour was produced (INIAV, 2018, with some modifications), aiming its use for bakery production. Nutritional analysis (AOAC methods), fatty acids (FA) profile (GC-FID), amino acids (AA) and vitamin E profiles (HPLC-DAD-FLD) and sugars profile (HPLC-ELSD) were determined. Cladodes flour showed high-fibre and ash but low-fat contents. The major FA, AA and sugar were palmitic and linoleic acids, glutamic acid and fructose respectively. Cladodes flour has the potential to be used as an ingredient in the bakery industry, making the cactus pear production more sustainable. In addition, it can be a partial substitute for cereal flours in bread production since there is a shortage in the supply of these ingredients due to the current situation in the world (Russia-Ukraine war), while also innovating basic traditional Mediterranean foods.

Keywords: *Opuntia ficus-indica*; Novel food products; Sustainability

Funding: AgriFood XXI I&D&I project (NORTE-01-0145-FEDER-000041).

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Properties of pre-cooked and germinated chickpea flours and gluten- free cookies baked from these flours

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Chickpea flour can be an alternative especially for gluten-free bakery products due to its protein and fiber content. Chickpea flour can be produced in different forms from raw, pre-cooked, roasted and germinated chickpeas. In this study, it was aimed to investigate the differences between the functional properties of pre-cooked (PCF) and germinated chickpea flours (GCF) as well as the cookies baked using these flours. Bulk density, color, water retention and oil absorption capacity, emulsion activity, foaming capacity, foam and emulsion stability of these flours were determined and SEM images were obtained. Diameter, thickness, spread factor, moisture content, baking loss, color and texture of cookies baked using two types of flours were measured.

Most significant difference between flours was observed in their water retention capacity and GCF has about 71% higher water retention capacity compared to PCF. Cookies baked with GCF have higher spread factor (7.86 ± 0.49 vs 3.89 ± 0.23). Although hardness of PCF cookies (5.03 ± 0.78 N vs 4.72 ± 1.04 N) was higher difference was statistically not significant. Baking loss were determined as $16.23 \pm 1.06\%$ for GCF cookies and $11.84 \pm 0.73\%$ for PCF cookies. Use of PCF and GCF in cookie formulations resulted in quite different products.

Keywords: Chickpea flour; Germinated chickpea flour; Cookie

Acknowledgements: We would like to thank the PRIMA programme for funding LOCALNUTLEG project (Grant Agreement no2033, Call 2020 Section 1 Agrofood IA).



Legume and nut-based flours with fruit powders in sponge cakes: Spectroscopic and textural properties

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Legumes and nuts occupy a significant part in the Mediterranean diet. The flours of legumes and nuts have started to gain the deserved attention in Mediterranean cuisine. They can be incorporated into gluten-free or vegan diets and can also enrich the classical bakery products made with wheat flour. In this study, chickpea flour, hazelnut flour, banana powder, and white mulberry powder were used in cake making. Flours were analyzed for some proximate, physical, and technological properties. A basic cake formulation was tested with a 100 g flour mixture containing legume flour and nut flour or fruit powder, alternatively. The same formulations were repeated with wheat flour as the replacement for chickpea flour. The FTIR-ATR spectra, color, and textural properties were determined. Among all flour and powders, chickpea and hazelnut flours had the highest protein contents, hazelnut flour had the highest crude fiber content. Carob flour had the highest total phenol content. Cakes with banana powder resulted in cakes with relatively higher hardness values (N). Gluten-free cakes containing chickpea flour have lower gumminess and chewiness than those made with wheat flour. FTIR profiles of baked products were modeled with multivariate statistical methods to differentiate the samples with respect to their ingredients and properties.

Keywords: Chickpea; Hazelnut; Banana; White mulberry; Gluten-free

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Mediterranean traditional snacks with a twist to meet consumer needs

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Snacking has become a daily ritual for people around the world, especially for younger generations, creating opportunities for new product development. The snack category is constantly innovating: consumers primarily look for convenience, but they also seek health promotion, new ingredient experience, transparent labels, friendly packaging and planet sustainability (Mintel Group Ltd, 2022). Consumers increasingly look for snacks with vegan ingredients, and 46% of savoury biscuit consumers in the UK say it is worth paying more for biscuits made with sustainable ingredients.

In this sense, this study aimed the development of salty crackers with ingredients found in the Mediterranean area, such as wheat flour, olive oil, and herbs as natural flavorings. Additionally, a novel, non-typical ingredient known as psyllium husk, obtained from *Plantago ovata* (native to Madeira archipelago), was used as source of fibre.

The color, water activity and texture properties of both the control and the prototypes were assessed within 24 h of preparation and after 7 days, as well as the NutriScore and organoleptic properties. A cracker with improved Nutriscore (A, 12% less energy, and with the claim ‘high in fibre’) was developed, with higher fracturability and sensory appealing.

Keywords: Crackers; Psyllium Fibre; Sustainability

Incorporating microalgae and chickpea protein isolate for a healthier 3D food printed product

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3D food printing represents a very broad and innovative area of research within the food sector. Thanks to the advantages that its use implies, among which we can highlight the preparation of modified meals both in texture and visual design, more palatable products could be achieved, being able to direct this concept to people with solid intake problems (dysphagia). In addition, it allows us to design food with a high nutritional contribution that, together with the visual appeal, will lead to a higher nutrient intake, preventing possible cases of malnutrition in patients. Three-dimensional food printing would also allow the creation of meals for different market segments, such as vegans and vegetarians, creating visually attractive textures that emulate the characteristics of animal products and provide an adequate portion of proteins. Within this framework, this study focuses on the formulation of foods for three-dimensional printing with legumes protein isolate (Chickpea) added with microalgae biomass (*Arthrospira platensis* & *Chlorella vulgaris*), which is a promising ingredient, thanks to its high nutritional contribution, within which we can highlight proteins, pigments, antioxidants, vitamins, and fatty acids. Considering the strong green coloration provided by microalgae and their salty taste, it was decided to use low concentrations (1.5% and 2.5%) in relation to the chickpea protein concentrate used. Techno-functional analyses were carried out to determine the properties provided by the combination of these ingredients, as well as the most appropriate concentrations, to obtain products with a soft texture, facilitating chewing and swallowing, and products with greater firmness to homologate the meat products on the market. Diverse challenges were observed during this process, consequently, closer investigation could lead to better formulations and better products to offer in the future.

Keywords: 3D food printing; Legume proteins; Chickpea; Microalgae

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Lentil-based snack: development and nutritious properties

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Legume grains provide not only a unique nutrient profile essential for good human health, such as protein, fiber, carbohydrates, fatty acids, minerals, vitamins, and phenolic compounds, but they also provide excellent environmental benefits. Besides, they adapt to contemporary food patterns, like flexitarian, vegetarian, vegan, and gluten-free. However, legume consumption continues to be less than desired, opening new opportunities for different intake alternatives. Furthermore, due to agriculture growth and unbalanced animal consumption the food industry aims to increase and diversify alternative protein formulations. Amongst the legumes, lentils have a fast-cooking time, high arginine, antioxidant flavonoids, and a low glycemic index which helps avoid peaks in blood glucose, improving metabolic control, and recent epidemiological studies suggest that they may help combat cardiovascular disease and diabetes mellitus, both with high prevalence worldwide. Based on this knowledge, we developed a muffin in which commercial oatmeal was partially substituted with lentil flour. The nutritional value of the snack was evaluated, and it was also performed microbiological analyses. The lentil-based muffin had higher protein and fiber and lower carbohydrate content compared to the oatmeal-based muffin. The aim of these muffins is that they are suitable for all consumers, including diabetics. This project seeks to be a central element in the promotion of one of the oldest grain legumes, contributing to an increase in its consumption and consequent commercial valorization.

Keywords: Legumes; Lentil; Health Benefits; Muffin





POSTER SESSION





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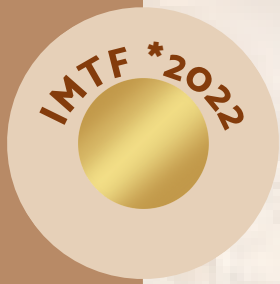
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**SECTION 1: INNOVATIVE
PLANT-BASED DAIRY ANALOGUES
(POSTER)**





Potato-based dairy analogues could be a future market trend?

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The agri-food sector has under enormous pressure from consumers, who are worried about their lifestyle and the impacts of their diets in health and environment. Plant-based milk alternatives are gaining market share and are marked as healthier and as a sustainable option to overcome the scarcity of natural resources. In Europe, 2142 new plant-based dairy alternative drinks were launched in the last 36 months. Alternative milks based on soy, almond, rice and oat are already well positioned on the market. However, the appeal for local and sustainable products, with high nutritional value, has stimulated companies to innovate and find new plant sources. Potato as a source of raw material for dairy analogues is still little explored, with only 3 products on the market, launched in 2022 (Mintel GNPD, 2022).

In this sense, our work intended to make a market analysis of plant-based dairy alternatives, and evaluated the applicability of 4 potato varieties in a preliminary plant-based drink prototype with the claim 'source of protein'. The potatoes dry matter content, and solution's color, soluble solids content, pH, dispersibility, sediment deposition, visual aspect and taste were assessed. The interaction with other ingredients of the beverage can modify the overall perception and is needed a further formula optimization to guarantee a more appealing dairy analogue to consumers.

Keywords: Plant-based; Consumer; Sustainability; Dairy alternatives.



**SECTION 2: PLANT AND NUT-BASED FLOURS
AND DEVELOPMENT OF BAKERY
PRODUCTS AND PASTA
(POSTER)**



Nutritional, chemical, and antioxidant evaluation of different Armuña lentil cultivars (*Len culinaris* spp): Influence of soil composition and year

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Lentils (*Lens culinaris* Medik) are a fast-cooking legume widely consumed around the world due to their valuable nutritional and chemical profiles. Here, the nutritional and chemical profiles of 34 Armuña lentil samples were assessed, as well as their antioxidant assets. Additionally, the influence of the meteorological conditions during the growing season, along with the type of soil in which they grow (Luvisol and Cambisol), on both nutritional and chemical profiles were also evaluated. Our results showed high amounts of valuable nutrients, such carbohydrates, of which approximately 47.06% and 29.11% are made by fibers and starch, respectively, and significant amounts of proteins (20.47 to 25.56 g/100 g fw) and ashes. Fatty acids assessment showed the prevalence of PUFAs (45.3 to 63.7%). A good antioxidant capacity (TBARS and OxHLIA) was also observed. Our results indicates that the growing season significantly impact major nutrients in lentils, such as the concentration of fat, ashes, fibers, and fructose and, to a lesser extent, proteins, and sucrose. Additionally, the two different types of soil in this study seem not to affect none of the analyzed parameters.

The attained results support the idea that different edaphoclimatic factors during cultivation must be considered, since the quality traits that stand out in lentils seems to be affected by these factors.

Keywords: *Lens culinaris*; Armuña lentil; Nutritional Value; Chemical Composition; Bioactive Properties

Yeast-free and Gluten-free Bread

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The aim of this study is to determine the effect of hazelnut flour addition as a fiber source on the textural and sensorial properties of bread, which is free of yeast and any animal-based product. Two types of chickpea flour, uncooked and germinated, were used in combination with hazelnut flour. Baking powder was used as a leavening agent. Bread samples with different combinations of chickpea and hazelnut flours were experimented with according to a mixture design.

SEM images of flour samples, specific volumes (seed displacement method), textural properties (Stable Micro Systems, UK), spectroscopic profiles (FTIR-ATR, Perkin Elmer, USA), and sensorial characteristics of bread samples were determined. According to the comparison in FTIR-ATR spectra of bread samples, the wavenumber regions (cm⁻¹) 1700 -1500 (proteins); 1200-800 (polysaccharides); and 3000-2850; 1800-1750 (lipids) define the differences based on flour compositions. Increase in hazelnut flour caused a decrease in specific volume. The sensory analysis revealed that the favorite bread sample had a flour composition of 25% hazelnut flour and 45% uncooked chickpea flour composition. This result was supported by principal component analysis of sensory scores of 27 panelists.

Keywords: Hazelnut flour; Chickpea flour; Texture; Spectroscopy; Sensory

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Development of Gluten- Free Tarhana with Purple Potato Flour and chickpea flour

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Tarhana is a traditional fermented cereal-based food, which is commonly consumed as a soup in Turkiye. Generally, it is produced by mixing cereal flours, yogurt, vegetables and spices. Tarhana can be produced with fermentation with lactic acid bacteria and yeast activity is responsible for tarhana's characteristic acidic and sour taste. Tarhana is a rich source of proteins, dietary fiber, antioxidants, free amino acids, organic acids, B vitamins, and minerals, depending on using raw materials and ingredients.

In recent years, the increasing number of people affected by coeliac disease has led to a growing demand for gluten-free products in the market. Most of the gluten-free foods do not contain enough essential nutrients. Purple potato flour and chickpea flour are excellent gluten-free ingredients with high nutritional profile, sensory characteristics, and techno-functional properties. In addition, purple potato flour has positive effects on nutrition and health due to high antioxidant capacity, anthocyanin, flavonoid and phenolic content. The aim of this study is to improve the nutritional value and functional properties of gluten-free tarhana formulation with using purple potato flour and chickpea flour. In addition physico-chemical, functional and sensory characterizations of the tarhana will also be determined.

Keywords: Tarhana; Purple potato; Chickpea; Traditional; Functional food

Acknowledgments: This study was supported by the Scientific Research Council of Bursa Uludag University, Turkiye (Project No: FGA-2022-1084).

Chemical, physical and functional properties of various legume and nut flours

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Legume and nut flours have been getting more attention with the changing diet habits of consumers; consequently, their market share is also increasing particularly in the formulation of bakery products. The purpose of this study was to determine chemical, physical and functional properties and mid-infrared spectral profiles of various legume and nut flours and to use these data in chemometric analysis to see the relation of the flours with each other. For this purpose, proximate analyses of flours were done and bulk density, color, water retention and oil absorption capacity, emulsion activity, foaming capacity, foam and emulsion stability of these flours were determined as their physical and functional properties along with the collection of mid-IR spectroscopic profiles. Data were analyzed using principal component analysis. Hazelnut flour is separated from others due to its high protein content. Navy bean and chickpeas flours are clustered together because of their similar protein contents. Carbohydrate content is the differentiating factor for carob flour. Chickpeas, wheat and carob flours form a group owing to their high emulsion and foaming stability and oil absorption capacity is the differentiating factor for hazelnut flour. Mid-IR spectroscopy provided clustering of flours similar to compositional parameters as expected.

Keywords: Legume flours; Nut flours; Functional properties; Physical properties.

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Development of gluten-free traditional cookie using chestnut flour

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Nowadays, the market of gluten-free products is expanding, due to an increase in consumers avoiding gluten for celiac disease or lifestyle reasons. Chestnut is becoming popular due to its unique eating qualities and nutritional properties, especially gluten free properties. Chestnuts contain various important nutritional and functional components: high carbohydrates, protein, dietary fibers, polyphenols, vitamins, minerals, and unsaturated fatty acids. In addition, chestnuts differ from other nuts for their low fat and salt content. Furthermore, chestnut flour may contribute to enhance colour and aroma in gluten-free bakery products. Chestnut flour has been used to formulate various bakery product and snack-type food products. Turkey has one of the most important and largest productions of chestnut (*Castanea sativa* Mill.) in the world. Chemical composition of chestnut flour is much influenced by genetic structure, ecological conditions, varieties and processing condition. The aim of the study to produce a traditional cookie as gluten-free by using chestnut flour obtained from native chestnut varieties (cvs. Mahmutmolla and Osmanoglu) in Türkiye. In addition to developing the recipe for these products, physical, chemical, functional and sensory characterizations of the products will also be determined.

Keywords: Formulation; Chestnut flour; Traditional cookie; Characteristic; Gluten free.

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Bioresidues of *Eugenia* fruits as a source of functional ingredients: application in a bakery product

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Eugenia brasiliensis Lam (EB) and *Eugenia involucrata* DC (EI) are Brazilian fruits that are still little known; however, some local food industries use these fruits in the confection of frozen pulps and ice creams, processing that can generate bioresidues with no commercial value, but that can have interesting nutrition value and could be a source of bioactive compounds. Therefore, the aim of this study was to develop functional flours from these bioresidues. For this, lyophilized peels and seeds of EB and EI were processed separately until obtaining a flour, then these were analyzed regarding their nutritional value (AOAC methodologies), and bioactive potential, namely by the determination of total phenols and antioxidant activity (by DPPH and TBARS assays). From the flours, cookies were developed with the substitution of different proportions of flours, and these were assessed through the same parameters described above. As result, the flours showed a high amount of dietary fibers (EB - 49 g/100 g and EI - 55 g/100 g) and high antioxidant activity. Likewise, the cookies also had a good amount of dietary fibers, excellent content of total phenols and antioxidant activity. The results showed that the bioresidues of *Eugenia* fruits can be useful for the development of functional foods with low cost.

Keywords: Functional food; Antioxidant activity; Dietary fiber; By-product

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Development of innovative bakery products: bread with different types of flour

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Bread is a widely appreciated and consumed food, due to its macro (carbohydrates, protein, and fat) and micronutrients (minerals and vitamins). In European countries, the per capita consumption of bread is very diverse, on average 59 kg of bread per year. In this study, a comparative analysis, of five non-conventional bread supplemented with different cereals namely Rye (RB), Chickpea flour (CFB), Multi-seed (MSB), biological spelt (BSB), and chickpea and wheat sprouted grains (CWSB), was carried out. The breads were made in Pão de Gimonde bakery and their centesimal composition was evaluated in CIMO by AOAC official procedures. Soluble sugars were determined using HPLC-RI and fatty acids by GC-FID. The results proved that the MSB and BSB breads had the highest amount of proteins (7.8 ± 0.1 g/100 g fw), while the RB presented the minor value (4.6 ± 0.1 g/100 g fw). The fat content was higher in CFB (4.4 g/100g fw), that can be attributed to the seeds and legumes that take part in the breads, and lower in RB, BSB and CWSB with values of 0.30 g/100g fw, with CWSB showing the highest concentration of dietary fibre (7.2 ± 0.4 g 100g⁻¹ fw). It was also evident the majority presence of mono (MUFA) and polyunsaturated (PUFA) fatty acids. In general, nonconventional bread is lower in calories, fat, and has a higher percentage of polyunsaturated fatty acids and dietary fibre. In this way, it can be concluded that incorporating alternative flour produces bread of higher nutritional quality.

Keywords: Innovative bakery products; Flour; Nutritional and chemical composition.

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***Malvaceae* leaf powder evaluated as enrichment for pasta flour**

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The growing demand of healthy-functional food, along with the increasing agriculture-associated environmental pressures are emphasizing the need for production of more nutritious food while applying sustainable practices. Utilization of edible wild plants might be a promising avenue to meet these needs. Wild species of the *Malvaceae* family, found in the Mediterranean area and named in the generic term "Khubeza", have been used as traditional food for many years. Our recent work showed that Khubeza leaves exhibited high nutritional value in comparison to spinach leaves, which were used as a reference commodity. Here we aimed to study the nutritional value of pasta made of wheat flour fortified with Khubeza powder. Khubeza leaves were treated, dried and ground to achieve fine powder that retains the nutritional and sensorial values during storage. A common recipe for pasta was adopted based on wheat flour as a control and the experiment includes three treatments of pasta dough, prepared by partially substituting of the wheat flour with 10%, 15% and 20% of Khubeza powder. Enriching pasta with Khubeza powder resulted in a significant increase in protein and dietary fibers contents that reached 25% and 83%, respectively, in the treatment of 20% Khubeza powder as compared to the control pasta. The levels of total polyphenols and ascorbic acid in the Khubeza pasta were increased in a dose- response manner up to three and four folds, respectively, in comparison to the levels in the control pasta. These findings, measured in the cooked pasta to imitate the actual consumption manner, emphasizes the nutritional relevance and beneficial contribution inherent in the use of Khubeza for nutritional fortification of bakery and pasta products.

Keywords: *Malvaceae*; Plant-based flour; Pasta enrichment; Nutritional Fortification.



Lipid fraction of low-carb breads formulated with by-products

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Recently, consumers are adopting low-carb diets which consist of a high ingestion of fats, moderate protein, and low carbohydrates. In this work, a gluten-free low-carb bread, which included mostly oilseeds, almonds, eggs, and coconut, was produced and its lipid fraction was analysed: total fat content (AOAC method) and fatty acids (FA) profile (GC-FID). Some ingredients were substituted by agri-food by-products, namely aquafaba (chickpea cooking water), cladodes flour and coffee silverskin to meet the increasing food demands worldwide and to produce a more sustainable and economic recipe. Four breads were prepared: 1-original recipe; 2-eggs were replaced by aquafaba to meet plant-based diets; 3-similar to bread 2 but with cladodes flour instead of sunflower seeds; 4-similar to bread 3 but Psyllium was replaced by silverskin. The highest total fat contents were obtained in samples 1 and 2 (34%), followed by sample 3 (32%) and lastly sample 4 (30%). The major FA in all breads was oleic acid. In conclusion, in a perspective of circular economy, the substitution of some ingredients in low-carb breads was able to reduce their price without changing the overall lipid profile, therefore it has potential to be a novel product for current diets.

Keywords: Aquafaba; Cladodes; Coffee silverskin; novel food products.

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Application of edible coatings for chestnut preservation

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Chestnut (*Castanea sativa* Mill.) preservation is extremely important to extend the shelf life and guarantee a pest-free fruit (Carocho et al., 2012). This work was based on the development of five innovative, sustainable, and industrially viable coatings, namely Wax, Chitosan, Chitosan+Rosemary, Chitosan+Wax, Chitosan+Wax+Rosemary. These coatings were compared with the commercial one, and also to the control sample (without any type of coating) over the storage time (T0 – 0; T1 – 7; and T3 – 21 days). Fatty acids were determined using GC-FID and the antioxidant activity was measured by the ability to inhibit the formation of thiobarbituric acid reactive substances (TBARS assay). Regarding fatty acids, at T0, it is observed that only the wax coating was able to maintain the total fatty acid contents (saturated fatty acids (SFA): 0.93 g/ 100 g dw, monounsaturated fatty acids (MUFA): 1.61 g/ 100g dw, and polyunsaturated fatty acids (PUFA): 1.75 g/ 100g dw), higher than the total contents obtained with the use of the commercial coating (SFA: 0.79 g/ 100 g dw, MUFA: 1.39 g/ 100 g dw, and PUFA: 1.59 g/ 100 g dw). In T1 and T3, the chitosan + wax-based coating revealed stronger results than the commercial one (SFA: 1.11 g/ 100 g dw, MUFA: 1.25 g/ 100 g dw, and PUFA: 1.70 g/ 100 g dw; SFA: 0.65 g/ 100 g dw, MUFA: 1.19 g/ 100 g dw, and PUFA: 1.94 g/ 100 g dw, respectively). Concerning the antioxidant activity, for T0 and T1, the chitosan + rosemary coating was the one that most protected the chestnut properties, exhibiting the lowest EC50 values (0.71 mg/mL and 0.35 mg/mL, respectively). The antioxidant capacity of the chestnut was affected from T3, in which it is possible to observe an increase in EC50 value (1.48 mg/mL for chitosan + rosemary). Therefore, it can be concluded that all chitosan-based coatings were more effective in T3. However, it is necessary to carry out more in-depth studies to confirm which coating should be applied to maintain the product's characteristics as much as possible.

Keywords: Chestnut; Preservation; Edible coatings; Fatty acids; Antioxidant activity.

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Increasing nutritional and bioactive properties of “Económicos” with chestnut flour

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“Económicos” are traditional Portuguese pastry products widely consumed in the Trás-os-Montes region. This work aimed at increasing the nutritional richness of “económicos” through the incorporation of chestnut (*Castanea sativa* Mill.) fruit flour. After incorporation at 9% of chestnut flour the following parameters were analysed: physical parameters (texture, colour, pH, water activity and moisture), nutritional content, chemical parameters (sugars, fatty acids and organic acids) and microbial load, over a shelf life of 32 days. Overall, the addition of the chestnut flour did not drastically change the appearance of the chemical and physical profiles of the cakes but resulted in a lighter crumb (L*), slight changes in the texture profile, reduction of fat, and most importantly, introduced healthier flour to this inexpensive cake. Furthermore, the addition of the chestnut flour did not promote growth of any type of microorganisms.

Keywords: Económicos; Chestnut flour; Nutritional profile; Analytical assays.



**SECTION 3: INNOVATIVE ADDED-VALUE
TRADITIONAL READY-TO-EAT MEALS
(POSTER)**





Promotion of local varieties of legumes and nuts for the improvement of traditional Mediterranean dishes

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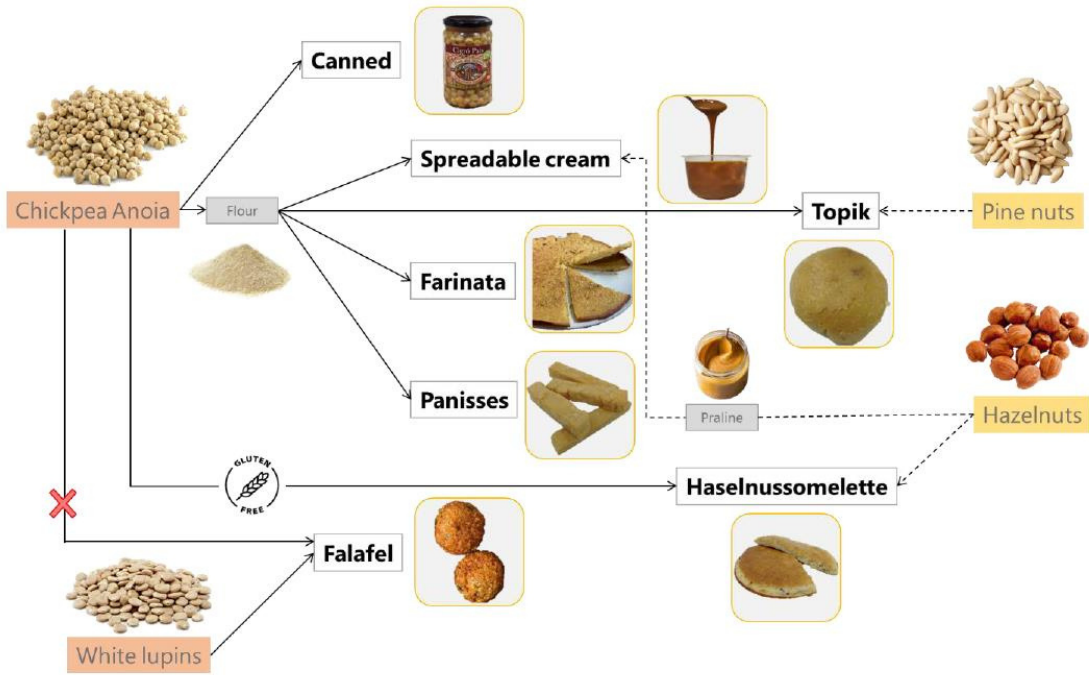
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The conservation and use of legume and nut species is of increasing national and regional importance in the Mediterranean area. Their genetic diversity is needed to sustain food supply and security for humans and livestock, especially because of the current loss of habitats, species, and genetic diversity worldwide (particularly in the Mediterranean region), but also because of the ever present need to feed the increasing human population. The use of native varieties as part of local food production can help create a more sustainable agricultural system, addressing an essential strategy to food scarcity as a source of food health and environmental well-being. In this study, we explore ways to use local plants from different countries of the Mediterranean hydrographic area (Spain, Portugal, France, Italy, Germany, Turkey, Morocco, and Israel) as food resources in order to improve traditional ready-to-eat (RTE) products. The aim is to improve traditional products with the best varieties, promoting the dietary diversity and agricultural resilience of legumes and nuts focused on the trend of healthy food consumption. Much evidence supports the health benefits of consuming a plant-based diet, linked to significantly lower risks of heart disease, high blood pressure, stroke, and type 2 diabetes. The versatility of legume and nuts covers a wide range of possibilities adopting them in Mediterranean diets through their use in plant-based dairy analogues, providing alternative-protein and maximum amount of nutrients and bioactive compounds, potential plant-based flours for bakery and pasta, and added-value traditional RTE meals.

Keywords: Ready-to-eat; Legumes; Nuts.

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Development of innovative ready-to-eat traditional dessert

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Nowadays, interest in vegan foods is increasing rapidly because of sensitivity of consumers on health (lactose intolerance, milk allergies, etc), natural life, animal welfare, ethical, religious tendencies, and sustainability. Vegan diet consists of vegetables, fruits, legumes and grains. Various plant-based milks such as coconut milk, almond milk, hazelnut milk, etc. are frequently used to create acceptable formulations suitable for a vegan diet. It is important to have functional properties, besides their desired sensory and textural qualities for these foods. For this purpose, chestnut flour, which is gluten-free and high nutritional value, can be used in many food formulations instead of cereal flours. In this study, it was aimed to produce Keşkül, a traditional milk dessert, as vegan, using chestnut flour and plant-based milk. The recipe optimization for this traditional vegan dessert variety produced within the scope of the study. Also the characterizations of the products will be evaluated. Thus, functional, delicious and ready-to-eat product will be developed that is suitable for different dietary habits.

Keywords: Chestnut flour; Plant-based milk, Gluten free; Traditional dessert; Recipe.

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Technofunctional characteristics of several plant-based proteins: Potential to obtain textured proteins

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Protein functionality is critical in determining the applicability of plant proteins concentrates and isolates. Techno-functionality is associated with the impact on the physicochemical characteristics of food products, affecting the texture, appearance, stability, emulsifying, solubility, foaming, gelling, water- and oil-holding capacities, cohesion-adhesion, elasticity, and viscosity. In this work, the technofunctional properties (viscosity, water binding capacity, oil binding capacity, emulsifying capacity and emulsifying stability) of pea protein isolate, faba bean protein isolate, chickpea concentrate proteins, and combinations, and their relationship with the sensory characteristics of meat analogs were determined. The results obtained indicate different behaviors for the different samples studied, mainly due to the protein structure, conformation, amino acid composition, surface functional groups, net and surface electric charge, and hydrophobicity/hydrophilicity. All the results obtained were compared with those obtained for soybean, used as a reference due to its good results, showing that faba bean presents results with values for water and oil holding capacity close to those of soybean. While the results for emulsifying capacity and stability closest to those of soybeans were for the chickpea and faba bean combination. Knowing the techno-functional properties of protein sources allows the selection of the most appropriate sources and their possible combinations to achieve the best characteristics in the final product.

Keywords: Plant-based proteins; Technofunctional characteristics; Extrusion.



Optimization of total phenolic content of fig obtained through Response Surface Methodology

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The fig (*Ficus carica* L.), cultivated in the Middle East and Mediterranean region has been known for its benefits for human health since ancient times. The high consumption of this fruit generates high amounts of waste, namely leftover leaves, which are known to have bioactive molecules like phenolic compounds that, used in foods could raise their bioactive properties, and also show preserving capabilities [1]. In this work, the ultrasound assisted extraction of leaves of five fig varieties, namely Dauphine (Da), Longue d'Aout (La), Pasteliere (Pa), Marseille (Ma) and Bourjassote Noire (Bn) were screened for their total phenolic content, using the response surface methodology to optimize it. The three chosen factors for optimization were time (3min–30min), ultrasonic power (5 - 75% of fixed 500W) and solvent percentage (0% and 100% ethanol). The total phenolic content were measured using the Folin Ciocalteu method, and the optimized response was the concentration (g/L) of total phenols on the recovered extract for each variety (Figure 1). A set of 17 extractions were performed for each of them and BN was the species with the highest concentration (6.77 g/L) being the optimum points set at 13.25 min, 73.19% (366 W) power and a solvent mixture with 16.36% of ethanol in water. Thus, it was possible to obtain an extract with high contents of phenolics (Figure 1).

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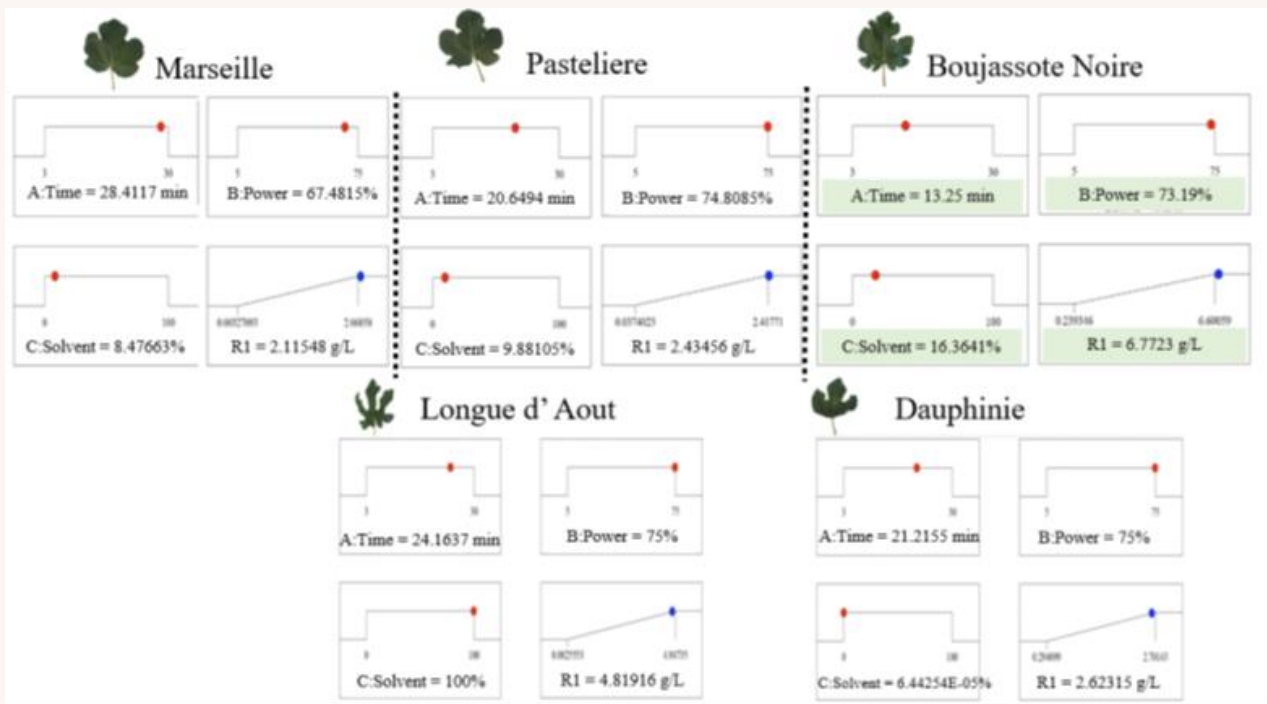


Figure 1: Response surface results of the optimal points, with the values of the promising species highlighted in green.

Crispy orange: A multi-purpose ready-to-eat snack

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With the war in Ukraine reshaping world trade, there is now a surplus of orange production in Europe, affecting the price in Portugal. Algarve is no exception, where producers are offering the fruit for lack of buyers. An innovative solution is on the agenda: transforming this Mediterranean diet fruit into a crispy ready-to-eat snack. The crispy orange snack is made exclusively from dehydrated oranges (and no other ingredients) and is not yet available in the market. Not only can this product be made from surplus orange production, but it can also be used in a variety of ways, including as a crunchy, ready-to-eat snack, as an edible cake topper, or even as an ingredient in beverages such as sparkling and tonic water, or gin. Following development, the product was fully characterized regarding nutritional value, water activity (aw), microbiology and sensory analysis with 66 consumers. Interestingly, unlike other orange products such as 100% orange juice, the crispy orange snack has a high fibre content (10% of the recommended daily dose). This is a major point as fibre is essential for regulating blood sugar levels. Furthermore, 95.5% of consumers who tested the product would buy it if it were available.

Keywords: Orange surplus; Mediterranean diet; dehydrated crispy snack; multi-purpose; consumer acceptance.



Preliminary analysis of *Opuntia ficus-indica* (L.) Mill. bioactive properties

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Opuntia ficus-indica (L.) Mill (fam. *Cactaceae*) is originally from Mexico and was one of the food bases of indigenous populations. Introduced in Europe by Spanish in the mid-1500s, it was spread throughout the Mediterranean basin. This species has a flat stem (cladodes) and fruits, known as prickly pears, with hard bark, elongated oval shape, thick pericarp, succulent and edible pulp, with numerous small seeds. It also presents a pleasant flavor, with varied colors, ranging from yellow to red. The pulp is a source of mineral nutrients (Ca, K, Mg and Se), fibers, amino acids, lipids, and biologically active compounds such as phenolics and also phytosterols. The fruit bioactive compounds can act to reduce cardiovascular diseases risk factors due to its several biological properties such as antioxidant, anti-inflammatory, among others. Currently, the fruit is commercialized “in natura” or in processed forms, as juices and jellies. Therefore, the main objective of this work will be to identify potential molecules (phenolic acids, flavonoids, betacyanins, or other organic acids), as well as to analyze their bioactive potential (antioxidant, antimicrobial, anti-inflammatory, and cytotoxic), in order to use this matrix to develop functional foods. Conventional and non-conventional extraction technologies will be applied and optimized through mathematical models to obtain the most promising technique to recover the highest amounts and purity in the target molecules. The identification and quantification of the individual compounds will be achieved through chromatographic techniques and the extracts will be subjected to several bioactive analysis, namely TBARs and cellular antioxidant assay for the antioxidant capacity, microdilution method for the antimicrobial potential, the sulforhodamine B assay for the cytotoxicity, and finally the anti-inflammatory capacity will be performed using Raw cells.

Keywords: *Opuntia ficus-indica* (L.) Mill; bioactive compounds; biological properties; functional foods.

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Traditional breads prepared with Portuguese thermal mineral waters: effects on centesimal and mineral composition

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Thermal waters (TW) are natural mineral waters emerging from the inside of a thermal spring, being known for their mineral composition, therapeutic application or health beneficial effects. The Northern region holds one of the main centers of TW in Portugal, located in Chaves. Although it has been used in cosmetic and pharmaceutical fields, in food products it has been underexploited. Thus, this study aimed to evaluate the effect of TW incorporation on the centesimal and mineral composition of *Biju* bread, which is typically consumed in Portugal. Breads were prepared using 80% of TW from Chaves, Vila Real, Portugal. According to the obtained results, the incorporation of TW did not affect the content of moisture, proteins, carbohydrates and energetic value. Compared with the *Biju* control, the mineral composition of potassium (K), sodium (Na), magnesium (Mg), iron (Fe) and zinc (Zn) increased in *Biju* bread with addition of TW and revealed the major minerals found in the sample. The total concentration minerals for both formulations (*biju* control and *biju* TW) ranged among 543,1658 and 599,4273 mg/100g FW, respectively. Thus, these results indicate that TW may be successfully incorporated in breads, adding value to regional products, and potentially improving their nutritional value.

Keywords: Centesimal composition; Minerals; Traditional food; Mineral water; *Biju* bread.

Spontaneous fermentation of olive pomace paste, a by-product of olive oil production – an exploratory approach

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Olive oil is an important mediterranean traditional food which consumption and processing is increasing in Portugal and worldwide. Along with its production, several by-products are generated such as olive mill wastewaters and olive pomace (OP). OP is a by-product composed by olive skin, pulp, and stone pieces, and it is a rich and low-cost source of natural compounds with high interest for food industry. By obvious reasons, the stone pieces must be removed before considering OP for food purposes, and after this process the olive pomace paste (OPP) is obtained. Our study evaluated the potential of OPP as a source of a fermented food ingredient, through spontaneous fermentation. OPP was collected in January of 2022 in Alfândega da Fé, (North of Portugal). OPP and saline solution (NaCl 0,85%) were placed in 3 glass bottles. The spontaneous fermentation was promoted in three different temperature conditions (4°C; room temperature (25 to 30°C); and 37°C), for 32 days. The total counting of microorganisms was evaluated at 0h, 48h, 96h, 8 days, 16 days and 32 days, through the technique of surface spread in plate count agar. The counting methodology was done in triplicate and the incubation at 37°C/24h. The results showed that, in general, the spontaneous fermentation of OPP promotes the growth of the natural flora of this by-product. The time evaluation showed that 48h was enough to change the natural flora, with highlight to 37°C with 4,3x10⁵% of total microorganism growth. The temperature conditions influenced differently the microbiological flora changes. The 37°C fermented product presented a fast profile of fermentation, with a decreasing tendency of total microorganisms after 48h. The room temperature fermented product showed a slow profile of fermentation, with a continuous increasing of microbiological population along the time, with a growth enhancement in the 16th day. This initial approach of OPP spontaneous fermentation shows that this by-product has potential to be transformed into a fermented food product, with promising results, with fast or slow fermentation according to the temperature conditions used.

Keywords: Olive pomace paste, Spontaneous fermentation, By-product valorization.

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Unsupervised exploratory analyses as a raw material selection tool to develop innovative food products

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The LOCALNUTLEG project aims to valorise local Mediterranean nuts and legumes by developing innovative plant-based food products. Thus, one of its priorities is to obtain a catalogue with the complete nutritional and biochemical characterisation of the chosen raw materials, which will facilitate a better selection. In this sense, the work presented at this congress aimed to determine the nutritional characterisation and the individual composition of fatty acids and sugars of 6 species of legumes and 19 different varieties. Their centesimal composition was obtained by AOAC official procedures, while soluble sugars and fatty acids were determined by HPLC-RI and GC-FID, respectively. A comparative study of the nutritional profiles of each variety was carried out through two unsupervised exploratory analyses, principal component analysis (PCA) and hierarchical cluster analysis (HCA). The PCA revealed that within all species of the Leguminosae family, all chickpea varieties studied (*Cicer ariteinum*) were associated with high amounts of fibre, energy, and fat. Carob (*Ceratonia siliqua*) was correlated with high concentration of carbohydrates, and all identified free sugars, except for raffinose. All other species and varieties studied were associated with high protein concentrations, a characteristic feature of Fabaceae. Similarly, to the PCA, HCA analysis using the variables from nutritional composition classified the species studied into three large groups. Chickpea varieties were compiled into one large group, the carob into another, and the remaining species and varieties were relegated to the third group. Therefore, depending on the type of new food to develop, one could choose carob, to produce food products rich in carbohydrates and sugars, chickpea to obtain a high calorie, fat, and fibre product, or any other species for a high protein product. In conclusion, these statistical techniques can be successfully used to assist in the identification of the best raw material to create new plant-based food products.

Keywords: Legume; PCA; HCA; multivariate statistical techniques; chemometrics.

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Plant-based meat analogues: alternative plant materials and optimization of critical extrusion parameters

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Meat analogs are a food category possessing meat-like characteristics without including animal-derived protein. Basically, plant-based protein rich powder material and water are fed into the extruder barrel, hydrated, transported, and intertwined by one or two co-rotating screws. Increasing temperature, pressure, and shear during extrusion processing create high mechanical and thermal energy, leading to endothermic physicochemical transformations of the constituents. In this work, the potential of other vegetable raw materials for the elaboration of meat analogs has been studied, among them, pea isolate, faba bean isolate and chickpea concentrate, which have been subjected to high moisture extrusion cooking (HMEC). Also, the different critical parameters of the extrusion process have been studied, such as screw speed, moisture content of the feed, barrel temperature, temperature of the cooling die, and chemical and physical composition of the feed. At the same time, the SME was calculated. The results obtained indicate that the temperature required for the heating modules of the barrel varies depending on the type of proteins present and should be sufficient to achieve protein denaturation for its subsequent realignment and formation of new fibers. It was also possible to verify that the high temperatures in the barrel cause a certain expansion of the product at the end of the extruder barrel so it is necessary that the temperature of the cooling die attached be lower to counteract the temperature of the product and prevent its expansion by reducing the temperature of the hot mass.

Keywords: Meat analogs; Extrusion parameters; HMEC.



The identification of preservative compounds from pumpkin fruit peel for the development of a fruit pulp product

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The food industry is facing a growing demand for ready-to-use or ready-to-cook products with a long shelf life and increased nutritional value to meet consumers' needs. However, there is also a growing concern about the widespread use of synthetic additives, which have been alarmingly correlated with adverse health effects. In this context, the opportunity to use the by-products generated during the industrial processing of pumpkin fruit to obtain a natural extract with preservative properties and to incorporate it in a fruit pulp product is being explored. In a preliminary study where pumpkin peels, seeds, and fibers were assessed, the peels showed the strongest bioactive properties, being thus selected to obtain the preservative extract in this work. To identify the bioactive molecules of the pumpkin peels, HPLC-DAD-ESI/MS was applied to the extracts of four genotypes. One to five different phenolic compounds were found in the tested samples, with (-)-epicatechin ([M-H]⁻ at m/z 289) as the major compound detected in all of the extracts. These results suggest the possibility of using a natural preservative obtained from this fruit by-product in a new pumpkin pulp formulation.

Keywords: By-products; Phenolic compounds; Pumpkin; Sustainability.

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Development of chestnut spreadables: how to keep them healthy?

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The *Castanea sativa* Mill. (Portuguese chestnut) represents approximately 52 000 hectares of chestnut plantation in Portugal, being a significant part of these in the Trás-os-Montes region.

Chestnut is a seasonal fruit well known and appreciated by European consumers for its value and sensory characteristics. However, in Portugal, the chestnut transformation and commercialization sectors are concentrated in a limited number of companies, dedicated only to the first transformation (freezing). Consequently, the focus on added-value products and second transformation is reduced. Furthermore, current consumers are looking for innovative, healthy, and ready-to-eat products. In this order, the chestnut industry needs to invest in transformation and production of new products, keeping in mind the demands of consumers.

Therefore, the aim of this present work was to develop a chestnut spreadable that can maintain the fruit's flavor and its nutritional properties. For this purpose, several formulations were tested in order to obtain a desirable consistency and flavor. After sensory analysis, two spreadable were selected and its physicochemical properties and microbial quality were evaluated.

Keywords: Chestnut, spreadable, innovation, ready-to-eat.

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