XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
MURCIA Food 25

STUDIES ON THE PRODUCTION OF NOVEL FERMENTED DRINKS FROM SWEET WHEY

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Introduction

Whey is a significant environmental contaminant since its waste load is estimated to be 100–175 times more than that of an equivalent volume of household wastewater. It is estimated that around half of the whey produced is used for human or animal use, and the other half is released into the environment as waste water, which adds to pollution. Thus, in accordance with the guidelines established by the EU Green Deal Program, its valorisation through the development of health-promoting products is an important step for the environment and the food sector. Numerous whey-based beverages are mentioned in the specialized literature. Wine-like beverages can be made by fermenting whey with different kinds of yeasts, producing liqueur-style drinks, a drink with an alcohol concentration of 10–14% etc. The purpose of the research was to obtain fermented drinks from deproteinized whey, endogenously impregnated with CO_2.

Fancello *et al.*(2024). Unlocking the potential of second cheese whey: a comprehensive review on valorisation strategies. *Reviews in Environmental Science and Bio/Technology*,1-31.

Research

The technological process of production was similar to that for obtaining bottled sparkling wines. The finished products were analyzed from a physical-chemical and sensory point of view after the period of fermentation in bottles and maturation. The obtained results are summarized in table 1 and table 2.
According to the researchers, using deproteinized whey to make various drinks not only gives them a unique flavour but also helps the beverage sector be more sustainable by using a valuable component and cutting down on food waste.

Results & Discussions

Research has shown that it is possible to obtain high-quality deproteinized whey alcoholic beverages, sparkling, naturally impregnated with CO2 and with an alcohol content that varied between 12.14% v/v and 13.10% v/v. The alcohol content of the new obtained drink is high, similar to that of wine. Moreover, and due to the high CO2 content, these new drinks are very similar to sparkling wines obtained by the fermentation method in bottles (Champenoise method).
According to our data, all drink samples were liked by the panellists from "like slightly" to "like very much"; mean general acceptability score ranged between 6.41 and 8.52 All the drink samples were very well appreciated for carbonatation which means value ranged between 8.02 and 8.54. This fact was explainable that there was enough fermentescible sugar to lead to an appreciable amount of carbon dioxide.
Sample V3 was the most appreciated one, receiving the highest score for sensory characteristics appearance, aroma, general taste, carbonatation, body and general acceptability.

Table 1
Physical-chemical properties of deproteinized whey drink

Characteristic	Deproteinized whey drink recipe variant			
	V1	V2	V3	V4
Density, g/cm^3	1.0198±0.002	1.0200±0.004	1,0207±0.002	1.0214±0.002
Apparent extract, % m/m	5.28±0.02	5.66±0,06	5.71±0.02	5.44±0.04
Alcohol content, % v/v	12.14±0.02	12.80±0.04	13.10±0.04	12.32±0.02
Real extract, % m/m	9.70±0.04	9.48±0.05	9.86±0.02	9.90±0.02
Final degree of fermentation, %	79.08±0.75	79.80±0.76	81.20±0.74	79.38±0.82
CO_2, g/L	4.28±0.02	4.56±0.03	4.84±0.02	4.90±0.04
pH	4.96±0.02	5.02±0.01	5.04±0.02	5.00±0.01

Results represents mean values ± standard deviation (SD), n=3

Table 2
Sensory characteristics of deproteinized whey drink

Characteristic	Deproteinized whey drink recipe variant			
	V1	V2	V3	V4
Appearance	7.04±1.18^c	7.06±0.33^b	8.60±0.13^e	6.82±1.03^b
Colour	6.12±1.40^b	6.71±0.23^a	7.96±0.57^{bc}	8.10±0.23^d
Aroma	6.67±0.33^d	6.83±0.14^a	8.32±0.18^d	8.21±0.77^c
General Taste	6.82±0.21^d	6.82±0.15^a	8.36±0.22^e	8.12±0.30^c
Carbonatation	8.02±0.18^{bc}	8.31±0.11^a	8.54±0.09^c	8.52±0.18^{bc}
Body	7.02±0.25^c	7.06±0.95^a	8.21±0.24^d	7.31±0.34^b
Mouthfeel	7.01±0.53^c	7.22±0.77^a	8.08±0.57^c	8.13±0.25^b
General acceptability	7.01±0.20^d	7.41±0.82^a	8.52±0.36^d	8.42±0.77^c

Data are expressed as mean ± standard deviation. $^{a-d}$- mean values in the same column followed by a different letter are statistically different ($p < 0.05$)

Conclusions

The obtained products are part of the category of effervescent alcoholic beverages, the composition of which includes only natural ingredients: whey, berry syrup, without the addition of food additives. The uniqueness of the products consists in the use of deproteinized whey, a by-product resulting from the whey cheese industry when obtaining an effervescent alcoholic drink. With an original recipe, the new assortment of alcoholic drink presents special sensory characteristics, unmistakable freshness, flavor given by the berry syrup from the manufacturing recipe and perlage, conferred by the carbon dioxide of endogenous origin resulting from the alcoholic fermentation.
In conclusion, whey is a by-product, multipurpose product that may benefit the environment and human health if it is produced responsibly. As a result, it's critical to assess how whey is processed into products and derivatives while also creating techniques that reduce the impact on the environment. Expanded markets for sustainable manufacturing may result from the various strategies being developed to profit on whey through food products. To fully comprehend the potential and constraints of these technologies on an industrial scale, more research is frequently required.

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RESEARCH ON IMPROVING BREAD QUALITY BY ADDING FRUITS FROM THE *PRUNUS* GENUS

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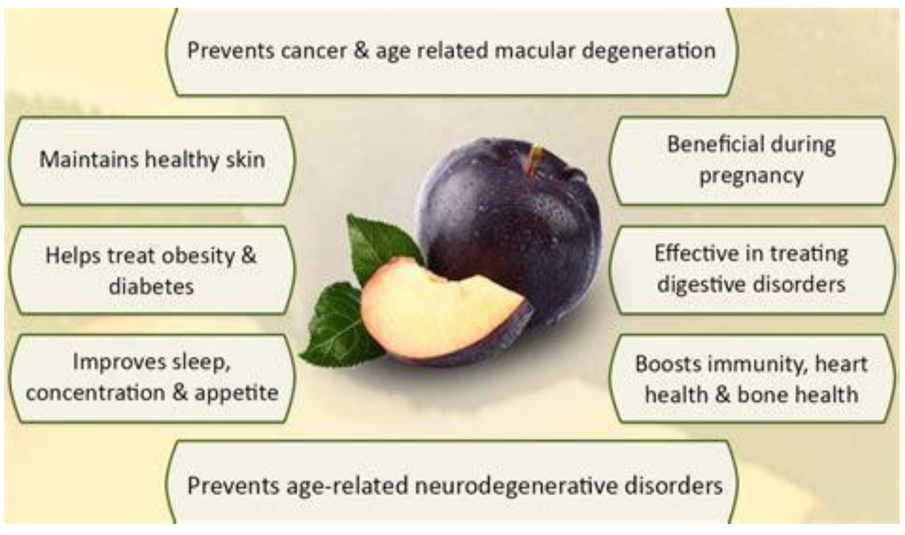
Introduction

Fruit's enhanced hydration properties, fermentability, phytochemical content, and balanced ratio of soluble and insoluble fibre make it a suitable fibre enrichment ingredient for bakery products. They can be processed to create jams, compotes, jellies, candied fruits, and baked items, or they can be consumed fresh or dried. The literature has extensively discussed the use of fruits from the *Prunus* genus in the food sector, including for making dough for extruded foods, creams, puddings, ice cream, and bakery and pastry products. This study aims to analyze the effect of the addition of dried plum flour on the physicochemical and sensory characteristics of bread, in order to determine the optimal incorporation percentage.

Materials and methods

Wheat flour type 650 and dried plum flour were used in the manufacturing processes. Plums flour was obtained by freeze-drying and grinding. Four bread variants were formulated: control (0% dried plum flour), and three variants with the addition of 5%, 10% and 15% dried plum flour, relative to the total flour mass. The following were analyzed: moisture, titratable acidity, fiber content, total phenolic compounds and antioxidant activity. Sensory analysis was performed using a semi-trained panel (n = 20), evaluating attributes such as: color, texture, porosity, taste, shell appearance and general acceptability, on a 9-point hedonic scale.

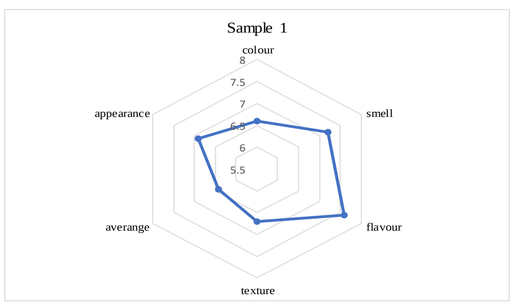


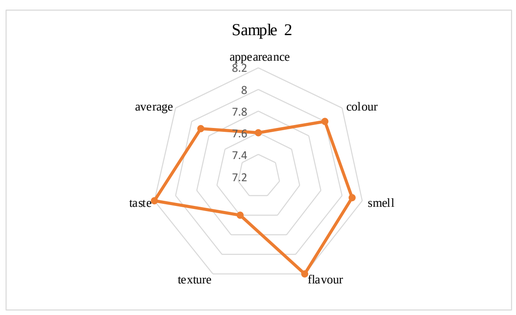
Functional properties and pharmacological effects of plums

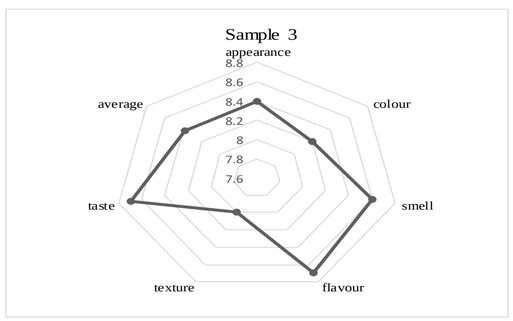
Bread with dried plum flour

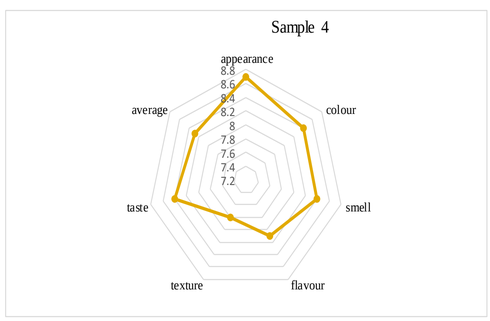
Results and discussion

The potential use of fruits from the *Prunus* genus in the creation of bakery products is also covered in detail in the paper. The addition of dried plum flour significantly influenced the physicochemical characteristics of the bread. The fiber content and antioxidant activity increased proportionally with the addition level, reaching maximum values in the variant with 15% dried plum flour. The moisture content was slightly higher in the samples with the addition, and the porosity of the core was optimal in the 5% and 10% variants. Sensory analysis revealed that the 5% variant obtained the highest score for texture and appearance of the crust, while the 10% and 15% variants were preferred by a segment of the tasters for the intense taste, specific to plums. No significant differences were recorded in terms of overall acceptability between the samples with 10% and 15% dried plum flour.









Sensory analysis of bread samples

Texture parameters of the bread samples with different levels of dried plum flour

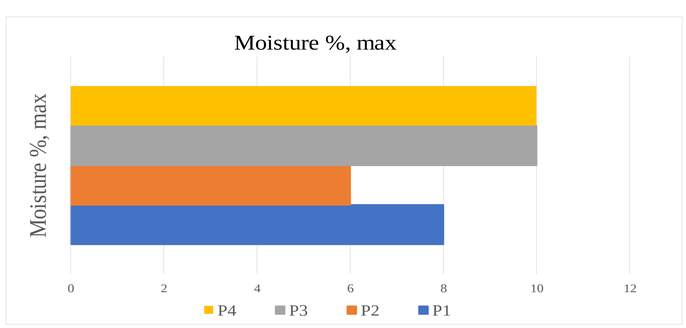
Bread samples	Firmness (N)	Gumminess (N)	Cohesiveness (Adimensional)	Chewiness (J)	Resilience (adimensional)
P1 control	9.55±3.05^{a}	7.28±1.72^{c}	0.48±0.03^{d}	7.28±1.72^{c}	1.94±0.04^{d}
P2	9.21±4.05^{a}	7.05±1.57^{c}	0.46±0.02^{b}	7.05±1.07^{c}	1.82±0.06^{c}
P3	8.7±1.58^{a}	6.20±3.05^{b}	0.38±0.03^{c}	6.20±3.05^{b}	1.61±0.05^{d}
P4	8.46±3.55^{a}	5.48±4.02^{b}	0.31±0.02^{a}	5.48±2.02^{b}	1.43±0.03^{a}

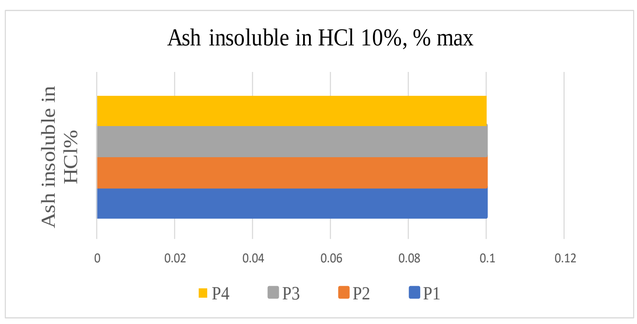
The results are the mean standard deviation (n=3). Bread samples(P1-P4), means values in the same column followed by different letters are significantly different ($p<0.05$).

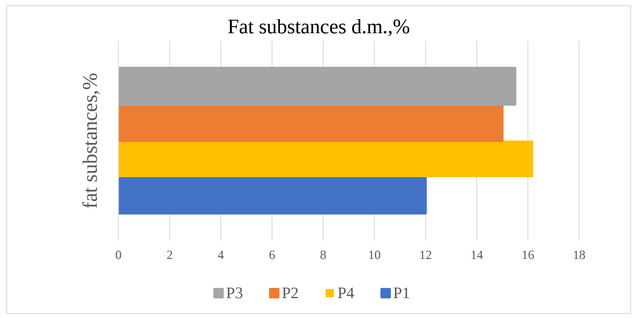
Alveograph parameters of the dough samples

Dough samples	Alveogram parameters				
	P[mm]	L[mm]	G(mm)	W[10 $^{-4}$J]	P/L
P1- control	86±2.51^{a}	87±1.15c	18.2±0.28^{b}	241±5.42^{d}	0.99±0.05^{a}
P2	91±1.15^{b}	78±4.62^{b}	16.8±^{a}0.30^{b}	136±6.32^{d}	1.78±0.15^{b}
P3	1241.15^{b}	64±2.0.8^{a}	15.1±0.60^{ab}	132±5.28^{bc}	1.86±0.25^{d}
P4	141±1.52^{b}	52±2.88^{a}	14.2±0.37^{b}	128±4.58^{ab}	1.92±0.24^{d}

P, maximum pressure; L; dough extensibility; G index of swelling; W baking strength; P/L configuration ratio of the alveogragh curve. The results are the mean ±standard deviation (n=3).







Physical-chemical properties of the finished product

Conclusions

The addition of dried plum flour in bread formulation favorably influences both the nutritional value and the sensory properties of the final product. The level of 15% proved to be optimal, providing a balance between functional intake and sensory acceptability, without negatively affecting the technological qualities of the bread. These results support the use of dried plum flour in the development of value-added bakery products, in line with current requirements for healthy and sustainable nutrition. Research will continue to capitalize on other options for adding *Prunus domestica* fruits to bakery products.

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POSSIBILITIES OF USING DIFFERENT GERMINATED PSEUDOCEREALS IN BREAD MAKING

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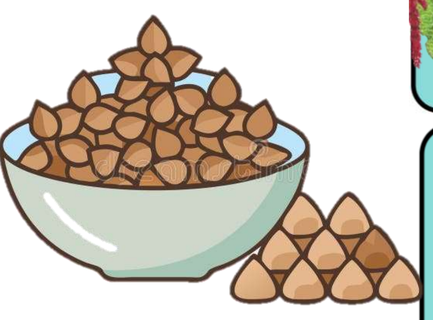
Bread is one of the most consumed food products. For this reason, researchers in the field is increasingly looking for ways to improve the original recipe or to modify it, so that it can be consumed by people suffering from celiac disease or to improve the nutritional value of bread. This study aims to analyze the possibilities of using germinated pseudocereals in bread making and the effects of their addition on bread quality, without the contribution of chemical additives to improve its nutritional value.

Amaranth

- **Amaranth is a pseudocereal belonging to the genus *Amaranthus caudatus* L. of the family *Amaranthaceae*.**
- **Amaranth is a pseudocereal with a very balanced nutritional profile. Studies in the field have shown that amaranth has a high content of essential micronutrients, namely: vitamin C, iron, calcium, folic acid, β-carotene.**
- **Amaranth is a pseudocereal that can be used by people with gluten intolerance or that who want to treat certain diseases and conditions due to its rich nutritional composition and the lack of gluten in its structure.**

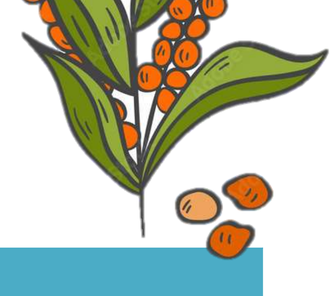


Buckwheat

- **Buckwheat is a pseudocereal that is part of the family *Polygonaceae* and belongs to the genus *Fagopyrum*.**
- **Buckwheat has an advantage over cereals due to its nutritional composition. Buckwheat, for example, has an optimal composition of amino acids, an increased content of protein, dietary fiber, vitamins, minerals and bioactive compounds.**
- **The addition of buckwheat to other food products leads to the improvement of the finished product due to the presence of essential amino acids needed by the body.**

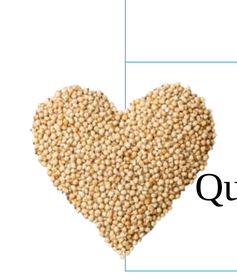
Quinoa

- **Quinoa is found under the scientific name of *Chenopodium quinoa* Willd..**
- **Quinoa stands out for its high content of proteins and important amino acids.**
- **The nutritional value of quinoa varies depending on the type of grain (variety) and the origins of the soil in which it was grown. Studies in the field have shown that the nutritional profile of quinoa grains is characterized by a balanced profile in amino acids such as lysine, methionine and threonine. It contains important values of lipids (1.8-9.5%), dietary fiber (7-14%), phenolic compounds, vitamins, minerals.**



Advantages brought by the germination process on the nutritional profile of pseudocereals

Type of pseudocereal	The influence of the germination process
Amaranth	• A 46.08% decrease in lipid content was revealed in the case of grains subjected to germination for 48 hours. • The fiber content of amaranth grains increased significantly from 3.83 to 6.69% after soaking and germination. Thus, there was a 74.67% increase in fiber content after germination.
Buckwheat	• A slight decrease in ash content was noted. • The lipid content decreased from 6.66 g/100 g to 4.89 g/100 g, for samples subjected to ultrasound treatment, followed by the germination process. The decrease in lipid content is attributed to the intensification of lipase activity during germination. This is explained by the fact that during the germination process lipids and carbohydrates are used as a source of energy for the development of the germ. • A decrease in starch content was recorded, from 59.94 g/100 g to 54.99 g/100 g, after 72 hours of germination. This is explained by the fact that , during germination, starch becomes more accessible to hydrolytic enzymes. • Samples of germinated buckwheat subjected to ultrasound treatment recorded an 18.6% decrease in the amount of protein.
Quinoa	• There was a decrease in ash content from 2.15 g/100 g to 1.90 g/100 g • Germination resulted in decreased starch content. • After subjecting the quinoa grains to germination for 48 hours, a slight decrease in the amount of protein was revealed, from 14.40 ± 0.00 g/100 g, to 13.04 ± 0.24 g/100 g (for samples subjected to ultrasound treatment).



CONCLUSIONS

Pseudocereals (amaranth, buckwheat, chia and quinoa) present a rich nutritional composition and are of interest in terms of their potential for consumer health. Also, pseudocereals can be successfully incorporated into various food products (bread, cakes, biscuits, fruit juices, yogurts, etc.) in order to improve them from a nutritional point of view, but without negatively influencing consumer acceptability. Currently, numerous studies have highlighted the nutritional and health benefits of pseudocereals for consumers. However, further research is needed to determine how to maximize the use of their nutritional compounds. Germination process leads to a decrease in the amount of antinutritive factors, the bioavailability of some nutrient compounds increases, the specific enzymes are activated. In the case of bread, the low degree of extraction leads to a low nutritional value. Starting from the fact that white bread is the most consumed, the researchers thought that a handy solution to bring a nutritional boost would be to incorporate pseudocereal flours into white wheat flour . However, it was taken into account that the dose of the additive must not negatively influence the food product from a sensory point of view.

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TOOLS FOR SUSTAINABILITY AND DIGITAL TRANSFORMATION OF THE AGRO-FOOD SECTOR . DIGISOST

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Region of Murcia Development Agency (INFO)
Modality 2 ref 2023.08.CT02.000003

AIM

Support for the agri-food sector in the Region of Murcia to act about the challenge that lies ahead in the transition towards a digital economy, applying it to all phases of the company to create a more efficient industrial fabric without ever forgetting its sustainability. Duration: 2023 and 2024

ACTIVITIES

1. **TECHNOLOGICAL MONITORING IN DIGITALIZATION OF THE AGRO-FOOD SECTOR FOR THE REGION OF MURCIA.**
2. **KNOWLEDGE ACQUISITION AND TRANSFER.**
3. **REPORT ON FOOD LEGISLATION.**

RESULTS

- During the second half of 2024, 80 results have been collected **for the Digitalisation theme** with the keywords among which are *industry 4.0; artificial intelligence AND food and; sensor AND food* . The accepted results have been added to the information available with the review of reports published by the Ministry of Agriculture, Fisheries and Food in the activity of the Digitalisation Observatory of the Agri-Food Sector, as well as the search through other entities with great activity in artificial intelligence, robots, etc. The news entitled " Scientists tap AI to elevate plant-based meat texture for enhanced consumer appeal " published in November 2024 and collected from its source foodingredientsfirst.com stands out. In the field of the Circular Economy, numerous results have been achieved, exceeding 1,000 and with nearly 30 transferred to the sector. The news entitled "Beer pomace becomes vegetable snacks with the help of Better Balance" published in September 2024 on revistaaral.com stands out.
- CTNC has issued a new Technology Surveillance Report where the collection and analysis of information from bibliographic sources such as specialized digital media, technical and scientific journals; and databases (Science Direct, Espacenet , Enterprise European Network, etc.) on digitalization that affects the agri-food sector has been carried out. In addition, to achieve our objective of technology transfer, the search for Digitalization companies in the Region of Murcia has been proposed. The information is presented in different sections for easy viewing and a reference section is included to include those results related to scientific articles, doctoral theses and R&D&I projects, mainly.
- Participation in the 22nd World Congress of Food Science and Technology in September 2024 in Rimini (Italy) provided an updated overview of new technological trends that will impact the future of the food industry, particularly in the fields of digitalisation and revalorisation of by-products. The innovations identified have high potential for application in the industries with which the CTNC collaborates, as well as in the projects in which it participates.
- A new training action and digital transformation sessions have been carried out in the sector, on artificial vision in food processing. It was shown how through UST's way of working and AI Vision, Machine Learning , IoT and Automation solutions, different challenges in food processing and the supply chain can be solved, such as inventory management, process adherence, productivity, quality, packaging, safety, losses, production equipment, logistics planning, etc.
- Other projects in line with sustainability have also been submitted to the call for INFO Grants for the contracting of Innovation and Competitiveness services (CHEQUE INNOVACIÓN), promoting technology transfer with companies in the Region of Murcia, specifically related to the use of innovative technologies that promote industrial competitiveness. A total of 10 proposals were submitted in July.
- They have been kept meetings and gatherings of scope international achieving the participation of companies regional and the CTNC itself in consortia for proposals from the Horizon Europe programme and others programs Europeans as INTERREG NEXT MED: **3 collaborative proposals (BRIDGE, HEEFTA and LETSGROW)** . Being this last a success from December 2024. The SEIMED CTNC collaboration has been maintained .
- Weekly newsletters have been published containing a total of 128 new legislative developments.

Jornada Técnica 'Industria 4.0 y digitalización en la producción' (GRATUITO)

Visión artificial en la industria de procesamiento de alimentos (Workshop)

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OLIVECIDA
GRUPO OPERATIVO REGIONAL

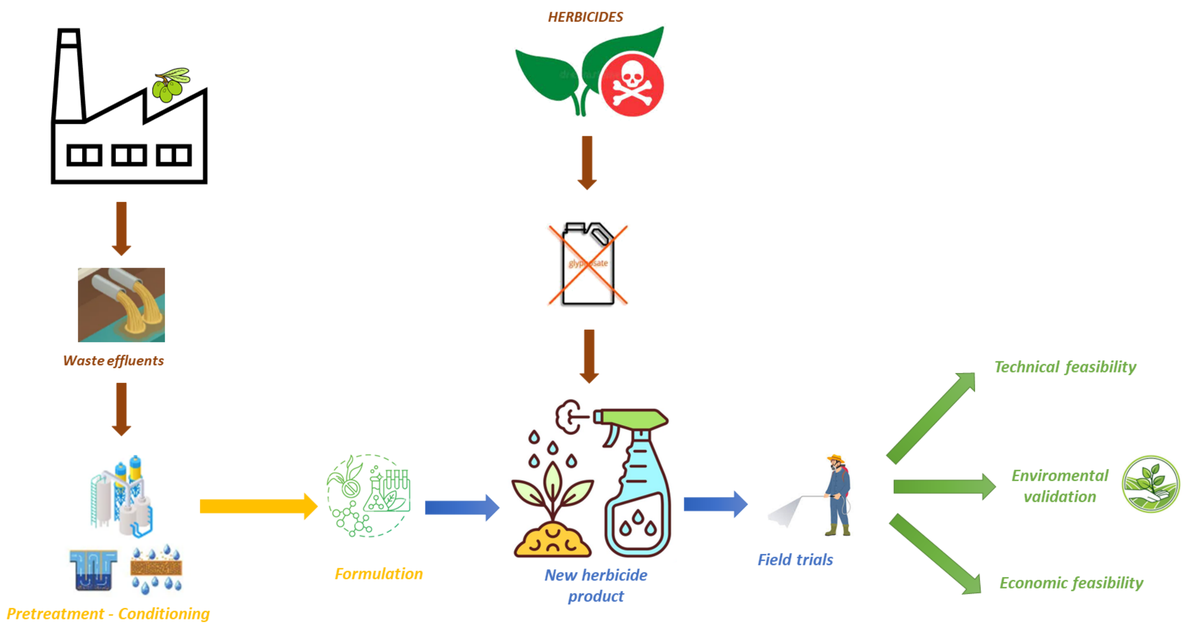
Environmental validation of the sustainable management of olive effluents as an herbicidal agent

Carrillo, M. [1], Moreno, L. [1], Romero-Gámez, M[2], Rodríguez, L.[2] Prieto, JL. [3], Corbacho, A. [3], Peral, N[4].

[1]Centro Tecnológico Nacional Agroalimentario, CTAEX, Badajoz, Spain. [2]360 Soluciones Cambio Climático, Badajoz, Spain.[3]Extremadura Verde, Cáceres, Spain. [4]Grupo IAN, Cáceres, Spain.

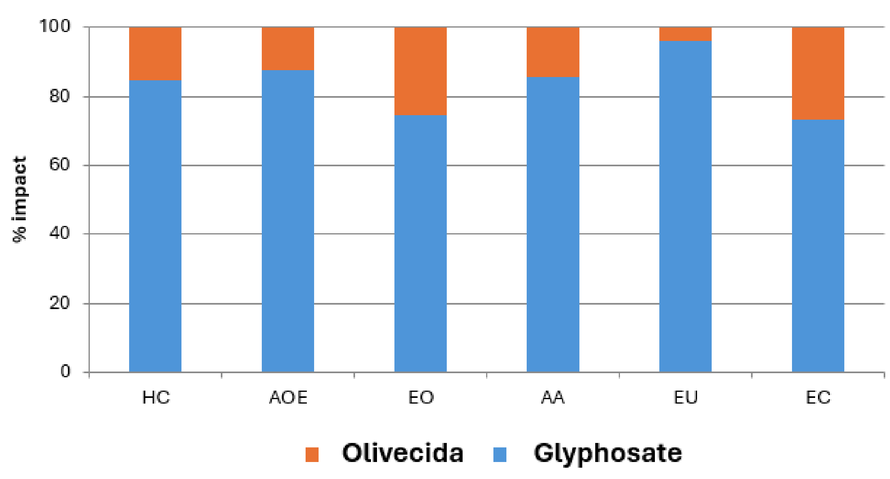
INTRODUCTION

Table olive processing industries generate large volumes of wastewater with a high pollution load due to their content of organic matter, suspended solids, fats, acidic and basic pH, phenolic compounds and high conductivity associated with excess salt. There are procedures for the purification of these waters, but at present they are not economically profitable, and the solution is storage in ponds, which have limitations. On the other hand, the use of herbicides, particularly glyphosate, entails environmental and human health risks due to their persistence, bioaccumulation and possible contamination of water and soil. Its indiscriminate application affects organisms essential to ecosystems, such as pollinators and aquatic species, generating a large-scale environmental problem. Both sectors require more sustainable treatment and management strategies to mitigate their impacts.

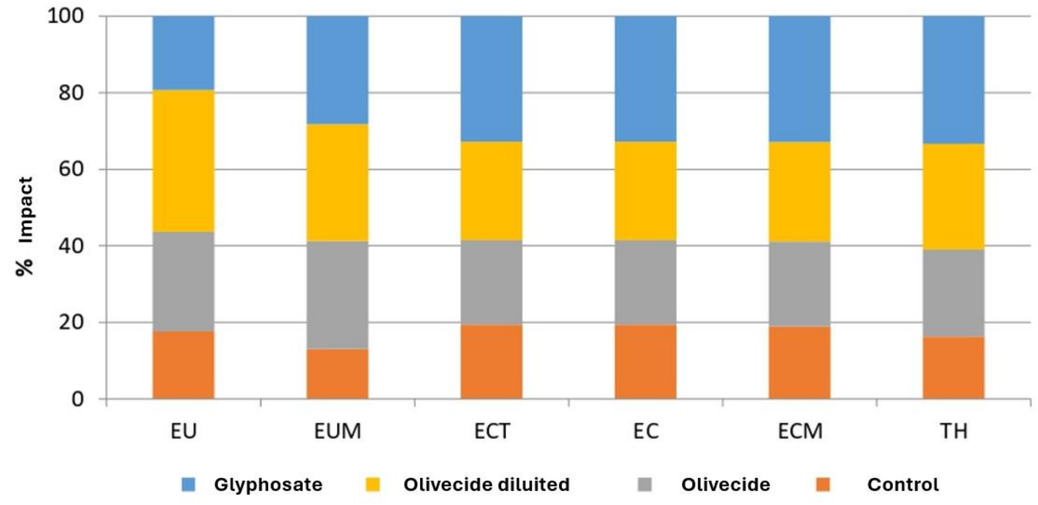


RESULTS

1. Control
2. Glyphosate
3. Olivecida
4. Olivecida diluited



Carbon footprint HC, Stratospheric ozone depletion AOE, Effect of ozone on human health EO, Acidification AA, Eutrophication in freshwater EU, Ecotoxicity in freshwater EC



Freshwater Eutrophication EU, Marine Eutrophication EUM, Terrestrial Ecotoxicity ECT, Freshwater Ecotoxicity EC, Marine Ecotoxicity ECM, Human Toxicity TH

CONCLUSIONS

- The best pre-treatment is filtration, economically and technically.
- The F3 formulation (Olivecida) was identified as the most suitable among all, as it presents a favorable balance in its properties, making it the best candidate for application.
- From an environmental point of view, the Life Cycle Assessment revealed that the production of Olivecida has significant impacts, especially in the transport and materials stage. In addition, filtration generates a water cost that is not sustainable.
- In terms of soil application, although ecotoxicity and toxicity impacts were lower than with glyphosate, eutrophication remains a problem. Further studies are recommended to assess its long-term impact and to optimize its application.
- The economic study indicates that industrial-scale production of the herbicide Olivecida could generate a net benefit from being a by-product.

Project co-financed 85% by the European Agricultural Fund for Rural Development (EAFRD) within the Rural Development Programme (RDP) of Extremadura 2014-2022, 11.28% by the Regional Government of Extremadura and 3.72% by the State, Ministry of Agriculture, Fisheries and Food (MAPA).

JUNTA DE EXTREMADURA
Consejería de Agricultura, Ganadería y Desarrollo Sostenible
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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

NEW THERMAL TREATMENTS FOR STABILIZING HEAT-SENSITIVE FRUIT AND VEGETABLE PRODUCTS

THE CHALLENGE

CURRENT ADVANCES IN PRESERVATION TECHNOLOGIES AIM TO OVERCOME THE LIMITATIONS OF CONVENTIONAL THERMAL TREATMENTS USED FOR STABILIZING HEAT-SENSITIVE FRUIT AND VEGETABLE PRODUCTS, SUCH AS JUICES, SMOOTHIES, PUREES, HOMOGENATES OR POWDERS. NEW TREATMENTS SEEK A BALANCE BETWEEN THE THERMAL DAMAGE TO THE PRODUCT AND ITS STABILITY AGAINST DETERIORATION. THE SO-CALLED NON-THERMAL EMERGING TECHNOLOGIES HAVE REPRESENTED SOME PROGRESS IN THIS REGARD BUT PRESENT CERTAIN LIMITATIONS. THE IMPLEMENTATION OF NEW PRESERVATION PROCEDURES MAY IMPROVE THE QUALITY AND STABILITY OF FRUIT AND VEGETABLE PRODUCTS.

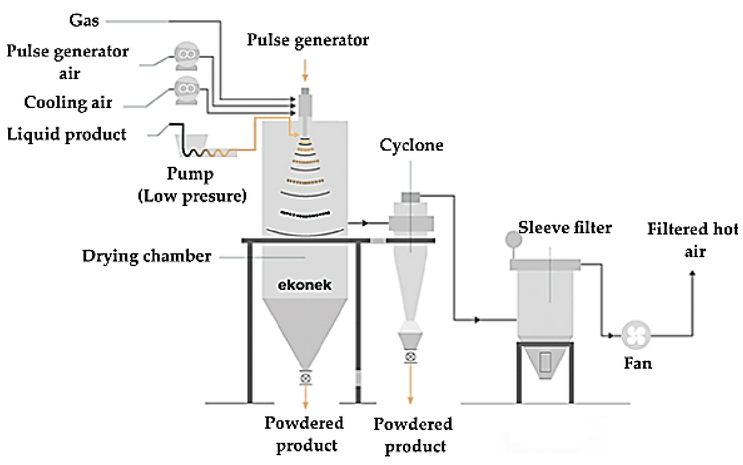
TECHNOLOGIES DESCRIPTION

HIGH-PRESSURE THERMAL STERILIZATION (HPTS):

- **HPTS** COMBINES A PREHEATING STAGE (70-90°C) WITH A HIGH-PRESSURE TREATMENT (400-600 MPA) AT 90-120°C. A CANISTER SYSTEM IS USED TO IMPROVE THE EFFICACY OF PROCESS.
- PREHEATING MAY SOLVE THE PROBLEM OF LACK OF ENZYME INACTIVATION IN FRUIT AND VEGETABLE PRESSURIZED PRODUCTS. SHELF-STABILITY MAY BE IMPROVED AND THERMAL DAMAGE TO THE PRODUCT MAY BE REDUCED.
- HIGH-PRESSURE INDUSTRIAL EQUIPMENT IS AVAILABLE FOR DISCONTINUOUS BATCHES IN SMALL AND MEDIUM-SIZED FACTORIES, WHICH CAN BE COUPLED TO DIFFERENT PREHEATING SYSTEMS.

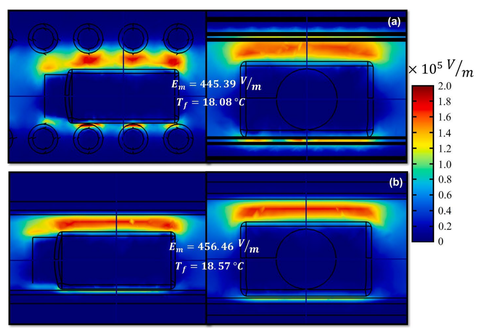
PULSE SPRAY DRYING (PSD):

- **PSD** TECHNOLOGY USES A GAS BURNER WITH A HIGH FREQUENCY PULSE GENERATOR THAT ACCELERATES THE LIQUID DROPLETS IN A LONG SPRAY, THUS INCREASING EVAPORATION SPEED AND REDUCING THE AIR AND ENERGY CONSUMPTION.
- THIS PROCESS DOES NOT GENERATE TOXIC COMPOUNDS AND EXHAUST GASES COMPLY WITH REGULATIONS. **PSD** CAN IMPROVE THE RESULTS OF CONVENTIONAL **SD** IN VISCOUS LIQUIDS OR PASTES.
- INDUSTRIAL EQUIPMENT IS AVAILABLE FOR POWDERING DAIRY AND OTHER PRODUCTS. SPECIFIC PILOT PROCESSES ARE BEING TESTED FOR FRUIT AND VEGETABLE PRODUCTS.



DIELECTRIC CONTINUOUS HEATING (DCH):

- FOOD IS CONTINUOUSLY HEATED BY APPLYING AN ALTERNATING ELECTROMAGNETIC FIELD THAT TRANSFERS ENERGY TO DIELECTRIC MATERIALS (WATER AND ELECTROLYTES).
- THIS TECHNOLOGY IMPROVES HEAT PENETRATION AND ENERGY TRANSFER (>80%), MINIMIZING ENERGY LOSSES. HEATING HOMOGENEITY MAY BE IMPROVED IN VISCOUS LIQUIDS, PACKED PRODUCTS OR SOLID PORTIONS.
- AVAILABLE INDUSTRIAL EQUIPMENT USES MAGNETRONS OR SOLID-STATE SYSTEMS WITH TRANSISTORS AND CAN OPERATE WITH RADIO FREQUENCIES (13.5, 27.12, AND 40.3 MHZ) OR MICROWAVES (433, 915, AND 2,450 MHZ).



OUR MULTIDISCIPLINARY RESEARCH TEAM:

- FOOD TECHNOLOGY DEPARTMENT, UNIVERSITY OF MURCIA (UM): DESIGN AND VALIDATION OF ELABORATION PROCESSES FOR FRUIT AND VEGETABLE PRODUCTS.
- FOOD QUALITY AND TECHNOLOGY PROGRAM. INSTITUTE OF AGRIFOOD RESEARCH AND TECHNOLOGY (IRTA): PILOT AND INDUSTRIAL IMPLEMENTATION OF PRESERVATION TREATMENTS FOR FRUIT AND VEGETABLE PRODUCTS.
- FOOD TECHNOLOGY DEPARTMENT POLYTECHNIC UNIVERSITY OF VALENCIA (UPV): SUSTAINABILITY ASSESSMENT OF FOOD UPSCALED PROCESSES.

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Plan de Recuperación, Transformación y Resiliencia

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

TECHNOLOGICAL, SENSORY AND NUTRITIONAL ASSESSMENT OF FUNCTIONAL INGREDIENTS FOR FOOD APPLICATIONS

THE CHALLENGE

There is a growing demand for functional food products, specially those made with natural ingredients. Among them, antioxidants and prebiotic dietary fibres stand out due to their potential applications in food. Prebiotic fibres can also serve as bulk agents to reduce the caloric value in sugary food. Most natural ingredients are obtained through separation methods (extraction, centrifugation, etc.) and are not pure compounds, so that they must be carefully assessed from a technological, sensory and nutritional perspective.

NATURAL INGREDIENTS WITH PRESERVATIVE AND FUNCTIONAL POTENTIAL

Aromatic and medicinal crop

Industrial Distillation

Essential oil

Dietary fibre from chicory

Distillation Residues

Rosemary and sage extracts

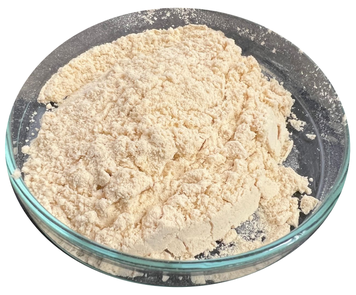
Grape extract

Through several R&D projects, our multidisciplinary research team has developed and/or tested different functional ingredients from tea, grape, rosemary, sage, thyme, chicory inulin, etc., in different food products, such as candies, fruit and vegetable smoothies, yogurt, fish and meat products.

NUTRITIONALLY ENHANCED FOODS

Yogurt sauce and pate of salmon and with Rosemary and sage extract

Candies with Rosemary and sage extract

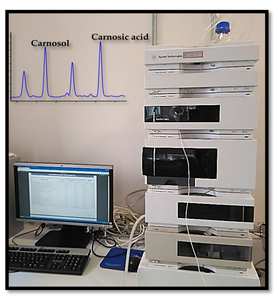


Fruit smoothie (Apple, orange and babana)

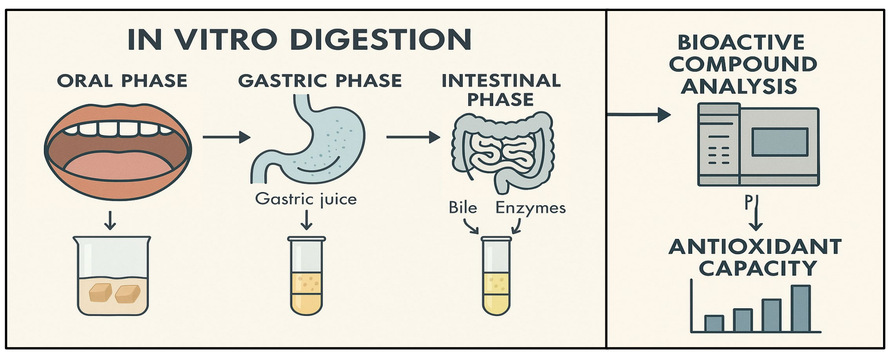
vegetable smoothie (pumkin, carrot and apple)

Salmorejo (Inulin)

OUR RESEARCH EXPERIENCE INCLUDES



- ✓ Optimization of technological processes (heating, drying, agglomeration, packing, etc.)
- ✓ Sensory and nutritional evaluation of ingredients
- ✓ Degradation and/or retention of active compounds
- ✓ Stability and shelf-life studies
- ✓ *In vitro* bioavailability of active compounds and their properties (antioxidant capacity, etc.)



CONTACTS

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Development of gluten-free sourdough bread enriched with broccoli by-products

Jhazmin Quizhpe, Pablo Ayuso, María de los Ángeles Rosell , Pascual García-Pérez, Rocío Peñalver, Gaspar Ros and Gema Nieto .

Department of Food Technology, Food Science and Nutrition, Faculty of Veterinary Sciences, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Murcia, Spain; jhazminedith.quizhper@um.es; pablo.ayuson@um.es; mariaangeles.rosellp@um.es; pascual.garcia@um.es; rocio.penalver@um.es; gros@um.es; gnieto@um.es.

INTRODUCTION

Coeliac disease is a genetically predisposed chronic autoimmune disease (HLA-DQ2 and HLA-DQ8 alleles) characterized by an adverse immune response to gluten, which damages the lining of the small intestine, affecting nutrient absorption. The most effective current treatment is a strictly gluten-free diet. However, commercially available gluten-free products have nutritional limitations, as they are often low in fiber, protein, vitamins and minerals, as well as having a high glycemic index and lower quality fats derived from less nutritious flours or corn starch. On the other hand, broccoli is a vegetable that contains numerous bioactive compounds such as glucosinolates and isothiocyanates, antioxidant compounds, vitamins and fiber, making it a food with multiple health benefits [1]. However, during its production and processing, large volumes of by-products are generated, which poses an environmental challenge.

OBJECTIVES

The aim of this study was to use broccoli by-products from the agri-food industry for the production of a gluten-free functional bakery product (sourdough bread) as a source of dietary fiber to cover the fiber deficiencies of commercial gluten-free foods, especially for celiac patients. For this purpose, a treatment with lignocellulosic enzymes was applied to the by-products to enhance the conversion of insoluble dietary fiber into soluble dietary fiber, providing greater benefit to the consumer of gluten-free products.

RESULTS AND DISCUSSION

Gluten-free sourdough bread formulations enriched with broccoli extract showed a significant improvement in their nutritional profile compared to a commercial gluten-free product. The results showed a lower glycemic index and higher antioxidant capacity, suggesting a potential health benefit. Enzymatic treatment of broccoli extract significantly increased the total dietary fiber content (13.65%), total phenolic compounds (461.36 mg gallic acid equivalents/gram) and improved the antioxidant capacity of the product. Furthermore, in the organoleptic evaluation, the enzymatically treated broccoli extract bread scored better in terms of taste and texture than the untreated bread and was preferred to the commercial bread by people who regularly consume gluten-free products [2,3].

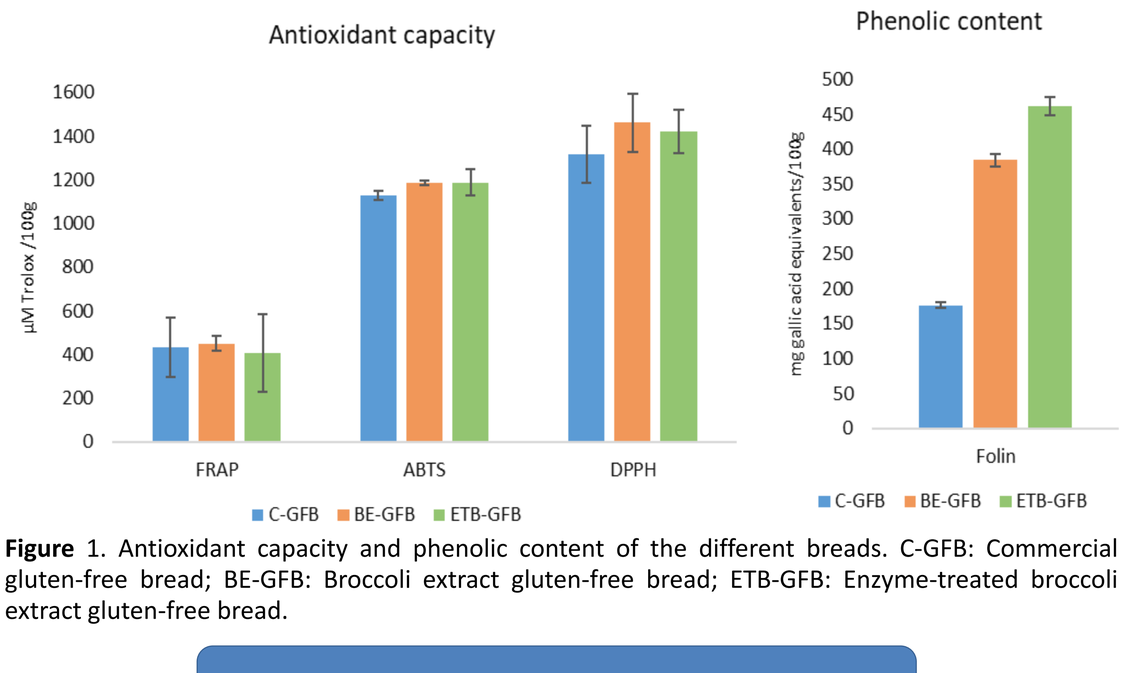

Figure 1. Antioxidant capacity and phenolic content of the different breads. C-GFB: Commercial gluten-free bread; BE-GFB: Broccoli extract gluten-free bread; ETB-GFB: Enzyme-treated broccoli extract gluten-free bread.

CONCLUSION

In conclusion, the incorporation of broccoli agri-food industry by-products in functional gluten-free sourdough breads resulted in an improvement in nutritional, antioxidant and hypoglycemic properties, with organoleptic acceptability. This represents a novel and effective strategy for the valorization of broccoli by-products as enhancers of the nutritional profile of gluten-free bakery products.

MATERIALS AND METHODS

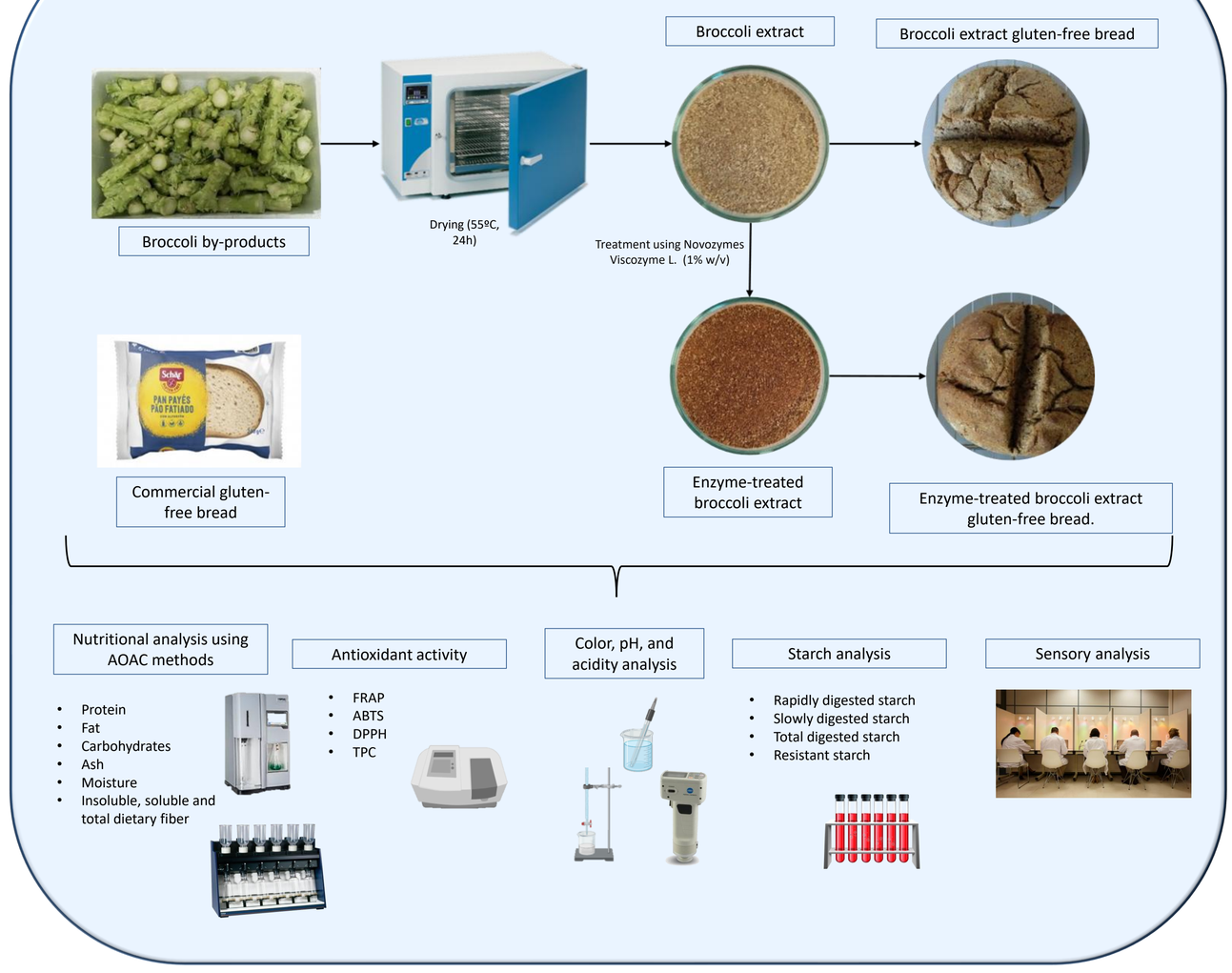

Table 1. Proximal composition of the different breads (g/100g).

	Commercial GF bread	Broccoli extract GF bread	Enzyme-treated broccoli extract GF bread
Moisture (%)	40.36 ± 0.16^{b}	35.04 ± 0.72^{a}	33.31 ± 1.51^{a}
Protein (%)	3.66 ± 0.12^{a}	6.56 ± 0.085^{b}	7.18 ± 0.07^{c}
Fat (%)	0.50 ±0.15^{a}	2.36 ± 0.93^{a}	2.44 ± 0.12^{a}
Ash (%)	1.47 ± 0.03^{a}	2.31 ± 0.21^{a}	2.21 ± 0.28^{a}
IDF (%)	3.45 ± 0.62^{a}	10.02 ± 0.12^{b}	10.99 ± 1.01^{b}
SDF (%)	0.26 ± 0.03^{a}	1.52 ± 0.15^{b}	2.66 ± 0.15^{c}
TDF (%)	3.72 ± 0.59^{a}	11.54 ± 0.04^{b}	13.65 ± 0.86^{b}
Carbohydrates (%)	50.29 ± 0.68^{b}	42.20 ± 1.40^{a}	41.20 ± 2.70^{a}
Energy content (Kcal/g)	220.29 ± 3.64^{a}	216.26 ± 2.46^{a}	215.53 ±10.00^{a}

a–c: Different letters within in the same row indicate significant differences between samples ($p < 0.05$). GF: Gluten-free; IDF: insoluble dietary fiber; SDF: soluble dietary fiber; TDF: total dietary fiber.

Table 2. Starch analysis of the different breads (g/100g)

	Commercial GF bread	Broccoli extract GF bread	Enzyme-treated broccoli extract GF bread
Rapidly digested starch	49.12 ± 0.11^{c}	30.97 ± 0.11^{b}	29.24 ± 0.16^{a}
Slowly digested starch	14.12 ± 1.68^{a}	14.22 ± 0.97^{a}	15.53 ± 4.02^{a}
Total digested starch	50.00 ± 0.27^{b}	45.11 ± 0.54^{a}	49.80 ± 0.44^{b}
Resistant starch	3.01 ± 0.05^{b}	1.29 ± 0.18^{a}	1.39 ± 0.05^{a}

a–c: Different letters within in the same row indicate significant differences between samples ($p < 0.05$). GF: Gluten-free

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Development of functional meat products with byproducts from artichoke industry

Pablo Ayuso, Jhazmin Quizhpe, María de los Ángeles Rosell, Pascual García-Pérez, Rocío Peñalver, Gaspar Ros and Gema Nieto

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BACKGROUND

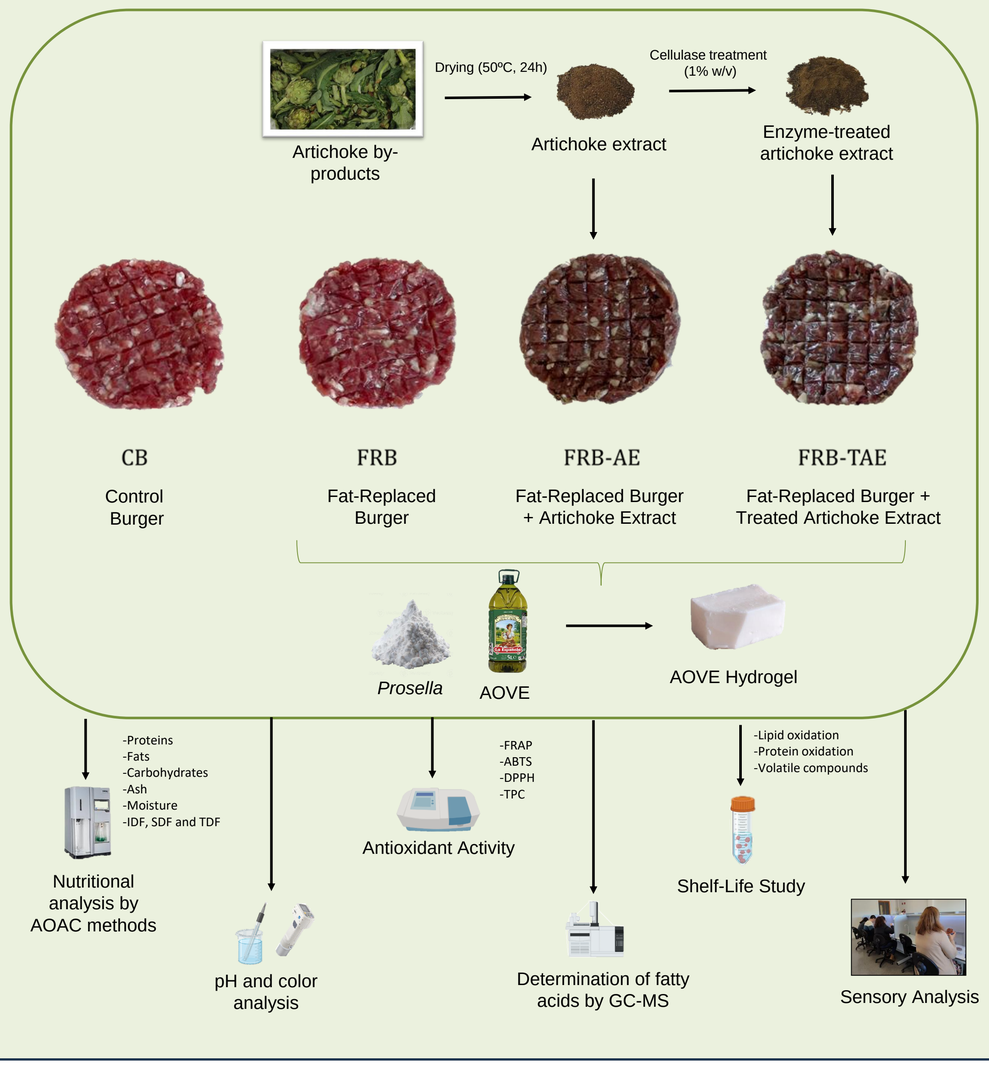
Beef burgers are widely consumed for their convenience and appealing sensory properties. However, their high fat content, rich in saturated fatty acids (SFA) has raised nutritional concerns, as it contributes to increased LDL cholesterol and the risk of cardiovascular diseases [1]. Additionally, beef exhibits an unbalanced n-6/n-3 polyunsaturated fatty acid (PUFA) ratio, which may promote inflammation and the development of chronic diseases. In response, consumers are increasingly demanding healthier alternatives that retain the desirable qualities of traditional meat products. One innovative approach is the replacement of animal fat with oil-in-water hydrogel emulsions using vegetable oils [2] such as extra-virgin olive oil (EVOO), which is rich in monounsaturated fatty acids (MUFA), particularly oleic acid, and bioactive compounds like hydroxytyrosol and vitamin E.

In addition to healthy lipids, incorporating functional ingredients such as artichoke (*Cynara scolymus* L.) by-products has emerged as a promising strategy. These by-products, obtained from industrial processing, are rich in dietary fiber, especially inulin and pectins, and antioxidant compounds including phenolic acids and flavonoids [3]. While most of this fiber is insoluble, enzymatic treatments can increase its solubility, enhancing its health benefits and technological applications. Despite their potential, the use of artichoke by-products in meat products remains limited. Their high content of fiber and antioxidants makes them valuable ingredients for improving the nutritional and functional quality of reformulated meat products like beef burgers.

OBJECTIVES

- Evaluate the effects of enzymatically treated and non-treated artichoke by-product extracts on beef burgers.
- Assess the impact of replacing 50% of animal fat with an extra-virgin olive oil (EVOO) emulsion.
- Analyze physicochemical, sensory properties, and oxidation stability during 3 days of refrigerated storage at 4 °C.

MATERIALS & METHODS



RESULTS

Table 1. Beef Burgers proximate composition (g/100g)

	Burgers			
	CB	FRB	FRB-AE	FRB-TAE
Energy	198.73 ± 6.72[a]	169.07 ± 12.21[a]	183.93 ± 5.01[a]	165.72 ± 17.05[a]
Moisture	62.46 ± 0.08 [a]	66.43 ± 1.50 [a]	63.84 ± 0.99 [a]	65.13 ± 1.95 [a]
Ash	2.46 ± 0.02 [b]	2.70 ± 0.05 [ab]	2.80 ± 0.05 [ab]	2.90 ± 0.07 [a]
Fat	12.16 ± 1.25 [a]	9.59 ± 1.29 [ab]	10.57 ± 0.25 [ab]	7.99 ± 1.81 [b]
Protein	19.14 ± 0.79 [a]	18.50 ± 0.36 [ab]	18.92 ± 0.24 [ab]	17.54 ± 0.06 [b]
Carbohydrates	2.98 ± 0.31 [a]	1.32 ± 0.04 [a]	1.91 ± 1.12 [a]	4.52 ± 0.49 [a]
IDF	0.74 ± 0.06 [a]	1.39 ± 0.15 [a]	1.85 ± 0.48 [a]	1.77 ± 0.40 [a]
SDF	0.08 ± 0.11 [a]	0.07 ± 0.00 [a]	0.16 ± 0.23 [a]	0.23 ± 0.29 [a]
TDF	0.81 ± 0.05 [b]	1.46 ± 0.15 [a]	1.87 ± 0.66 [a]	1.93 ± 0.63 [a]

a-b: Different letters within the same row indicate significant differences between samples ($p < 0.05$). CB: control patty; FRB: fat-substituted patty; FRB-AE: fat-substituted patty and artichoke extract; FRB-TAE: fat-substituted patty and treated artichoke extract; IDF: insoluble dietary fiber; SDF: soluble dietary fiber; TDF: total dietary fiber.

Fat reduction and TDF improvement

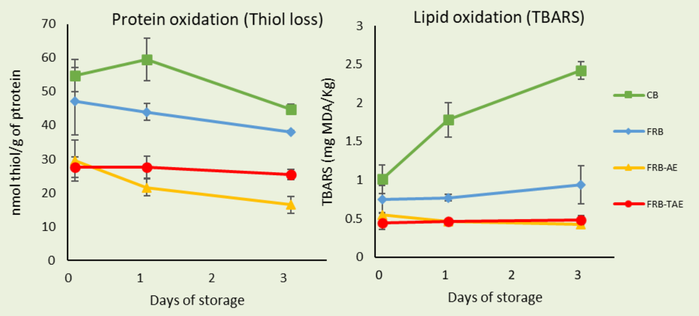


Figure 1. Protein and Lipid oxidation of beef burgers. CB: control burger; FRB: fat-replaced burger; FRB-AE: fat-replaced burger with artichoke extract; FRB-TAE: fat-replaced burger with treated artichoke extract.

Inhibition of proteic and lipid oxidation

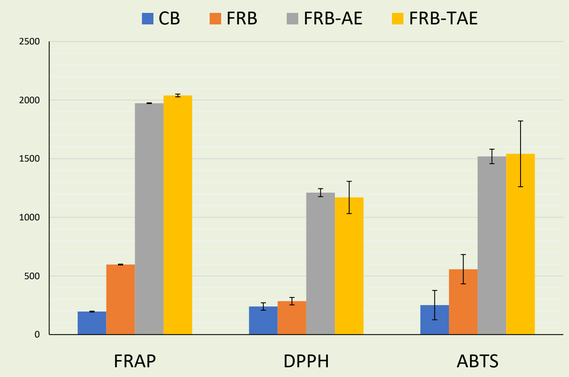


Figure 2. Antioxidant activity of beef burgers. CB: control burger; FRB: fat-replaced burger; FRB-AE: fat-replaced burger with artichoke extract; FRB-TAE: fat-replaced burger with treated artichoke extract.

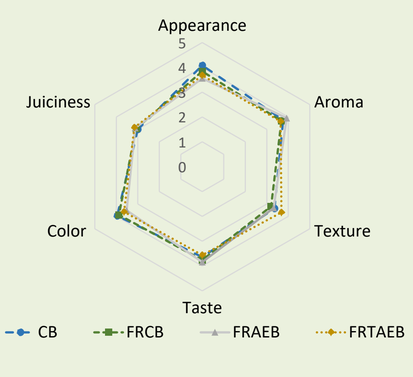


Figure 3. Sensory analysis of beef burgers. CB: control burger; FRB: fat-replaced burger; FRB-AE: fat-replaced burger with artichoke extract; FRB-TAE: fat-replaced burger with treated artichoke extract.

Enhancement of antioxidant capacity and Good sensory Acceptability

CONCLUSIONS

The findings highlighted the positive impact of incorporating artichoke by-products and partially substituting animal fat with an EVOO hydrogel. This approach led to enhanced nutritional value, extended shelf life, and improved antioxidant properties of beef burgers, all while preserving their sensory quality. These outcomes suggest that artichoke by-products could be effectively revalorized, offering promising potential as high-value functional ingredients within the meat industry.

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Acknowledgements: Artichoke by-products have been provided by Cricket Campo de Lorca S.C.L..
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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
MURCIA Food 25

DEVELOPMENT OF FUNCTIONAL BREADSTICK ENRICHED BY EXTRACTS FROM ARTICHOKE INDUSTRIAL WASTES AS SOURCE OF BIOACTIVE PHENOLIC COMPOUNDS

Giovanna Dellapina, Giovanna Poli, Andrea Brutti

SSICA- Experimental Station for the Food Preserving Industry –Consumer Science and Technology Divisions, Parma, Italy

INTRODUCTION

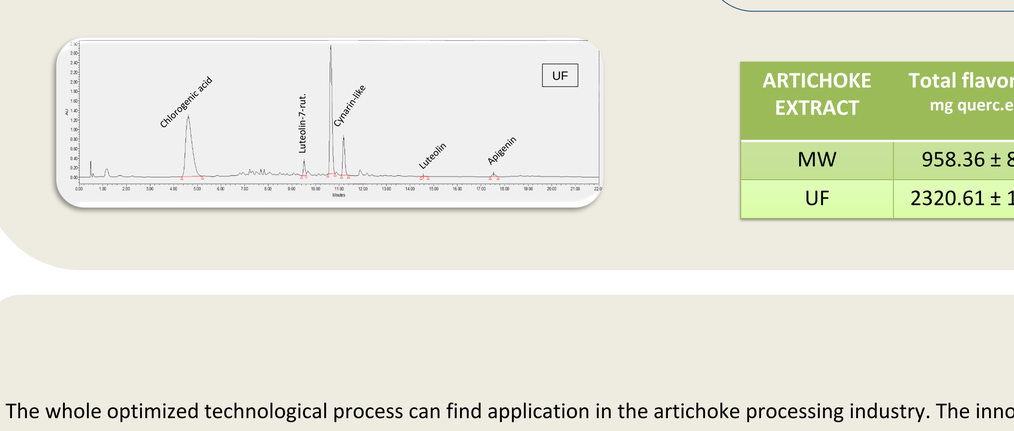
The agro-food industry produces millions of tons of fruit and vegetable waste every year, causing environmental and economic problems. In addition, there is a strong change in the cultural consumers attitude, with an increased focus on sustainability issues and a greater willingness to change their lifestyles according to this interest. Therefore, different strategies have been studied to valorise fruit and vegetable waste (FVW) by recovering the huge amount of biomass and valuable nutrients in order to obtain products with high added value [1]. The artichoke (*Cynara scolymus*), among them, besides being a particularly popular vegetable in Mediterranean gastronomic culture, possesses health-promoting properties (hepatoprotective effect and ability to reduce blood cholesterol levels) due to its high levels of bioactive molecules, antioxidants, minerals and fibres (soluble and insoluble). The huge amount of artichokes by-products (bracts, leaves and stems) of field harvesting and industrial processing constitutes about 80-85% of the total plant biomass and represents a massive loss of its valuable resources. This waste material is nowadays left directly in the field during harvesting and/or is used as animal feed. As the recovery of these valuable molecules is suitable for the production of food supplements and food additives, the valorisation of plant processing waste represents an opportunity for companies in the sector to develop new products and help increase economic and environmental sustainability. By transferring the know-how acquired within the EU-funded projects Medismart and Agro2Circular (PRIMA and Horizon 2020), extracts rich in beneficial bioactive molecules could be produced from industrial processing waste, through processing/extraction techniques that do not involve the use of organic solvents.

OBJECTIVES

The aim of this work was to develop a functional food aimed at meeting the latest consumer demands for well-being and environmental sustainability by recovering the bioactive molecules in artichokes industrial processing waste and incorporating them into a new functionally enriched product following a micro-encapsulation process. While these compounds are undoubtedly healthy, their supplementation in food can affect the sensory properties leading to unpleasant effects, namely bitter taste and astringency perception. In addition, the great reactivity and lack of chemical stability make necessary to deliver these compounds in encapsulated forms . The project consisted of 3 phases: a) MICROWAVE ASSISTED EXTRACTION; b) MICRO-INCAPSULATION; c) NEW PRODUCT DEVELOPMENT.

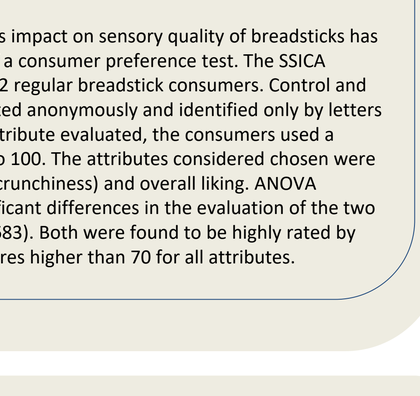
MATERIALS AND METHODS

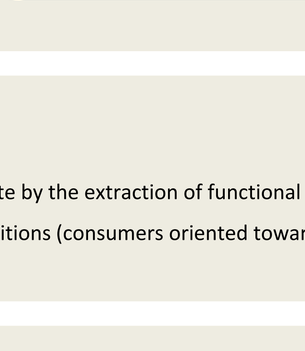
PHASE 1. The extraction step had been optimized for different vegetable species in the international MEDISMART and A2C projects, using MAE (Microwave Assisted Extraction) technology. Figure represents the extraction and purification processes.



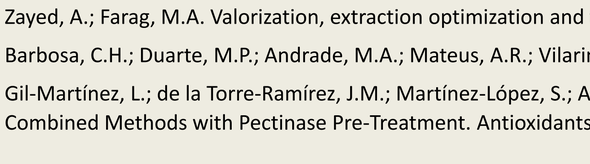
PHASE 2. In order to preserve the characteristics of the bioactive substances (mainly chlorogenic ac., cynarins, luteolin) and allow their preservation in food matrices, it is necessary to protect them from oxidation caused by, e.g., high T (cooking and/or stabilization), changes in humidity during storage, exposure to oxygen, etc. In addition, the possible presence of off-flavors (i.e. bitterness) and off-odors (burnt, cooked smell) could affect consumer acceptability. To overcome these drawbacks, the extracts have been micro-encapsulated and used in a dried form. Following indications from market surveys, breadstick with artichoke extracts were prototyped and proposed for sensory panel evaluations.

PHASE 3. Results obtained in the survey conducted in previous experiments were used for product development. Functional snacks have been prepared with an added amount of flavonoids (equal to about 200mg/100g of snacks) which represents a dietary supplement corresponding to 1/5 of daily maximum intake (recommended by Italian Ministry of Health).





RESULTS



EXTRACT CHARACTERIZATION
Among the identified and quantified phenolic compounds, 42.2% was chlorogenic acid, 44.4% cynarin-related compounds, 4.5% apigenin, 7.8% free luteolin or luteolin bound to sugar groups, and <1% other phenolic or carboxylic acids such as ferulic acid, vanillic acid and coumaric acid.

ARTICHOKE EXTRACT	Total flavonoids mg querc.eq/L
MW	958.36 ± 83.2
UF	2320.61 ± 145.4

SENSORY EVALUATION
The two snacks (functional and control) were assessed by triangle test (ISO 4120:2021) and liking test to determine whether the beads addition was perceived by consumers and the contribution to overall liking.
TRIANGLE TEST : The results obtained confirm that micro-encapsulated polyphenols added to snacks (breadsticks) do not modify sensory perception.
CONSUMER TEST : The beads impact on sensory quality of breadsticks has been evaluated by means of a consumer preference test. The SSICA sensory panel consisted of 32 regular breadstick consumers. Control and Beads samples were presented anonymously and identified only by letters A and B. For each sensory attribute evaluated, the consumers used a linear graphic scale from 0 to 100. The attributes considered chosen were appearance, taste, texture (crunchiness) and overall liking. ANOVA showed no statistically significant differences in the evaluation of the two products considered (p=0.1683). Both were found to be highly rated by the panel, with averages scores higher than 70 for all attributes.

CONCLUSIONS

The whole optimized technological process can find application in the artichoke processing industry. The innovation offers, on the one hand, an alternative solution to the disposal of the industry's waste by the extraction of functional molecules from the bracts, leaves, and stems coming from the industrial plants, on the other hand, represents an opportunity aimed at its expansive and commercial grow. The new products developed respond to changing market conditions (consumers oriented toward healthy and sustainable choices) with the aim of creating new niches commodities and leading the whole supply chain towards new consumers.

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
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FINE-TUNING EXTRUSION PROCESSING PARAMETERS TO ENHANCE THE TEXTURAL AND NUTRITIONAL QUALITY OF SOY-BASED MEAT ANALOGS

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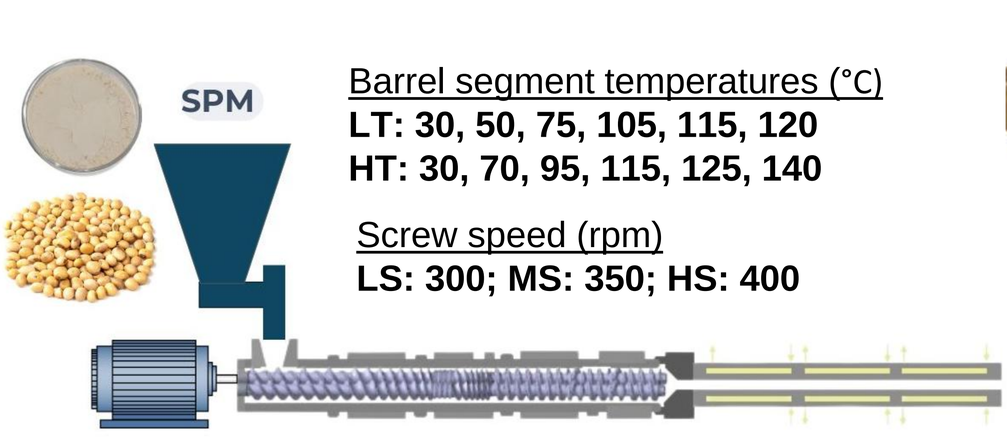
INTRODUCTION

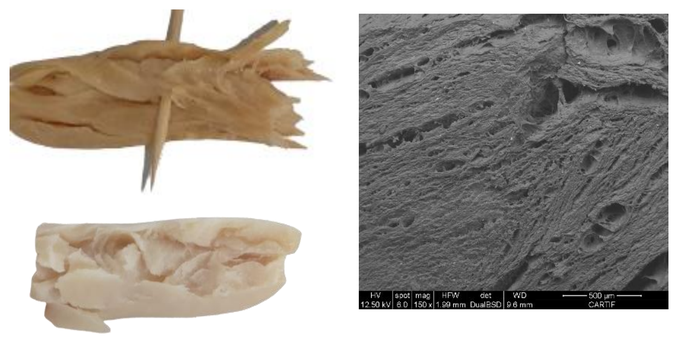
This study aimed to evaluate the influence of extrusion temperature and screw speed on the textural, structural and nutritional properties of soy-based meat analogs produced from a blend of soy protein concentrate (SPC) and soy protein isolate (SPI), (9:1), (SPM).

EXPERIMENTAL DESIGN



Barrel segment temperatures (°C)
LT: 30, 50, 75, 105, 115, 120
HT: 30, 70, 95, 115, 125, 140

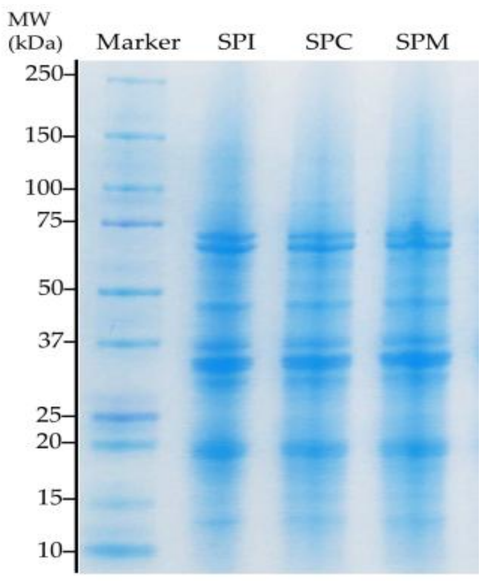
Screw speed (rpm)
LS: 300; MS: 350; HS: 400



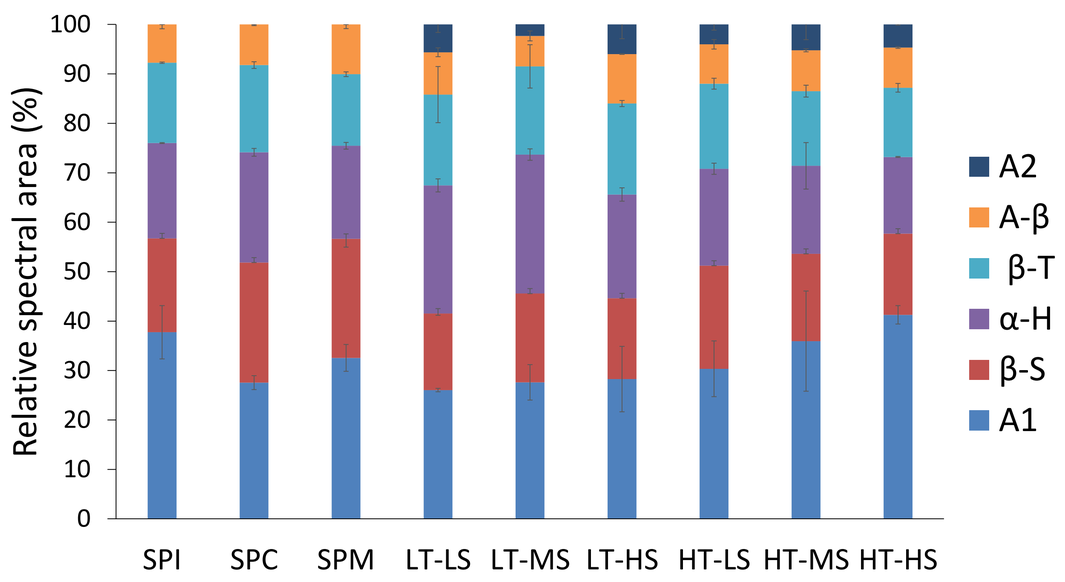
Visual appearance and microstructure of the high-moisture extrudates cut longitudinally to the flow direction.

RESULTS

Protein molecular profile (SDS-PAGE)



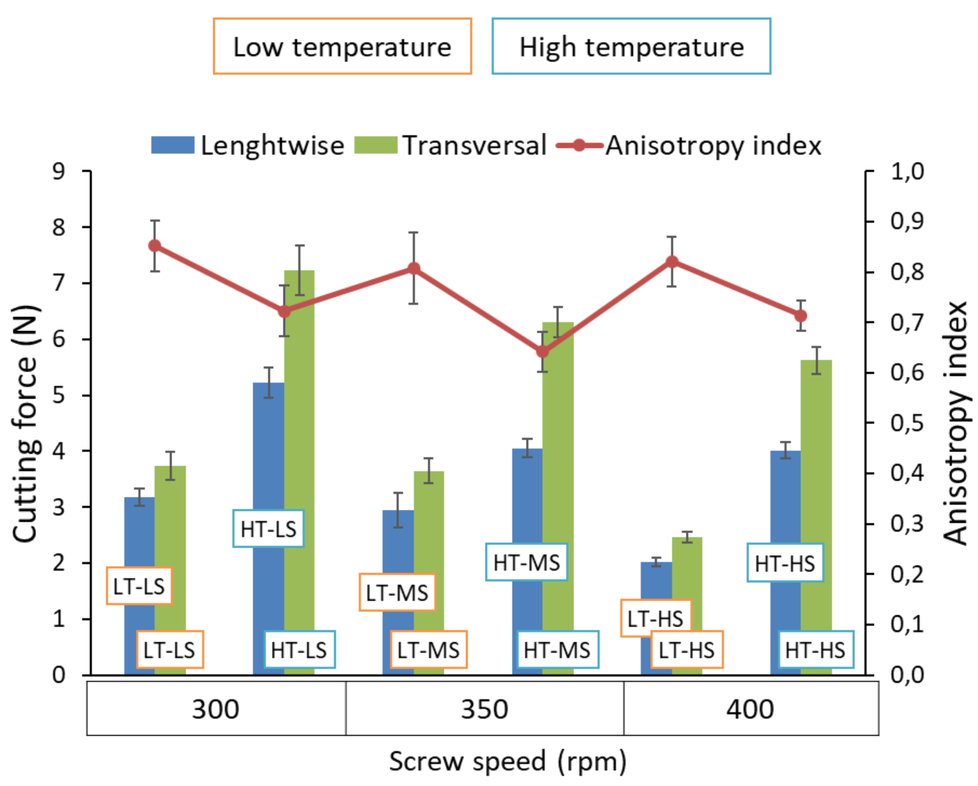
Changes in protein secondary structure during extrusion



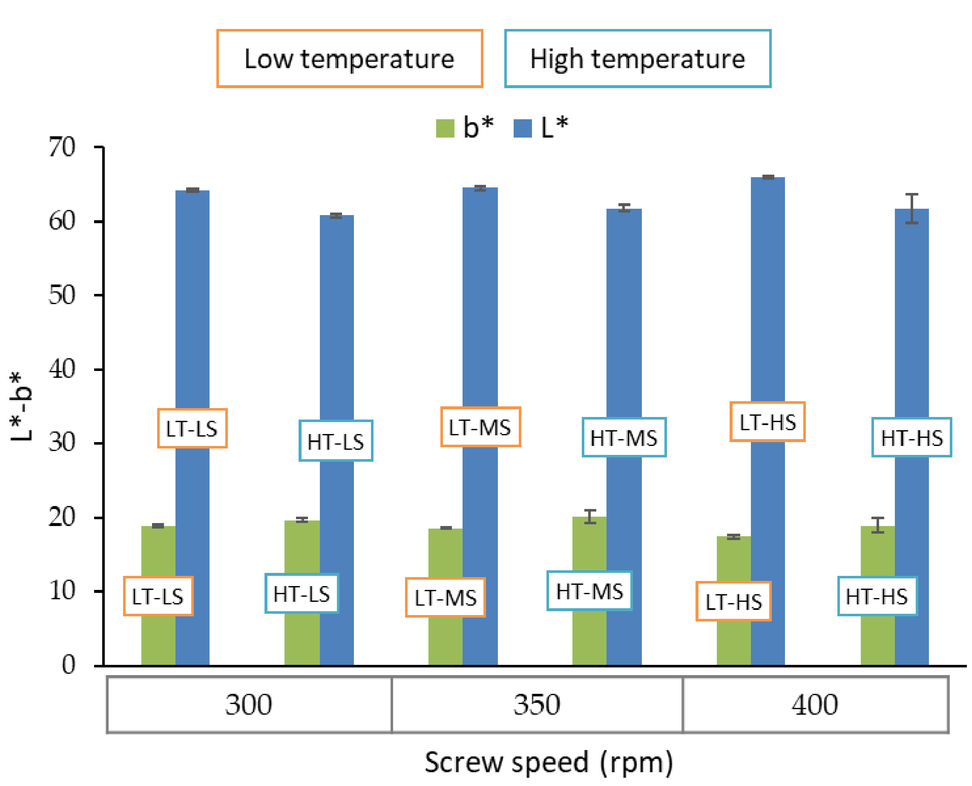
Trypsin inhibitors

Samples	mg inhibitors/g
SPI	4.62±0.76
SPC	7.4±1.01
SPM	2.51± 0.82
LT-LS	<0.1
LT-MS	0.1±0.0
LT-HS	0.16±0.93
HT-LS	<0.1
HT-MS	0.2±0.76
HT-HS	<0.1

Textural properties



Color CIE L*-b*



CONCLUSIONS

FTIR analysis denoted a reduction in β-sheet structures and an increase in aggregated protein structures upon extrusion, particularly at higher temperature (140°C). Trypsin inhibitors decreased by over 90%, improving the nutritional quality under all extrusion conditions. Higher extrusion temperatures led to softer, darker extrudates with enhanced visual anisotropy, whereas increased screw speeds resulted in lighter, softer textures but with minimal impact on fiber alignment. These findings highlight the importance of selecting the appropriate extrusion parameters to optimize both the textural and nutritional properties of plant-based meat analogs.

REFERENCE: Ribeiro, G., Piñero, M.-Y., Parle, F., Blanco, B., & Roman, L. (2024). https://doi.org/10.3390/foods13111748

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IBERFLUID INSTRUMENTS

KEOFITT® WORLD LEADERS IN STERILE SAMPLING™

Does sampling play a role in food safety?

How right equipment is important to ensure proper microbiological samples

"It takes many years to build a good brand, but only a tank of bad product to destroy it.

Sampling is not something we talk about and it's something we should talk about a lot more.

Sampling seems like an easy concept to understand, but it's often ignored during equipment design. Perhaps simply, because it is considered laboratory equipment, installed in the process area.

The right team says it all

Small producers, in many cases, will lose a lot of money because they throw away something that was right. It will make sense to invest in proper sampling equipment because you avoid throwing away a healthy product. There are a lot of different places in production where things can go wrong, but if you have the right equipment, things very rarely go wrong.

First Class Valves

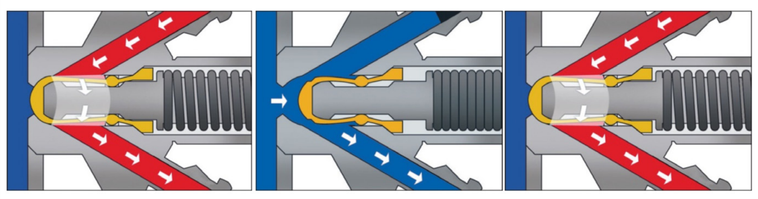
Sanitary conditions are crucial for food processing. And being able to take completely clean samples from storage tanks and process pipes is essential for both chemical and microbiological sampling. That is why, for more than 40 years, KEOFITT has continued to develop and innovate in hygienic, sterile and aseptic sampling. The KEOFITT sterilizable sampling valve combines the two functions. Efficient cleaning and sterilization of the valve can be carried out between random samples, regardless of the stage of the production process and without compromising the process.

The valve is Certified Internal Electropolishing Ra 0.2, 3-A, FDA, Type E1 EHEDG, ADI free-TSE/BSE-free and USP Class VI. For this reason, it is also appreciated, in addition to the agri-food sector, also the Pharma and Biotech industries.

A Unique Valve Design

The sterilization procedure can be performed by rinsing the valve with alcohol or steam, through the steam inlet of the valve. It is the perfect, hygienic design and polish of all product contact surfaces that enable valve sterilization.

According to the EHEDG requirements test, carried out by the Biotechnological Institute in Denmark, just one minute with steam at 121º C/1 bar(g) will be enough to sterilize the valve. Once sterilized, the valve is opened, and the sample is collected through the connection to the lower one.



1.Valve Closed (Sterilization) | 2. Open Valve (sampling) | 3. Closed Valve (Sterilization)

The valve is designed for frequent cleaning and efficient sterilization and representative sampling, without interrupting production.

Electro-polishing of the internal surfaces of the valves

Electro-polishing is an electrochemical process by which surface material is removed from an object immersed in a liquid and subjected to an electric current.

For a sampling valve, it is much more important to have a smooth inner surface than a shiny outer surface. For this reason, Keofitt has developed a method of internal electro-polishing of the connection spouts and the valve chamber, with repeatable and consistent results. The effect takes place when the electric current flows, from the anode + (valve) to the cathode – (electrode).

Electro-polishing principle according to fig.1:

1. Electrolyte
2. Cathode
3. Workpiece to be polished (Anode)
4. Particle moving from the part to the cathode
5. Surface before polishing
6. Surface after polishing (removed peaks and rounded corners)

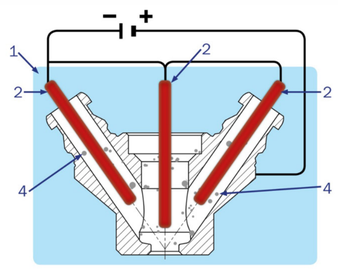


Fig.1

Individual cathodes are placed in the internal cavities, allowing electrical current to flow from the internal surfaces, resulting in the removal of high peaks from these internal surfaces.

The advantages of electro-polishing:

The most important advantage is the reduction of product adhesion and ease of cleaning, because of the improved surface finish.
Other advantages are improved corrosion resistance (surface contaminants are removed and the chemical resistance of the stainless steel surface is improved) and appearance in terms of the glossy surface.

The surface roughness is measured and expressed as the Ra value.
A roughness meter with a stylus is used for this purpose. The surface topography of the object (the vertical movements of the pencil) is recorded and transferred as an electrical signal. From it, a curve is drawn and a midline (CLA) is calculated, fig. 2.

The Ra value is based on the current deviations (blue arrows, peaks, and valleys) of a perfectly flat surface (the CLA midline). The position of the midline is such that the current surface profile is equally represented above and below the midline.

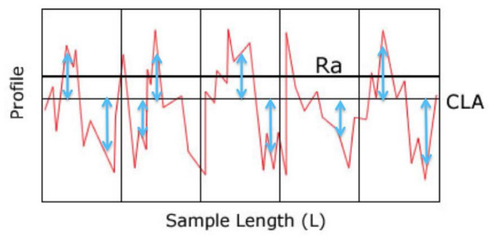
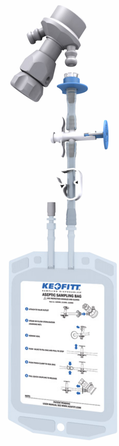


Fig.2

Mechanical Polishing vs. Polishing Electrochemical:

Many mechanically polished products claim low roughness figures, such as, Ra-0.4, which is possible by spending a lot of time polishing with fine diamond paste. But the internal areas and ducts will be difficult to polish due to mechanical constraints. In addition, mechanical polishing tends to round the peaks rather than remove them, which could facilitate unwanted bio-film buildup. In addition, it leaves many fine "scratches" on the surface, hygienically inadequate, despite an acceptable Ra value.

The first big step was to move from inlet/outlet outlets welded to the valve body, to machined one-piece bodies.



A great advantage of electro-polishing over mechanical polishing, is to remove any "loose" molecules, such as iron, chromium, carbon or nickel, that are not chemically bonded to the steel alloy and can dissolve in the product and contaminate it.

With the electro-polished inner surface, it is very difficult for any substance to adhere, reducing the risk of cross-contamination. At the same time, the time required for cleaning/disinfection is minimal.

Serial Number:
Internally electro-polished valve bodies are marked with an "E" in front of the serial number: E12345678. Roughness as a single number is expressed as maximum acceptable roughness, such as Ra - 0.8 µm or Ra - 0.5 µm. However, the average value of Ra in a batch could also be 0.6 or 0.4 µ; all of them meet the only criterion of being less than 0.8 µ. However, if the average is 0.4 µ, most items will have high roughness just below the 0.5 µ limit and you will most likely have to discard a considerable number of valves above 0.5 µ, in order to live up to the max. 0.5 specification.

Keofitt relies on the average Ra value at 0.2 µ and at the same time indicates the standard deviation, as an indicator of how far from the average roughness a given valve is. This is achieved through a combination of: a) optimized machining on high-quality machining centers and b) final internal electro-polishing.

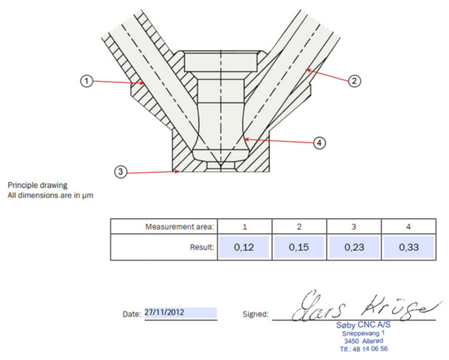
As an example: In a production batch of 100 valve bodies, the Ra value is measured on each piece and the average is 0.2 µ. The standard deviation (sigma) is calculated at 0.08 µ. This low standard deviation is due to rigorous process control. Ensuring that more than 97% of all valves have a Ra value below 0.36 µ (average + 2 x sigma).

Keofitt presents:

* Ra (max.) = 0,5 µ
* Ra (average) = 0.2 µ
* Ra (standard deviation) = 0.08 µ

• The individual certificates (such as the lower cutout) of each valve declare the measured roughness on 3 internal surfaces and 1 external surface (in contact with the product):

1. Interior entrance
2. Interior exit
3. Contact surface of the valve body with the product
4. Inner valve chamber



"Sampling School" in situ.

A hands-on sampling point and procedure evaluation session in customer processing plants. Followed by a training course and points of improvement in sampling/ cleaning/sterilization. Replacement of non-hygienic devices, mapping of microbiological samples, etc. As well as training in maintaining hygienic sampling equipment. Diplomas for attendees.

Sample Handling and Transport

It is not enough to have the right equipment and correct handling to be successful and completely reliable in the sample. To this end, KEOFITT provides the widest range of products and accessories. Highlighting the Portable Aseptic Sampling System with bottles, as well as the "sampling bags": three types of transportable sampling bags: "spike", sterile and aseptic.

Single-use, pre-sterilized, pharmaceutical-grade, to collect samples from 250 cc to 2L, for microbiological analysis. They can be cold transported to any laboratory with the guarantee that the microbiological sample will be representative, maintaining its integrity.

Authors: Francesc Terradellas and Borja García

(IBERFLUID Instruments, S.A.)
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¿Qué importancia le damos al muestreo?

El equipo adecuado garantiza la buena microbiología

"Se necesitan muchos años para construir una buena marca, pero sólo un tanque de mal producto para destruirla".

El muestreo no es algo de lo que hablamos y es algo de lo que deberíamos hablar mucho más.

El muestreo parece un concepto fácil de entender, pero a menudo es ignorado durante el diseño de equipos. Quizás simplemente, porque se considera un equipo de laboratorio,instalado en el área de proceso.

El equipo adecuado lo dice todo

Los pequeños productores, en muchos casos, perderán mucho dinero porque tiran algo que estaba bien. Tendrá sentido invertir en equipos de muestreo adecuados porque evitas tirar un producto saludable. Hay muchos lugares diferentes en la producción donde las cosas pueden salir mal, pero si tienes el equipo adecuado, las cosas muy rara vez van mal.

Válvulas de Primera Clase

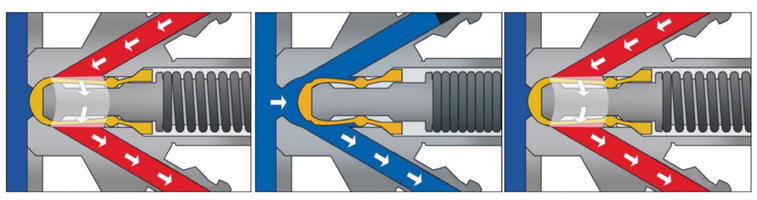
Las condiciones sanitarias son cruciales para la elaboración de alimentos. Y poder tomar muestras completamente limpias de los tanques de almacenamiento y tuberías de proceso, es esencial tanto para muestreo químico y como para muestreo microbiológico. Por ello, durante más de 40 años, KEOFITT continúa desarrollando e innovando en muestreo higiénico, estéril y aséptico. La válvula de muestreo esterilizable KEOFITT combina las dos funciones. La limpieza y esterilización eficientes de la válvula se pueden llevar a cabo entre muestras aleatorias, independientemente de la etapa del proceso de producción y sin comprometer el proceso.

La válvula es Certificada de Electropulido interno Ra 0,2, 3-A, FDA, Tipo E1 EHEDG, ADI free-TSE/BSE-free y USP Clase VI. Por ello, también es apreciada, además de en el sector agroalimentario, también las industrias Farma y Biotec.

Un Diseño Único de Válvula

El procedimiento de esterilización se puede efectuar enjuagando la válvula con alcohol o vapor, mediante la entrada de vapor de la válvula. Es el diseño perfecto e higiénico y la pulidez de todas las superficies de contacto del producto que habilitan la esterilización de la válvula.

Según el test de requisitos EHEDG, realizado por el Instituto Biotecnológico en Dinamarca, con sólo un minuto con vapor a 121º C/1 bar(g) será suficiente para esterilizar la válvula. Una vez esterilizada, se abre la válvula y se recoge la muestra por la conexión la inferior.



1.Válvula Cerrada (esterilización) | 2. Válvula Abierta (muestreo) | 3. Válvula Cerrada (esterilización)

La válvula está diseñada para limpieza frecuente y eficiente esterilización y muestreo representativo, sin interrumpir la producción.

Electro-pulido de las superficies internas de las válvulas

El electro-pulido es un proceso electroquímico mediante el cual, el material de superficie se elimina de un objeto sumergido en un líquido y sujeto a una corriente eléctrica.

Para una válvula de muestreo, es mucho más importante tener una superficie interna lisa que una superficie exterior brillante. Por ello, Keofitt ha desarrollado un método de electro-pulido interno de las bocas de conexión y la cámara de la válvula, con resultados repetibles y consistentes. El efecto tiene lugar cuando la corriente eléctrica fluye, desde el ánodo + (válvula) hasta el cátodo – (electrodo).

Principio de Electro-pulido según fig.1:
1. Electrolito
2. Cátodo
3. Pieza de trabajo a pulir (Ánodo)
4. Partícula moviéndose de la pieza al cátodo
5. Superficie antes de pulir
6. Superficie después de pulir (picos eliminados y esquinas redondeadas)

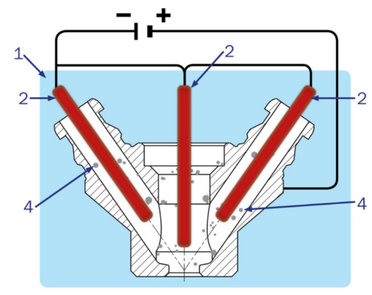


Fig.1

Los cátodos individuales se colocan en las cavidades internas, permitiendo que la corriente eléctrica fluya desde las superficies internas, resultando en la eliminación de los picos altos de estas superficies internas.

Las ventajas del electro-pulido:

La ventaja más importante es la reducción de la adherencia del producto y la facilidad de limpieza, como resultado del acabado superficial mejorado.
Otras ventajas son una resistencia mejorada a la corrosión (se eliminan los contaminantes superficiales y mejora la resistencia química de la superficie del acero inoxidable) y la apariencia en términos de la superficie brillante.
La rugosidad de la superficie se mide y se expresa como el valor Ra.

Para ello se emplea un rugosímetro con lápiz óptico. La topografía superficial del objeto (los movimientos verticales del lápiz) se registra y se transfiere como una señal eléctrica. A partir de la misma, se dibuja una curva y se calcula una línea media (CLA), fig. 2.

El valor Ra se basa en las desviaciones actuales (flechas azules, picos y valles) de una superficie perfectamente plana (la línea media CLA). La posición de la línea media es tal que el perfil de superficie actual se representa igualmente por encima y por debajo de la línea media.

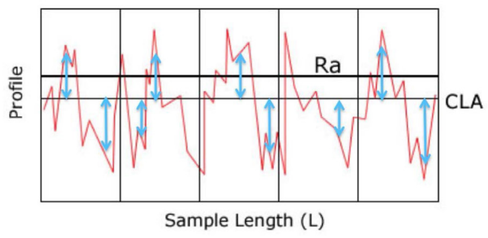


Fig.2

Pulido Mecánico vs. Electroquímico:

Muchos productos pulidos mecánicamente alegan cifras de baja rugosidad, como, Ra-0.4, lo que es posible pasando mucho tiempo puliendo con pasta de diamante fina. Pero las áreas internas y los conductos serán difíciles de pulir debido a restricciones mecánicas. Además, el pulido mecánico tiene una tendencia a redondear los picos en lugar de eliminarlos, lo que podría facilitar la acumulación no deseada de bio-película. Dejando además, muchos "rasguños" finos en la superficie, higiénicamente inadecuados, a pesar de un valor Ra aceptable.

El primer gran paso fue pasar de bocas de entrada/salida soldadas al cuerpo de la válvula, a cuerpos mecanizados de una sola pieza.

Una gran ventaja del electro-pulido en lugar del pulido mecánico, es eliminar cualquier molécula "suelta", como hierro, cromo, carbono o níquel, que no están unidas químicamente a la aleación de acero y que pueden disolverse en el producto y contaminarlo.

Con la superficie interna electro-pulida es muy difícil la adherencia de cualquier substancia, reduciendo el riesgo de contaminación cruzada. A la vez que, para su limpieza/desinfección el tiempo requerido es mínimo.

Número de Serie:
Los cuerpos de las válvulas electro-pulidas internamente son marcadas con una “E” delante del número de serie: E12345678.
La rugosidad como número único, se expresa como rugosidad máxima aceptable, tal como Ra - 0,8 µm ó Ra - 0,5 µm. Sin embargo, el valor medio de Ra en un lote podría ser también 0,6 como 0,4 µ; todos ellos cumplen con el único criterio de ser inferiores a 0,8 µ. Sin embargo, si el promedio es 0,4 µ, la mayoría de los artículos tendrán una rugosidad alta justo por debajo del límite de 0,5 µ y lo más probable, es que tenga que descartar un número considerable de válvulas por encima de 0,5 µ, con el fin de estar a la altura de la especificación de máx. 0,5.

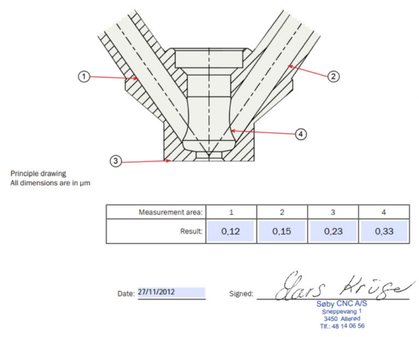
Keofitt apuesta por el valor medio de Ra a 0,2 µ y al mismo tiempo indicar la desviación estándar, como un indicador de lo lejos de la rugosidad media que esté una válvula dada. Esto se obtiene a través de una combinación de: a) mecanizado optimizado en centros de mecanizado de alta calidad y b) electro- pulido interno final.

Como ejemplo:
En un lote de producción de 100 cuerpos de válvula, el valor Ra se mide en cada pieza y el promedio es 0.2 µ. La desviación estándar (sigma) se calcula a 0.08 µ. Esta baja desviación estándar se debe a un riguroso control del proceso. Asegurando que más del 97% de todas las válvulas tienen un valor Ra por debajo de 0,36 µ (promedio + 2 x sigma).

Keofitt presenta:
* Ra (máx.) = 0,5 µ
* Ra (promedio) = 0.2 µ
* Ra (desviación estandard) = 0.08 µ

• Los certificados individuales (como el recorte inferior) de cada válvula declaran la rugosidad medida en 3 superficies internas y 1 externa (en contacto con el producto):

1. Interior entrada
2. Interior salida
3. Superficie de contacto del cuerpo de válvula con el producto
4. Cámara interior de la válvula



“Sampling School” in situ.

Una sesión práctica de evaluación de puntos de muestreo y procedimientos en las plantas de procesado de clientes. Seguida de un curso formativo y de puntos de mejora en el muestreo/limpieza/esterilización. Reemplazo de dispositivos no- higiénicos, mapeo de las muestras microbiológicas, etc. Así como formación en mantener los equipos de muestreo higiénico. Diplomas para los asistentes.

Manejo y transporte de muestras

No basta con disponer de los equipos adecuados y un correcto manejo para tener éxito y total fiabilidad en el muestro. Para ello, KEOFITT proporciona la más amplia gama de productos y accesorios. A destacar el Sistema Portátil de Muestreo Aséptico con botellas, así como los “sampling bags”: tres tipos de bolsas de muestreo transportables: “spike”, estéril y aséptica.
De uso único pre-esterilizadas y de calidad farmacéutica, para recoger muestras desde 250 cc hasta 2L, para análisis microbiológico. Pueden ser enviarlas por transporte a cualquier laboratorio con la garantía de que la muestra microbiológica será representativa, manteniendo su integridad.

Autores: Francesc Terradellas y Borja García

(IBERFLUID Instruments, S.A.) con permiso de KEOFITT A/S

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

CONSUMPTION OF ULTRA-PROCESSED FOODS IN CHILDREN AND YOUNG POPULATION IN THE REGION OF MURCIA AND ITS IMPACT ON THE RISK AND PROGRESSION OF STEATOTIC LIVER DISEASE ASSOCIATED WITH METABOLIC DYSFUNCTION (MASLD)

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INTRODUCTION

The consumption of ultra-processed foods has increased significantly among children and adolescents, in the last decades (1). Excessive intake of these products is associated with various metabolic diseases, including metabolic dysfunction-associated steatotic liver disease (MASLD) (2). Worldwide, MASLD is highly prevalent and its incidence is expected to increase, especially among the young population (3). Improving dietary habits through a Mediterranean style of eating and physical activity could reduce the progression of this pathology.

Objective >>> To evaluate the effect of the consumption of ultra-processed foods in the child and adolescent population of the Murcia Health Area III on the incidence and evolution of MASLD.

METHODOLOGY

Analytical prospective longitudinal study in children and adolescents in Area III of Murcia. Figure 1.

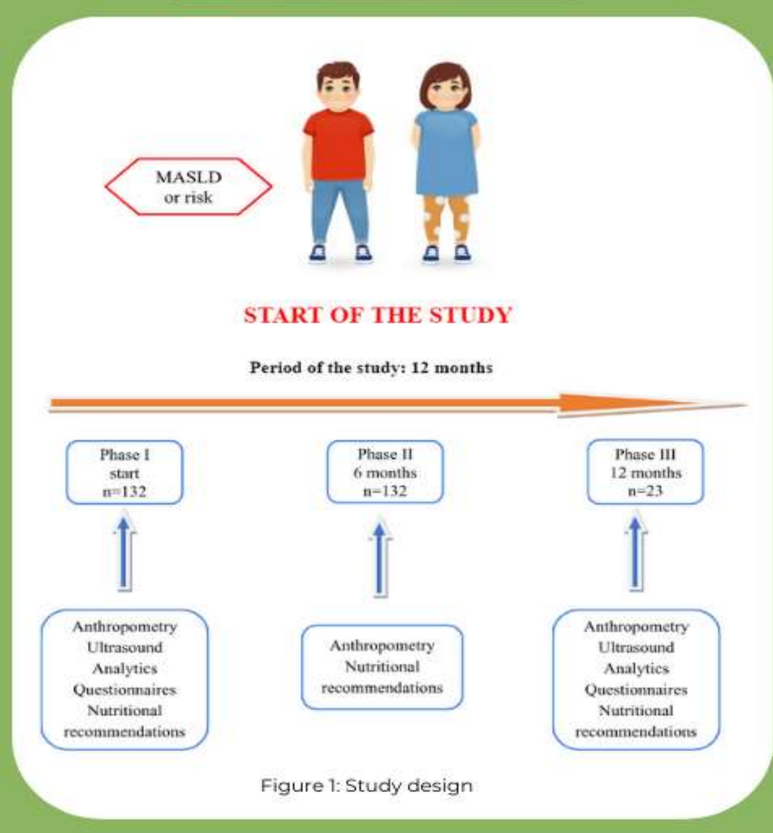

Figure 1: Study design

RESULTS

1. Greater increase in consumption of ultra-processed foods (UPF) rich in sugars and saturated fatty acids (SFA) in the MASLD group at the end of the study. Figures 2 and 3.
2. Of the eight patients initially diagnosed with grade I steatosis, one has progressed to grade II, while in two cases it has been reversed. Figure 4.
3. Significant increase in weight, % fat mass and decrease in % muscle mass in the MASLD group at the end. Figures 5, 6 and 7.

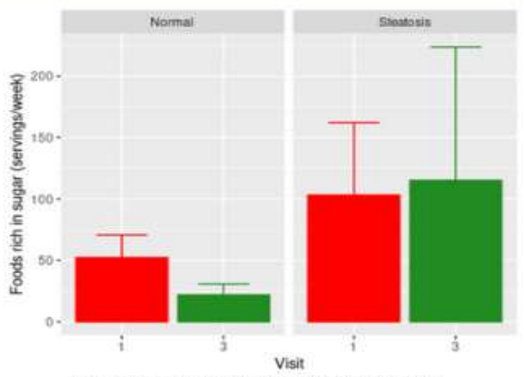

Figure 2 : Consumption of high-sugar UPF

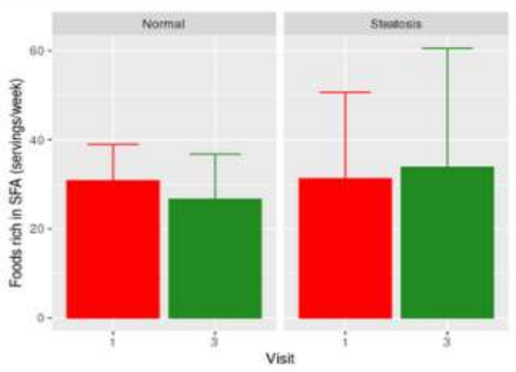

Figure 3: Consumption of high-SFA UPF

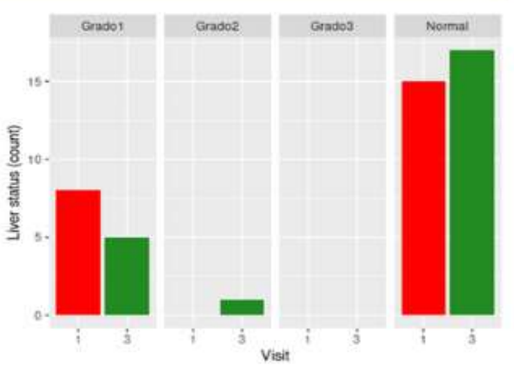

Figure 4: Ultrasound at baseline and at the end

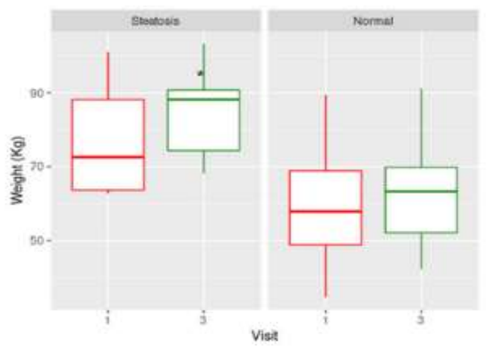

Figure 5: Weight at baseline and at the end

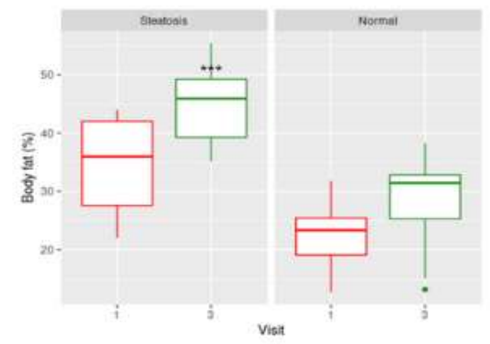

Figure 6: % Fat mass at baseline and at the end

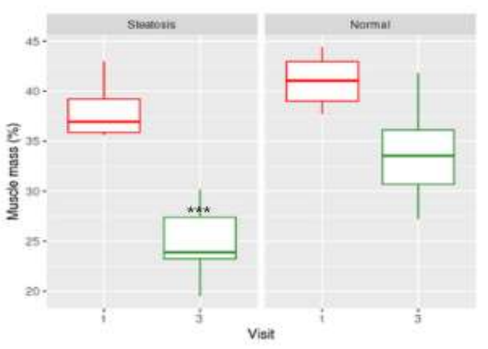

Figure 7: % Muscle massat baseline and at the end

CONCLUSIONS

- It is crucial to promote nutrition education on the adolescents and school-aged populations in order to increase awareness of the risks of overconsumption of ultra-processed foods.
- Furthermore, it is essential to promote healthy eating habits and physical activity to curb the worrying increase in MASLD in young population.

ACKNOWLEDGEMENTS

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Evaluating the Impact of Leaching on the Nutritional Composition and Bioactive Potential of *Quercus pyrenaica* Acorn Flour

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CATÓLICA PORTO

CBQF · CENTRE FOR BIOTECHNOLOGY AND FINE CHEMISTRY ASSOCIATE LABORATORY

Introduction

Acorns, the fruit of oak trees, are highly abundant in Portugal's territory. However, they remain largely unexploited, with less than 1% being integrated into human diets. *Quercus* trees, which cover approximately 34% of Portugal's forested area, produce around 300 thousand tons of acorns annually. Rich in fatty acids, phenolic compounds, tocopherols, and minerals, acorns are promising to enhance traditional foods with functional and health-boosting properties[1,2,3]. Given that Portugal is a net food importer, the valorization of this nutrient-dense resource can be advantageous, especially considering its established nutritional benefits[1,2]. Moreover, acorn by-products offer considerable potential for added-value bioactive compounds, contributing to industrial waste reduction, while encouraging upcycling and highlighting the potential of sustainable non-edible agrifood products for technical applications. This study aimed to evaluate the nutritional composition and bioactive potential of *Quercus pyrenaica* flour (QP), provided by LandraTech, before and after leaching (QPL).

Objective and Methods

This study aimed to evaluate the nutritional composition and bioactive potential of *Quercus pyrenaica* flour (QP), provided by LandraTech, before and after leaching (QPL). The leaching processes were performed using ultrapure water at a 1:6 (w/v) ratio and agitation for 24 h, at room temperature, followed by centrifugation (4,000 rpm, 15 min, 4 °C). The process was repeated three times.

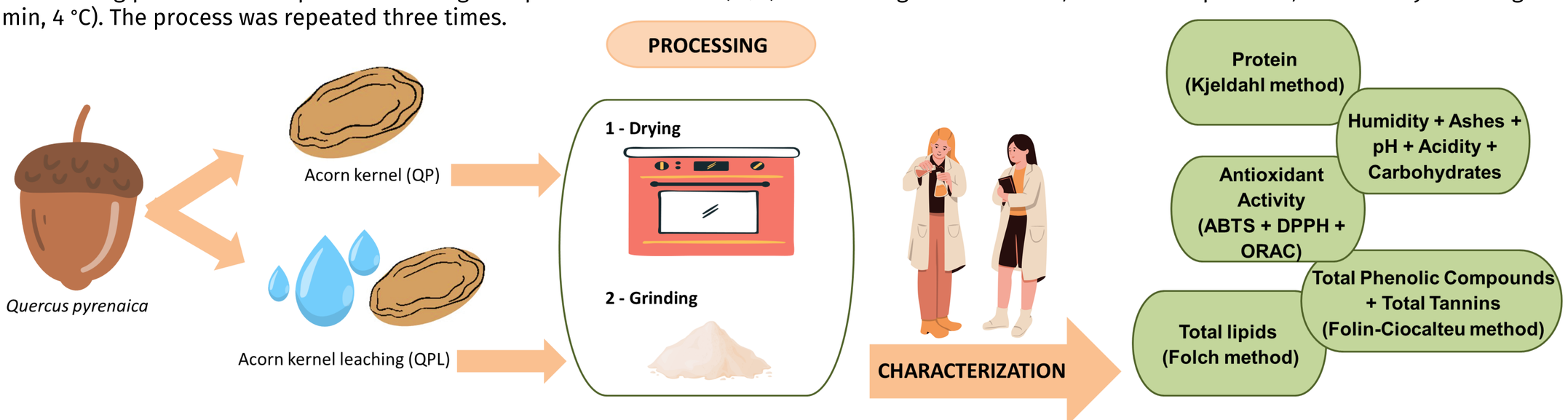
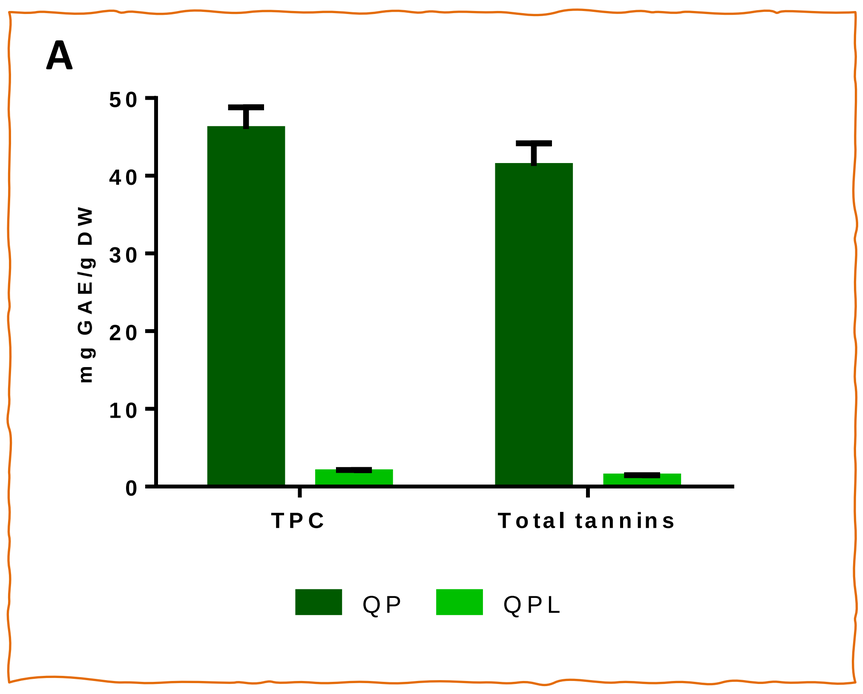


Figure 1. Processing and characterization methodologies diagram from the kernels of *Q. pyrenaica*, harvested in 2022.

Results

Table 1. Composition of the flours from *Q. pyrenaica* before (QP) and after leaching (QPL); DW – dry weight.

	pH	Acidity (g H_2SO_4/100 g DW)	Humidity (%)	Ash (% DW)	Protein (% DW)	Total lipids (% DW)	Carbohydrates (% DW)	Energy value (Kcal/100 g DW)
QP	5.88 ± 0.00	0.11 ± 0.00	10.34 ± 0.00	2.82 ± 0.01	8.60 ±0.07	7.19 ±0.79	71.11 ± 1.02	395.15 ± 2.66
QPL	5.32 ± 0.00	0.03 ± 0.00	5.84 ± 0.00	0.35 ±0.00	7.12 ±0.43	5.28 ±0.13	81.41 ±0.42	398.58 ±0.09



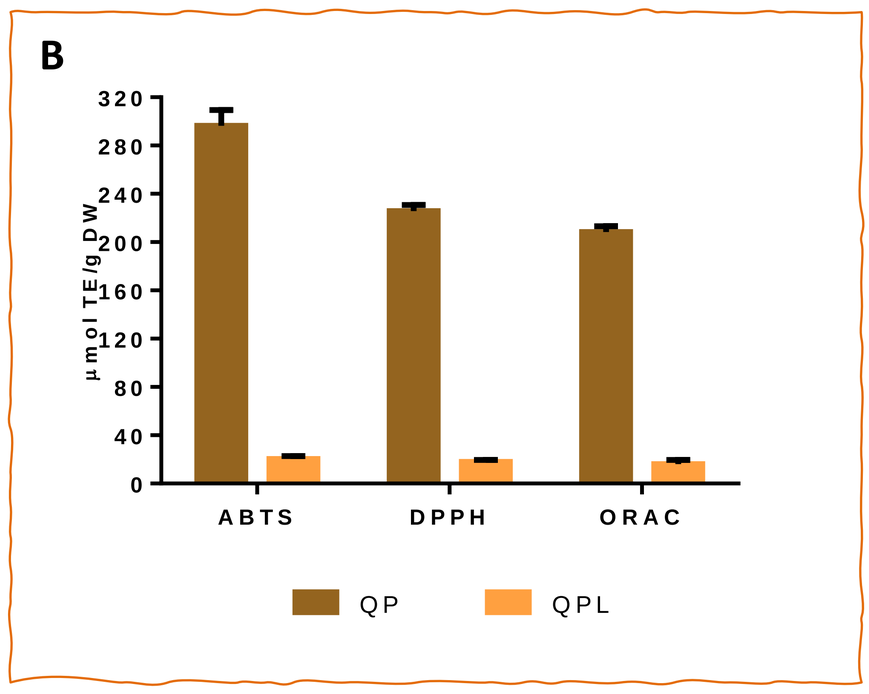


Figure 2. Differences between the flours from *Q. pyrenaica* before (QP) and after leaching (QPL) regarding (A) the total phenolic compounds (TPC) and total tannin composition; and (B) antioxidant capacity by ABTS, DPPH, and ORAC assays.

Overall, exploring alternative debittering techniques and their impact on the functional characteristics of acorn flour could enhance its integration into the food market. This study highlights the potential of acorns, particularly *Q. pyrenaica*, as a sustainable and promising versatile resource, rich in valuable nutritional compounds and bioactive properties.

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Exploring the Power of Lemon Co-Products: Potential Application in Edible Coatings

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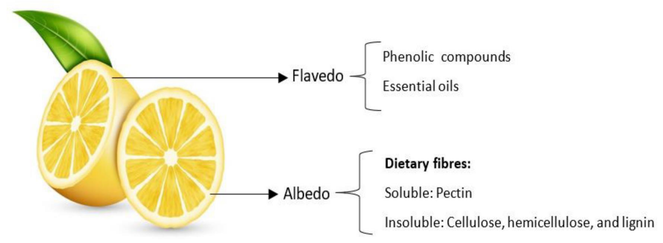
Introduction

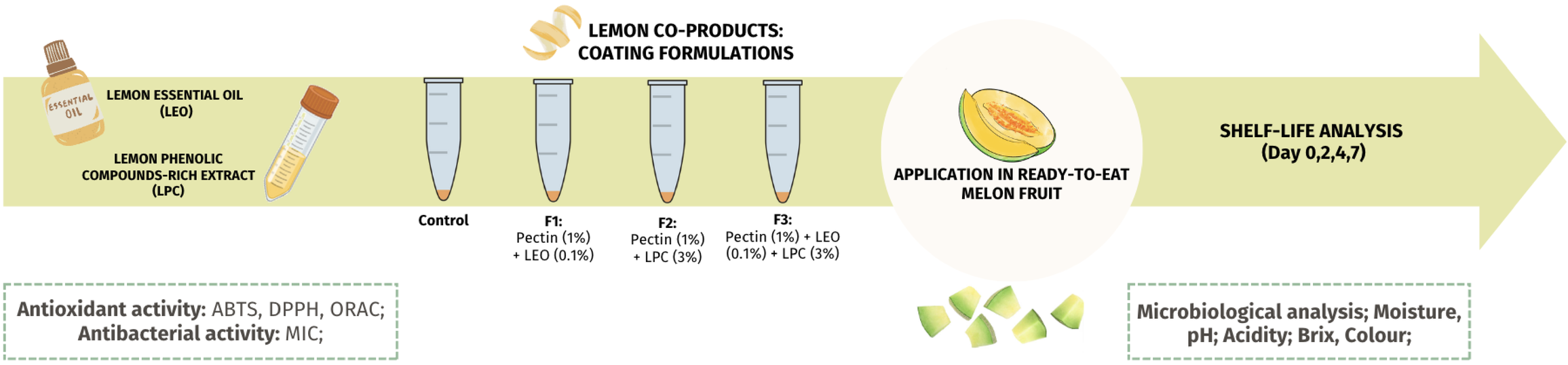
Citrus is one of the most widely cultivated fruit crops and among the most consumed products in the Mediterranean area. In 2019, the annual production of different citrus fruits was approximately 143 thousand tonnes, with lemons and limes accounting for around 20 thousand tonnes [1]. Industrial processes exploit only 45% of the total fruit weight, which generates a significant amount of waste, including peel (flavedo: 27%), pulp (albedo and endocarp: 26%), and seeds (2%). Lemon by-products contain significant amounts of bioactive compounds, which are associated with food preservation properties, such as antimicrobial and antioxidant activities [2]. Furthermore, these by-products, which are often discarded as waste in the environment, can be used to produce new ingredients, such as essential oil (LEO), lemon phenolic compounds-rich extract (LPC) and pectin (Lp), being an opportunity for the food industry to promote the zero-waste concept.



Objectives

✓To understand the preservative potential of LEO and LPC for use in edible coatings aimed at extending fruit shelf life, their antioxidant activity was assessed using ABTS, DPPH, and ORAC assays, while antibacterial properties were determined through the minimal inhibitory concentration (MIC) test. The main objective was to incorporate these functional ingredients into lemon pectin (Lp)-based coating formulations and assess their effectiveness over a 7-day storage period by monitoring microbiological parameters, moisture content, pH, acidity, ºBrix, and colour.

Methodology



Results

1. Preservative Potential of LEO, LPC and Synergy Effect

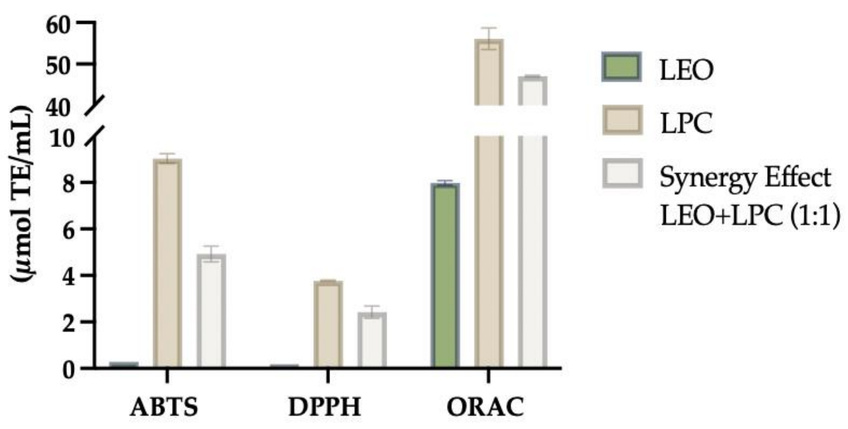


Figure 1. Antioxidant activity of lemon functional ingredients (LEO), (LPC) and the Synergy Effect (LEO+LPC; 1:1).

Table 1. Antibacterial activity (MIC) of lemon functional ingredients (LEO), (LPC) and the Synergy Effect (LEO+LPC; 1:1).

	LEO	LPC	Synergy Effect (LEO+LPC; 1:1)
	MIC (µL/mL)		
Escherichia coli	31.25	125.0	62.5
Staphylococcus aureus	31.25	62.5	62.5
Bacillus cereus	62.5	125.0	125.0
Pseudomonas aeruginosa	62.5	31.25	62.5

2. Shelf Life Analysis of Lemon Edible Coatings

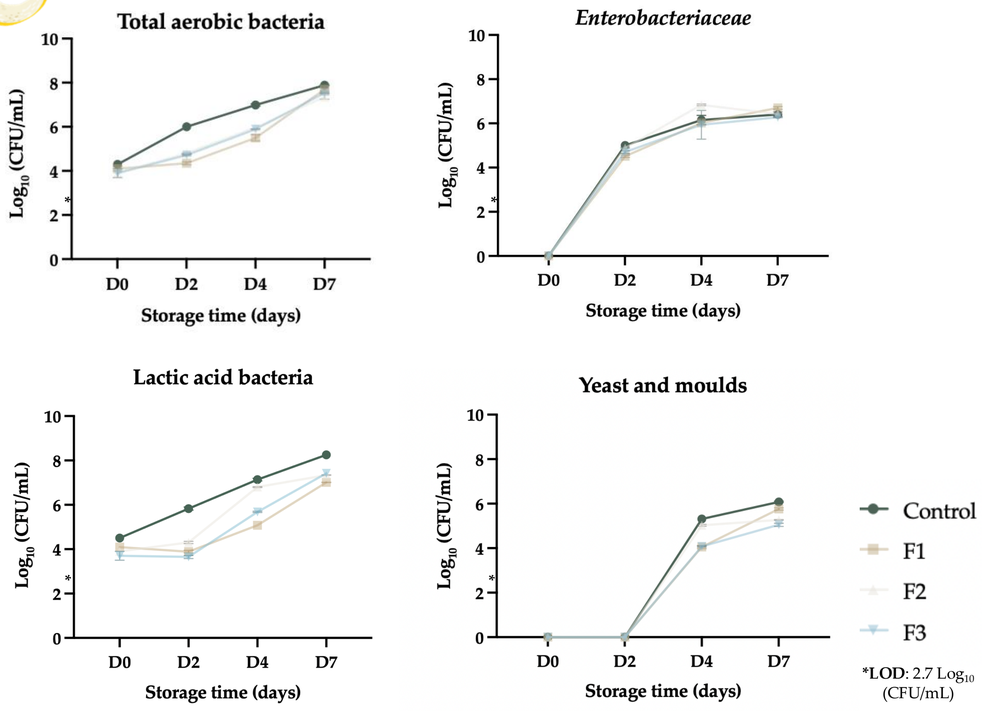


Figure 2. Microbial analysis of lemon edible coatings during the 7-day of storage.

Table 2. Shelf life analysis (Moisture (%), pH, Acidity (g citric acid/100 mL), ºBrix and Colour (L*)) of lemon edible coatings during the 7-day of storage.

	Control		F1		F2		F3	
	Day 0	Day 7	Day 0	Day 7	Day 0	Day 7	Day 0	Day 7
Moisture (%)	92.8 ± 0.8	91.2 ± 0.6	92.8 ± 0.8	92.0 ± 0.4	92.8 ± 0.8	92.1 ± 0.4	92.8 ± 0.8	92.1 ± 0.9
pH	7.2 ± 0.0	5.6 ± 0.0	7.2 ± 0.0	5.3 ± 0.0	7.1 ± 0.0	5.3 ± 0.0	7.1 ± 0.0	5.1 ± 0.0
Acidity (g citric acid/100 mL)	0.1 ± 0.0	0.3 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.2 ± 0.0
ºBrix	7.8 ± 0.1	7.6 ± 0.1	7.8 ± 0.1	7.2 ± 0.1	7.2 ± 0.1	6.9 ± 0.1	7.8 ± 0.1	7.1 ± 0.1
Colour (L*)	63.2 ± 2.2	53.5 ± 7.3	67.5 ± 3.6	54.5 ± 6.2	66.9 ± 2.0	65.0 ± 2.7	68.5 ± 1.5	64.5 ± 3.2

Main Conclusions

✓ Based on these results, lemon co-products are rich in valuable bioactive compounds and represent a suitable matrix for extracting functional ingredients.

✓ The colour (L*) was positively influenced by the formulations containing LPC extract, providing stabilization during 7 days of storage.

✓ This strongly supports their valorisation in edible coating applications an innovative idea for extending the shelf life of melon fruit.

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1. FAO Citrus Fruit Statistical Compendium 2020. **2021.**

2. Magalhães, D.; Vilas-Boas, A.A.; Teixeira, P.; Pintado, M. Functional Ingredients and Additives from Lemon By-Products and Their Applications in Food Preservation: A Review. *Foods 2023, Vol. 12, Page 1095* **2023**, *12*, 1095, doi:10.3390/FOODS12051095.

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Tailoring Food Products to Meet the Nutritional Needs of Seniors: The Diet65+ Project

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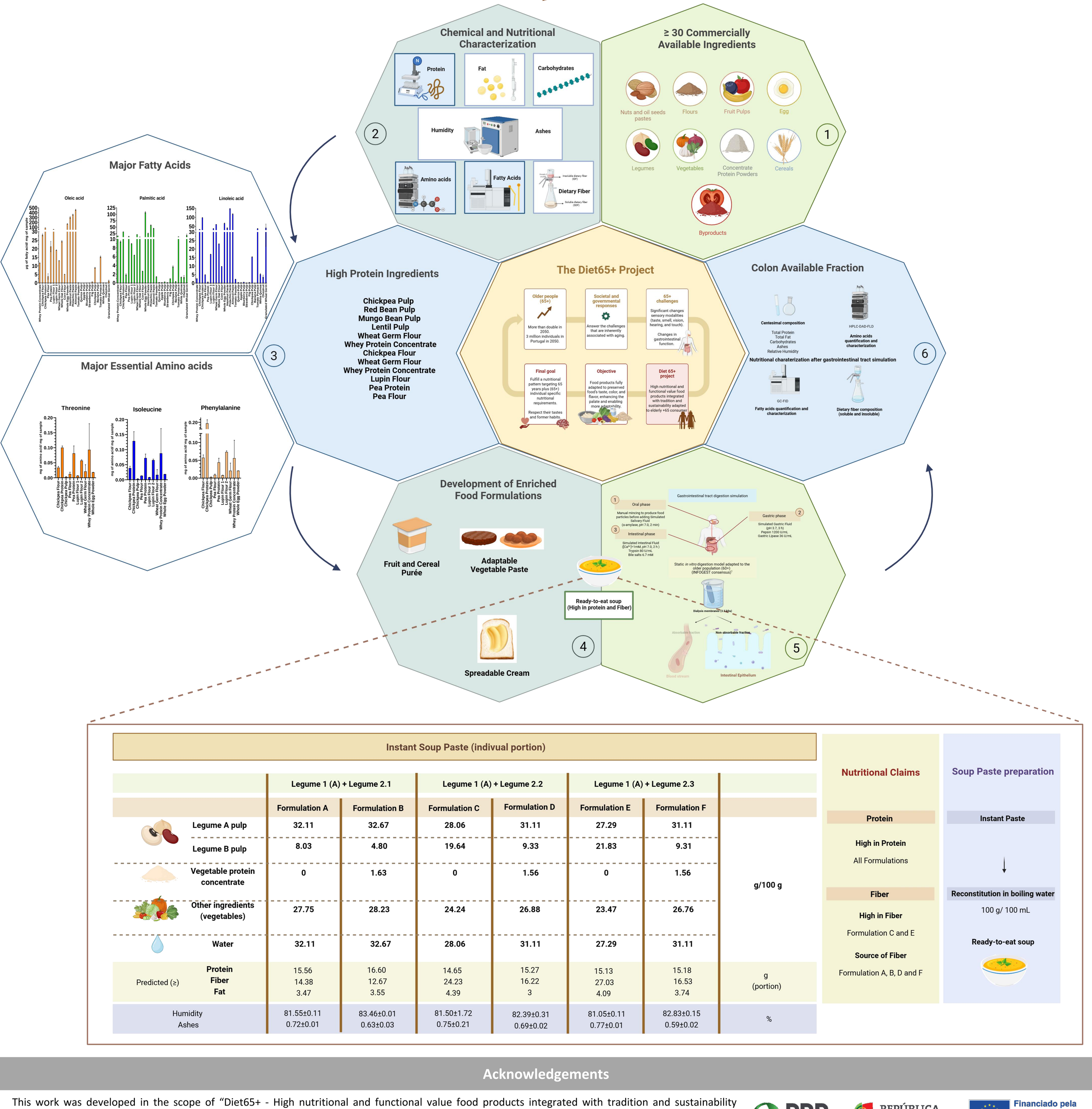
CATÓLICA FACULTY OF BIOTECHNOLOGY PORTO

Decorgel Innovating together



Instant Soup Paste (indivual portion)

		Legume 1 (A) + Legume 2.1		Legume 1 (A) + Legume 2.2		Legume 1 (A) + Legume 2.3		
		Formulation A	Formulation B	Formulation C	Formulation D	Formulation E	Formulation F	
	Legume A pulp	32.11	32.67	28.06	31.11	27.29	31.11	g/100 g
	Legume B pulp	8.03	4.80	19.64	9.33	21.83	9.31	
	Vegetable protein concentrate	0	1.63	0	1.56	0	1.56	
	Other ingredients (vegetables)	27.75	28.23	24.24	26.88	23.47	26.76	
	Water	32.11	32.67	28.06	31.11	27.29	31.11	
Predicted (≥)	Protein Fiber Fat	15.56 14.38 3.47	16.60 12.67 3.55	14.65 24.23 4.39	15.27 16.22 3	15.13 27.03 4.09	15.18 16.53 3.74	g (portion)
Humidity Ashes		81.55±0.11 0.72±0.01	83.46±0.01 0.63±0.03	81.50±1.72 0.75±0.21	82.39±0.31 0.69±0.02	81.05±0.11 0.77±0.01	82.83±0.15 0.59±0.02	%

Nutritional Claims

Protein

High in Protein

All Formulations

Fiber

High in Fiber

Formulation C and E

Source of Fiber

Formulation A, B, D and F

Soup Paste preparation

Instant Paste

↓

Reconstitution in boiling water

100 g/ 100 mL

Ready-to-eat soup

Acknowledgements

This work was developed in the scope of "Diet65+ - High nutritional and functional value food products integrated with tradition and sustainability adapted to elderly +65 consumer" project, which is part of Agenda VIIAFOOD – Plataforma de Valorização, Industrialização e Inovação Comercial para o AgroAlimentar (nºC644929456-00000040), a project supported by Plano de Recuperação e Resiliência (PRR, www.recuperarportugal.gov.pt).

PRR Plano de Recuperação e Resiliência · REPÚBLICA PORTUGUESA · Financiado pela União Europeia NextGenerationEU

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Natural-based strategies in pre- and post-harvest handling and value addition of subtropical crops.

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INTRODUCTION

Subtropical fruits, such as mango and avocado fruits, contain nutrients that provide healthy biological properties and a high antioxidant capacity, but their limited life after harvesting make these fruits targets of research lines to look for effective post-harvest handling. On the other hand, the high production rates of the agri-food sector and the demands of the market require the development of new strategies aimed at improving and maintaining the quality of fruit and ensuring the sustainability and low environmental impact. In response to this challenge, **EcoSkin project** has been created among 4 entities including a primary producer, fertilizer company, research center and foundation, with the common objective of developing sustainable and effective strategies that will allow farmers to produce a high-quality subtropical fruit and ensure its safety and a long shelf-life. In addition, in line with current circular economy policies, the project aims to give a second life to the by-products generated during cultivation and to develop extracts with agronomic potential.

Figure 1. Avocado and mango by-products studied.

Figure 2. Edible coating applications in fruits.

METHODOLOGY

A complete study was carried out of the main by-products generated during the cultivation of mangos and avocados (pruning residues and fruit wastes) by means of a complete physicochemical characterization (organic matter, pH, phenolic content and antioxidant activity, etc.). These wastes were then subjected to two extraction protocols: I) aqueous extraction and II) ethanolic extraction, after which a phytochemical screening was carried out to determine the presence of compounds of agronomic interest (alkaloids, phenols, tannins, etc.). The development and formulation of new products with agronomic application are currently in progress. Conversely, other study was carried out on preservation protocols and the extension of the shelf-life of subtropical fruits through the application of coatings based on natural extracts. These coatings were applied to the fruit by immersion at the established dose (3 cc/l) and stored under refrigeration for 21 days. Finally, several parameters were monitored to determine the suitability of the formulations (firmness, color, acidity, visual appearance, ºBrix, etc.).

RESULTS AND DISCUSSION

Among all the characterized waste materials (leaves, skins and stones of avocado crops and peels of mango fruits), **higher phenolic content of the mango peel** (5.1 mg a.g/g) compared to the rest of the avocado by-products (~1.5 mg a.g/g) was highlighted as a **potential biostimulant ingredient**. On the other hand, considering the high biocidal potential of alkaloids and tannins, aqueous extracts of avocado leaf and mango skin and ethanolic extracts of avocado skin and stone were selected to formulate new prototypes with **biocidal capacity** (currently in progress) (Figure 1). Additionally, regarding the post-harvest applications, several prototypes of **coatings based on natural compounds** were developed and assessed to determine their feasibility of an extension of shelf-life period in subtropical fruits. In these trials, physicochemical and **deterioration changes during storage were less pronounced in fruit treated** with some of the prototypes to be tested, showing an **improvement in post-harvest quality parameters** (such as weight loss, firmness, visual quality, respiration rate, or dry matter) compared to the control (untreated fruit). Based on these results, new prototypes will be formulated and/or reformulated for further post-harvest trials (currently in progress).

	Avocado						Mango	
	Leaves		Piel		Stone		Peel	
	H_2O	EtOH	H_2O	EtOH	H_2O	EtOH	H_2O	EtOH
Alkaloids	+	+	+	+	+	+	+	+
Flavonoids	-	-	-	+	-	-	++	-
Glycosides	-	-	-	-	-	-	-	-
Terpenoids	-	-	-	-	+	++	-	-
Tannins	-	+	-	-	-	-	+	+
Coumarins	+	-	-	-	-	-	+	+
Saponins	+	-	-	-	+	-	-	-
Steroids	-	-	-	-	-	+	-	-
Anthraquinones	-	-	-	-	-	-	+	+

Figure 1. Qualitative analysis of the different phytochemical compounds in the extracts evaluated.

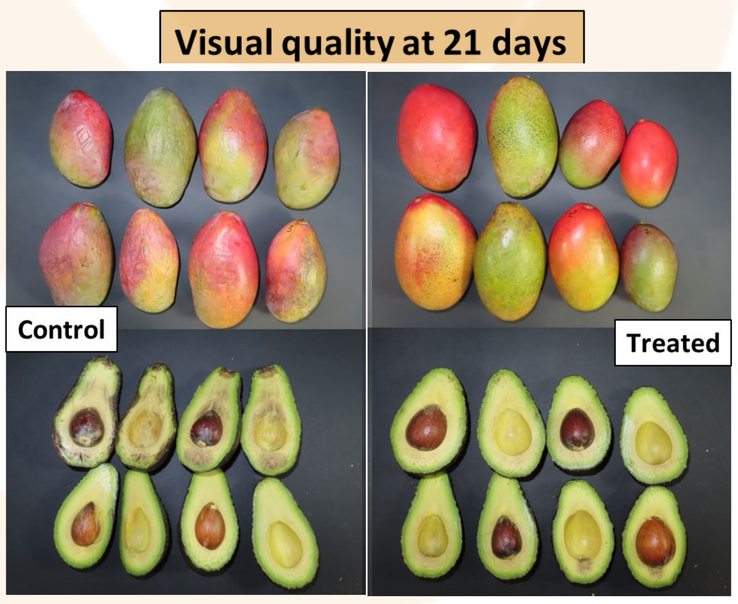
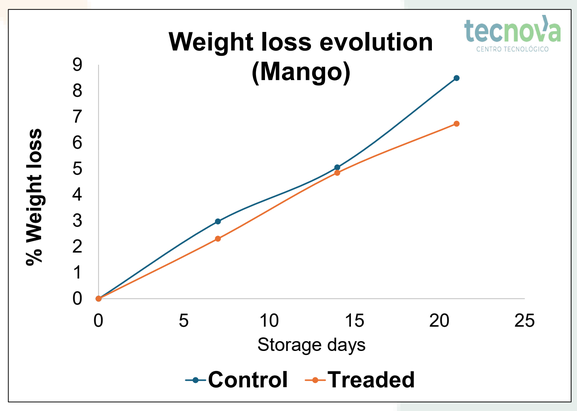


Figure 4. Visual quality of mango and avocado fruits at 21 days of storage; control (left) and treated (right).



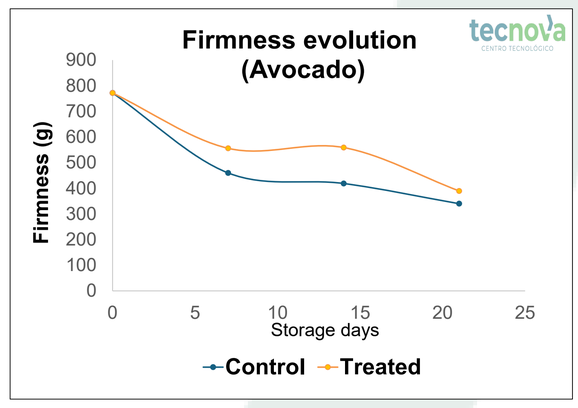


Figure 3. Weight loss and firmness evolution during postharvest shelf life of mango (left) and avocado (right).

CONCLUSIONS

The use of different **subtropical wastes** seems to be **valuable ingredients to be included in agronomic formulations** with interesting biocidal properties. Although no final conclusions can be drawn due to the lack of conclusive data, it is expected **that natural coating prototypes designed for post-harvest applications can be effective to reduce weight loss during the shelf-life** and to **improve the texture** of the targeted subtropical fruits, and hence, **extend their useful life**.

ACKNOWLEDGEMENTS

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Breakfast Cereals: Insights into Market Diversity, Nutritional Value, and Potential Innovation

CATÓLICA CBQF · CENTRE FOR BIOTECHNOLOGY AND FINE CHEMISTRY ASSOCIATE LABORATORY PORTO

Luís M. G. Castro[1], Sara Silva[1], Ema Dias[2], and Manuela Pintado[1*]

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germen MOAGEM DE CEREAIS

INTRODUCTION

The breakfast cereals (BC) market is experiencing steady global and national growth, including in Portugal, where consumption is widespread due to convenience and variety. Despite their popularity, many BC lack an optimal balance between taste and nutritional quality, particularly for children. Research shows that only a small fraction of BCs meet the nutritional standards required for child-targeted marketing, indicating a need for reformulation to reduce sugars, fat, and salt while increasing dietary fiber - an area where Portuguese BC fall short. This review explores the nutritional quality of 178 different BC from 23 brands available on-line on the Portuguese market collected and based on the most recent literature, find out how it is possible to innovate to respond to market needs.

METHODOLOGY

DATA COLLECTION

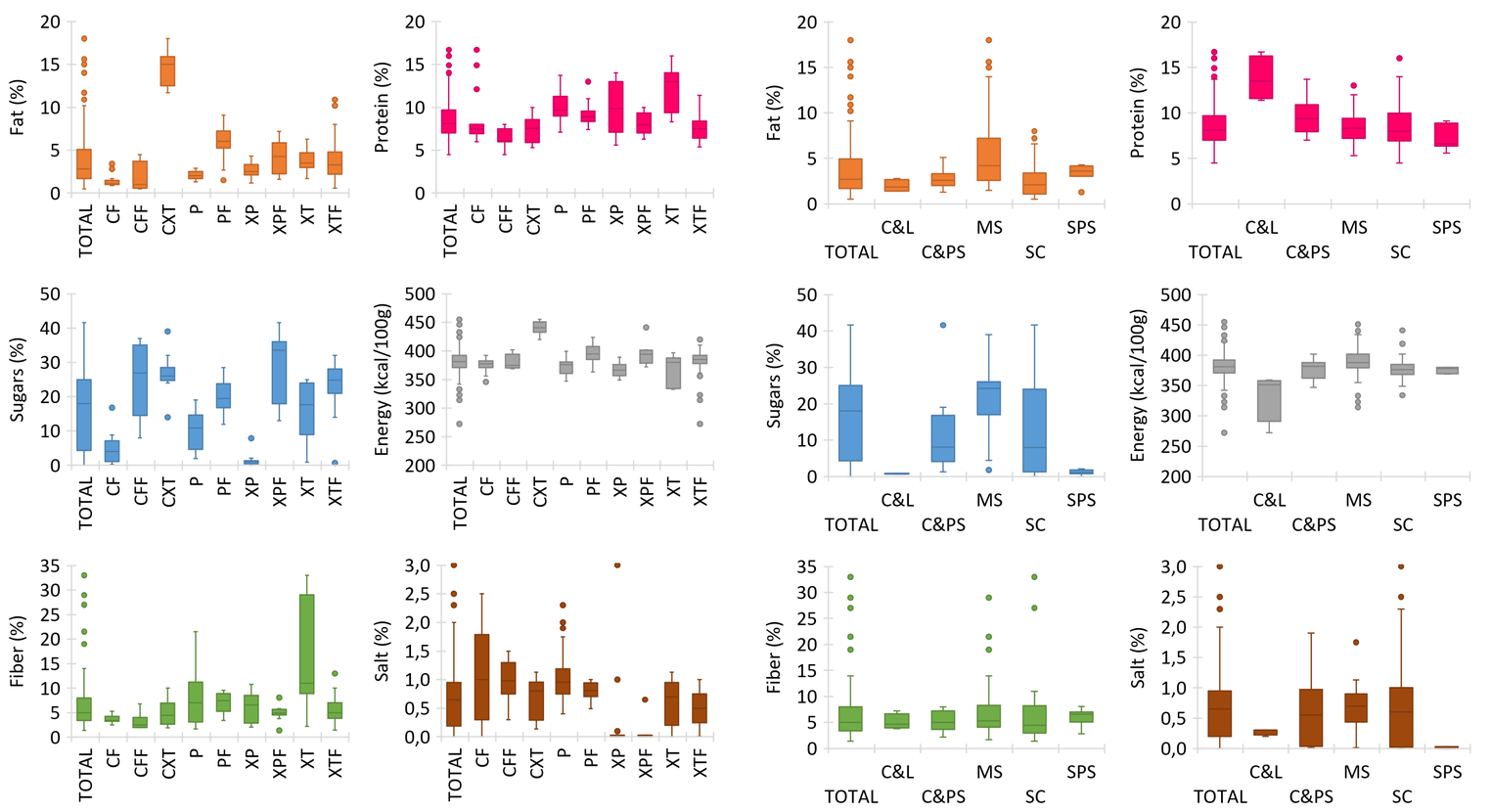
Nutritional facts
Nutri-Score
Nutritional Claims

DATA ANALYSIS

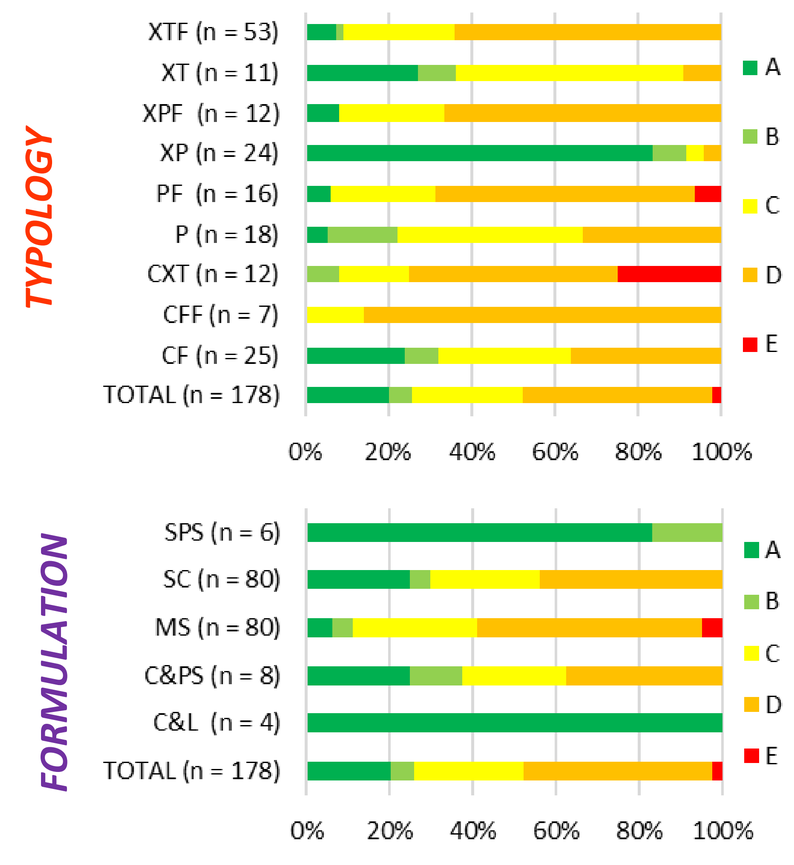
TYPOLOGY: Cornflakes (CF); Flavored cornflakes (CFF); Co-extruded (CXT); Petals (P); Flavored petals (PF); Expanded (XP); Flavored expanded (XPF); Extruded (XT); Flavored extruded (XTF)

FORMULATION: Cereal & legumes (C&L); Cereal & pseudocereals (C&P); Multi-cereal (MS); Single cereal (SC); Single pseudocereal (SPS)

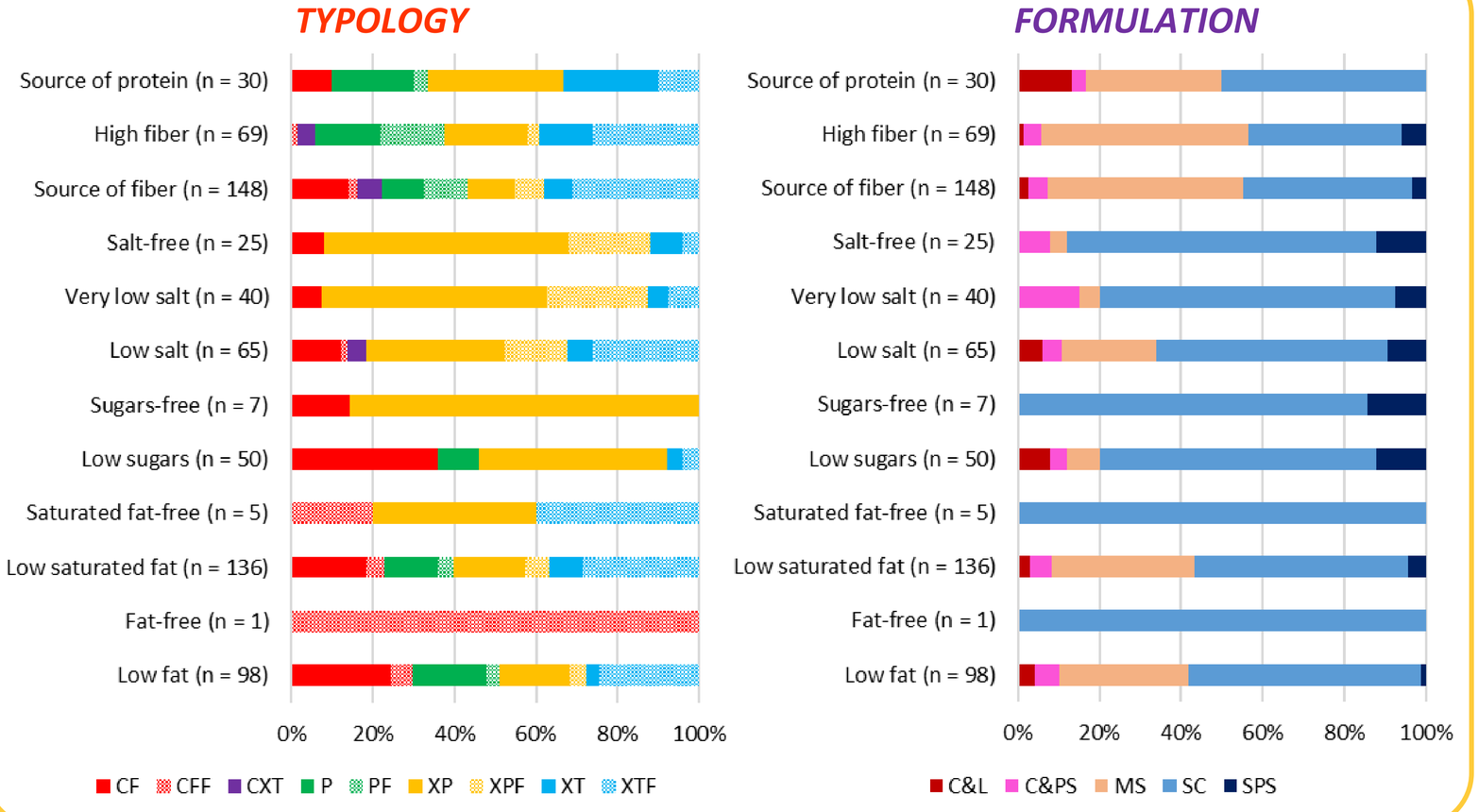
RESULTS



NUTRI-SCORE



NUTRITIONAL CLAIMS



CONCLUSIONS

- Only 26% of BC had good nutritional quality (Nutri-Scores A or B).
- XP had the highest Nutri-Scores A or B percentage (90%). All flavored and CXT had the lowest (≥ 9%).
- All SPS and C&L have good nutritional quality.
- Most nutritional claims were found on CF, XP, and XTF.
- *Low-fat*, *sugar*, *salt*, and *protein* claims prevailed on unflavored BC.
- *Fat-free*, and *fiber* claims prevailed on flavored BC.
- Most claims prevailed in SC, but *fiber* ones were mainly on MS.
- Literature shows that red and black rice, purple corn, algae, silkworm pupae powder, and butterfly pea flower can enhance fiber and protein contents, improve physicochemical and sensorial properties, increase antioxidant activity and phytochemical contents.

ACKNOWLEDGMENTS

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

One Health approach as promoter of Sustainable Food System

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National R&D Institute for Food Bioresources, IBA Bucharest

One Health

- addressing health threats in the animal-human-environment interface;
- designing and implementing programmes, policies, legislation and research;
- inter and transdisciplinarity, collaboration across sectors.

food safety | **laboratory services** | **neglected tropical diseases** | **antimicrobial resistance**
control of zoonotic diseases | **environmental health**

achieving better public health outcomes

Food and nutritional security | **Houses for people** | **Global challenges** | **Healthy life environment** | **Biodiversity protection**

Increasing food production - soil erosion, decrease in biodiversity, environmental pollution

Globalization and easy access to travel - transboundary diseases - contagious to animals, economic threat - food safety and food security on the top of concerns, with significant impact on food costs and availability

Natural disasters fires and floods - routes for pathogens, chemicals, heavy metals, and other pollutants that can contaminate the air, water, and environment in which we live, and produce food

One Health

One Health and Sustainable Development Goals

Food safety in the process of food system transformation

Diversifying of **sustainable** agrifood resources: alternative protein crops, forgotten cultures, algae, fish and invertebrate species, insects, etc.

Sustainable processing: the mild processing of foods → Combined with **new preservation sustainable schemes**

"0" lost and waste: **Circularity** - new methods of recycling and processing, tools for reducing food waste. → Tools and safety measures; preservation methods, hygienic models and control of diseases.

The relocation and the adapted logistics schemes to the resizing of processes and alternative supply chains through **biorefinery** – first food, second feed, third non-food applications (pharmaceutical, cosmetics, biomaterial, bioenergy).

Digitalization of processes and food supply chains - efficient use of resources, food safety and authenticity of food. → **Complex modeling of food systems, authenticity, transparency** - AI, blockchain technologies, etc.

Risk/benefit assessment

Development of skills and education to increase the diversity of sustainable, healthy and safe foods in a correct and inclusive way.

Knowledge and technology transfer

US$110 billion is lost each year in productivity and medical costs resulting from unsafe food in low- and middle-income countries; children under 5 bear 40% of the burden of foodborne illness, with 125,000 deaths each year; **foodborne diseases impede socio-economic development by bottlenecking health systems and affecting national economies, tourism and trade.**

The WHO, May 2019: every year, more than **600 million** people get sick and **420,000** die from eating food contaminated with biological and chemical agents, resulting a **loss of 33 million healthy life years**

Unsafe food creates a vicious cycle of disease and malnutrition.

Achieving food security, improving nutrition and promoting sustainable/ renewable agriculture can only be achieved when **food is safe**.

Economic losses associated with unsafe food are both lost household income and health care costs due to foodborne illness;

- Refusal of food exports;
- overburden health systems and compromise economic growth, trade and tourism.

The agricultural and agri-food sectors are the main pillar of employment and a major driver of sustainable economic development and poverty reduction.

Traditional food markets are part of the culture of communities and are an important source of livelihood for millions of people.

As such, unsafe food can cause economic losses and increase the rate of unemployment in agri-food sectors (WHO, 2022).

To change the way our society produces and consumes foods.

Food system stakeholders must play an active role in changing unsustainable consumption and production patterns and promote social and economic development within the carrying capacity of ecosystems.

The pandemic crisis has demonstrated that **the role of partnerships to ensure sustainable, inclusive and resilient development is more essential and urgent than ever**.

The partnership is needed for regional and global challenges to be solved such as climate change, foodborne diseases and others, and the vital need for **multi-stakeholder collaboration** to collectively build more inclusive, resilient and sustainable societies.

In the context of the United Nations 2030 Agenda for Sustainable Development, **One Health supports the ambitions of the SDGs to anchor health in development**, recognizing that good health and contribute to the achievement of development objectives and to the prosperity and protection of the environment, on the basis of social and economic justice.

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Magnetic solid-phase extraction for the determination of dyes in candies using high performance liquid chromatography coupled to mass spectrometry

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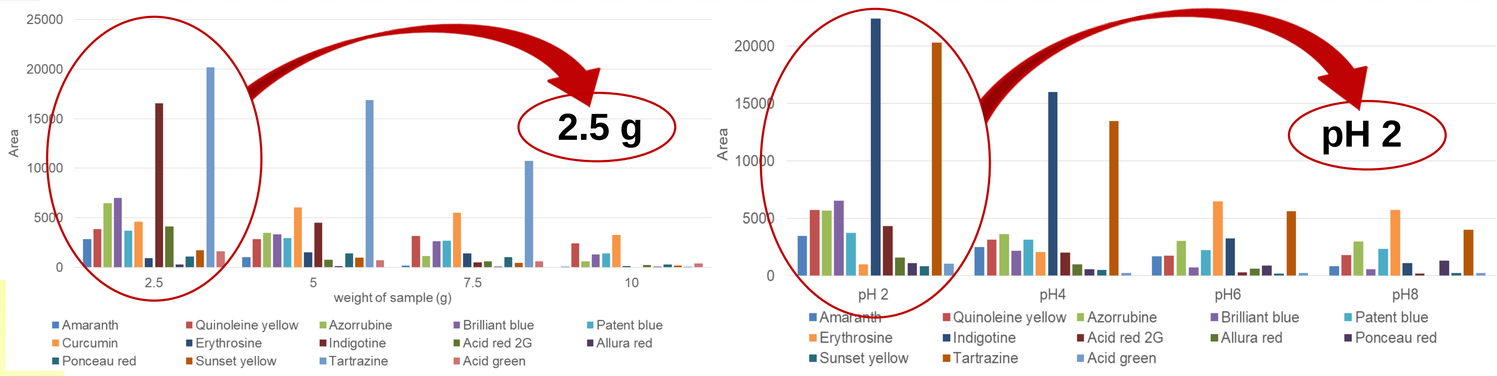
Topic: Synthetic food dyes, widely used for their stability and low cost, have been regulated due to potential health risks, with limits ranging from 50 to 300 mg/kg. Consequently, they are being replaced by natural alternatives like curcumin, which is considered safer and has a limit of 300 mg/kg.

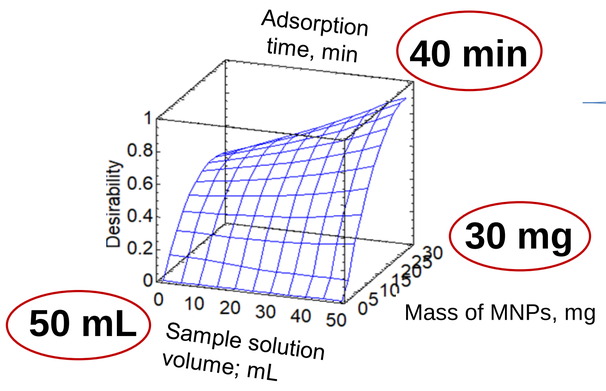
The **objective** of this study was the development of an analytical method for the simultaneous determination of a total of 14 dyes (including both natural and artificial) in candies. For this purpose, magnetic solid-phase extraction (MSPE) was applied for sample treatment and liquid chromatography (LC) coupled to tandem mass spectrometry with triple quadrupole analyzer (MS/MS-QQQ) was applied.

Sample treatment optimization

- ✓ Sample mass: 2.5, 5, 7.5 and 10 g
- ✓ pH of sample solution: 2, 4, 6 and 8
- ✓ Types of magnetic nanoparticles (MNPs) assayed:
  - ➢ Polyaniline@ferrite (PANI@Fe_3O_4)
  - ➢ Cellulose@Fe_3O_4
  - ➢ Polyethyleneimine@polydopamine@Fe_3O_4 (PEI@PDA@Fe_3O_4)



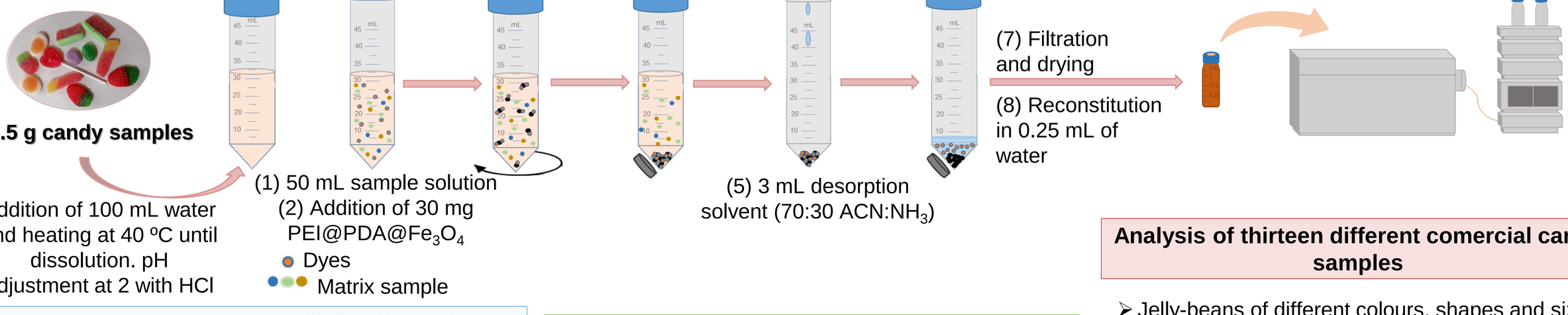
Only this material provided preconcentration of the analytes



- ✓ Mass of PEI@PDA@Fe_3O_4 MNPs: 5, 17.5 and 30 mg
- ✓ Volume of sample solution: 10, 30 and 50 mL
- ✓ Adsorption time: 10, 25 and 40 min
- ✓ Desorption solvent:
  - ➢ Ethanol
  - ➢ Acetonitrile (ACN)
  - ➢ 85:15, 70:30, 50:50, 25:75 (v:v) ACN:NH_3 mixtures
- ✓ Desorption time: 2, 5 and 10 min
- ✓ Desorption volume: 2, 3 and 4 mL

- ❖ **ACN:NH_3 (70:30)**
- ❖ **3 mL**
- ❖ **10 min**

Proposed sample treatment



Analytical characteristics of the MSPE with HPLC-MS/MS method

Dye	R^2	LOD (µg/kg)	LOQ (µg/kg)
Amaranth	0.9914	30.4	101
Quinoleine yellow	0.9936	1.12	3.72
Azorubine	0.9911	0.52	1.73
Brilliant blue	0.9943	1.56	5.20
Patent blue	0.9918	0.53	1.76
Curcumin	0.9921	0.80	2.67
Erythrosine	0.9927	0.60	2.00
Indigotine	0.9979	47.1	157
Acid red 2G	0.9924	0.98	3.28
Allura red	0.9915	18.5	61.7
Ponceau red	0.996	275	918
Sunset yellow	0.9923	0.38	1.27
Tartrazine	0.9967	37.1	124
Acid green	0.9911	0.03	0.11

LOD: Limit of detection calculated using signal-to-noise ratio (S/N) of 3. LOQ: Limit of quantification calculated using S/N=10.

Repeatability, %RSD (n=3) and recoveries (%) in candies using the proposed method

The results of repeatability at three concentration levels, with RSD lower than 24% in all cases, were between:

○ 77-115% (lower) 0.02-0.2-2 mg/kg ○ 72-115% (middle) 0.05-0.5-5 mg/kg ○ 74-114% (upper) 0.08-0.8-8 mg/kg

Analysis of thirteen different comercial candy samples

- ➢ Jelly-beans of different colours, shapes and sizes
- ➢ Sugar-coated sweets
- ➢ Coloured marshmallows

Contents above the LOQ were obtained for different dyes, between 0.018 - 4.45 mg/kg.

Dye	Concentration ranges in analyzed sweets (mg/kg)
Azorubine	0.37
Brilliant blue	0.018-1.41
Patent blue	0.17
Curcumin	0.039-0.12
Allura red	0.065-1.97
Tartrazine	1.21-4.45

- ➢ No signals were detected for amaranth, quinoleine yellow, erythrosine, indigotine, acid red 2G, ponceau red, sunset yellow and acid green.
- ➢ Signals between the LOD and LOQ were detected in ponceau red for the red marshmallow sample and in tartrazine for two samples (sugar-coated worms and gummy bears).

In **conclusion**, the proposed method based on MSPE with HPLC-MS/MS is suitable for the quantification of 14 dyes in candies. The method is able to quantify concentrations from 0.11 µg/kg to 10 mg/kg, depending on the analyte, with good precision. The optimized extraction allowed accurate results to be obtained using minimal volumes of organic solvents with a low sample mass consumption (2.5 g).

Acknowledgements: Financial support of National Technological Centre for the Food and Canning Industry (CNTC) and Comunidad Autónoma de la Región de Murcia (CARM, Fundación Séneca, Región de Murcia (Spain)) for fellowship 21496/CTC/21 to M. Miras López. The authors thank the Spanish MCIN project PID2021-123201NB-I00 financed by MCIN/AEI/10.13039/501100011033/ FEDER, EU.

Ecosistema de Innovación NUTRIALITEC (ECO-20241004), subvencionado por el CDTI y que ha sido apoyado por el Ministerio de Ciencia, Innovación y Universidades del Gobierno de España

Dried olives: A byproduct of olive growing with therapeutic potential for chronic inflammation.

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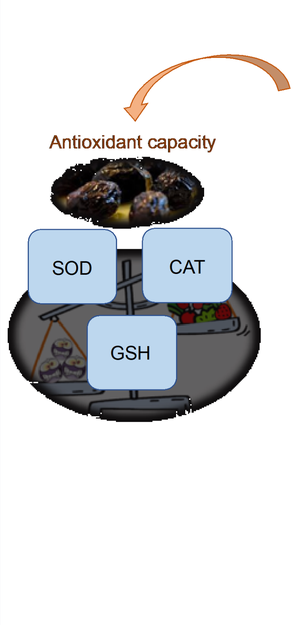
BACKGROUND & OBJECTIVES

Dried olives, both at their green and ripe stages, represent an underutilized byproduct of olive cultivation, which could have valuable applications due to their high concentration of bioactive compounds. These olives contain polyphenols with antioxidant and anti-inflammatory properties, as well as protective effects against various metabolic and cardiovascular diseases. The objective of this study was to evaluate the antioxidant activity of dried olives at both ripening stages and to explore the ability of polyphenols extracted from dried olives to reduce inflammation in a cellular model of human pancreatic cells.

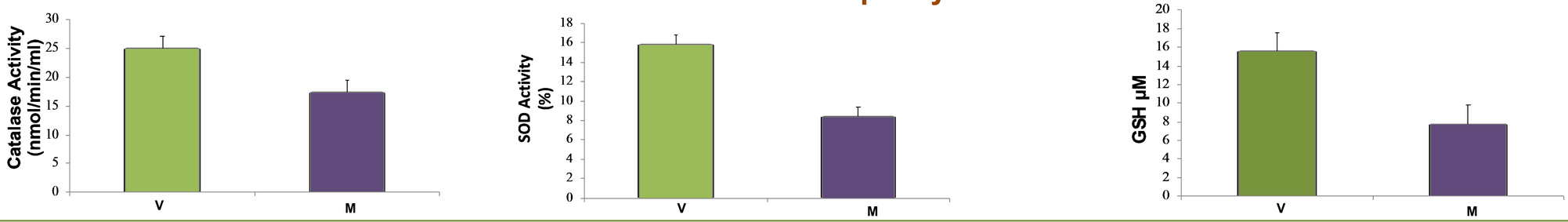
MATERIALS & METHODS



Antioxidant enzymes (catalase, SOD, GSH) were measured in green and ripe dried olives. Polyphenol extracts were evaluated for antioxidant activity and tested for cytotoxicity using the MTT assay. Their anti-inflammatory effects were assessed in PANC-1 cells stimulated with PMA, PHA, or LPS. Pro-inflammatory cytokines were quantified and iNOS expression was assesed.

RESULTS

Antioxidant capacity



Anti-Inflammatory properties

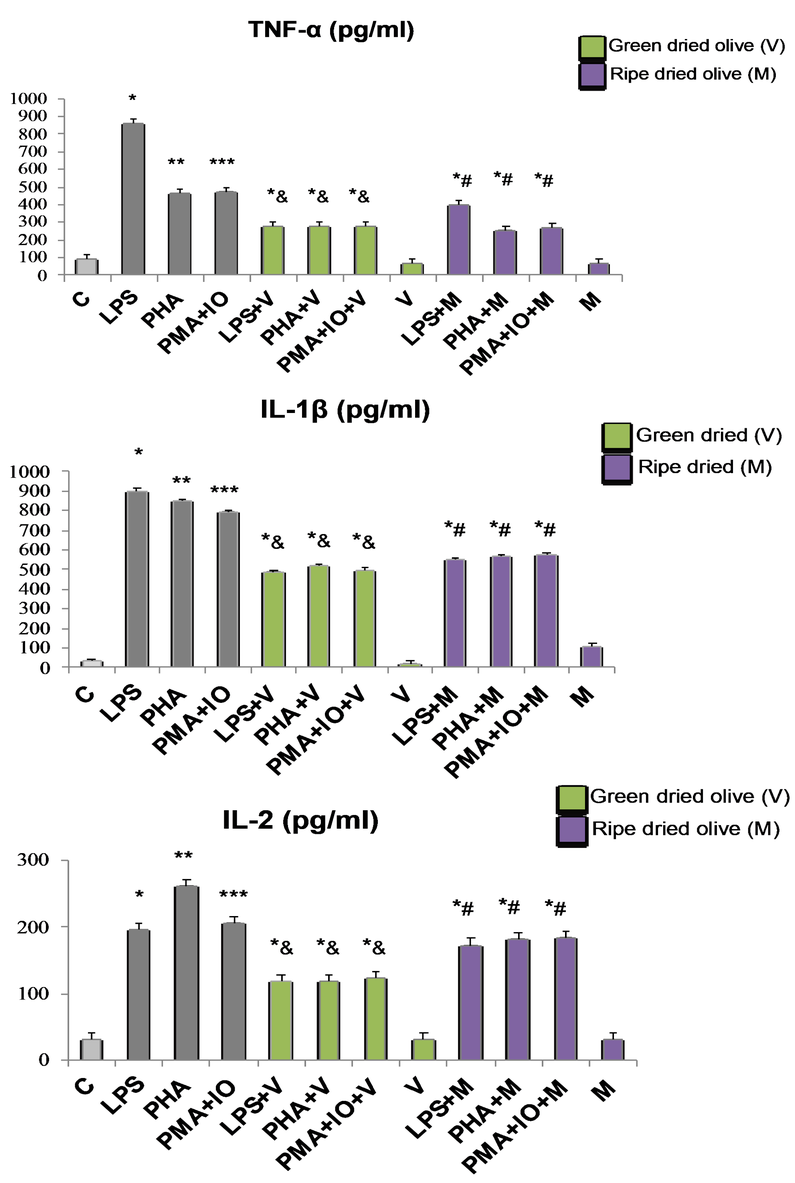


Figure 1. *ELISA assays performed in PANC-1 cells.*
The concentration of TNF-α, IL-1β and IL-2 was measured by ELISA in PANC-1 cells subjected to different treatments: LPS (1 µg/mL), PMA (100 nM), or PHA (10 µg/mL) + ionomycin (1 µM), either alone or in combination with polyphenolic extracts from green or ripe dried olives. Results are expressed as mean ± SEM (n = 10). Statistical significance was determined using one-way ANOVA followed by Tukey's post hoc test; $p < 0.05$ was considered significant.

PANC-1 Cells viability

Components	Viability (%) Methanol + PBS
Polyphenol extract Green dried olive	99 ± 6.8
Polyphenol extract Ripe dried olive	98.8 ± 5.1
Polyphenol extract Green dried olive +LPS	99.7 ± 2.7
Polyphenol extract Green dried olive +PMA	97.73 ± 3.2
Polyphenol extract Green dried olive + PHA+IO	97.43 ± 12.6
Polyphenol extract Ripe dried olive +LPS	97.4 ± 0.7
Polyphenol extract Ripe dried olive +PMA	114.1 ± 1.2
Polyphenol extract Ripe dried olive + PHA+IO	114 ± 0.6

Table 1. The viability in PANC-1 after applying the tested compounds was measured using the MTT assay. Data are presented as mean ± SEM (n = 10).

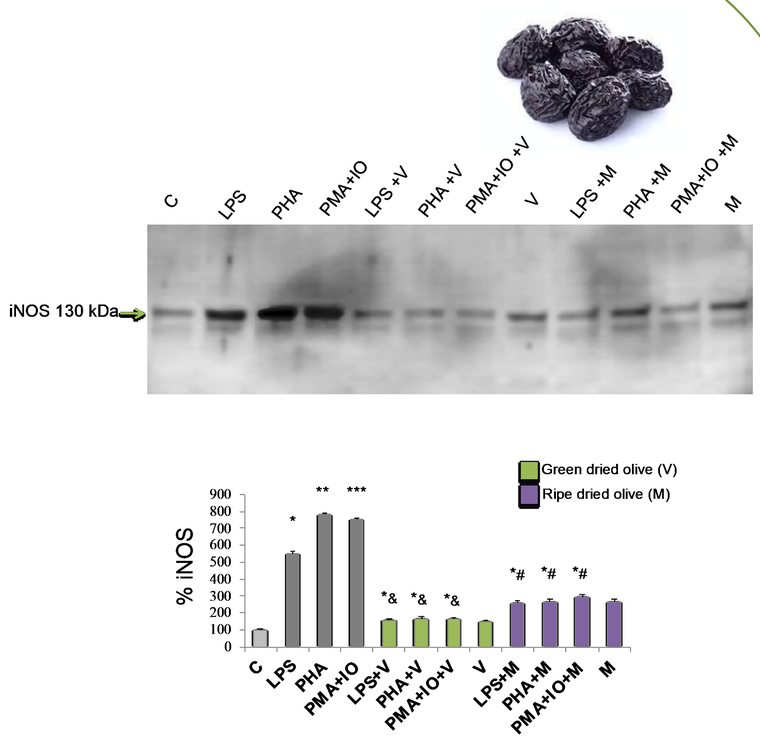


Figure 2. *Western blot analysis of iNOS expression and densitometric quantification.*
Representative Western blot images showing iNOS protein expression in PANC-1 cells treated with LPS (1 µg/mL), PMA (100 nM), or PHA (10 µg/mL) + ionomycin (1 µM), either alone or in combination with polyphenolic extracts derived from green or ripe raisins. Graph represents densitometric analysis Data are presented as mean ± SEM (n = 10). Statistical significance was determined using one-way ANOVA followed by Tukey's post hoc test; $p < 0.05$ was considered significant.

DISCUSSION

High antioxidant activity was observed in dried olives at both ripening stages, with greater antioxidant capacity noted in the green stage. The polyphenol extracts showed no toxicity at the concentrations used in the MTT assay, maintaining cell viability around 100%. In PANC-1 cells induced with PMA, PHA + IO, and LPS, the polyphenol extracts significantly reduced the production of TNF-α, IL-1β, and IL-2, in addition to decreasing iNOS expression compared to controls. These results suggest that the polyphenols in dried olives may have a protective effect against chronic inflammation, offering new therapeutic alternatives and opening opportunities for the valorization of agricultural alternatives, contributing to both human well-being and environmental sustainability.

ACKNOWLEDGMENTS

This work was supported by research projects: PYC20 RE 009 CSIC. EEZ and P18-RT-1577 (Junta de Andalucía), RTC-2016-4824-2, TED2021-130015B-C22(MCINN),andREGAGE23e0006522 6662 (MAPA)

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
MURCIA Food 25

NON-INVASIVE NEAR INFRARED SPECTROSCOPY (NIRS) FOR ON-LINE SODIUM CONTENT PREDICTION IN DRY-CURED HAM SLICES: DEVELOPMENT OF TEMPERATURE-COMPENSATED MODELS

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ABSTRACT

Sodium plays a vital role in cured meats by contributing to microbial stability, texture, and flavor. However, excessive sodium intake is associated with health risks, making accurate monitoring essential. This study explores the potential of near-infrared spectroscopy (NIRS) as an online analytical tool for predicting sodium content in dry-cured ham slices. Implementing salt monitoring directly on the slicing line allows for real-time control of product characteristics without compromising production speed. Additionally, it supports consumers in selecting products with appropriate salt levels. The study also examines the effect of temperature variations on model performance, as such fluctuations can significantly influence spectral data accuracy.

METHODOLOGY

Analytical technique: **NEAR INFRARED SPECTROSCOPY (NIRS)**
Accurate, fast and low cost per measurement. Non-destructive and non-invasive, without sample pre-treatment or reagents.

Equipment: Fourier Transform NIR spectrometer model Matrix-F emission provided with a non-contact probe Q-412/AF with two tungsten sources (Bruker Optik). Spectral data processing was carried out using OPUS™(V 7.0) software.

Reference method: Inductively Coupled Plasma Atomic Emission Spectrophotometry (ICP–AES) with a 720-ES Varian spectrometer. Quantification was performed based upon calibration curves produced from 1000 ppm standards of in 0.5 M nitric acid. The means of two determinations, were expressed as g sodium/100 g wet matter.

NIRS Methodology

In the experimental design, key factors such as sample temperature, sodium variability, and measurement area were considered. Three temperature ranges were established between −12 and +20 °C. Sliced dry-cured ham samples were scanned in the spectral range of 12,000 to 4000 cm^{-1} after removing the plastic packaging to avoid interference, and at different sample temperatures. Spectra were collected with a wavenumber resolution of 16 cm^{-1}.

RESULTS

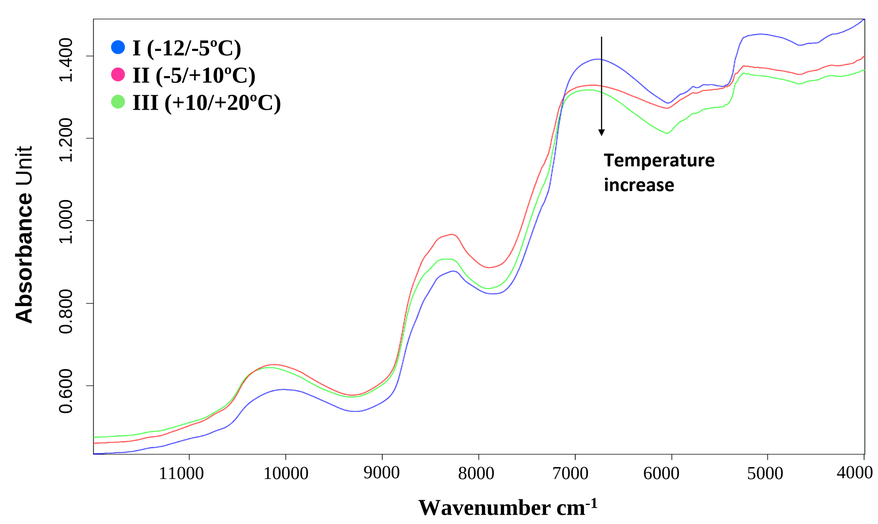
Statistical overview of sodium content (% wet matter) in three sample sets by spectral measurement temperature range

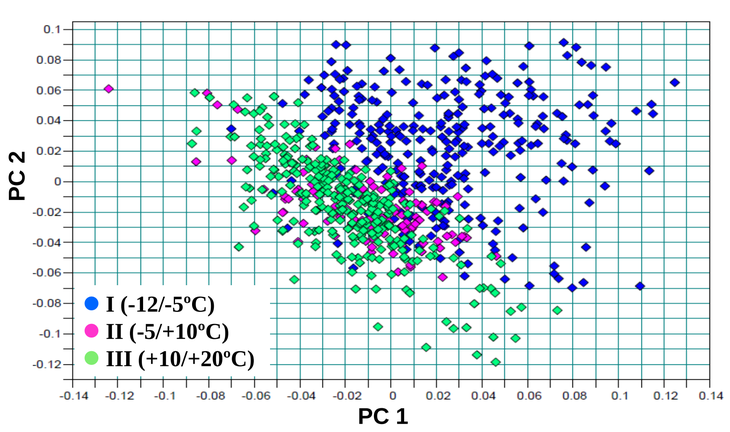
Temperature range	No. Samples	Mean	Range	SD
I (-12/-5ºC)	291	2.00	1.21-3.10	0.45
II (-5/+10ºC)	107	2.11	1.27-3.10	0.40
III (+10/+20ºC)	291	1.98	1.21-3.10	0.43

SD, Standard Deviation; CV, Coefficient of Variation (SD * 100/mean)

Prediction models: Multivariate models relating the multi-wavelength spectral response to the analyte concentration were developed using partial-least squares regression (PLSR). An internal full cross-validation method was used to determine the optimal number of factors in the regression models in order to avoid overfitting.

Average NIR spectra of dry-cured ham slices in three temperature ranges

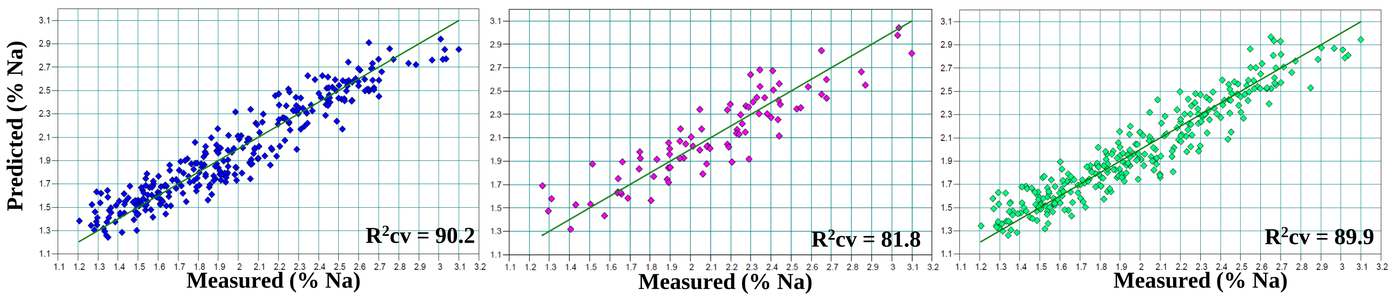




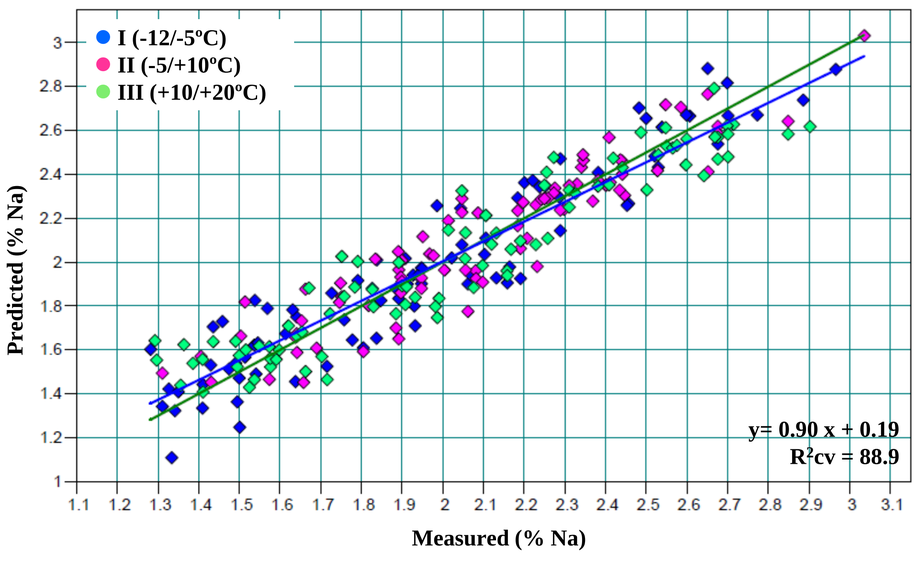
Principal component score plot of the NIR spectra of dry-cured ham slices grouped according to sodium content

Those spectra collected within the same temperature range tend to group together. There is a clear separation between ranges I (blue colour) and III (green colour), due to the large difference between temperatures, in the NIR spectra this variation induces changes in the conformation of the molecules. In the spectra range II (pink colour), the temperature was taken before being irradiated by the laser, it is understandable that they overlap with group III, the heating shifts the spectra towards this group.

Depending on the spectra used in calibration (cross-validation) and external validation, two types of models were constructed: **local and global temperature models.**



The **local models** are sensitive to temperature deviations beyond the range in which they were developed, the **global model** demonstrates superior performance, achieving a 90% adjustment with more accurate results, making it a more versatile option for packaging lines. **This work confirms the feasibility of integrating NIRS technology for real-time sodium monitoring.**



Extracted from M.I. Campos PhD. Work
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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

DETECTION AND QUANTIFICATION OF MELAMINE IN MILK POWDER BY NIR SPECTROSCOPY

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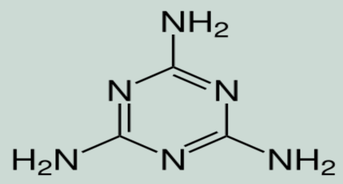
[2] Analytical Chemistry Department, Faculty of Sciences, University of Valladolid. Spain.



MELAMINE
2,4,6-triamino-1,3,5-triazina

MILK POWDER

September 2008 China
300,000 children poisoned

ABSTRACT

Melamine is a nitrogenous compound that has been fraudulently used to increase the apparent protein content in dairy products, leading to severe health consequences due to its toxicity. In this work, near infrared spectroscopy (NIRS), combined with chemometric methods, has been used to detect and quantify melamine in milk powder samples.

METHODOLOGY

Analytical technique: **NEAR INFRARED SPECTROSCOPY (NIRS)**
Accurate, fast and low cost per measurement. Non-destructive and non-invasive, without sample pre-treatment or reagents.

Equipment: Fourier Transform (FT) NIR spectrometer model MPA (Bruker Optik), He-Ne laser beam of 633 nm. PbS detector.

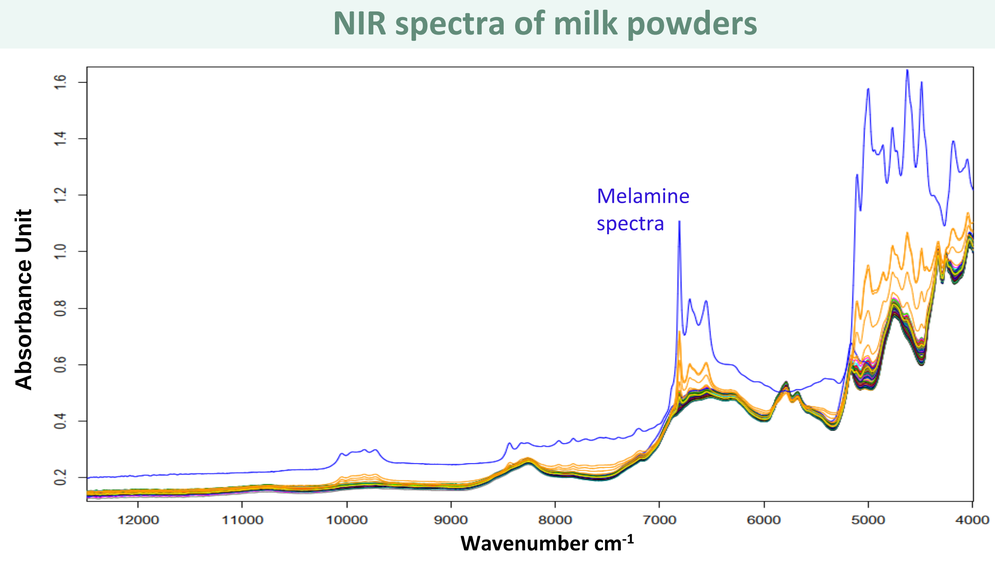
Reference method: HPLC with UV-Visible detection (λ, 204 nm). Temperature, 20ºC ; Flow rate, 1 mL/min; Injection volume, 5 µL
Mobile phase: Water and acetic acid (1%) in a 90:10 ratio
Stationary phase: Column C18
Standard solution 100 ppm melamine in deionised water, from which standard solutions of different concentrations are prepared
Well-defined peak at 12 minutes. 1.07 ppm LOD and 3.26 ppm LOQ

NIRS Methodology

A total of 130 solid samples with different melamine concentrations were prepared from commercial milk powders. Reflectance spectra were collected using a NIR fibre optic probe in a spectral range between 4000 and 12500 cm^{-1}. Scans were performed at a wavenumber resolution of 16 cm^{-1}.

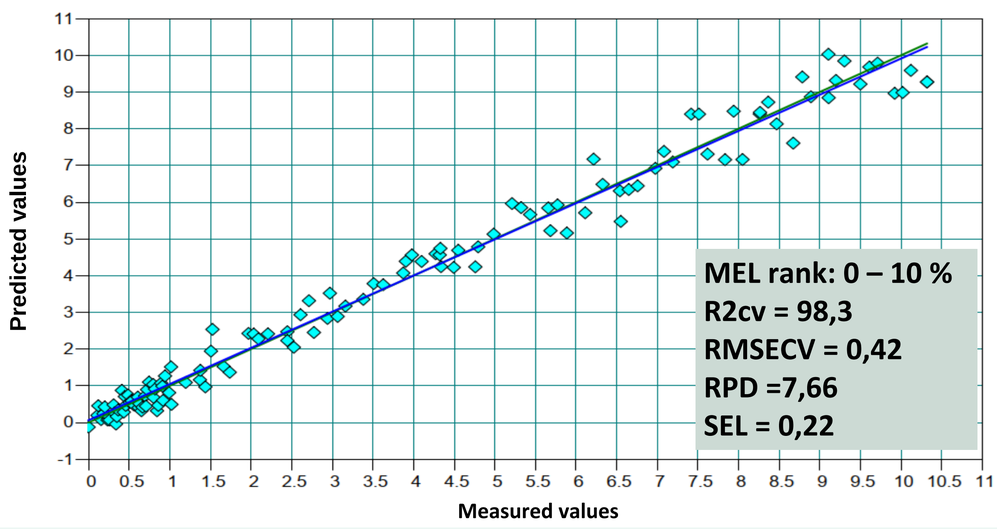
Prediction models: Spectral data were analysed by principal component analysis (PCA) and cross-validated calibration equations were constructed using partial least squares regression (PLSR).
(OPUS/QUANT chemometric software)

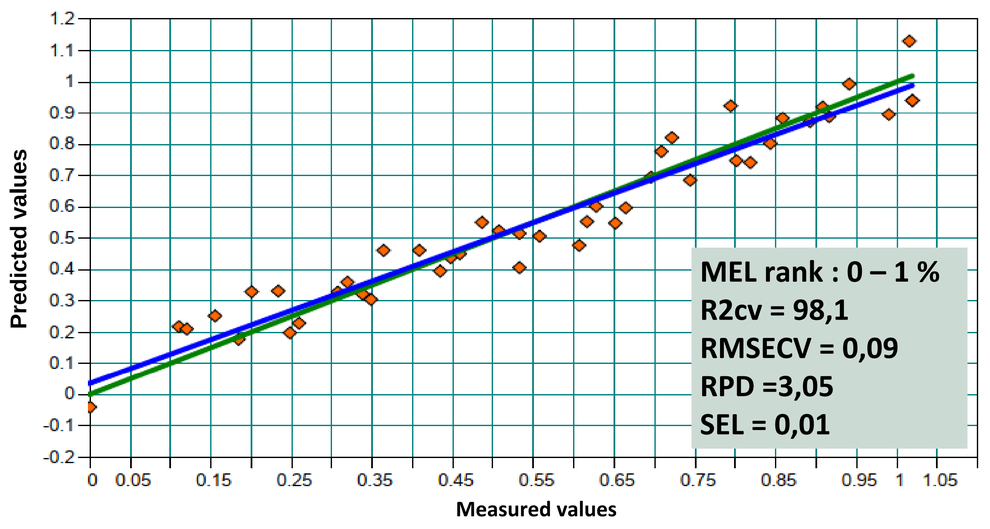
NIR spectra of milk powders



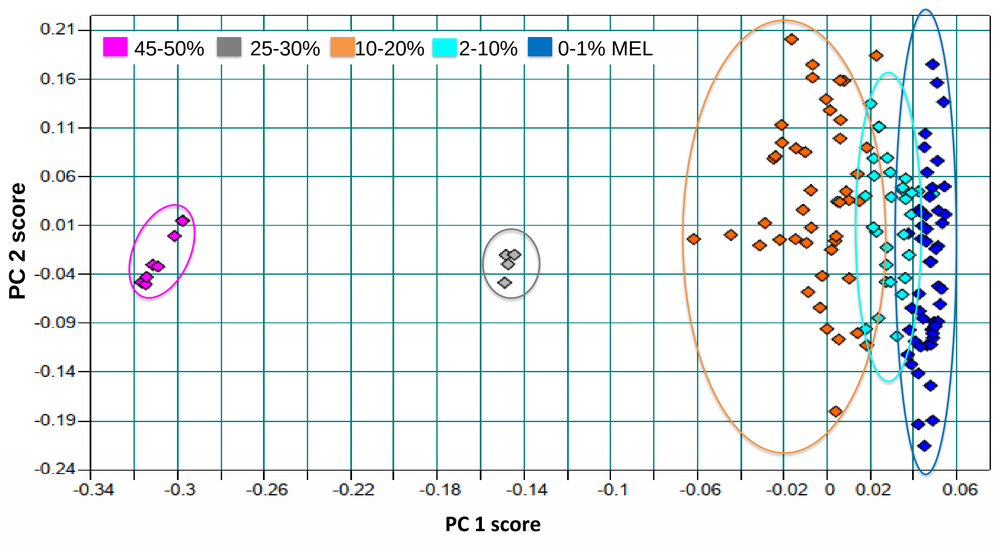
RESULTS

QUANTITATIVE PREDICTIVE MODELS: NIR prediction plot: True vs predicted (% melamine)





QUALITATIVE MODEL:
Principal component score plot of the NIR spectra of milk powders grouped according to melamine content



CONCLUSIONS

Prediction models in different melamine concentration ranges between 0-10%, obtaining cross-validation correlation coefficients (R^2CV) higher than 98%. The predictive capacity in the external validation reached values of 7.66 and 3.05, with standard errors of prediction of 0.42% and 0.09%. PCA enabled the classification of samples according to their melamine concentration, detecting the degree of contamination solely by spectral information. **These results confirm that NIRS is a viable alternative for the detection and quantification of melamine in milk powder samples.**

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Fostering the Urban food System transformation through Innovative Living Labs Implementation

Intelligent Waste Bins to Reduce Food Waste in Differdange: a data-driven approach

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INTRODUCTION

According to the 2024 **Food Waste Index Report (UNE)**, Luxembourg ranks 4th among EU-27 countries in food waste generation per capita, following Portugal, Malta, and Greece. On average, 120 kg of food is wasted per resident per year across restaurants, shops, canteens, and households. This significant level of waste presents both an environmental and social challenge, especially considering the associated greenhouse gas emissions and the missed opportunity to redistribute edible food.

In response, the **city of Differdange** (Luxembourg) has taken proactive steps by launching an innovative **pilot project** aimed at **reducing food waste in public catering services**. The project involves the use of AI-powered intelligent waste bins to monitor and reduce food waste in a public kitchen. These smart bins automatically weigh the waste, identify food categories, and provide real-time data that helps kitchen staff and decision-makers understand waste patterns and adjust meal planning and purchasing accordingly.

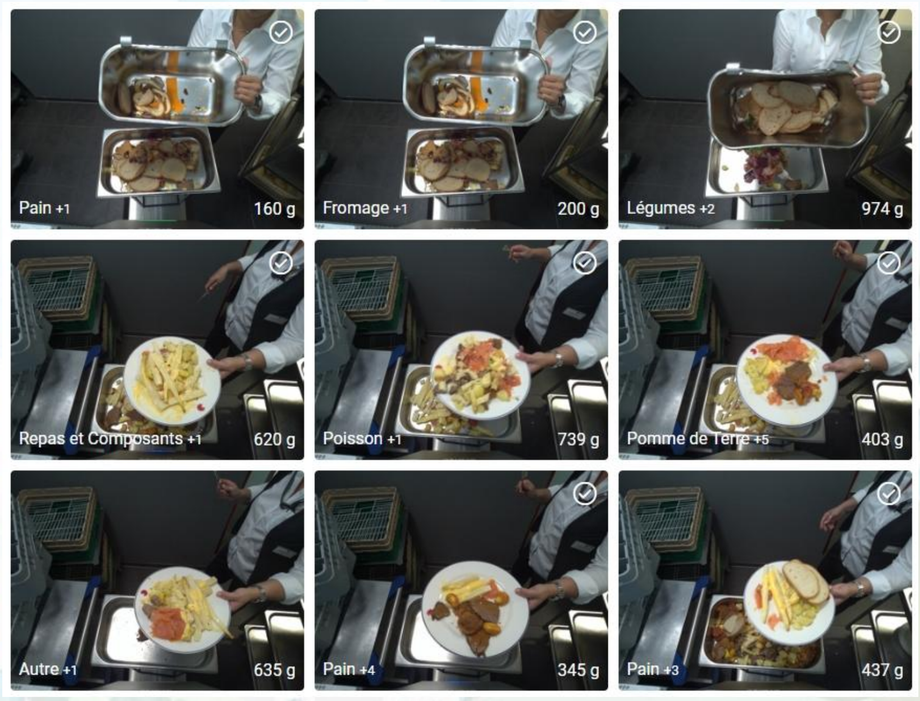
United Nations Environment Programme (2024). Food Waste Index Report 2024. Nairobi.

ORBISK SMART BINS

Two **Orbisk smart bins** were installed in a public kitchen managed by Servior, public establishment responsible for housing for seniors in Luxembourg, tracking kitchen and plate waste over **20 weeks** (October 2024 – March 2025).

A direct service model is used where staff plate, serve meals and collect leftovers from residents.

The AI-driven system analyzed: waste composition, frequency, and weight, collecting data on **total waste volume**, **financial costs**, and **CO_2 emissions** to provide actionable insights for operational improvements.



This figure shows **Orbisk AI scans waste composition**.

CONCLUSION: The use of AI-powered waste bins has proven effective in **reducing food waste**, financial losses, and environmental impact. This project highlights the **scalability and replicability of smart waste management solutions**, offering a data-driven approach to sustainable food systems and supporting Differdange's climate action strategy.

RESULTS

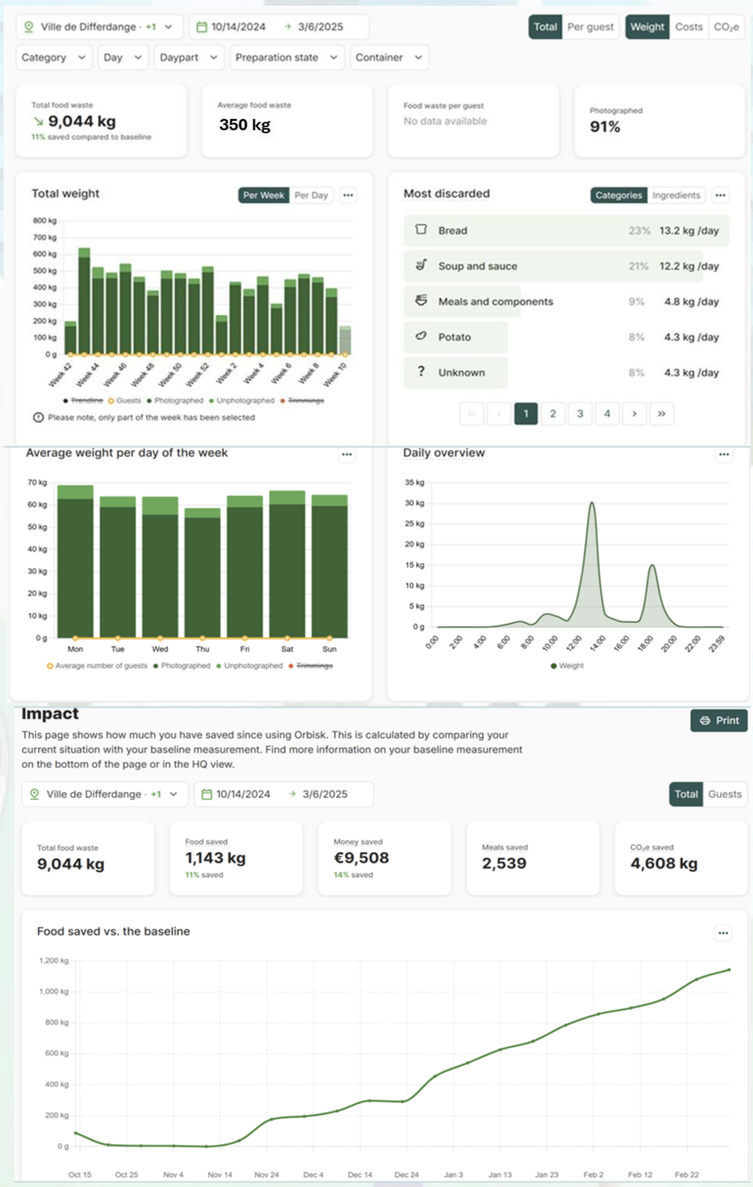
During the 20 weeks of monitoring, **total food waste** was 9 T (11% reduction from baseline), equivalent to almost 60,000 € of cost and 27.000 kg of CO2 emissions.

On average, **food waste discarded per week** was 350 kg, decreasing by 31% in 20 weeks and resulting in a 33% cost reduction and a 29% drop in CO_2 emissions.

Mondays showed the highest waste levels, with **bread, soups and sauces**, being the most discarded categories while snacks and drinks were the least wasted.

Over five months, **the project saved over 1 T of food**, equivalent to 2,539 meals, translating into estimated savings of 9,508 € and 4,608 kg of CO_2 emissions.

The implementation of AI-powered smart bins in elderly care homes in Differdange has proven to be an **effective tool for reducing food waste** and improving kitchen operations. The system has already enabled staff to make informed decisions—such as adjusting bread purchases and modifying menus based on residents' preferences—resulting in measurable environmental and economic benefits.



ACKNOWLEGMENT

This initiative was co-developed with the **Differdange Food Council** and supported by the **EU-funded FUSILLI Project** and the **NetZeroCities** initiative. It forms part of the city's broader strategy to transition towards more sustainable food systems and contribute to its ambitious goal of achieving climate neutrality by 2030.

/fusilli_project

www.fusilli-project.eu

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101000717.

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
MURCIA Food 25

EVALUATION OF THE VALUE CHAIN IN THE CULTIVATION OF MEDICINAL PLANTS WITH THE PURPOSE OF OPTIMIZING THEIR VALUE IN THE FORM OF ORGANIC TEAS

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Introduction

In the context of increasing demand for natural and organic products, the valorization of medicinal plants in the form of organic teas represents a promising direction for consumer health and sustainable development of agriculture. Ionna Plant SRL has developed an integrated production model that ensures superior quality, traceability and sustainability. The objective of this paper is to evaluate the value chain applied by the company, from the selection of seedlings to the finished certified organic product.

Material and Method

The study was conducted in collaboration with the Buzău Vegetable Research and Development Station. The methodology included:

- ***Obtaining plant material:*** seedlings were selected based on criteria of bioactive content, adaptability and yield.
- ***Organic cultivation technology:*** without the use of pesticides or synthetic fertilizers; integrated pest control and efficient irrigation.
- ***Organic certification:*** products are verified by an accredited body.
- ***Phytochemical analyses:*** the content of essential oils, flavonoids, tannin, alkaloids, glucosinolat, saponins, phenolic acids was quantitatively evaluated
- ***Processing:*** harvesting was carried out at the optimal time; drying and packaging were carried out in a controlled environment, to maintain quality.

Results and Discussion

Analyses have shown that plants grown and processed in an organic system retain a high content of bioactive compounds:

- ***Flavonoids:*** with antioxidant and antimicrobial role
- **Saponins and alkaloids:** support the nervous system, general well-being
- ***Tannins and phenolic acids:*** anti-inflammatory properties and blood sugar regulation

IONNA PLANT organic teas are distinguished by excellent organoleptic quality, high content of active principles, full traceability and sustainable packaging. They offer real benefits in combating oxidative stress, supporting immunity and mood. Example (Table 1)

Table 1. Nutritional analysis of the product ISOP – IONNA PLANT SRL
Comparison with values from the specialized literature for similar vegetable products.

Parameter	ISOP value	Comparable values (literature)	Conclusion
Dietary fiber	51,9 g/100 g	Bran: 43 g Psyllium: 70-80 g	very high value
Protein	17,4 g/100 g	Lentils: 25 g Quinoa: 14 g	excellent protein profile
Total sugars	3,6 g/100 g	Dried fruits: 30–60 g	low in sugars
Total fat	2,4 g/100 g	Oilseeds: 30–50 g	low in fats
Omega-3 (ALA)	1,1 g/100 g	Nuts: 9 g Flax 17 g	good non-oily content
Energy value	240 kcal/100 g	Nuts: 600 kcal Cereals: 300–400 kcal	low calorie density
Sodium	0,0012 g/100 g	Permissible limits < 0,5 g	very low content

Conclusions

The model applied by Ionna Plant SRL demonstrates the efficiency of integrating research, genetic selection, organic farming and modern processing to obtain higher value products. This approach provides a viable example for expanding organic value chains and creating functional products with real impact on health.

Hyssopus officinalis is among the richest plant products in dietary fiber, which makes it excellent for regulating intestinal transit, supporting microbiota, and reducing the risk of metabolic diseases.

Hyssopus officinalis falls into the category of functional plant products with high nutritional value, comparable to other products based on dried leaves, pulberil or prebiotic fibers. Recommended as a base in:

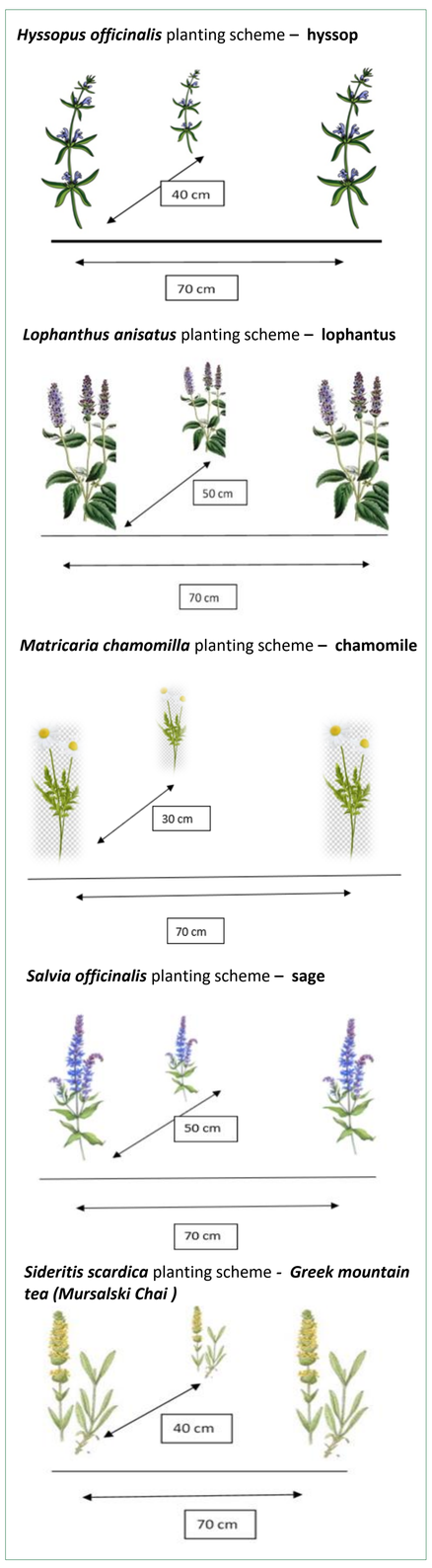
- food supplements;
- functional drinks;
- detoxification mixtures;
- dietary foods rich in fiber and protein, but low in calories and fat.

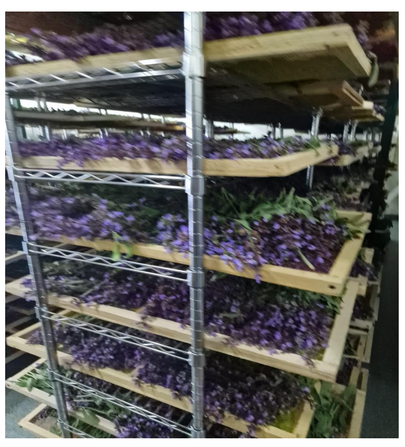
Selective bibliography:

1. USDA FoodData Central – for nutritional values of lentils, nuts, cereals etc.US Department of Agriculture. FoodData Central. 2019. *https://fdc.nal.usda.gov/*
2. *M*UNTEANU, N., et al. (2016) – Medicinal and aromatic plants – Technological guide, Ed. Ion Ionescu de la Brad, Iași – for estimated values for dried leaves.
3. Codex Alimentarius and Reg. (UE) 1169/2011 – for indicative values regarding daily intakes, sodium limits, sugars etc
4. MÎRZAN, O., et al. Research regarding the technological sequences influence on the productivity of Lophantus anisatus (Lofantus) species in the central Moldova pedoclimatic conditions. 2021..

Cultivation technology – with mulch film and drip irrigation

1. ***Land preparation:*** deep plowing (25-30 cm), then discing and leveling.
2. ***Basic fertilization:*** incorporation and administration of mineral fertilizers, according to the nutritional requirements of the plant.
3. ***Installation of the drip system:*** placement of drip hoses in rows (check pressure, uniformity and tightness).
4. **Installation of the mulching film** (anti-weed texagril): the film is placed over the rows, with fixing on the edges. It is cut at the established planting distances.
5. ***Planting seedlings:*** healthy, well-hardened seedlings, planted manually in the foil cuts. Watering immediately after planting.
6. ***Maintenance work:*** drip irrigation, adapted to the phenophase and climate. Fertigation, if necessary, with compatible nutrient solutions. Regular phytosanitary monitoring and gentle interventions, in accordance with standards for medicinal plants.
7. ***Harvesting*** (to high quality standards): is done exclusively by hand, with clean gloves, to avoid contamination of the product.
8. ***Quality control:*** samples are collected for analysis from each batch. A physico-chemical and microbiological analysis report is carried out, in collaboration with an accredited laboratory:
9. ***Quality control:*** samples are collected for analysis from each batch. A physico-chemical and microbiological analysis report is carried out, in collaboration with an accredited laboratory (moisture, volatile oil, content of active principles, purity, heavy metals, pesticides, contaminants)
10. ***Drying and processing***: drying is done in clean, ventilated spaces, away from direct sunlight. Temperature controlled to preserve the active compounds. Packaging is done in certified materials, appropriately labeled (batch, harvest date, origin).





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Predictive Analysis of Allergens in Novel Foods by Using Advanced Proteomic and Bioinformatic Tools

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BACKGROUND & OBJECTIVES

One of the most significant challenges in bringing novel foods to market is ensuring food safety. New food scenarios drive the need to detect novel allergens that must be identified and quantified for proper labeling. Allergenic reactions are primarily caused by proteins that are abundant in foods, typically of low molecular mass, glycosylated, water-soluble, and highly stable to proteolysis. The most relevant plant and animal food allergens, such as lipid transfer proteins, profilins, seed storage proteins, lactoglobulins, caseins, tropomyosins, and parvalbumins from fruits, vegetables, nuts, milk, eggs, shellfish, and fish, have been studied. As a massive preliminary screening, proteomic methods should be employed to search for potential allergens. This work focuses on proteomic and bioinformatic tools for food researchers to identify allergens in novel foods.

ALLERGENS IN TRADITIONAL FOOD

Table 1. Several protein allergens in food. For the WHO/IUIS nomenclature, the allergens are named according to the species source of food.

Food	Protein Name	Species	Allergen
Milk	Caseins	*Bos taurus*	
	α S1-casein (23.6 kDa)		Bos d 9
	α S2-casein (25.2 kDa)		Bos d 10
	β -casein (24 kDa)		Bos d 11
	κ-casein (19 kDa)		Bos d 12
	β-lactoglobulin (18.3 kDa) α-lactalbumin (14.2 kDa)		Bos d 5
	Serum albumin (66.3 kDa)		Bos d 4
	Immunoglobulin (160 kDa)		Bos d 6
			Bos d 7
Eggs	Ovomucoid (28 kDa)	*Gallus domesticus*	Gal d 1
	Ovalbumin (44 kDa)		Gal d 2
	Ovotransferrin (78 kDa)		Gal d 3
	Lysozyme (14 kDa)		Gal d 3
	α-livetin (69 kDa)		Gal d 5
	YGP42 (35 kDa)		Gal d 6
Fish	Parvalbumin	*Gadius callarias* (Baltic cod)	Gad p 2
	α-parvalbumin (13 kDa)		Gad p 1
	β-parvalbumin (11.6 kDa)		
Shellfish	Tropomyosin (34 kDa)	*Metapenaeus ensis* (Shrimp)	Met e 1
Peanuts/tree nuts	7 S seed storage globulin, vicilins (64 kDa)	*Arachis hypogaea*	Ara h 1
	2 S albumin (17 kDa)		Ara h 2, Ara h 6, Ara h 7
	Nonspecific lipid transfer proteins		Ara h 9, Ara h 16, Ara h 17
	Oleosins		Ara h 10, Ara h 11, Ara h 14, Ara h 15
			Ara h 12, Ara h 13
	Defensins		Ara h 5
	Profilins		Ara h 8
	Plant pathogenesis-related proteins PR-10		
Soy	7 S seed storage globulin, β-conglycinin	*Glycine max*	Gly m 5
	11 S seed storage globulin, glycinin		Gly m 6
Wheat	α-amylase inhibitor (13 kDa)	*Triticum aestivum*	Tri a 28
	Gamma gliadin (88 kDa)		Tri a 20
	Elongation factor 1		Tri a 45
Sesame	2 S albumins	*Sesamum indicum*	Ses i 1, Ses i 2
	7 S vicilin-type globulin (45 kDa)		Ses i 3.
	Oleosins		Ses i 4, Ses i 5
	11 S globulin, legumins		Ses i 6, Ses i 7
	Profilin		Ses i 8

ALLERGENS IN NOVEL FOODS

Figure 1. Novel protein sources of plant, algal, fungal and insect origins are being researched by the food industry.

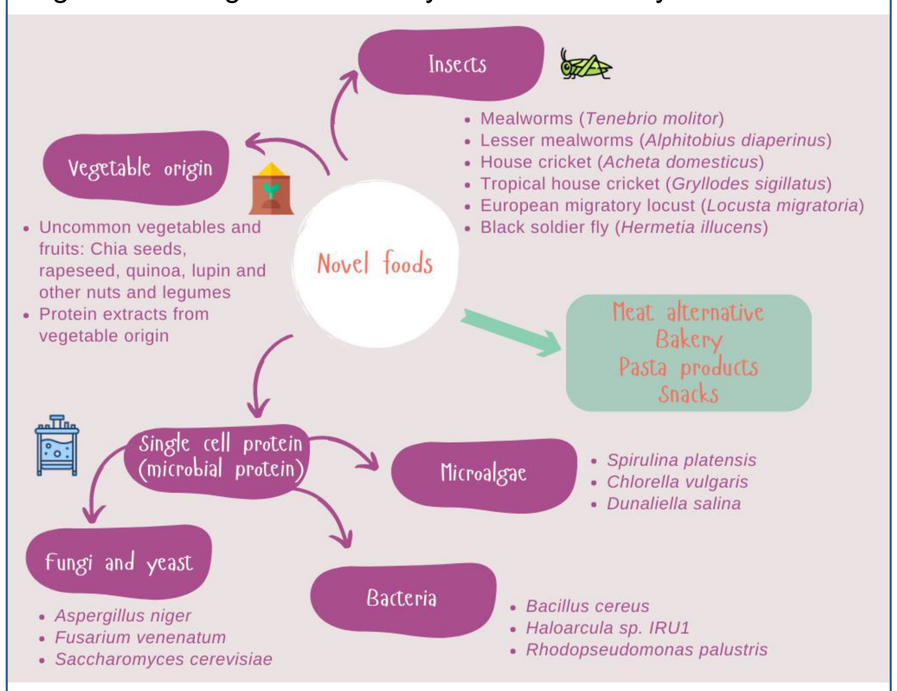


Table 2. Presence of allergens in novel foods based on microalgae and insects.

Food	Protein Name	Species
Microalgae	C-phycocyanin Thioredoxins Superoxide dismutase Glyceraldehyde-3-phosphate dehydrogenase Triosephosphate isomerase	*Microalgae spirulina (A. platensis)*
Microalgae	viz. calmodulin Fructose-bisphosphate aldolase	*Microalgae chlorella (C. vulgaris)*
Insects	Tropomyosin, myosin, actin, troponin C (muscle proteins) Tubulin (cellular proteins) Hemocyanin, defensin (circulating proteins) Arginine kinase, glyceraldehyde 3-phosphate dehydrogenase (GAPDH), triosephosphate isomerase, α-amylase, trypsin, phospholipase A, hyaluronidase (enzymes)	

PROTEOMIC APPROACHES TO IDENTIFY ALLERGENS IN NOVEL FOODS

Table 3. Relevant examples of the recent use of proteomic approaches for the detection of allergens in novel foods.

	Novel Food	Bioinformatic Tool	Goal/Main Achievements
VEGETABLES	Bread wheat spelt and rye	Database of Allergen Families-AllFam AllergenOnline Allergome	Comparison of allergenicity in cereal products
	Cashews	BLASTP Search against AllergenOnline sequence	Analysis of allergen stability under heat treatment
	Goji berries	AlgPred software hybrid approach	Identification of 11 IgE-binding proteins
	Macadamia nut	AllergenOnline Immune Epitope Database Analysis Resource (IEDB)	Analysis of homology and linear epitope similarities to known allergens
	Medicago sativa	COMPARE allergen database	Identification of three allergenic protein families
	Lentil (Lens culinaris)	Blast2GO—Functional Annotation and Genomics	Quantification of major allergen proteins
	White- and red-fleshed pitaya seeds	AllermatchTM webtool Algpred 2.0 AllerCatPro web server	Identification of five potential allergens
SEA WEEDS	Spirulina and chlorella microalgae	AllergenOnline	Six proteins exhibit significant homology with food allergens
INSECTS	Cricket	Allermatch TM webtool AlgPred 2.0 ABCPred Bepipred	Description of the impact of processing on allergenic reactivity of insect proteins.
	Cricket Acheta domesticus	Database of Allergen Families-AllFam Allergen nomenclatura (WHO/IUIS) CLC Genomics Workbench 20.0.4. AllerCatPro web server	Identification of 20 putative allergens
	Lesser mealworms, black soldier flies and their protein hydrolysate	AllermatchTM webtool	Identification of potential allergens by similarity to known allergens
PARASITES	*Anisakis simplex*, *Pseudoterranova decipiens*, and *Contracaecum osculatum*	Blast2GO—Functional Annotation and Genomics AllergenOnline AllerTOP web server ver. 2.0 PREAL web server	Prediction of 53 probable allergens in three species

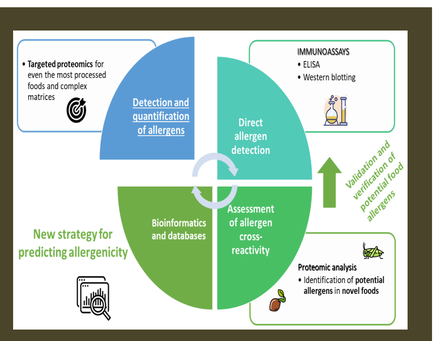
BIOINFORMATIC TOOLS

Table 2. Bioinformatic software tools most used for allergen analysis.

Name	Link (Website)	Description
Allergen nomenclature	http://www.allergen.org (accessed on 12 February 2023)	Official site for the systematic allergen nomenclature provided by the World Health Organization and International Union of Immunological Societies (WHO/IUIS)
AllerBase	http://bioinfo.unipune.ac.in/AllerBase/Home.html (accessed on 12 February 2023)	Database of allergens detected as IgE-binding epitopes, IgE antibodies and cross reactivity. Allergen data such as experimental information on its allergenic activity and food source is compiled, resulting in a curated database.
AllerCatPro	https://allercatpro.bii.a-star.edu.sg/ (accessed on 12 February 2023)	Provides protein allergenicity potential prediction based on the similarity of amino acid sequence and 3D protein structure
AllergenOnline	http://www.allergenonline.org (accessed on 12 February 2023)	Provides sequence database of allergens to identify proteins and assess the potential risk of allergenic cross-reactivity. This database offers 2233 peer-reviewed sequences from 912 taxonomic protein groups (February 2021)
Allergome	http://www.allergome.org (accessed on 12 February 2023)	A website with detailed information on Allergenic Molecules (Allergens) causing an IgE-mediated (allergic, atopic) disease (anaphylaxis, asthma, atopic dermatitis, conjunctivitis, rhinitis, urticaria).
Comprehensive protein allergen resource (COMPARE allergen database)	https://comparedatabase.org/ (accessed on 12 February 2023	A database comprised of protein sequences of known allergens
Database of Allergen Families-AllFam	http://www.meduniwien.ac.at/allfam/ (accessed on 12 February 2023)	Comprises a resource for classifying allergens into protein families as well as biochemical properties and allergology significance
Immune Epitope Database and analysis resource (IEDB)	https://www.iedb.org (accessed on 12 February 2023)	Provides experimental data on antibody and T-cell epitopes to identify allergens and to assist in the prediction and analysis of allergenicity
Structural Database of Allergenic Proteins (SDAP)	https://fermi.utmb.edu (accessed on 12 February 2023)	Tool for testing the FAO/WHO allergenicity rules in new proteins and investigating cross reactivity, also offering information about protein sequence and structure

TAKE-HOME MESSAGE

- Proteomic approaches using advanced MS will continue providing relevant information in food safety.
- Detection, identification and quantification of known allergens in complex matrices and highly processed food have already been developed, and targeted MS allows monitoring of them during food processing.
- Identification of novel protein allergens in insects, seaweeds, microalgae or other non-common vegetable foods is one of the most important challenges over the next few years.
- Bioinformatic tools and curated allergen databases will enable the prediction of potential allergens, wich should be validated subsequently.
- This information could be used to improve the design and safety of food products by novel devices.
- Advanced technologies, including biosensors, could identify specific interactions between receptors and allergens, enabling us to address the challenges of food safety monitoring.



López-Pedrouso, M.; Lorenzo, J.M.; Alché, J.d.D.; Moreira, R.; Franco, D. Advanced Proteomic and Bioinformatic Tools for Predictive Analysis of Allergens in Novel Foods. **Biology 2023, 12, 714.** https://doi.org/10.3390/Biology12050714

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
MURCIA Food 25

A ONE HEALTH APPROACH TO MICROPLASTICS RISK ASSESSMENT IN THE FOOD ECOSYSTEM

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INTRODUCTION

Microplastics—plastic particles less than 5 mm in size—have emerged as pervasive pollutants affecting terrestrial, aquatic, and atmospheric environments [1]. Their persistence, bioaccumulation potential, and interactions with co-contaminants raise serious concerns across human, animal, and environmental health domains [2]. Increasing evidence links microplastics to adverse effects on soil fertility, crop productivity, and the health of wildlife and humans, with implications for food safety and ecosystem services [3,4]. These risks are further amplified in the context of climate change, contributing to food system vulnerabilities, pathogen dynamics, and disruptions such as soil erosion and urban flooding [5]. Despite growing awareness, the complexity of microplastic pollution—including variability in polymer types, shapes, and weathering states—challenges risk assessment and regulatory responses. A One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, offers a comprehensive framework for understanding and managing microplastic risks in the food ecosystem. By fostering interdisciplinary collaboration, this approach supports the development of context-specific research and holistic mitigation strategies.

Fig. 1. Plastic pollution has multiple potential effects on every aspect of global health.

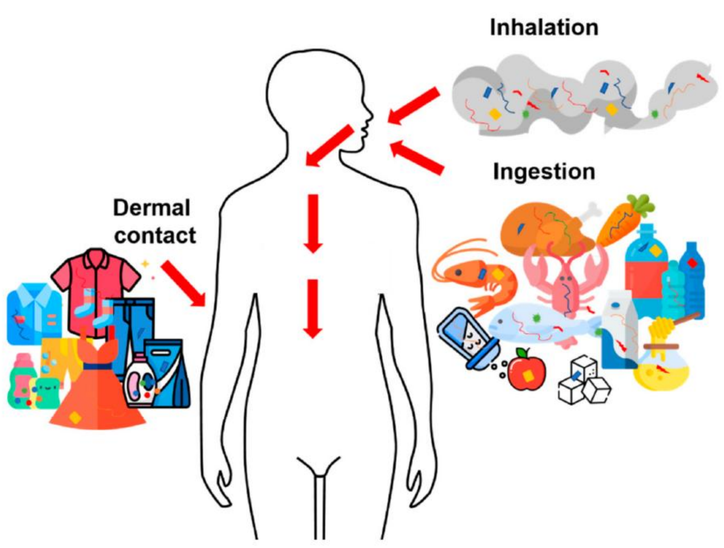

Fig. 2. Schematic representation of exposure to microplastics

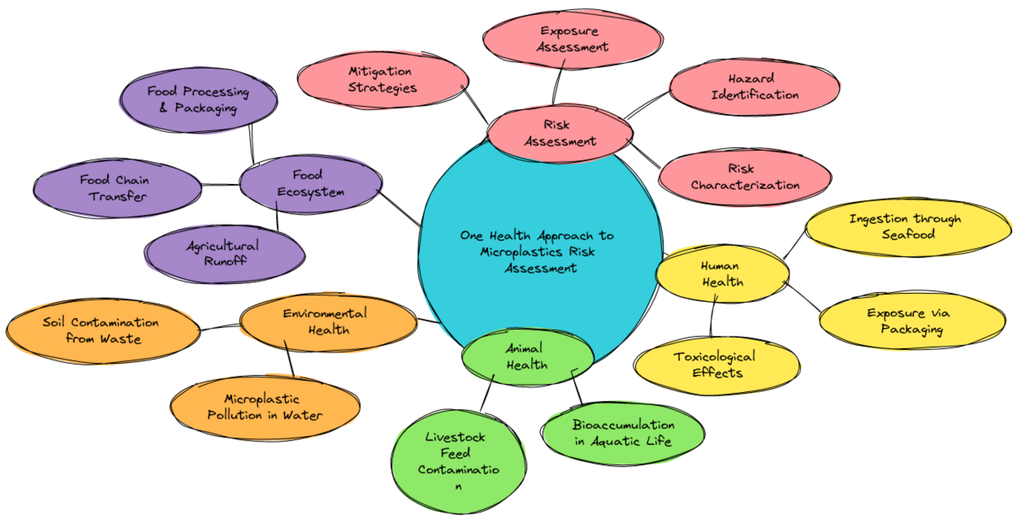

Fig. 3. Mindmap diagram of a One Health approach to microplastics risk assessment in the food ecosystem

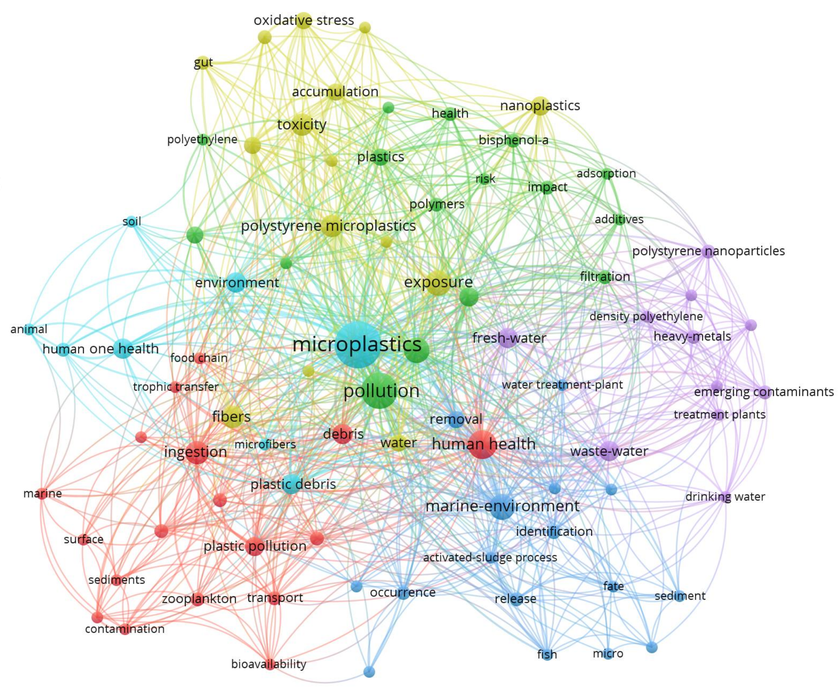

Fig. 4. Clustering of keywords related to *One Health* and *microplastics* topics in WoS (created with VOSviewer)

Growing evidence indicates that plastics affect various levels of biological organization, from molecular and cellular mechanisms to whole organisms and populations. These impacts span a broad range of biological processes, including inflammation, oxidative stress, metabolism, neurological function, behaviour, reproduction, development, and microbiome composition. Such effects arise both from the physical presence of ingested or absorbed plastic particles and from the associated chemicals and microbes they carry.

CONCLUSIONS

Microplastics pose diverse and potentially harmful effects on **animal health**, yet critical knowledge gaps remain regarding their impact under realistic environmental conditions.

Microplastics may pose serious risks to **human health** through ingestion, inhalation, and dermal exposure, but their full impact remains unclear and demands further investigation.

Microplastics disrupt key ecosystem processes and threaten **environmental** resilience, underscoring the urgent need for research on their effects under realistic ecological conditions.

ACKNOWLEDGEMENTS

This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI -UEFISCDI, project number PN-IV-P8-8.1-PRE-HE-ORG-2024-0165, within PNCDI IV and by the Romanian Ministry of Agriculture and Rural Development through the project *ADER 16.1.2 Research on the development of a certification scheme in the food chain according to the One Health concept*.

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY
MURCIA Food 25

Augmented Innovation: Implementing Generative AI in Corporate Innovation

Ángel Alba, Ángela Medina and Andrea Ferro

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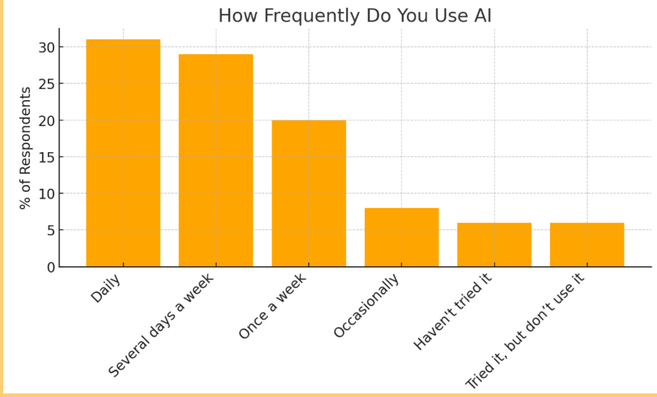
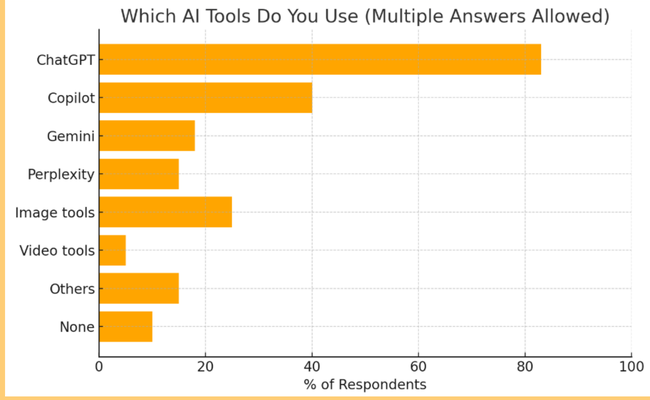
Generative Artificial Intelligence (Gen-AI) is transforming corporate innovation, redefining how new solutions are created, processes are optimized, and value is generated. Augmented Innovation means that this technology does not replace us as innovators but rather enhances our capabilities. However, its adoption still faces significant challenges, from technological integration to change management, while recognizing that implementing Gen-AI is an innovation process by itself.

State of the Art of Generative AI used in Innovation

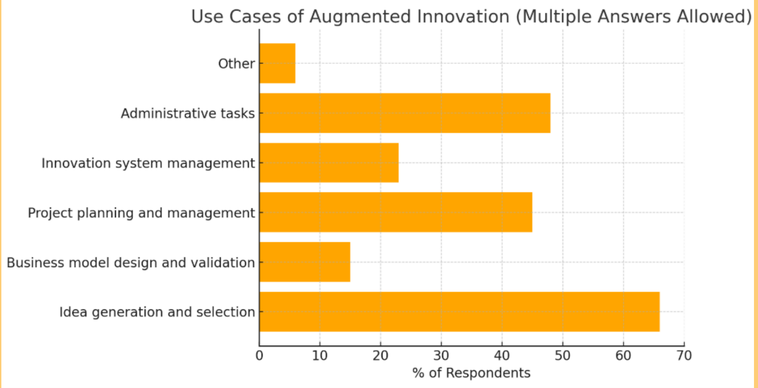
The use of generative AI in innovation is widespread: 61% use it frequently, while only 11% whereas only 11% have yet to experiment with it.



ChatGPT stands out as the "standard" tool, with over 80% of professionals reporting they use it.

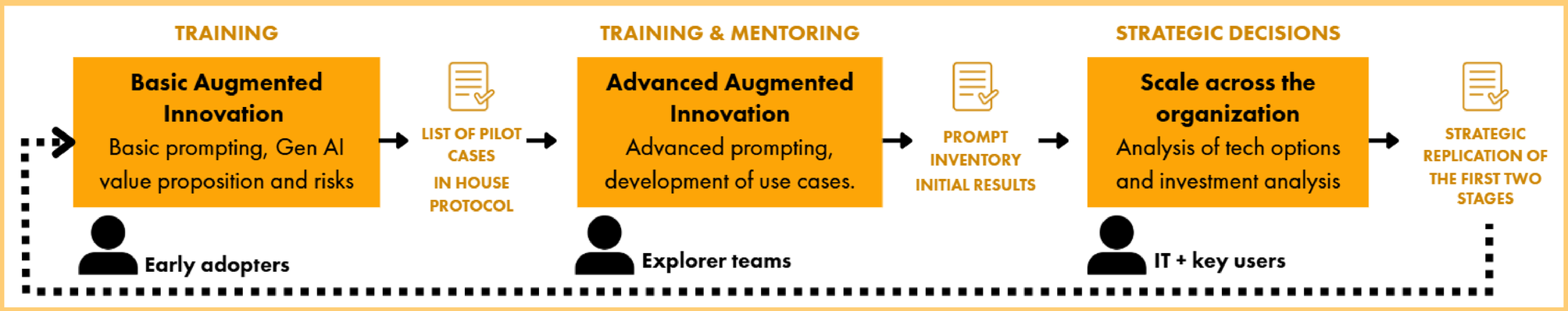


65% of innovation professionals use AI primarily to support idea generation and selection.



Methodology

The "accelerator" is the methodology developed within the framework of Augmented Innovation for the implementation of Gen AI. It is represented in the following figure:

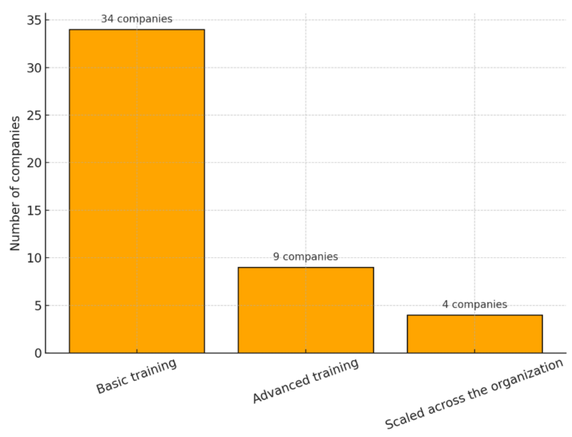


Results

From the implementation of the accelerator, we have obtained the following results:

Scale-up process data

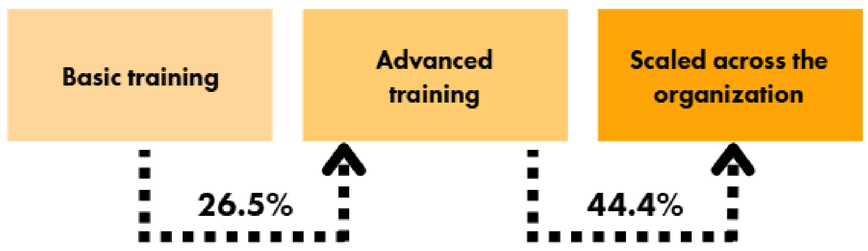
Total companies involved (unique or accumulated)	Basic training	Advanced training	Scaled across the organization
34	34	9	4



Percentages based on the total

Companies that completed only the basic training	Companies that completed the advanced training	Companies that scaled across the organization
73.5%	26.5%	11.8%

Percentages at each stage (based on the previous one)



Discussion & conclusions

- There is significant initial hype around the technology, but the organizational effort required to scale it across the company leads most firms to stop at basic, general training. This results in a high initial interest, but a significant drop-off in the advanced training stages; only one in four companies perceived enough value or were sufficiently prepared to continue investing in advanced training.
- As a result, in most situations, use cases are not explored, nor is the standardization of these tools.
- Without standardized use, habits are not formed, making it more likely that people will eventually abandon the use of these tools, resulting in sporadic usage and low productivity for others.
- However, nearly half of the companies that completed the advanced training decided to scale the initiative within their organization. This is a strong indicator that they are seeing value, and that once they deepen their understanding of the methodology, they are more willing to institutionalize the use of generative AI.

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

INNOVATIVE SUSTAINABLE CLUSTER FOR OLIVE VALUE CHAIN

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101116124-OASIS-SMP-COSME-2023-AGRICLUSTER

May 2024 / May 2027

Co-funded by the European Union

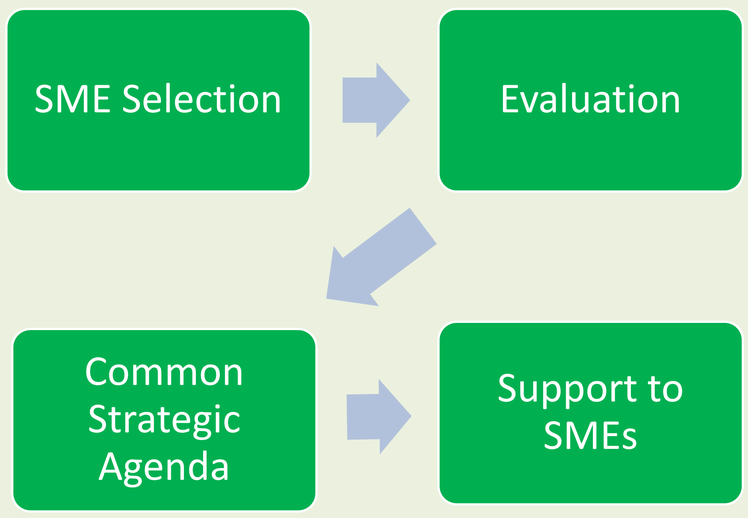
Introduction

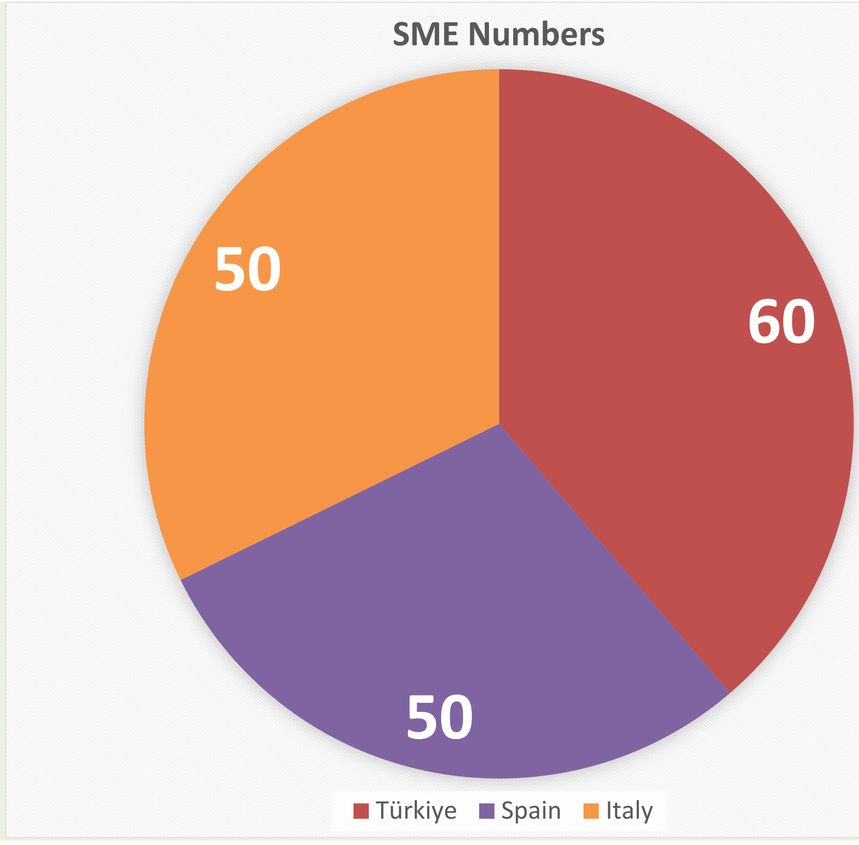
The 'Innovative Sustainable Cluster for Olive Value Chain (OASIS) Project', funded by the European Innovation Council and SME Executive Agency (EISMEA) within the scope of the Single Market Programme (SMP COSME), is implemeted by the consortium under the coordination of under the coordination of Izmir Commodity Exchange (ICE) from Türkiye. The partner organizations are Izmir Agricultural Technology Centre (ITTM) from Türkiye; Centro Tecnológico Nacional de la Conserva - CTNC (National Technology Centre for Food and Canning) and Camara De Comercio e Industria Italiana Para Espana - CCIS (Spanish Italian Chamber of Commerce and Industry) from Spain, and CIHAEM Bari (Mediterranean Institute of Agricultural Sciences, Bari) and Unioncamere Puglia (Union of Chambers of the Puglia Region) from Italy.

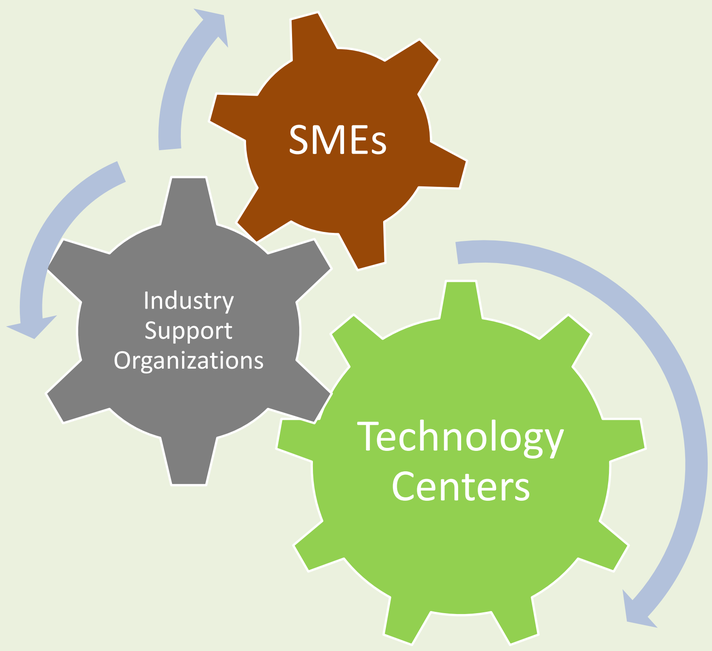
General objectives

1. Reaching out 150 SMEs in olive sector to develop their sustainability skills in the selected themes.
2. To create and cultivate 'European Agri-food Sustainability Cluster Partnerships' aimed at facilitating the adoption of the EU Code of Conduct on Responsible Food Business and Marketing Practices among small and medium-sized enterprises.
3. To decrease the vulnerability of food production systems to external factors, such as adverse weather events linked to climate change, while harnessing the Farm to Fork Strategy's goal of fostering sustainability.
4. To enhance the adoption of resource-efficient technologies by SMEs by identifying and implementing measures to enhance the efficiency of material utilization in processes; incl. preventing and reducing (food) waste and losses, as well as fostering collaboration among food supply chain to minimize food losses and waste. E.g: exploring opportunities for new products development using co-products and new items.
5. To stabilize the food supply chain, reduce production costs, and foster a more competitive and resilient marketplace by developing and implementing strategies to improve resource efficiency and reduce food waste.

Implementation







OASIS Cluster

Results

- Turkish partners and SMEs will be able to discover and learn from best practices in sustainable processing, resource efficiency and waste management from their counterparts in Italy and Spain.
- Reaching out maximum number of best practices within these SMEs.
- 15 training sessions on food losses; waste management for 150 SMEs training to be planned.
- Green Transition Advisors will communicate with the maximum possible agri-food SME
- 10 training sessions on process monitoring for 150 SMEs training to be planned.
- Organising one conference in Türkiye and one thematic online webinar.
- Provide a robust assessment of the economic impact of the project in order to assess how OASIS Project can generate increased economic returns.

COLLABORATING ENTITIES

"Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Innovation Council and SMEs Executive Agency. Neither the European Union nor the European Innovation Council and SMEs Executive Agency can be held responsible for them."

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Comparison of Nutritional and Functional Properties of Single-Cell Protein from Saccharomyces cerevisiae and Soy Protein for Meat Substitute Applications.

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INTRODUCTION

The growing demand for sustainable protein sources has led to increased interest in single-cell proteins (SCP) derived from microbial biomass. Among them, *Saccharomyces cerevisiae* offers a promising nutritional profile and functional versatility for food applications. This study compares the amino acid composition and potential of SCP from *S. cerevisiae* with conventional soy protein, focusing on their suitability for use in meat substitute formulations.

MATERIALS AND METHODS

SCP was produced from *Saccharomyces cerevisiae* under controlled fermentation. Protein concentrate was obtained after heat treatment through alkaline extraction. Soypro900E from Shandong Crownchem Industries soya protein concentrate served as a reference (Shandong, China). Amino acid composition was determined by HPLC after hydrolysis, expressed in g/100 g protein and g/100 g concentrate. Nutritional composition (protein, fat, ash, moisture, carbohydrates, nucleic acids) was also analyzed.

Technofunctional properties were assessed using standardized methods: water and oil absorption capacities (WAC, OAC) via centrifugation; soluble fraction (SF) by protein quantification in supernatant; emulsifying activity and stability (EAI, ESI) through turbidimetry at 500 nm; foaming capacity and stability (FC, FS) by volume retention; and gelation capacity (GC) as the minimum protein concentration forming a stable gel upon heating and cooling.

RESULTS AND CONCLUSIONS

The amino acid profile per 100 g of protein and per 100 g of concentrate revealed that soy protein is richer in glutamic acid, aspartic acid, and arginine, which contribute to flavor (umami), solubility, and bioactivity. However, SCP showed higher levels of methionine and histidine—two essential amino acids often limiting in plant proteins (enhancing its nutritional value, especially when used in combination with soya).

From a nutritional standpoint, soy protein presented a higher protein content (85.4%) compared to SCP (78.8%), and a lower fat and carbohydrate content. Nonetheless, SCP had higher ash content, likely due to mineral richness, and measurable nucleic acids, which is typical in microbial proteins but should be monitored for dietary intake.

Functionally, soya protein showed superior water (355%) and oil absorption capacity (73.3%), indicating better performance in moisture and fat retention (desirable for meat analog texture). However, SCP exhibited higher emulsifying activity (EAI: 28.9 m²/g) and stability (ESI: 0.28 min), which are crucial for forming and maintaining stable emulsions in complex food matrices.

In foaming properties, soya clearly outperformed SCP, with higher foaming capacity (14.7% vs. 4.9%) and stability (21.3% vs. 4.5%), making it more suitable for aerated food systems. Gelation capacity (GC), on the other hand, was much higher for SCP (345.7 g/L), indicating a significantly lower gelling ability compared to soy (86.1 g/L).

In conclusion, while soya protein remains a benchmark for plant-based applications, SCP from *S. cerevisiae* presents a highly complementary profile: nutritionally robust (especially in methionine), technologically advantageous for emulsification, and a promising candidate for blending in high-protein formulations. Their combination could yield optimized plant-based meat substitute products in terms of nutrition, texture, and functionality.

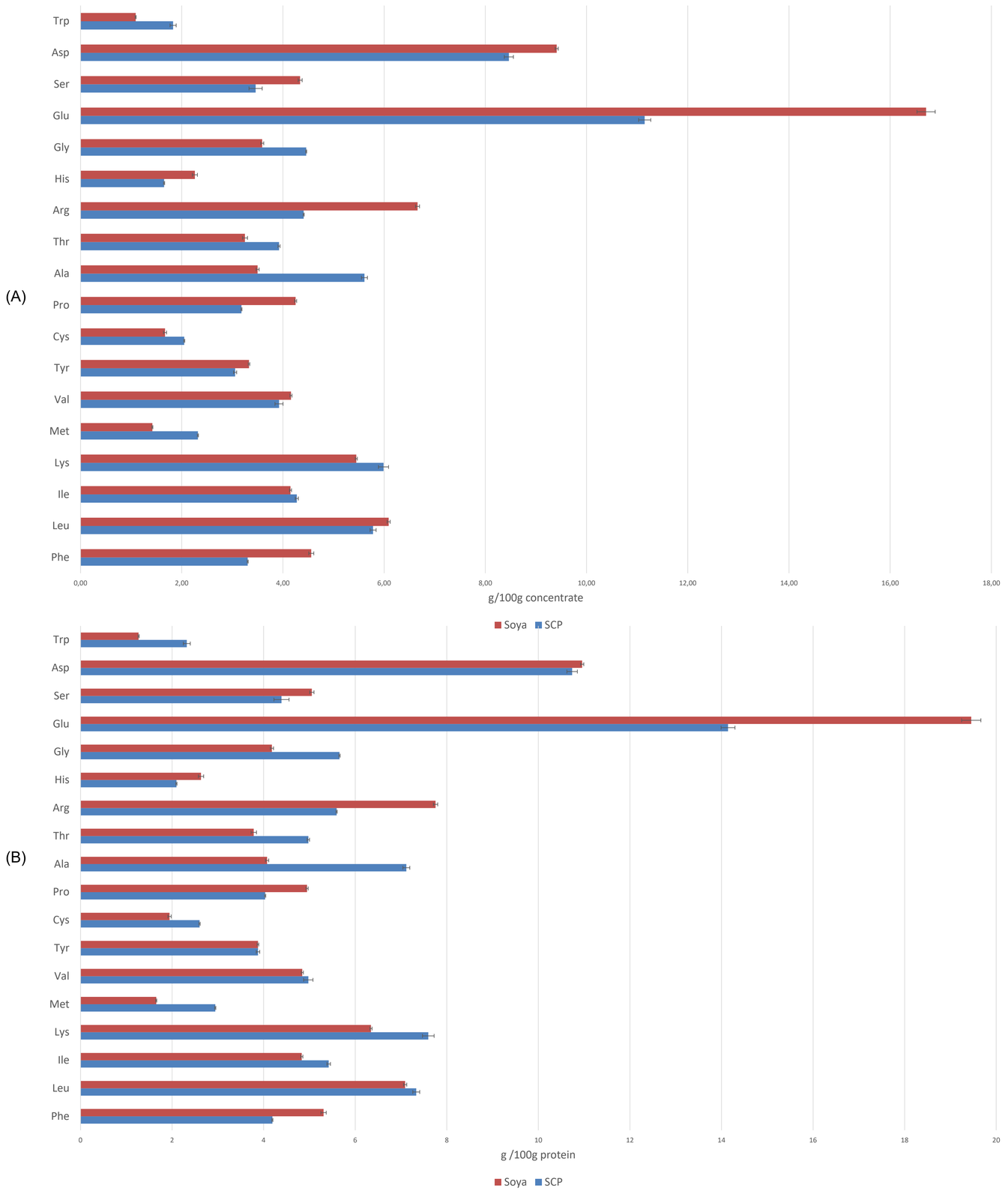

Figure 1. Aminograms of the SCP and soya protein concentrate: expressed as g of aa/100g concentrate (A) and g of aa/100g protein (B)

Table 1. Nutritional profile of SCP and soya protein concentrates

	SCP	Soya
Protein, %	78,83 ± 3,27	85,37 ± 5,41
Fat, %	1,1 ± 0,29	0,52 ± 0,12
Ash, %	7,4 ± 0,88	4,67 ± 0,39
Moisture, %	3,23 ± 0,25	5,26 ± 1,08
Carbohydrates, %	8,19 ± 1,10	0,36 ± 0,27
Nucleic acids, %	0.86 ± 0.93	< 0,5

Table 2. Functional properties of SCP and soya protein concentrates

	WAC, %	OAC, %	EAI, m²/g	ESI, min	FC, %	FS, %	GC, g/L	SF, %
SCP	138.3 ± 7.5	2.9 ± 0.5	28.9 ± 1.3	0.28 ± 0.13	4.9 ± 0.0	96.9 ± 0.0	345.7	4.5 ± 0.9
SOYA	355 ± 16.6	73.3 ± 2.5	26.6 ± 1.1	0.16 ± 0.11	14.7 ± 1.5	97.2 ± 0.1	86.1	21.3 ± 1.8

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Ooptimization of a solid-liquid extraction method for blackberry fruits bioactive compounds using a Box-Behnken design.

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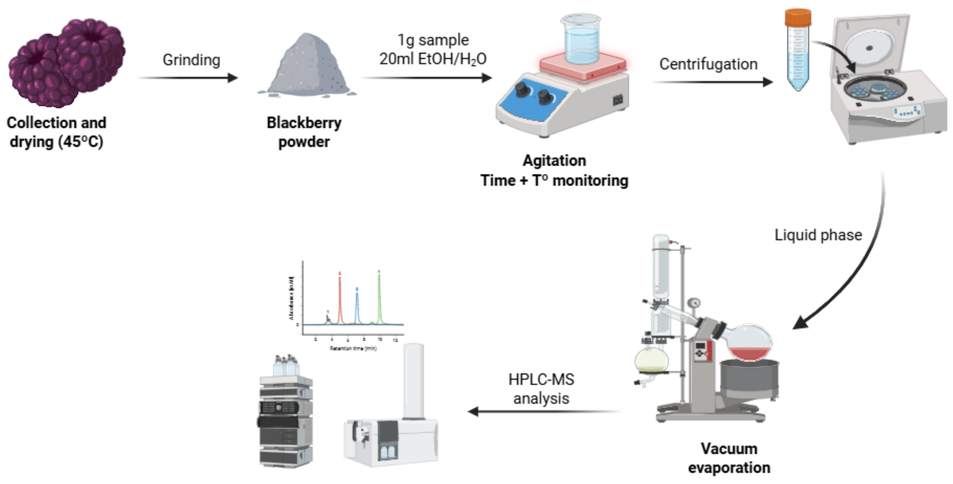
INTRODUCTION

Blackberries (Rubus fruticosus) are rich in phenolic compounds with notable antioxidant, anti-inflammatory, and antimicrobial properties, making them valuable as functional food ingredients[1,2]. This study optimized the solid-liquid extraction method using GRAS solvents (ethanol and water), with total phenolic content as dependent variable. Response Surface Methodology (RSM) was employed to enhance the efficiency and sustainability of the extraction process for potential food and nutraceutical applications.

MATERIALS AND METHODS



Equation 1. Second order polynomial equation for RSM.

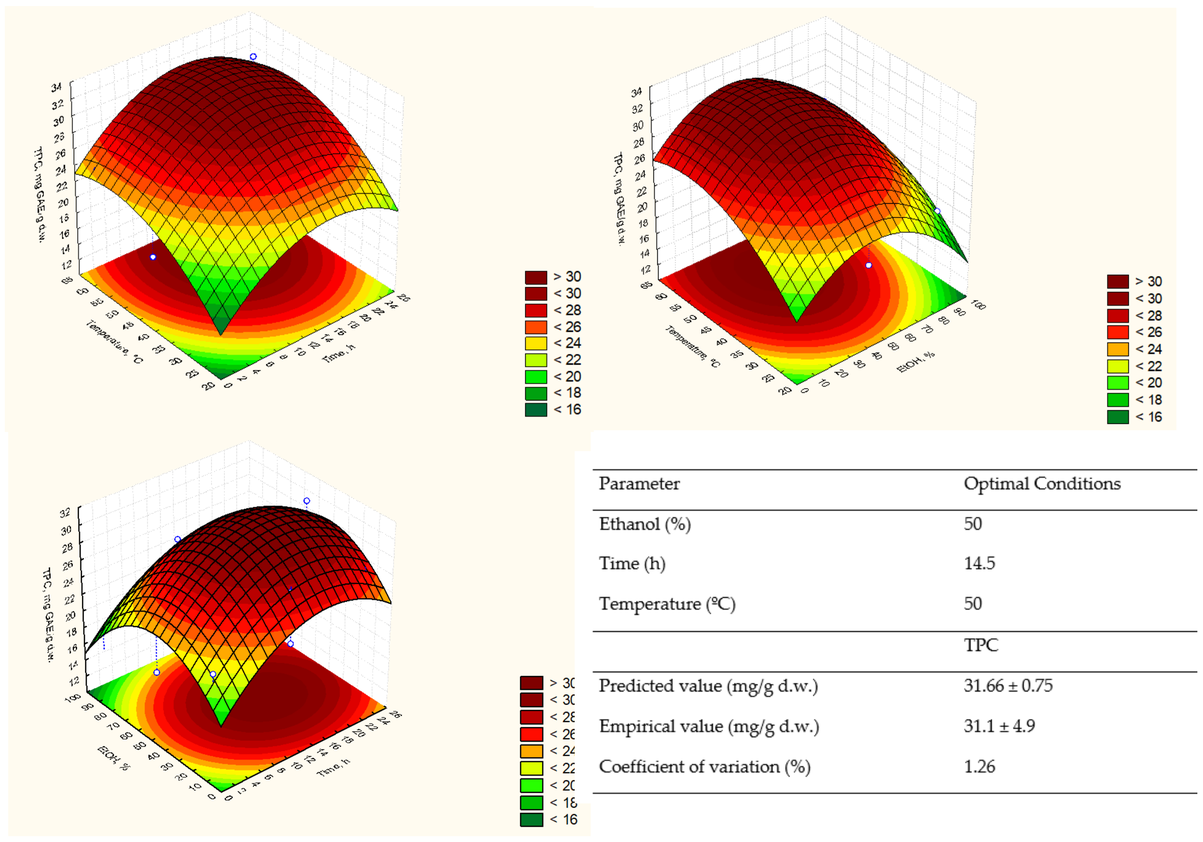
$$Y = \beta_0 + \sum_{i=1}^{3} \beta_i X_i + \sum_{i=1}^{3} \beta_{ii} X_{ii}^{\ 2} + \sum_{i=1}^{2} \sum_{j=i+1}^{3} \beta_{ii} X_i X_j$$

RESULTS

The Box-Behnken design revealed that ethanol concentration (β1), extraction time (β2), and temperature (β3) significantly affected total phenolic content (TPC). The response surface model showed a high predictive accuracy (R^2 = 0.9981) with no significant lack of fit (p > 0.05). The strongest effects on TPC were observed for ethanol concentration, followed by time and temperature, with significant linear and quadratic terms. Optimal extraction conditions were determined as 50% ethanol, 14.5 h, and 50 °C, yielding 31.1 ± 4.9 mg gallic acid equivalents (GAE)/g dry weight (predicted value of 31.66 ± 0.75 mg GAE/g d.w). A total of 34 phenolic compounds were characterized by UPLC-QTOF-MS, including phenolic acids, flavonoids, ellagitannins, lignans, and anthocyanins, with cyanidin-3-O-glucoside (1635.15 µg/g d.w.), cyanidin-3-O-rutinoside (505.34 µg/g d.w.), and sanguiin H6 isomer (35.09 µg/g d.w.) being the most abundant.

CONCLUSIONS

Response Surface Methodology successfully optimized the extraction of antioxidant phenolic compounds from blackberry fruits. The model demonstrated excellent predictive accuracy and robustness, defining optimal conditions (50% ethanol, 14.5 h, 50 °C) that maximize extraction efficiency while maintaining sustainability. Additionally, UPLC-QTOF-MS characterization revealed a rich phenolic profile, with cyanidin-3-O-glucoside, cyanidin-3-O-rutinoside, and sanguiin H6 isomer identified as the major compounds. These findings support the development of high-value blackberry extracts for functional food and nutraceutical applications.



Parameter	Optimal Conditions
Ethanol (%)	50
Time (h)	14.5
Temperature (ºC)	50
	TPC
Predicted value (mg/g d.w.)	31.66 ± 0.75
Empirical value (mg/g d.w.)	31.1 ± 4.9
Coefficient of variation (%)	1.26

Figure 1. Response surface plots showing combined effects of process variables for TPC (mg GAE/g d.w.): temperature (ºC)—time (h) (a), temperature (ºC)—% EtOH (b) and % EtOH—time (h) (c). Optimal conditions of extraction and predicted and empirical values of the model (n=3)

Table 4. Identification and quantification of phenolic compounds present in blackberry extract.

Peak No.	Retention Time (Min)	m/z Exp.	m/z Calc.	Error (ppm)	Molecular Formula	Score	Proposed Compound	Quantification (µg/g d.w.)
Phenolic acids and derivatives								
3	0.433	333.057	333.061	−4.8	$C_{16}H_{14}O_8$	93.9	Jaboticabin	27.68 ± 0.26
7	4.979	223.06	223.0606	−3.6	$C_{11}H_{12}O_5$	97.4	Sinapic acid	17.83 ± 0.12
9	5.476	385.111	385.1135	−7.3	$C_{17}H_{22}O_{10}$	92.7	Sinapic acid hexoside	13.35 ± 0.03
16	6.639	183.025	183.0293	−2.4	$C_8H_8O_5$	99.2	Methylgallic acid	19.18 ± 0.07
20	7.707	433.041	433.0407	−0.2	$C_{19}H_{14}O_{12}$	84.5	Ellagic acid-pentoside	27.98 ± 0.02
21	7.888	433.041	433.0407	2.7	$C_{19}H_{14}O_{12}$	92.9	Ellagic acid-pentoside isomer	25.62 ± 0.16
24	8.726	300.999	300.9984	3.3	$C_{14}H_6O_8$	100	Ellagic acid	19.46 ± 0.13
29	9.276	447.056	447.0564	−0.9	$C_{20}H_{16}O_{12}$	94	Ellagic acid 2-rhamnoside	20.89 ± 0.10
32	9.917	315.012	315.0141	−7.0	$C_{15}H_8O_8$	86	3-*O*-Methylellagic acid	10.41 ± 0.05
Flavonoids and derivatives								
6	4.367	463.085	463.0877	−5.8	$C_{21}H_{20}O_{12}$	95.6	Quercetin-*O*-hexoside	3.37 ± 0.09
10	5.487	577.14	577.1405	−1.6	$C_{30}H_{26}O_{12}$	85.4	B-type procyanidin dimer	7.57 ± 0.12
11	5.716	315.123	315.1232	−1.9	$C_{18}H_{20}O_5$	85.8	4-hydroxy-5,7,4'-trimethoxyflavan	5.89 ± 0.01
14	6.335	289.071	289.0712	0.7	$C_{15}H_{14}O_6$	87.9	Epicatechin	7.90 ± 0.03
15	6.517	577.136	577.1346	3.1	$C_{30}H_{26}O_{12}$	86.5	B-type procyanidin dimer isomer	7.94 ± 0.05
25	8.801	609.148	609.1456	3.1	$C_{27}H_{30}O_{16}$	99.8	Rutin	8.46 ± 0.15
26	9.046	463.089	463.0877	1.9	$C_{21}H_{20}O_{12}$	99.6	Quercetin 3-galactoside	5.63 ± 0.09
27	9.051	609.146	609.1456	0.7	$C_{27}H_{30}O_{16}$	99.6	Rutin isomer	5.50 ± 0.18
28	9.213	463.085	463.0877	−5.0	$C_{21}H_{20}O_{12}$	97.5	Quercetin-*O*-glucoside	3.96 ± 0.02
30	9.577	477.066	477.0669	−2.7	$C_{21}H_{18}O_{13}$	98.2	Quercetin 3-glucuronide	4.01 ± 0.01
34	10.199	505.1	505.0982	3.6	$C_{23}H_{22}O_{13}$	99.5	Quercetin-*O*-acetylhexoside	3.24 ± 0.11
Ellagitannins								
19	7.519	935.079	935.0791	−0.1	$C_{41}H_{28}O_{26}$	100	Casuarictin	21.02 ± 0.23
22	8.29	934.075	934.0712	2	$C_{41}H_{28}O_{26}$ (X2)	83.6	Sanguiin H6	25.99 ± 0.18
23	8.381	934.076	934.0712	1.5	$C_{41}H_{28}O_{26}$ (X2)	89.5	Sanguiin H6 isomer	35.09 ± 0.27
Lignans								
33	9.984	571.218	571.2179	−0.7	$C_{30}H_{36}O_{11}$	89.6	Kadsurarin	28.17 ± 0.14
35	10.509	571.213	571.2179	−7.9	$C_{30}H_{36}O_{11}$	85.7	Kadsurarin isomer	12.37 ± 0.06
36	10.74	341.137	341.1389	−5.6	$C_{20}H_{22}O_5$	99.9	Kadsurenin B	8.85 ± 0.10
Anthocyanins (MS+)								
12	5.859	449.107	449.1084	−2.2	$C_{21}H_{21}O_{11}$	99.9	Cyanidin-3-*O*-glucoside	1635.15 ± 13.24
17	6.691	595.165	595.1663	−2.9	$C_{27}H_{31}O_{15}$	92.3	Cyanidin-3-*O*-rutinoside	505.34 ± 5.37
18	7.268	419.098	419.0919	0.7	$C_{20}H_{19}O_{10}$	98.6	Cyanidin-3-*O*-arabinoside	145.05 ± 1.63
38	11.499	465.104	465.1033	1.1	$C_{21}H_{21}O_{12}$	96.3	Delphinidin-3-*O*-galactoside	32.46 ± 0.97
39	11.501	611.16	611.1612	−2.3	$C_{27}H_{31}O_{16}$	92.9	Cyanidin-3,5-*O*-diglucoside	132.11 ± 2.08
40	11.672	465.104	465.1033	1.9	$C_{21}H_{21}O_{12}$	99.4	Delphinidin-3-*O*-glucoside	63.56 ± 1.05
41	11.83	611.159	611.1612	2.1	$C_{27}H_{31}O_{16}$	91.6	Cyanidin-3-*O*-sophoroside	94.96 ± 1.58
43	13.572	465.106	465.1033	5.4	$C_{21}H_{21}O_{12}$	82.4	Delphinidin-3-*O*-galactoside	11.38 ± 0.46

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

POWER PROTEINS: UNLOCKING THE POTENTIAL OF CEREALS & PULSES

Denisa Eglantina Duta*[1], Gabriela Daniela Criveanu-Stamatie[1], Sabina Bobea[1], Cristian Florea[1], Nastasia Belc[1]

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Keywords cereals, pulses, chickpeas, proteins, plant-based diet

INTRODUCTION: Cereals and pulses are staple food sources worldwide, offering a rich and complementary profile of essential amino acids and making them valuable for addressing global nutritional challenges. Cereals, such as quinoa, amaranth, and teff, along with pulses, such as lentils, chickpeas, and beans, provide diverse protein options that can meet the nutritional needs of various dietary preferences. Moreover, the cultivation of cereals and pulses requires fewer resources and has a lower environmental impact than animal agriculture, aligning with global efforts toward sustainable food production.

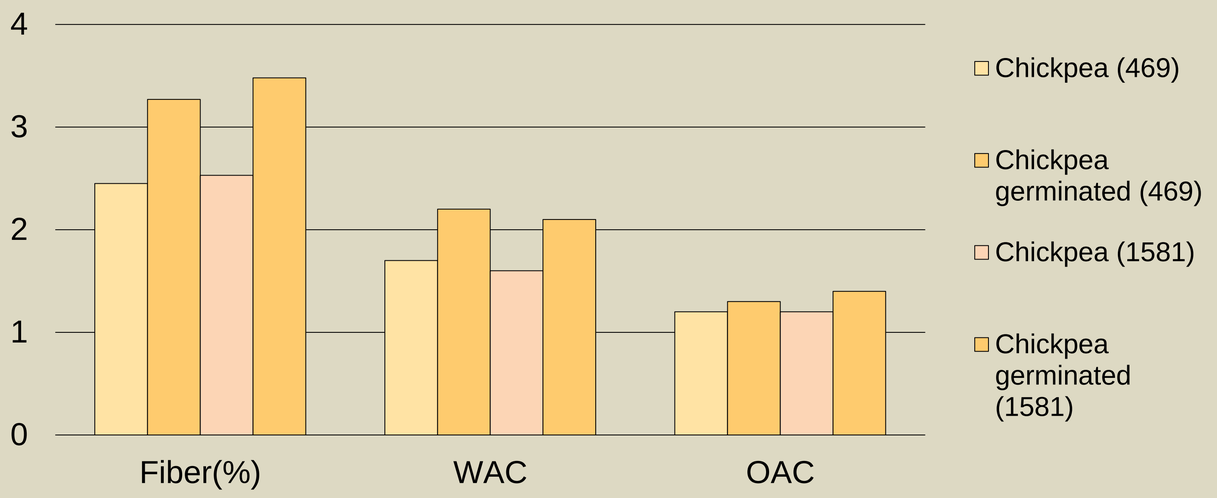
Objective: This study explored the potential of these plant-based proteins to enhance food security, promote sustainability, and improve human health.

Raw material and germination analyses

1. Physical and chemical: moisture (%), protein (%), lipids (%), ash (%), fiber (%)
2. Functional proprieties: solubility, water-holding capacity, emulsifying, gelling
3. Microbiological: yeasts and molds (cfu/g), *Enterobacteriaceae* (cfu/g)

Results and comparative analysis:

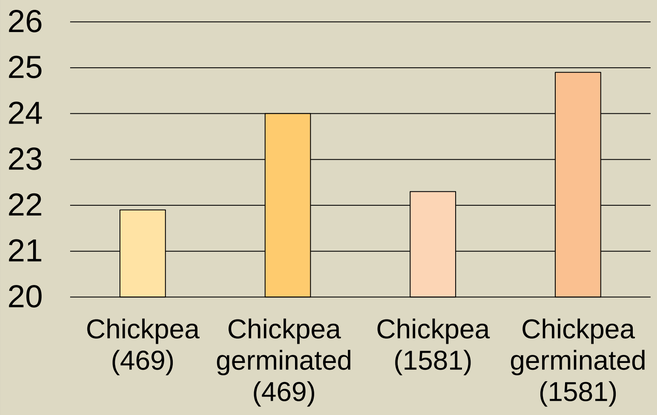
Influence of germination on fiber content, WAC and OAC



WAC: water absorption capacity, OAC: oil absorption capacity

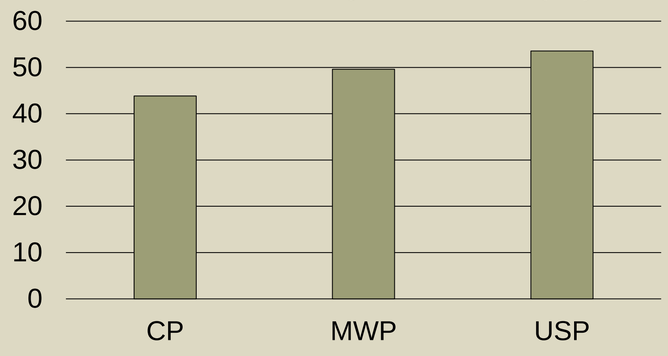
(Sajad Ahmad Sofi, et. al., 2023)

Protein (%)



(Sajad Ahmad Sofi, et. al., 2023)

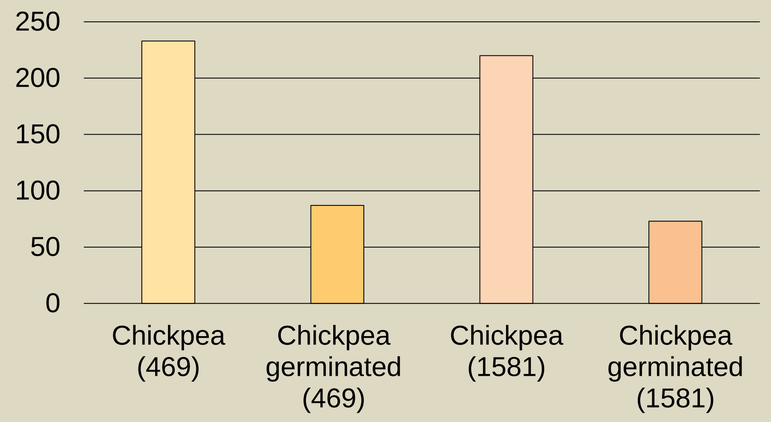
Protein solubility in water (%)



CP-conventional processing;
MWP-microwave processing; USP-ultrasound processing.

(Neha Sharma et. al., 2024)

Tannins (mg TAE /100 g)



(Sajad Ahmad Sofi, et. al., 2023)

Discussions and conclusion: Pretreatment methods, such as soaking and germination, have been shown to be effective in reducing antinutritional factors (Tannins mg TAE /100g) and improving protein solubility, fiber, water, and oil absorption capacity *(Sajad Ahmad Sofi, et. al., 2023).* For chickpea by-product resulting from juice extraction, microwave and ultrasonic processing methods demonstrated notable improvements in extraction yield and protein content compared to conventional processing *(Neha Sharma, et. al., 2024).*

References: Sajad Ahmad Sofi, Shafiya Rafiq, Jagmohan Singh, Shabir Ahmad Mir, Sushil Sharma, Parshant Bakshi, David Julian McClements, Amin Mousavi Khaneghah, B.N. Dar, 2023. Impact of germination on structural, physicochemical, techno-functional, and digestion properties of desi chickpea (*Cicer arietinum L*.) flour. *Food Chemistry*, Volume 405, Part B, 135011.

Neha S., Nushrat Y., Valérie O., 2024. Physicochemical, microstructural, and functional properties of *Cicer arietinum* okara flour–a chickpea beverage by-product. *International Journal of Food Science and Technology*, Volume 59, Issue 11, Pages 8697–8707, https://doi.org/10.1111/ijfs.17146

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

ISOLATION AND CHARACTERIZATION OF EPS-PRODUCING LACTIC ACID BACTERIA FROM ARTISANAL SOURDOUGHS

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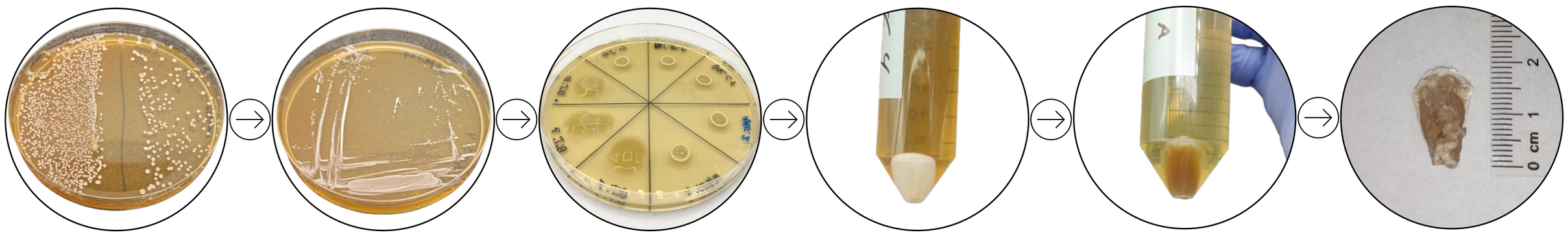
INTRODUCTION

Exopolysaccharides (EPS) are extracellular polymers produced by lactic acid bacteria (LAB). Composed mainly of monosaccharides, these compounds enhance the technological and functional properties of fermented foods, influencing texture, viscosity, stability, and water retention.

The present study aims to evaluate the production of EPS by LAB strains isolated from traditional sourdoughs, in order to investigate their potential functional and technological applications in food systems.

METHODS

A total of 108 LAB strains were isolated from five sourdough samples using MRS agar. To screen for EPS-producing strains, the isolates were cultured on MRS agar supplemented with 2% (w/v) sucrose. Colonies exhibiting mucus formation after six days of incubation at 30 °C were considered EPS-positive and selected for further analysis. The chosen strains were inoculated in modified MRS broth with 2% (w/v) sucrose as the sole carbon source. Following a 48-hour incubation at 30 °C, the EPS were recovered by centrifugation (6000 g, 15 min), precipitated with absolute ethanol (1:2 v/v), and stored at -18 °C. The recovered EPS were freeze-dried, and their dry weight was quantified to assess production yield.



Isolation on MRS agar | Purification on MRS agar | Selection on MRS agar + 2% sucrose (mucoid colonies → EPS+) | Culture in MRS broth + 2% sucrose (48 h, 30 °C) | EPS recovery (centrifugation), precipitation with absolute ethanol, storage (-18 °C) | Lyophilization and quantification (dry weight)

Figure 1. Experimental workflow diagram.

RESULTS

Six EPS-producing wild strains were successfully isolated and characterized.

The results indicated that the strain BLT.1 was identified as the strain that produced the highest biomass, thus highlighting its potential for applications in the production of EPS in fermented food systems.

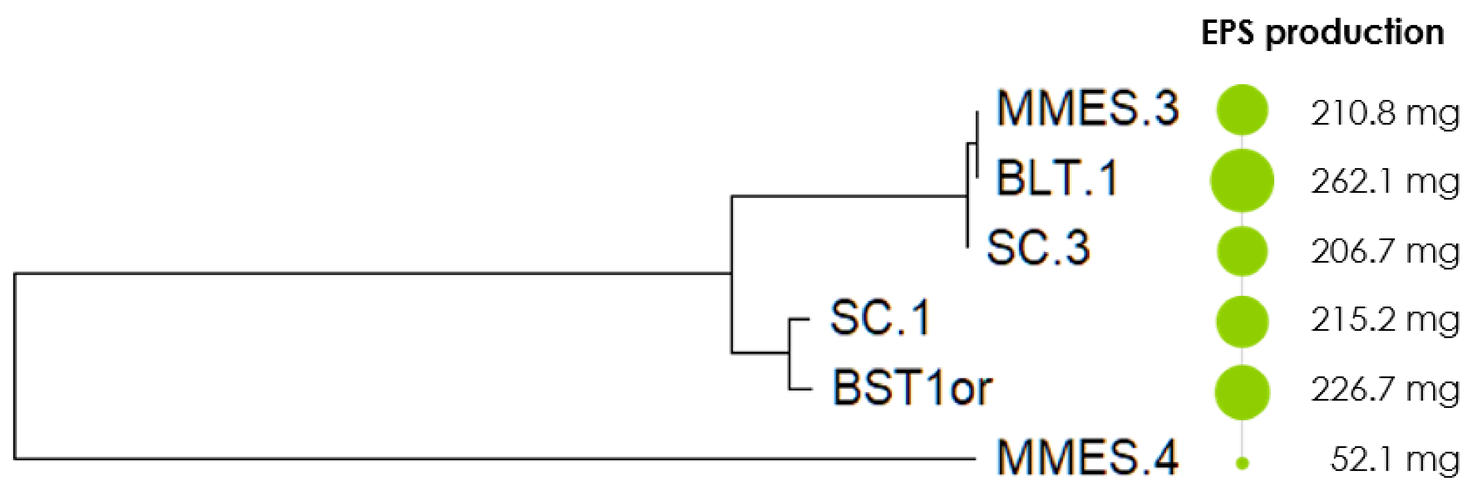


Figure 2. Phylogeny and EPS production profiles of six bacterial isolates.

Table 1. Phenotypical identification of bacterial isolates from sourdough matrices.

Code	Sourdough matrix	Colony appearance	Microscopic features	Gram staining	Oxidase test	Catalase test
BST1or	Wheat	Small, smooth, white	Cocci in chains	+	-	-
BLT.1	Wheat	Small, smooth, white	Cocci in chains	+	-	-
SC.1	Rye	Transparent, mucous	Cocci in chains	+	-	-
SC.3	Rye	Transparent, mucous	Cocci in chains	+	-	-
MMES.3	Spelt	Transparent, mucous	Cocci in chains	+	-	-
MMES.4	Spelt	Transparent, mucous	Chained bacilli	+	-	-

CONCLUSION

In this study, EPS-producing lactic acid bacteria strains were isolated and thoroughly characterized. This represents a significant advance, as these strains can be incorporated into fermented foods to enhance their functional properties and overall quality.

Financiado por la Unión Europea NextGenerationEU

Plan de Recuperación, Transformación y Resiliencia

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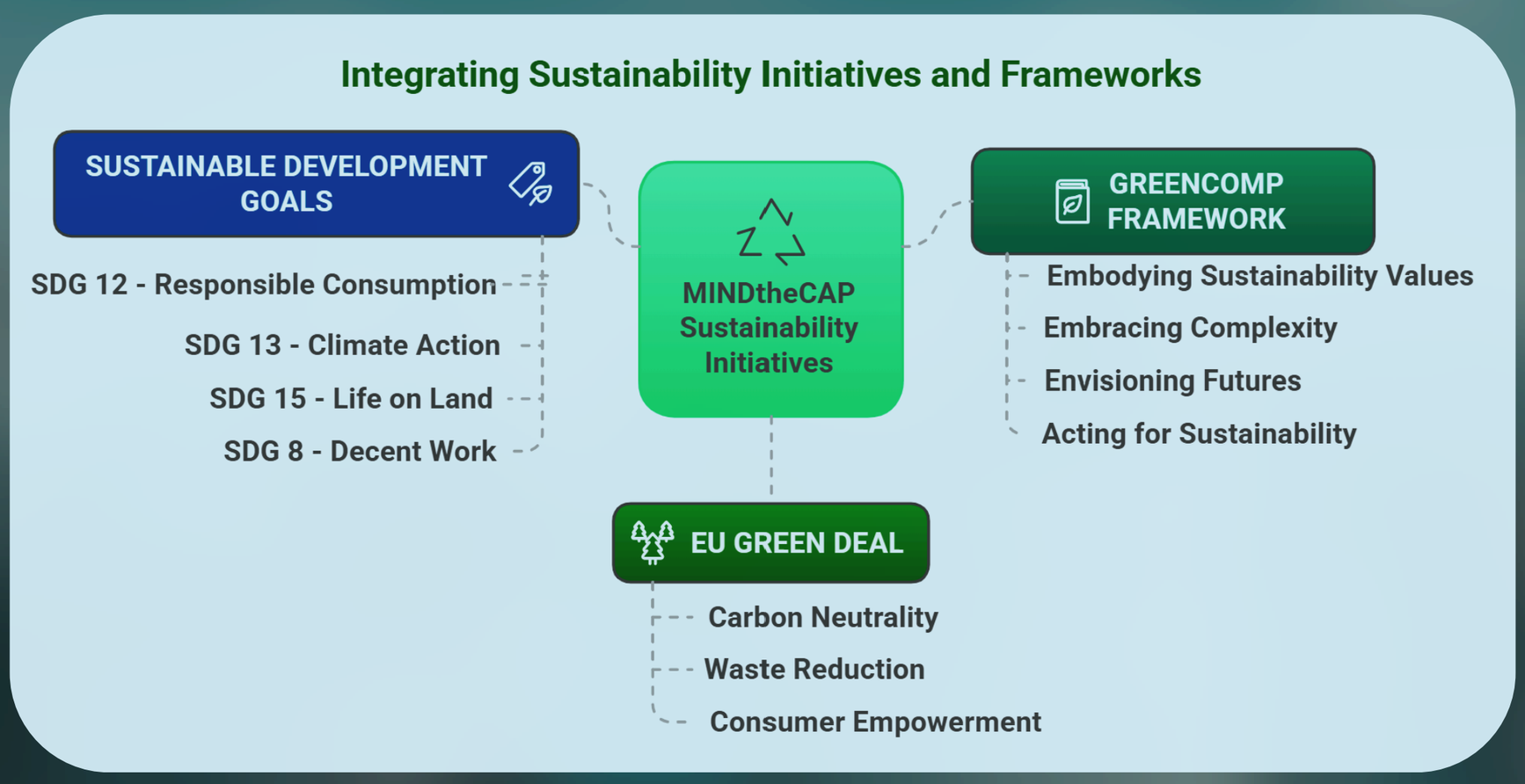
ENVIRONMENTAL BEHAVIORS GUIDELINE AT THE GROCERY SHOP

PRACTICAL TIPS FOR SUSTAINABLE SPENDING IN EVERYDAY GROCERY SHOPPING

🎯 WHY THIS MATTERS?

Climate change and environmental degradation are significantly influenced by our everyday consumer choices. The **Grocey Store** is a critical space where individuals can adopt sustainable, climate-conscious behaviors that collectively drive positive environmental change.



🥕KEY MESSAGES OF THE GUIDELINE

- ✅ Choose local & seasonal produce
- ✅ Prioritize low-packaging or bulk goods
- ✅ Minimize food waste with mindful planning
- ✅ Support fair trade & ethically produced items
- ✅ Use reusable bags and containers
- ✅ Opt for organic when possible
- ✅ Avoid impulse buying - buy what you need
- ✅ Learn to read labels critically (origin, certifications, etc)

Download the full guide from our

Catalogue of Innovative Educational Resources

www.mindthecap.eu

MURCIA Food 25

mind the CAP

ERASMUS+ CAPACITY BUILDING IN THE FIELD OF YOUTH

Co-funded by the European Union

📌 TAKEAWAY

Every item you put in your basket is a vote for the kind of world you want, so:

Shop consciously!

Act globally!

Start locally!

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

NOVel Antimicrobial coatings and PACKaging in the Mediterranean (NOVAPACK)

Francisco Lorca Salcedo[1], David Quintín Martínez[1], Presentación García Gómez[1], Daniela Magalhães[2], Ana A. Vilas Boas[2,3], Débora Campos[2,3], Adma Melo[2], Lazhar Zourgui[4], Faten M. Ibrahim[5], EL Sayed El Habbasha[6], Nuria López Aznar[7], Agnieszka Kobus[7], Oscar Ballesta Caravaca[8], Amel Chelbi[9], Manuela Pintado[2]*

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Introduction

The **NOVAPACK** project addresses the growing need for sustainable solutions in the food packaging sector, focusing on the valorization of agri-food waste. In the Mediterranean region, the food industry generates significant quantities of by-products such as non-conforming fruits, peels, pomaces, and seeds. These residues are currently underutilized, yet they represent an abundant, renewable, and low-cost source of valuable compounds including fibers, vitamins, minerals, and phenolic compounds with recognized bioactive and antimicrobial properties. NOVAPACK aims to exploit these by-products to develop cost-effective, biodegradable antimicrobial films and coatings that extend the shelf life of minimally processed foods. Special attention is given to key Mediterranean crops like citrus fruits, pomegranates, tomatoes, grapes, and olives.

Objectives

- ✓ Valorize food industry by-products as raw materials for new packaging applications.
- ✓ Extract and optimize the obtaining of fibers, antimicrobial compounds and pigments from food by-products.
- ✓ Characterize the physicochemical, nutritional, functional and microbiological properties of the materials.
- ✓ Develop and optimize bio-based coatings and films adapted to Mediterranean food products.
- ✓ Provide scalable and integrative solutions to reduce environmental impact across the food supply chain.

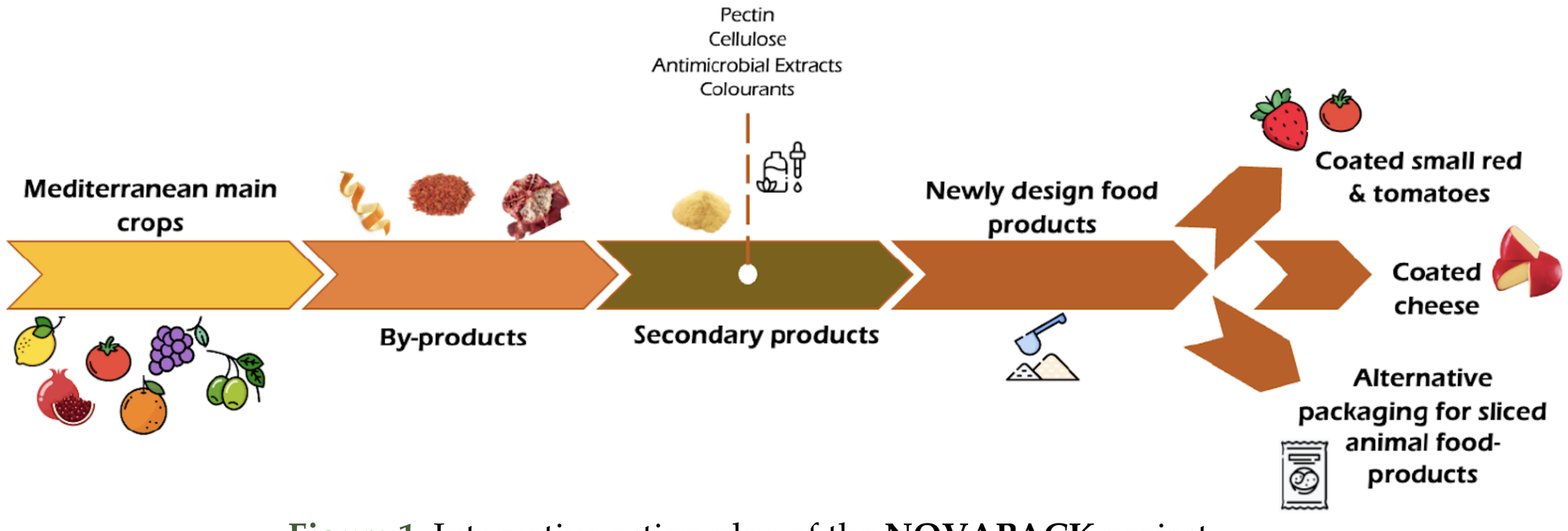

Figure 1: Integrative action plan of the **NOVAPACK** project.

Expected Results

- ✓ Validated extraction and formulation processes for bioactive compounds with optimized functionality.
- ✓ Characterization data (physicochemical, nutritional, functional and microbiological properties) demonstrating the efficacy, functionality and safety of the materials developed.
- ✓ Biodegradable packaging prototypes based on extracted fiber, antimicrobial compounds and pigments from Mediterranean agri-food waste.
- ✓ Enhanced food preservation through antimicrobial properties incorporated into coatings and films.
- ✓ Reduction in plastic use and food waste, contributing to circular economy practices in the Mediterranean agri-food sector.

Acknowledgements

Project funded under the Horizon Europe program and the European Regional Development Fund (ERDF). The authors would like to thank the NOVAPACK project (PRIMA/0006/2023).

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Ecosistema de Innovación NUTRIALITEC (ECO-20241004), subvencionado por el CDTI y que ha sido apoyado por el Ministerio de Ciencia, Innovación y Universidades del Gobierno de España

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

BLOOD4GOODS: Valorizing Porcine Blood as a Sustainable High-Protein and Iron-Rich Ingredient

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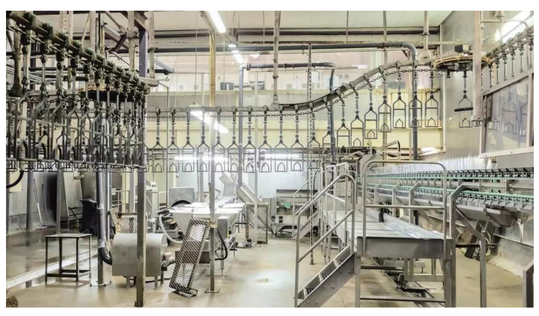
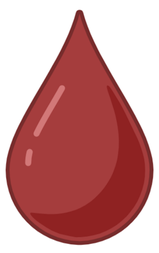
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN

Context



Porcine blood is one of the main waste products in slaughterhouses and its management represents a huge economic and environmental challenge



Porcine blood is a source of:

- Protein
- Iron

Highly interesting ingredient for the food industry

BLOOD4GOODS

The aim of the project is to transform porcine blood into a **functional ingredient** with a high **protein** and **iron** content that can be incorporated into the formulation of new food products

Protein hydrolysis

Main processing steps

Chemical hydrolysis for protein precipitation

Stabilization of the final product

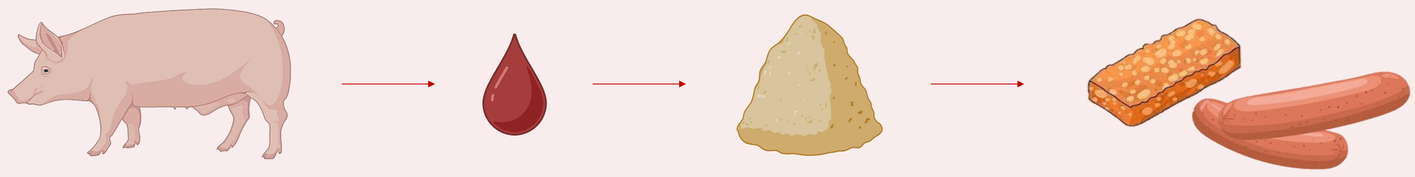
Final ingredient

>95% of protein
>2.000 mg / 100g of Fe
no flavor
no smell

Keratin's patent: *'Procedimiento para la recogida y transformación de la sangre en una proteína hidrolizada a partir de sangre de animales de abasto obteniéndose proteína hidrolizada de la sangre (PHS)'*

Conclusions

The final ingredient with a **high concentration** of **protein** and **iron** can be integrated into various **food products**, showing the high potential of porcine blood valorization, turning it into a **functional** and **sustainable resource** for the food industry



G.O. BLOOD4GOODS_Valorización del residuo generado por la sangre de vacuno y porcino para aumentar la circularidad de los mataderos.

Este Grupo Operativo como organismo responsable del contenido ha sido beneficiario de una ayuda para la preparación y ejecución de proyectos de innovación de interés general por grupos operativos supraautonómicos de la Asociación Europea para la Innovación en materia de productividad y sostenibilidad agrícolas (AEI-Agri), en el marco del Plan Estratégico de la PAC de España (PEPAC); cofinanciadas al 80% por el Fondo Europeo Agrícola de Desarrollo Rural FEADER y al 20% por el Ministerio de Agricultura Pesca y Alimentación.

El montante total de la ayuda asciende a 599.959,81€ y el presupuesto del proyecto a 599.959,81€.

Financiado por la Unión Europea NextGenerationEU

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Centro Tecnológico Nacional de la Conserva y Alimentación

Región de Murcia

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Labelling and Traceability of Potatoes in the Canary Islands: An Isotopic Approach

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OVERVIEW

The potato is the basis of the diet of the Canarian population. Due to its high demand, it is necessary to import potatoes from other countries, mainly from the UK. These imported potatoes compete and cause fraud in the markets due to mislabelling. The determination of the carbon isotope ratios of locally grown and imported potatoes was carried out. The results were analysed and significant differences were observed for the carbon isotope ratios.

INTRODUCTION

The Potato (Solanum tuberosum L.) is a staple food in the diet of the Canary Islanders. In this outermost region of the European Union (Figure 1), potato cultivation has an important cultural and economic value. Currently, local production cannot meet the high demand for potatoes, leading to imports from the others countries, with the United Kingdom (UK) being the main supplier. This dependence on international markets is necessary to satisfy local demand. However, competition with local production is intensified by inadequate labelling practices in local markets, which can contribute to food fraud and mislabelling issues. In this work, carbon isotope ratios were studied by Elemental Analysis Isotope Ratio Mass Spectrometry (EA-IRMS) to determine their usefulness to verify the authenticity and geographical origin of these crops.

Figure 1.- Geographical situation of the Canary Islands in Europe and other importing countries

METHODS

A total of 168 potato samples identified as locally grown (Canarias, N = 124) and imported (UK, N = 22; Cyprus, N = 9; Egypt, N = 9; Israel, N = 5) were collected from marketplaces in Canary Islands between 2021 and 2023. The samples were processed and freeze-dried and milled for isotopic analysis. The carbon ($\delta^{13}C$) isotope ratios were determined using the standard delta notation formula (Coplen, 2011), where values are expressed to a reference standard in part per thousand (‰). Statistical analysis was performed to the samples using open-source software.

RESULTS

First, the $\delta^{13}C$ values were grouped according to the origin of the samples, showing statistically significant differences between imported and local potatoes. Cypriot, Egyptian and Israeli samples showed very different values, while UK samples were closer to the Canarian samples (Figure 2). Secondly, the samples were analysed according to the place where they were purchased (supermarkets, public market and the countryside). Outliers were detected in samples purchased in public market, which could be due to mislabelling. In supermarkets, traceability showed better data consistency, with a lower data dispersion than in other data sets, but inconsistencies were still found (Figure 3 and Figure 4). One-way analysis of variance (ANOVA) confirmed statistically significant differences according to geographical origin, showing that samples from the Canary Islands showed significantly different $\delta^{13}C$ values.

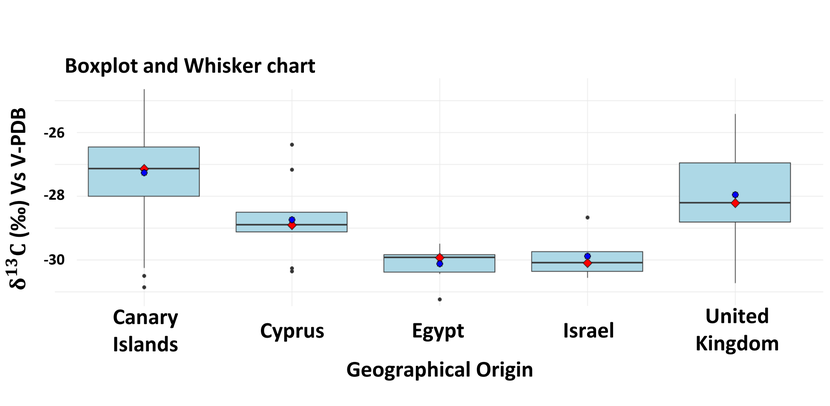

Figure 2.- Box and whisker plot for $\delta^{13}C$ values by origin

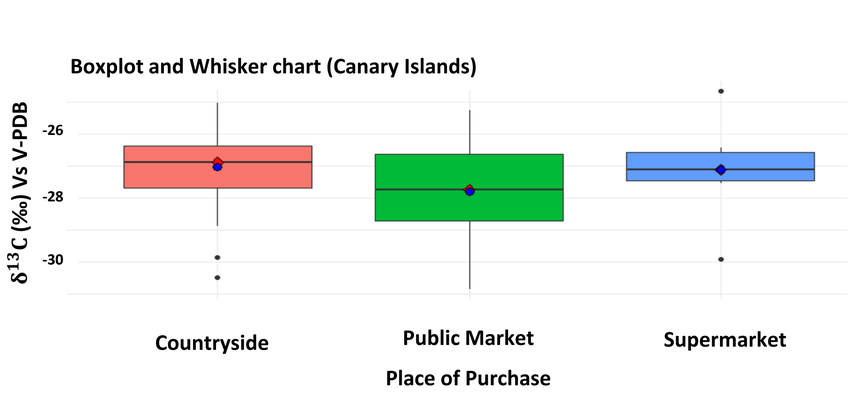

Figure 3.- Box and whisker plot for $\delta^{13}C$ values by Place of Purchase (Canary Islands)

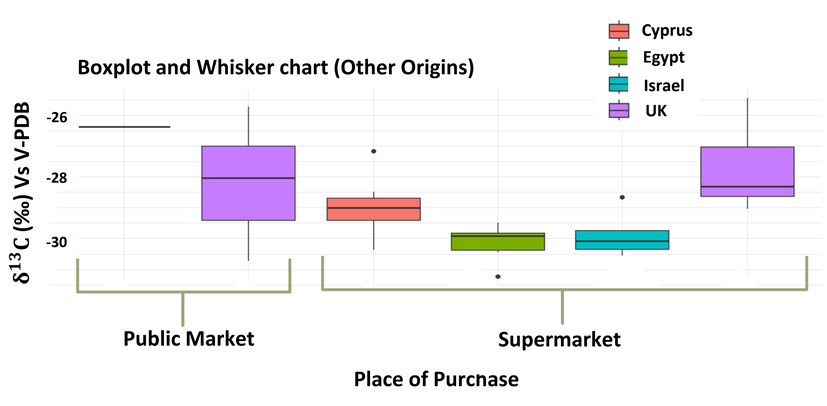

Figure 4.- Box and whisker plot for $\delta^{13}C$ values by Place of Purchase (Other Origins)

CONCLUSIONS

This study would permit the isotopic characterisation of potatoes grown in the Canary Islands in order to prevent fraud in marketing and ensure the authenticity of local products in the Canary Islands. Food fraud and the geographical origin of potatoes marketed in the Canary Islands cannot be rigorously identified by this parameter alone. Additional analytical parameters must be added to develop a robust mathematical classification model. Finally, collaboration with local farmers and authorities is needed to increase the database and improve marketing control.

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T. B. Coplen, “Guidelines and recommended terms for expression of stable-isotope-ratio and gas-ratio measurement results,” Rapid Communications in Mass Spectrometry, vol. 25, no. 17, pp. 2538–2560, 2011, doi: 10.1002/rcm.5129.

ACKNOWLEDGMENTS

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Centro Tecnológico Nacional de la Conserva y Alimentación

ADAPTA INDUSTRIA PROJECT

César Nicolás Martínez, Antonia María Ruiz Gandía and José Ramón Miralles Silvestre
Murcia Food Industry Association – Agrupal.
Contact : agrupal@agrupal.com

AIM

Development of a self-diagnosis manual for risks and the integration of climate change adaptation in the food industry, through the selection of methodologies and successful experiences discussed in technical seminars, their implementation through pilot projects in companies in eastern Spain, and the development of training, experience-sharing, and awareness-raising activities. Duration: 2023, 2024 and 2025

ACTIVITIES

1. Outreach and Communication

2. Development of an initial knowledge base

3. Development of four technical seminars

4. Drafting of a methodological manual for climate risk self-assessment

5. Implementation of two specific training courses for company technicians

6. Implementation of self-assessments through pilot projects

7. Creation of a space for disseminating information sources, success stories, and case studies. "Campus Adapta Industria" (Industry Adaptation Campus)

8. Conducting two awareness-raising sessions for project writers and company CEOs

9. Estimation of the adaptations and changes that will be generated in the sector thanks to the commitments achieved in the project and the diagnosis generated.

RESULTS

The Association of Food Industries of Murcia, Alicante and Albacete (AGRUPAL), to assist companies facing the challenge of climate change, has launched, with the support of the Biodiversity Foundation of the Ministry for Ecological Transition and Demographic Challenge, the ADAPTA INDUSTRIA project. The purpose of this project is to generate knowledge so that, through self-assessment, the food and beverage industries can evaluate their situation and design adaptation strategies. The food and beverage industry is a fundamental piece in the value chain of the agri-food sector. It is a sector that absorbs a significant portion of local agricultural production and a substantial part of the production from the packaging industry .

Within the framework of the ADAPTA INDUSTRIA project, work has been done on identifying and selecting methodologies and successful experiences that have been discussed in four technical seminars with the participation of company technicians and experts. In these seminars, quantitative objectives have been identified that allow, by comparison, the self-assessment of a company with respect to regulatory trends and the levels of eco-responsibility demanded by investors, consumers, and other stakeholders.

Additionally, training activities have been developed to apply the resulting knowledge through the organization of two specific training courses on possibilities for adaptation to climate change in companies.

Similarly, more than 25 pilot projects have been developed to allow the application of tools and resulting knowledge to the real situation of companies, a space for dissemination of information sources, successful experiences, and practical cases of interest has been created, which is the "Adapta Industria Corporate Campus," as well as the creation of 7 informative panels that have been sent to organizations and entities in a traveling exhibition.

The Adapta Industria Project also developed awareness activities with the celebration of meetings and informative sessions especially directed at Food Industry executives, company technicians, and project writers.

The project, in general, will facilitate a first approach of the food and beverage processing industry to the challenge of climate change, enabling the estimation of associated risks and the competitive advantages derived from reducing emissions contribution, embracing the principles of a low-carbon and circular economy, and adaptation to physical impacts

Through the development of this project, the various risks facing the food industry in the future due to the impact of climate change on its production activities have been identified, and various adaptation measures have been established that companies in the sector can implement in the future. Various training activities and four outreach sessions have been conducted, and more than 25 companies in the sector have participated in the project, developing pilot projects for adapting to climate change.

More information at www.adaptaindustria.es, +34 968355040 , agrupal@agrupal.com

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

Irene Ríos Grau - AIMPLAS

MURCIA Food 25

inno protein

new sustainable proteins for food, feed and non-food bio-based applications

The project aims to push up Europe's protein self-sufficiency and resolve European needs about diversification of protein sources for food, feed, and non-food bio-based applications, as well as full valorization of biomass generated in protein production process enabling industrial symbiosis.

How?

INNOPROTEIN will explore new protein sources (Single Cell Proteins (SCP) and insect) and use emerging technologies for protein recovery from them adopting a circular & zero waste strategy.

Whats in it for you?

INNOPROTEIN will develop new protein-based products for food, feed and non-food-based applications (bioplastics and biostimulants) and new eco business model. Get in contact with us and don't miss any opportunity!

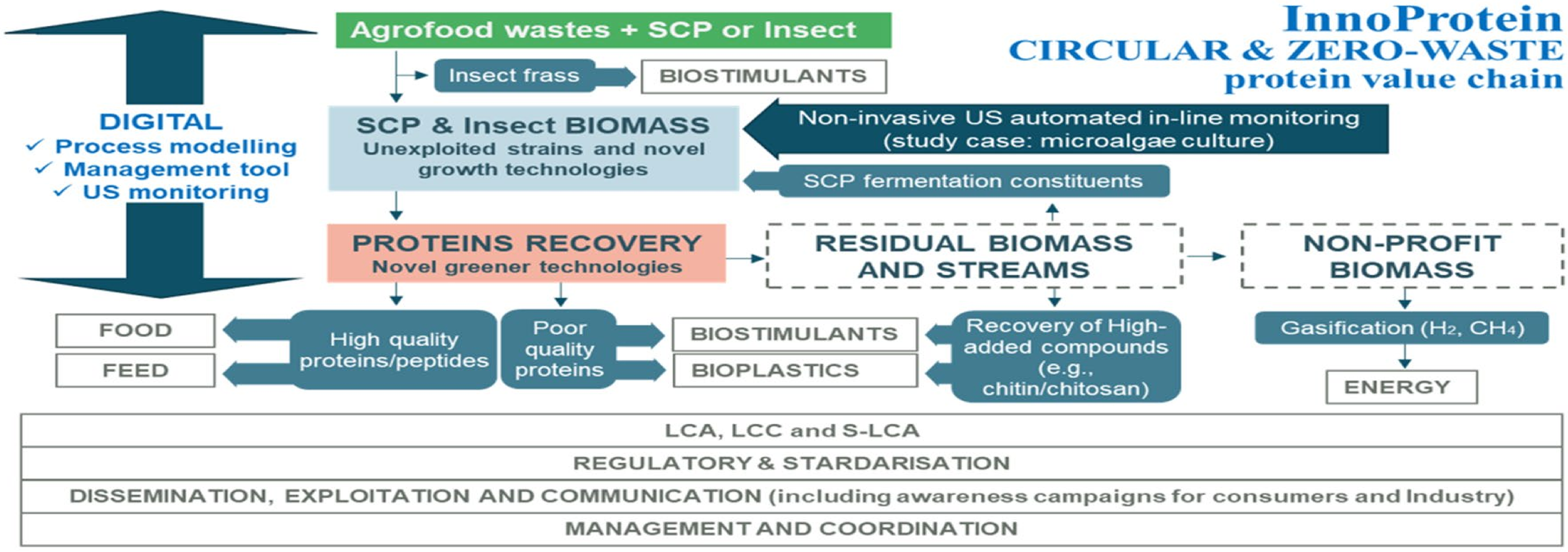
info@innoprotein.eu

June 2023 — May 2027

Consortium

Coordinator: tecnalia

Partners: AIMPLAS, biotrend, a4f algae for future, biozoon, ENKOA, ZERO-E ENGINEERING, NST, ALPHA CHITIN, SD, promic, eufic, SCL Italia, VRI, DUBLIN



Advances

✓ First culture trials for the selection of potential SCP and Insect:

Microalgae	Bacteria	Fungi	Insect
Haematococcus pluvialis (produced by A4F)	*Methylophilus methylotrophus*	*Aspergillus oryzae* (produced by NST)	*Hermetia illucens*
Euglena gracilis (produced by A4F)	*Methylorubrum extorquens* (produced by Biotrend)	*Rhizopus microsporus (produced by Tecnalia)*	*Tenebrio molitor* (produced by Alpha Chitin)
Schizochytrium limacinum (produced by Tecnalia)			

- SCP and Insect biomasses have a protein content between 36%-56%. Its protein content is higher than other conventional sources such as cheese (23%), legumes (22%), chicken (20%), pork (19%), fish (19%), beef (17%) and eggs (13%)[2,3].
- The SCP and the insect studied contain a significant amount of protein, suggesting they could hold substantial potential as a viable protein source.

✓ Selection of 1 specie/each source (microalgae, bacterial, fungal and insect) with potential as unconventional protein sources.
✓ Selection of the recovery methodology of proteins from SCP & Insect.
✓ Design of sensor topology, mechanical holder and hardware of non-invasive US prototype.
✓ Design of Process Simulating, Management tool and US monitoring tool.

Co-funded by the European Union | Circular Bio-based Europe Joint Undertaking | Bio-based Industries Consortium

nutrialitec | Financiado por la Unión Europea NextGenerationEU | Gobierno de España, Ministerio de Ciencia, Innovación y Universidades, CDTI Innovación | Plan de Recuperación, Transformación y Resiliencia

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XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Characterization of Low- Cadmium Accumulating Genotypes in Bread Wheat (*Triticum aestivum L.*)

Haitham Mokhles Saad Khatlan, Mohammed Hamdan Edan Al-Issawi

Department Agriculture of Field crops – College of– University of Anbar- Iraq

Abstract

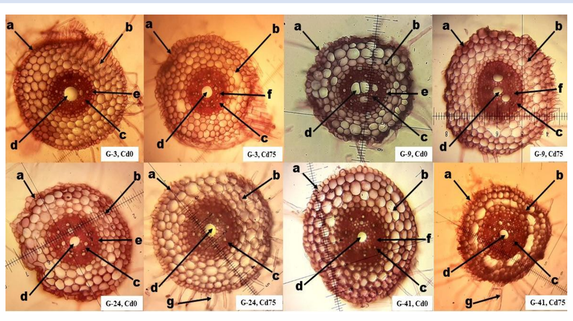
The most important results can be summarized as follows: Anatomical traits were greatly affected by cadmium stress in either two directions. Some of anatomical traits were slightly enhanced such as cortex thickness which can be considered from the clear responses to Cd accumulation in plant tissues. However, the majority of anatomical traits were negatively affected by Cd stress. The genetic background of genotypes has the vital role in the response to Cd stress. The genotype G-3 was superior in terms of its ability to accumulate Cd in its parts of which roots. According to molecular detection of *PCS1* expression and Cd concentration in wheat genotypes parts it is evident that *PCS1* expression is correlated to Cd concentration in plant especially in genotype G-3. It is obvious from chemical analysis to Cd content in grain of wheat genotypes that grain Cd of genotypes G-28, G-29 and Al Diar which cultivated in Cd polluted soils (75 mg Kg^{-1}) was low and within safe limits (0.163, 0.169 and 0.197 mg Kg^{-1} for the aforementioned genotypes respectively). While genotype G-39 recorded the lowest concentration in its vegetative parts and it was within the safe limits (0.19 mg Kg^{-1}).

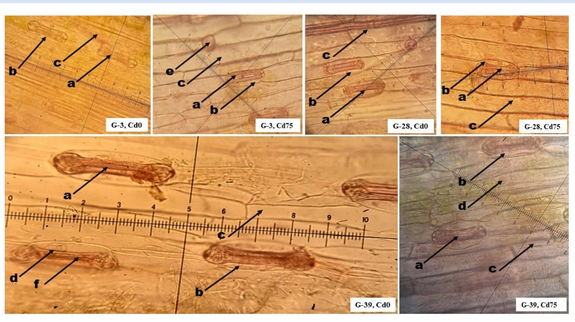
1. Introduction

Iraqi population depends of wheat in their daily life as source of carbohydrates. Every single meal might have one of the wheat products. Based on this, wheat grain safety from pollutants is very important issue for human health especially, the sources of pollutions become very popular due to human unplanned activities. One of the riskiest pollutants is the heavy metals which accumulated in the environment due to the misuse of the fertilizers, pesticides, sewerage which discarded directly to the river without pretreatment, factories waste and war residuals. Since heavy metals pose a threat to human life when they enter the food chain, and given the increasing problem of pollution from these metals in recent times, it has become necessary to focus on stopping the flow of these toxic metals into the human or animal body through the consumption of wheat grains in their various forms. Based on the aforementioned, and due to the importance of food security in terms of production and quality, a field experiment was conducted under the conditions of the western region of Iraq. The aim of the study was to characterize wheat genotypes with low cadmium accumulation that can be used for human nutrition .

2. Materials & Methods

This study included eight introduced genotypes that showed high and acceptable yields under the conditions of the study area, in addition to two locally approved varieties. All genotypes were treated with cadmium (75 mg Cd kg^{-1} soil), in addition to control plants that were not treated with cadmium. Cadmium is one of the most widespread heavy metals, so it was used as an indicator of pollution. It was added in the form of cadmium chloride salt ($ClCd_2.H_2O$, FW:183.33) as a source of cadmium (Thomas Baker Company, Mumbai, India) to the soil along with humic acid, with the aim of making the cadmium available for absorption by the wheat genotypes to study their response to this stress and their genetic ability to absorb, transport, and accumulate cadmium. For this purpose, a randomized complete block design (R.C.B.D) was used in a split-plot arrangement with three replicates for each treatment.



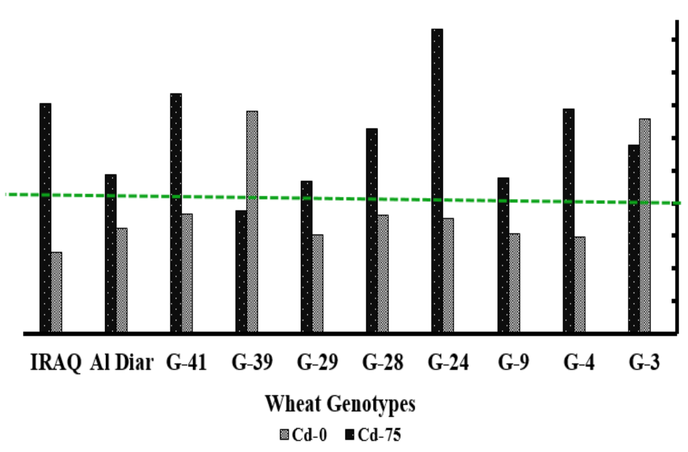


3. Results

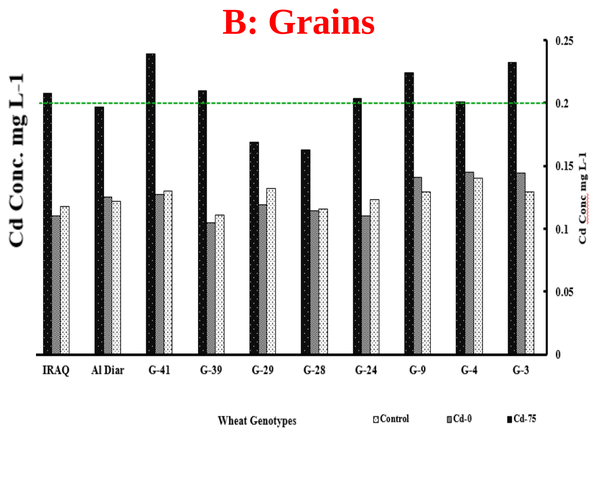
The results of this study concluded that the genotype G-3 was superior in its high ability to accumulate cadmium in plant parts, especially the roots. The results also showed that the cadmium concentration in the grains of the two genotypes G-28 and G-29, in addition to the variety "Diyar," which were planted in soil contaminated with cadmium at a concentration of 75 mg kg^{-1}, was low and within the permissible limits set by the Food and Agriculture Organization (FAO) (0.20 mg Cd kg^{-1} grains). The concentrations were 0.163, 0.169, and 0.197 mg Cd kg^{-1}, respectively. Meanwhile, the genotype G-39 was the only genotype that recorded a low cadmium level in the vegetative parts (stems and leaves), within the globally accepted limit of 0.19 mg Cd kg^{-1}. Based on the abovementioned information, it can be concluded that the genotypes G-28 and G-29 can be used for human consumption, especially since these two genotypes exhibit high and acceptable yields under arid and semi-arid conditions. Meanwhile, the other genotypes that accumulate heavy metals in plant parts other than the grains can be used for other purposes, such as bioremediation of soils contaminated with heavy metals.

From the graphs A and B, it is clear that the cadmium concentration in the vegetative and grains of wheat genotypes varied. Genotypes located under the green line (Figure B) can be used for human nutrition..

A: Vegetative Parts



B: Grains



4- Conclusions

The results showed that all genotypes grown in cadmium-contaminated soil had high cadmium content in their roots. Only genotype G-39 had a low cadmium content in its stems and leaves, within the permissible limits. Meanwhile, genotypes G-28 and G-29, as well as the cultivar Diyar, showed low cadmium content in grains, within the permissible limits. In addition, genotypes G-4 and G-24, as well as the cultivar Iraq, also showed low cadmium content, but slightly exceeding the permissible limits.

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Ecosistema de Innovación NUTRIALITEC (ECO-20241004), subvencionado por el CDTI y que ha sido apoyado por el Ministerio de Ciencia, Innovación y Universidades del Gobierno de España

XII INTERNATIONAL SYMPOSIUM FOOD TECHNOLOGY

MURCIA Food 25

Empowering Agri-Food and Logistics Innovation in continental Europe and Outermost Regions: Insights from the STARRISE Project

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Overview - A gateway for innovation

The STARRISE Project, funded by the European Union, aims to foster innovation and collaboration within the agri-food and logistics sectors, particularly in less developed and Outermost Regions of the EU. Accompanied by one more develop region, the project aims to promote interregional innovation collaboration and the development of innovative value chain investment portfolios in Shared Smart Specialization Strategy (S3) Areas, specifically in logistics and food sectors. Through a comprehensive journey encompassing capacity-building activities, mentorship, and networking opportunities, STARRISE supports SMEs and stakeholders in developing sustainable and impactful innovation projects and interconnected regional ecosystems.

Key definitions - Innovation and sustainability in the agri-food and logistics sectors

Agri-food and bioeconomy

The project promotes innovation and sustainable development in the agriculture and food sectors, including the development of new technologies, products, services, and circular bioeconomy.

Sustainable mobility and logistics

STARRISE aims to minimize harmful impacts on the environment, society, and the economy by reducing the use of fossil fuels, decrease greenhouse gas emissions, and the efficient use of resources.

Methodology- The STARRISE Journey

The STARRISE Journey includes training (online and face-to-face), events with experts, personalised support for the development of innovation projects, mentorship and networking opportunities.

Ecosystem building workshops

Identify challenges, trends and opportunities to transform them into successful Innovation projects.

Hybrid hackatons

Explore new ideas and transform them into successful Innovation projects.

Tailored training programs

Support to further develop the selected innovation projects, focused on innovation investment projects

Matchmaking activities

Virtual and face-to-face matchmaking events and workshops

Masterclasses in innovation management

Topics: strategy, innovation, digitalization, starting-up, corporate venturing

Personalised support with experts

Help to assess the feasibility, market maturity and bankability of innovation projects.

Reachability - Permeating innovation throughout the ecosystem

SMEs

SMEs (small and medium enterprises) of the agri-food and logistics sectors from the 6 STARRISE countries are the main beneficiaries of the project.

Stakeholders & General Audience

Stakeholders are essential, the project works with those of regional ecosystems (clusters, business associations, chambers of commerce, industry, innovation agencies, public authorities, NGOs, consumer associations, etc.).

Results - Expected outcomes

Capacitation

STARRISE aims to foster capacity building skills as the first step towards a more innovative and impactful agri-food and logistics sector.

Interregional collaboration

By leveraging interregional collaboration and promoting resilience, the project enhances knowledge transfer, strengthens regional innovation ecosystems, and facilitates integration into EU value chains for Latvia, Portugal, Romania, Greece, Canary Islands, (Spain), and Martinica (France).

Learn more about STARRISE!

www.starriseproject.eu

Email: starrise@itccanarias.org

STARRISE

Funded by the European Union

Consortium members

Ecosistema de Innovación NUTRIALITEC (ECO-20241004), subvencionado por el CDTI y que ha sido apoyado por el Ministerio de Ciencia, Innovación y Universidades del Gobierno de España